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महाराष्ट्र एज्युकेशन सोसायटी, पुणे
स्थापना १८८०

Maharashtra Education Society's

Garware College of Commerce

(Autonomous)

Karve Road, Pune-411004





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Conferred with 'The Best College Award'
By Savitribai Phule Pune University.

YOUNG RESEARCHER 2026

M.E.S.

GARWARE COLLEGE OF COMMERCE

Karve Road, Pune 411 004.



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पुणे विद्यापीठाच्या गुणवत्ता सुधार योजनेअंतर्गत
शैक्षणिक वर्ष २०१३-२०१४ साठीचा

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Department of Research, Innovation and Consultancy (DRIC)

MES Garware College of Commerce has always taken passionate efforts to develop the research culture among the students and staff. The Vision and Mission Statement of the College reflects its obsession towards research.

In July 2013, to pursue the dreams in the sphere of Research. GCC established the Department of Research, Innovations and Commutate (DRIC). Then Vice-Chancellor of Savitribai Phule Pune University, Hon. Dr. Wasudeo Gade, was the chief guest of the grand function organised on this occasion. Since July 2013, the College is a recognized Research Centre in the faculty of Commerce and is affiliated to Savitribai Phule Pune University to undertake PhD in Commerce. Currently, 11 faculty members as recognized Research Guides are associated with the Research Centre and around 35 research scholars are pursuing their Ph.D. under the guidance of these faculty members.

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From the Desk of Principal . .

It gives me immense pleasure to address you through this journal, a publication that stands as a testament to our students' unwavering commitment to research and innovation. The 12th National Level Student Research Competition has once again proven to be a vital platform—one that not only nurtures young minds but propels them toward academic excellence and profound intellectual growth.

In today's rapidly evolving global landscape, the spirit of inquiry is indispensable. The ability to question, explore, and innovate is the hallmark of both great individuals and leading institutions. At our institution, we have always prioritised a culture of curiosity and critical thinking. This journal, housing a rich collection of scholarly work, is a direct reflection of those core values.

The theme of this year's competition, "Redefining Business, Commerce, and Management through Sustainability" was chosen to challenge our students to think beyond conventional boundaries. It is heartening to observe the diversity of topics and the depth of exploration within these pages. From groundbreaking technological concepts to profound insights into the social sciences and humanities, our students have demonstrated remarkable originality and dedication.

I extend my heartfelt congratulations to all the participants. Each paper published here is the culmination of tireless effort and the result of rigorous mentorship by our esteemed faculty. I also wish to express my sincere gratitude to the organising committee, whose meticulous planning ensured this event was a resounding success.

To the readers of this journal, I encourage you to delve into these papers with an open mind and a thirst for knowledge. May this compilation serve as a source of inspiration for the academic community and beyond.

As we celebrate these achievements, let us reaffirm our commitment to creating an environment where ideas flourish and innovation thrives. Together, we continue to build a brighter, more informed future.

Warm Regards!

Dr. Kishor Desarda
Principal
MES Garware College of Commerce (Autonomous), Pune

Dear Young Researchers,

Young Researcher 2026: A Milestone in Academic Excellence

It is with immense pride and great enthusiasm that we present the **12th edition of Young Researcher 2025.** This distinguished publication serves as a vibrant showcase of the innovative spirit and intellectual rigour of budding scholars from across the nation. This anthology, a curated collection of high-quality research, stands as a testament to the dedication and talent displayed during the National Research Competition held at **MES Garware College of Commerce** on February 7, 2026.

Research is the ultimate engine of progress—a tool that not only unravels the mysteries of the world but also addresses the complex challenges of the present to pave the way for a sustainable future. Our institutional vision and mission are deeply aligned with this endeavor, prioritizing inquiry, innovation, and intellectual growth. This publication, formally recognized with an ISBN, is a significant milestone that reflects our unwavering commitment to academic excellence and the global promotion of scholarly activity.

Young Researcher is more than a mere compilation of articles; it is a dynamic platform designed to nurture the spirit of inquiry. As India strives to solidify its position as a global knowledge hub, the concerted efforts of young intellectuals are vital to developing sustainable solutions for pressing global issues. By encouraging students to think critically, question established norms, and push the boundaries of conventional thought, this initiative plays a pivotal role in shaping the leaders of tomorrow.

As we celebrate the achievements captured in these pages, we also look forward to new horizons. The journey of research is one of continuous evolution, where every milestone achieved is a stepping stone toward greater discovery. At MES Garware College of Commerce, we remain steadfast in our support of students and faculty in their pursuit of excellence and innovation.

The 12th edition of Young Researcher 2026 is a celebration of the talent, creativity, and hard work of our students. It is a reflection of our collective belief in the power of research to transform lives and create a better future. I invite you to delve into the pages of this publication and discover the remarkable work of our budding researchers.

Young Researcher 2026 is an example of what can be achieved when young minds are encouraged to explore, innovate, and excel. I extend my best wishes to all the contributors and readers of this publication. May this edition inspire many more students to embark on the path of research and innovation, contributing to the growth and development of our society.

I take this opportunity to Sincerely thanks are also extended to our Principal, **Dr. Kishor Desarda,** Vice Principal, **Dr. Vinayak Pawar,** and the Management of the **Maharashtra Education Society** for their constant support and motivation.

With Warm Regards!

Prof. Dr. Asha Khilare

Head, DRIC

MES Garware College of Commerce (Autonomous), Pune

From the Desk of the Coordinator...

Cultivating a Legacy of Inquiry: The 12th Research Paper Competition

I am delighted and honoured to welcome the brilliant minds and emerging researchers participating in the 12th Research Paper Competition, hosted by MES Garware College of Commerce (Autonomous). As we commemorate this milestone edition, it is truly inspiring to witness our young scholars' unwavering dedication to the pursuit of knowledge and the spirit of academic inquiry.

This competition stands as a testament to the steadfast commitment of MES Garware College of Commerce to foster active research at the undergraduate level. In an ever-evolving academic landscape, nurturing critical thinking is essential. We take immense pride in providing a platform that develops the next generation of thought leaders, equipping them with the analytical tools necessary for future success.

Serving as the stage for this scholarly endeavour, the "Young Researcher" journal has become a hallmark of quality and creativity. As we launch this eleventh edition, it is heartening to observe how this initiative has flourished, showcasing the intellectual capacity and research prowess of students across a diverse range of academic disciplines.

To our participants: I urge you to embrace this opportunity with passion. Your research has the power to challenge existing paradigms, spark vital discussions, and illuminate new avenues of exploration. Remember, this journey is about more than accolades—it is about the rigorous skills you develop and the lasting impact your work may have on the global academic community.

I want to express my sincere gratitude to our Honourable Principal, Dr Kishor S. Desarda, for his visionary leadership, and to the entire Research Competition team for their tireless collaboration and unwavering support.

As we commence this competition, let us celebrate the thrill of discovery and our collective contribution to the ever-expanding body of knowledge. May this experience inspire you to achieve academic excellence and leave a lasting footprint on the world of research.

Best Wishes to all the Participants!

Dr. Sharmila Kavediya
Coordinator - Research Competition
MES Garware College of Commerce (Autonomous), Pune

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1.Sustainable Cooling Transitions: A Study of Awareness and Barriers to Adoption of Eco-friendly Refrigerants

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Abstract:

Refrigerants refer to the types of material used in the air conditioning and refrigeration systems to take on and give out heat and thus allow cooling to take place. The environmental impact of eco-friendly refrigerants is low as compared to the traditional refrigerants which add to the global warming as well as depleting ozone. The proposed research uses the mixed- method research design to examine the awareness, adoption barriers, and market acceptance of eco-friendly refrigerants in residential air conditioners in Pune. As per the recent studies, consumers and other stakeholders of the HVAC industry generally lack awareness about the use of eco-friendly refrigerants. The most accepted substitute of high-GWP refrigerants is R-32. The results revealed that most respondents were ready to use green air conditioning systems even despite not knowing much about them in case they are offered relevant incentives. The key existing barriers that are dominant are mostly lack of awareness, expensive prices, lack of product supply and poor training of technicians. The findings of the study are that the government, the manufacturers, the dealers and the consumers should work together to hasten the shift to sustainable cooling to complete the meeting of the commitments of climate in India.

Keywords: Consumer awareness, Eco-friendly refrigerants, HVAC industry, Pune metropolitan region, Sustainable cooling.

1.0 Introduction

1.1 Background of the Study

Air conditioners are becoming a requirement especially in the fast growing cities such as Pune. The demand of air conditioners is likely to skyrocket in 2030 with the growth of incomes, dense housing, and rise in temperature (NRDC, 2018). Green substitutes such as R-32, R-290, and HFOs are on the international agreements such as Kigali Amendment in 2016 and Cooling Action Plan in Kigali in 2019 in India. The technological access is not necessarily translated into the perception or usage of environment-friendly type of refrigerants materials by Indian consumers, particularly in the intermediate cities, such as Pune.

1.2 Problem Statement

Although eco-friendly refrigerants are commercially available, their use remains minimal in Pune because of low awareness amongst the consumers, high costs of installation, short supply chains, and lack of training of the technicians. Besides, the transition is not technical since it is difficult to switch to other refrigerants, further slowing the process.

2. Literature Review

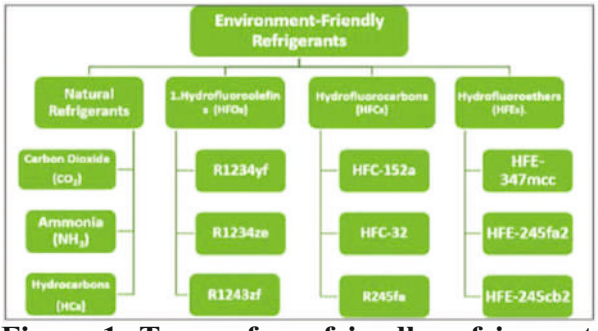


Figure 1: Types of eco-friendly refrigerants (Ajay et al, 2024).

2.1. Global Regulations and Eco-Friendly Cooling

Figure (1) Shows types of eco-friendly refrigerants available in market. The Kigali

Amendment (2016) mandates an 80% phasedown of high-GWP HFCs over 30 years to reduce greenhouse gas emissions and slow global warming. With 165 countries, including India, ratifying it by 2025, it reinforces global climate action while supporting the Montreal Protocol's ozone-protection goals. (KIGALI, 2019)

With AC stock expected to hit 2.5 billion units by 2050, boosting efficiency is essential to cut energy use and emissions. The Kigali Amendment drives the shift to low-GWP refrigerants, supported by stronger standards, incentives, and updated safety norms. (Park, Won Young & Shah, 2019)

Global regulations are phasing down high-GWP refrigerants like R-410A, pushing the shift to low-GWP options such as R-290, R-32, and R-454B, despite their added flammability risks. Policies like the AIM Act and Kigali Amendment enforce strict timelines, requiring new system designs, stronger leak controls, and updated safety standards. (Bill Goetzler & Jim Young 2024)

The study shows global shift from harmful CFCs and HCFCs to eco-friendly refrigerants, including natural options like ammonia, CO_2, and hydrocarbons, as well as low-GWP HFOs and advanced blends. It also highlights emerging solutions ionic liquids, phase-change materials, and while stressing safety, regulations, and continued research for sustainable cooling systems. (Bhatti et al, 2023). Rising concerns about high-GWP HFCs are pushing the transition to natural refrigerants and low-GWP HFOs. While safety, compatibility, and cost challenges remain, research and policy support are enabling wider adoption for climate and ozone protection. (Rohit Yadav & Dr. Shrihar Pandey, 2024)

2.2 Sustainable transitions of ACs in India

Growing AC demand in India, driven by urbanization and rising heat, is increasing energy use and emissions. As high-GWP refrigerants are phased out, the sector is shifting toward efficient, low-GWP cooling solutions to support sustainable growth. (NRDC, 2018)

This shift is towards low-GWP natural refrigerants like hydrocarbons, ammonia, and CO_2, but adoption is slowed by costs, awareness gaps, retrofitting challenges, and safety concerns. It requires incentives, supportive policies, technical assistance, and capacity building, supported by BIS standards and ICAP initiatives. (ICAP, 2021).

2.3 Evaluating the best eco-friendly refrigerants for HVAC systems

The alternate eco-friendly refrigerants such as CO_2, NH_3, and hydrocarbons (R290, R600, R600a) are sustainable alternatives to ozone-depleting, high-GWP fluids. However, their applications and the system modifications needed to enhance efficiency in environmentally responsible HVAC and refrigeration. (Basma Souayeh et al, 2022)

Low-GWP refrigerants like R-290 cut emissions and improve efficiency for small AC units, despite added safety needs and slightly higher costs. New HFO blends such as DR-55 and DR-5A provide low-GWP, safety-enhanced, and performance-compatible replacements for R-410A, easing the transition to eco-friendly cooling systems. (Chandrasekar Raja & Soniya sriram ,2024)

R-290 is a natural, eco-friendly refrigerant with negligible global warming potential, no ozone depletion, and better energy efficiency than R-410A due to superior thermodynamic properties. However, its flammability demands strict safety measures, making it a high-performance but safety-sensitive alternative to the non-combustible yet environmentally harmful R-410A. (A. Andrade & J. Zapata-Mina,2024)

2.4. Refrigerants for a sustainable future

The global shift highlights from high-impact CFCs, HCFCs, and HFCs to low-GWP, zero-ODP options like ammonia, CO_2, hydrocarbons, and HFOs. This transition, guided by global protocols, relies on innovation, strong safety standards, and supportive policies to achieve efficient, climate-friendly cooling. (Uddin, K., & Saha, B. B. 2022)

R513a and R450a are low-GWP replacements for R134a R513a matches its COP, while R450a offers higher efficiency with lower power use. Both run at lower pressures and temperatures, making them cleaner, reliable

choices for automotive and industrial AC systems. (Prajakta Waghe & M. Ramkumar Raja, 2025)

2.5 Objectives of the Study

- To study consumer awareness towards eco-friendly refrigerants in Pune.
- To identify key barriers and motivators influencing their adoption among HVAC users.
- To suggest suitable solutions for easier adoption of eco-friendly refrigerants.

2.6. Research Gap

The literature available so far emphasizes more on the technical benefits of using eco-friendly refrigerants as compared to socio-market drivers, particularly in the emerging Indian markets. The international studies incline to be policy-oriented and technical performance-oriented, yet the local consumer perceptions, dealer difficulties, technician preparation, and market adoption reasons are seldom explored in such cities as Pune. The current work fills the gaps in the current literature by investigating the real-world awareness, the real adoption trends and obstacles in the residential HVAC sector of Pune.

3.0 Research Methodology

Method – Descriptive and Mixed method

3.1 Primary data

The primary data is collected through structured questionnaire survey using Google forms from residents in Pune city.

3.1.1 Population & sample size

There are approximately 1.5–2 lakh households likely to have residential air conditioners. (Census 2011, Hindustan Times, 2025).

The respondents are:

Consumers (Ac users): 92 respondents are consumers.

Dealers: 5 respondents are dealers.

Retailers: 3 respondents are retailers.

3.1.2. Sampling method – Convenience Sampling

3.2 Data Collection Methods

Primary data comes from structured surveys and semi-structured interviews exploring awareness, adoption, technical issues, and market readiness.

Secondary data from books, journals, reports, and policy documents supports context building and comparison with existing research.

3.3 Data analysis It was done using MS Excel

4.0. Findings and Data analysis

4.1. Quantitative Study

Survey Analysis:

Question 1:

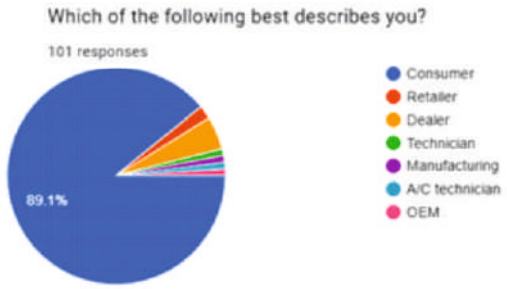


Figure 2: Identity of respondents (From Survey)

Most respondents (89.1%) are consumers, with very few from technical or industry roles. This means survey insight largely reflects consumer perspectives.

Question 2:

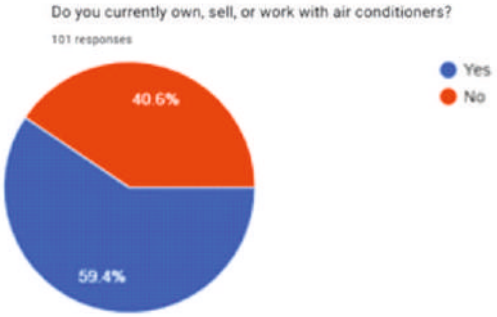


Figure 3: Air-conditioner's availability (From Survey)

About 59.4% own, sell, or work with ACs, while 40.6% do not showing the survey includes both users and non-users.

Question 3:

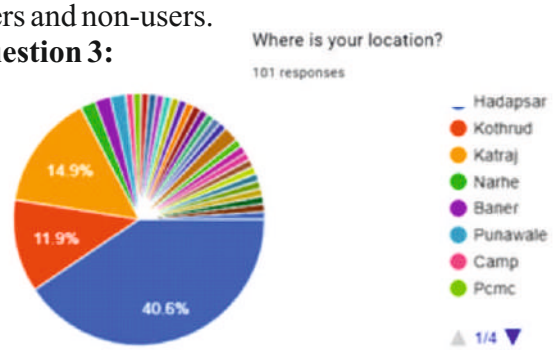
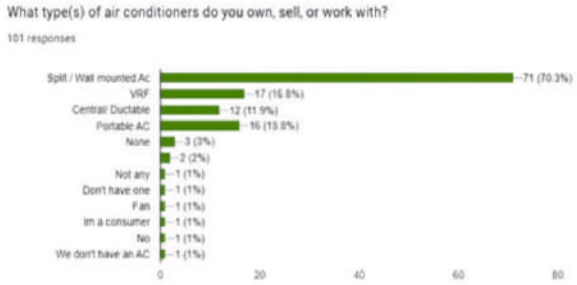


Figure 4: Locations of respondents (From Survey)

Responses came from multiple Pune areas such as Hadapsar, Katraj, and Kothrud, giving a broad urban and suburban representation.

Question 4:



Split/wall-mounted ACs dominate (70.3%). VRF, portable, and ductable units have smaller shares.

Question 5:

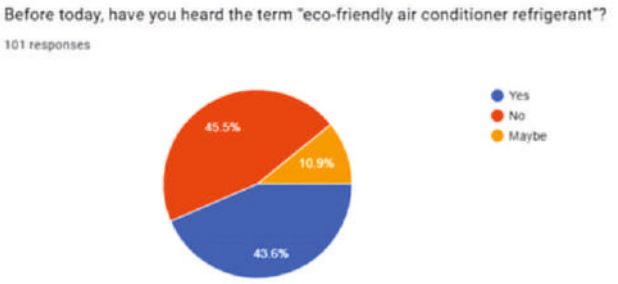


Figure 6: Awareness of "eco-friendly air conditioner refrigerant" among survey respondents(From Survey)

Awareness is split: 43.6% know the term, 45.5% do not, and 10.9% are unsure.

Question 6:

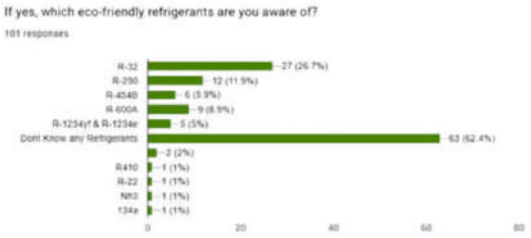


Figure 7: Known refrigerants (From Survey)

62.4% cannot name any eco-friendly refrigerant. Among those aware, R-32 is most known (26.7%), while others (R-290, R-600A, etc.) have low recognition.

Question 7:

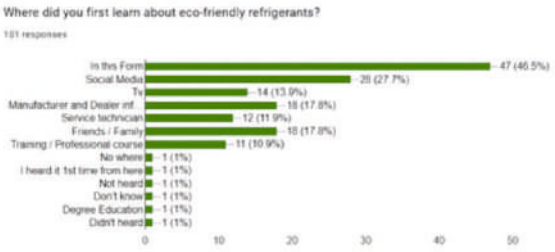


Figure 8: Awareness of eco-friendly refrigerant in respondents (From Survey)

Most learned about eco-friendly refrigerants through the survey (46.5%) or social media (27.7%). Other sources include TV, technicians, manufacturers, and training. Because of surveys taken there is bit of awareness created between all stakeholders.

Question 8:

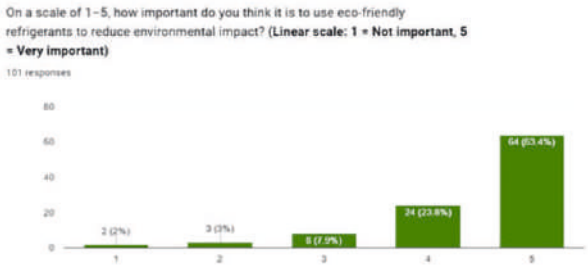


Figure 9: Importance of eco-friendly refrigerants according to respondents(From Survey)

A strong majority (87%+) consider eco-friendly refrigerants important or very important for environmental protection.

Question 9:

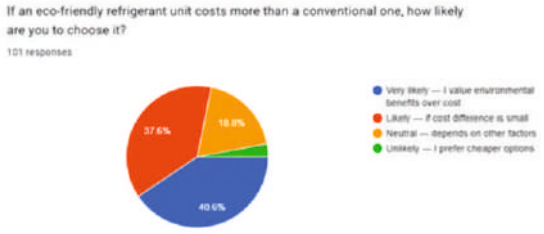


Figure 10: Likeliness of respondent towards eco-friendly refrigerants (From Survey)

Around 78% are willing to pay more for eco-friendly ACs. A small group is unsure or prefers lower cost over sustainability.

Question 10:



Figure 11: Factors influencing decisions of respondents (From Survey)

Top factor: environmental impact (70.3%). Other important factors: price, safety, and energy efficiency. Availability has low influence.

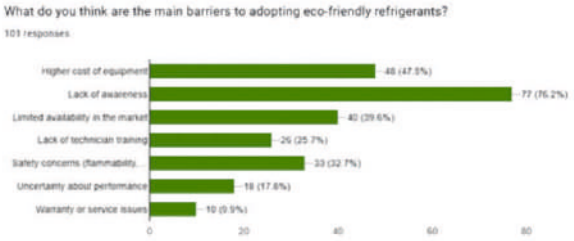


Figure 12: Barriers in adopting eco-friendly refrigerants (From Survey)

Lack of awareness is the biggest barrier (76.2%). Cost, limited availability, safety concerns, and lack of training also affect adoption.

Question 12:

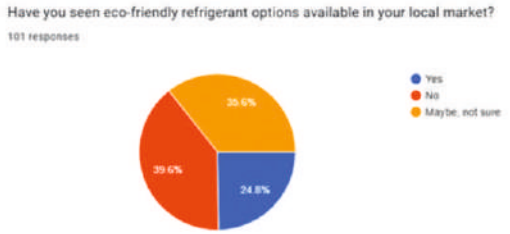


Figure 13: Options of eco-friendly refrigerant (From Survey)

Only 24.8% have seen eco-friendly options; 39.6% have not; 35.6% are unsure showing low market presence.

Question 13:

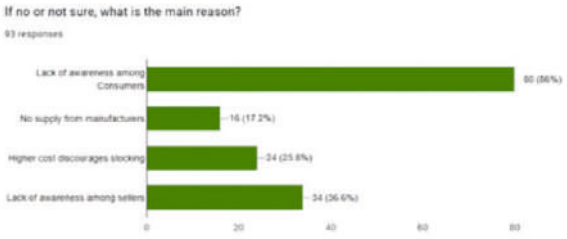


Figure 14: Main reason for lack of awareness about eco-friendly refrigerants(From Survey)

Main reason: low consumer awareness (86%). Dealer awareness, high costs, and limited manufacturer supply follow.

Question 14:

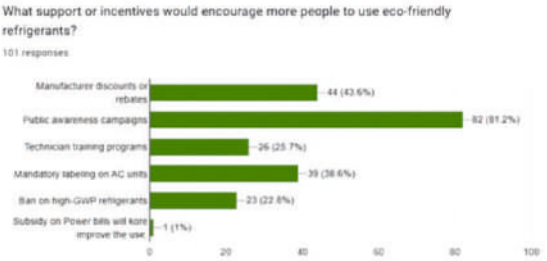


Figure 15: Incentives to encourage use of eco-friendly refrigerant(From Survey)

Awareness campaigns (81.2%) are the strongest motivator. Discounts, product labels, technician training, and regulation also help.

Question 15:

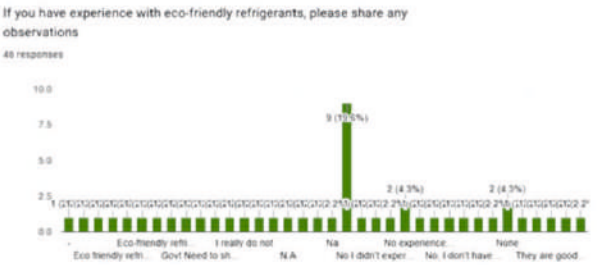


Figure 16: Experience of consumers; dealers; retailers; etc. (From Survey)

Most respondents lack hands-on experience. Those who have experience note benefits (environmental, efficiency) and challenges (cost, retrofitting, safety). They recommend more awareness and subsidies.

Question16: Any other suggestions or comments on promoting eco-friendly refrigerants in your area?



Figure 17: Key suggestions for promoting eco-friendly refrigerants (From survey, made by author)

Respondents suggest extensive awareness campaigns (social media, posters, programs), government incentives, technician training, better market availability, and stricter rules on harmful refrigerants.

4.2. Qualitative Analysis:

Thematic analysis of 8 dealers

Customer: The eight dealers possess a diverse customer base including residential, commercial, small business, institutional and industrial customers indicating a comprehensive coverage of the customer segments in the HVAC market of Pune. Awareness: The general awareness of all dealers is that there are environmentally friendly refrigerants but they do not wish to adopt to it because it will be expensive.

Challenges: The six dealers are experiencing challenges such as high price, lack of consumer knowledge, no discounts offered by the manufacturers and also very low market share of the eco-friendly refrigerants.

Government support and Manufacturer Support: All the eight dealers were willing to have government support to encourage the use of green refrigerants by offering subsidies and GST concessions, which would make it easy to transact business in green refrigerants. Besides that, five out of eight dealers expressed the necessity of manufacturer assistance to aid decrease in prices of green refrigerants.

Measures to embrace green refrigerant: Dealers proposed that more awareness should be created between the consumers and the government should also be supportive in making eco-friendly refrigerant through subsidies.

The HVAC market in Pune has dealers serving all classes of customers including residential, commercial, small business, institution, and industrial clients. All dealers had reported to know about eco-friendly refrigerants, but the primary factor contributing to poor adoption is high costs. Six out of eight dealers cited a number of problems they were experiencing which included high price, consumer ignorance, no discounts being offered by the manufacturers, and low market share of eco-friendly refrigerants. Every dealer would desire government support in the form of concessional GST and subsidies which will help them conduct the dealings easier. Five dealers emphasized that manufacturers need to support the prices. The dealers believe that more people will use eco-friendly refrigerants due to more awareness among the consumers and the incentives provided by the government encouraging people to use this type of refrigerant.

5.0. Findings, Suggestions and Conclusions

5.1 Findings

Awareness Gap: Market knowledge is low with R-32 being the only widely recognized eco-friendly option. Lack of awareness (76.2%) represents the dominant adoption barrier.

Market Readiness: Although the awareness is low, 78% consumer willingness to adopt shows potential market responsiveness to properly designed incentive programs. High costs, limited product availability, and inadequate technician training curtail dealer participation and consumer access. The findings support the objectives of the Cooling Action Plan in India through documented local barriers requiring targeted interventions. (ICAP,2021)

5.2 Suggestions

Awareness Campaigns: Consumer, dealer, and technician education via social media, advertising, community programs, labelling, and product demonstrations.

Govt. Support: Subsidies, GST reduction, bill

discounts, and strict regulations for phasing out high-GWP refrigerants.

Training & Infrastructure: Better training of technicians, stronger supply chains, reliable spare parts, and financing options like EMI to make adoption easier.

5.3 Limitations

Limited Time-Frame; Biased due to convenient sampling method, limited sample size.

5.4 Conclusion:

The study shows that the level of consumer awareness is low, however, most dealers are aware of the environmentally friendly refrigerants but not being willing to incur exorbitant expenditures on the functions of Air-conditioners using the assistance of eco-friendly refrigerants. The consumers are novices and yet they are willing to take the green refrigerants at high prices. The integration of green refrigerants within the residential HVAC of Pune is a challenge because of the limited supply chain. Nevertheless, the potential to grow is high, and the adoption by consumers is recorded to be 78% and the environmental concerns. Sustainable cooling transitions are essential to both mass awareness, enforcement of regulations, financial incentives, certification of technicians and reinforcement of the supply chain which should be implemented in an interfiled strategy.

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List of Abbreviations

Abbreviation	Description
HVAC	Heating, Ventilation, and Air Conditioning
GWP	Global Warming Potential
ODP	Ozone Depletion Potential
AC	Air Conditioning
HFC	Hydrofluorocarbon
HCFC	Hydro Chlorofluorocarbon
HFO	Hydrofluoroolefins
OEM	Original Equipment Manufacturer
ICAP	India Cooling Action plan
ISHRAE	Indian Society of Heating, Refrigerating and Air Conditioning Engineers
IEC	International Electro technical Commission
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
Montreal Protocol	International treaty to phase out ozone- depleting substances
Kigali Amendment	Amendment to the Montreal Protocol, Phase-down of HFCs
BIS	Bureau of Indian Standards
R-32	Low-GWP HFC refrigerant, popular eco- friendly choice
R – 290	Propane; natural refrigerant, very low GWP, flammable
R-410A	HFC blend, high GWP, being phased
R-600a	Isobutane; natural refrigerant, very low GWP, flammable
R-1234yf/ze	Hydrofluoroolefins (HFOs), ultra-low GWP

2.Topic of research: Cooperative model for fair income to farmers

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Abstract:

Agriculture continues to be the primary livelihood source for the majority of rural households in India; however, farmers struggle to secure fair income due to fluctuating prices, small landholdings, lack of credit, and limited access to markets. The cooperative model, which operates on the principles of collective ownership and mutual benefit, provides an effective institutional arrangement for improving farmers' income and reducing exploitation in agricultural markets. This study evaluates the impact of cooperative organizations on farmers' economic well-being using a comparative approach. Data were collected from a sample of 40 farmers—20 cooperative members and 20 non-members—to understand differences in income levels, access to resources, benefits experienced, and challenges faced.

The study finds that cooperative members earn significantly higher and more stable income due to collective bargaining, better market access, reduced dependency on intermediaries, and availability of credit and agricultural inputs at an affordable cost. The research highlights how cooperatives promote economic empowerment, social cohesion, and market participation of farmers. However, challenges such as inadequate management skills, limited digitalization, and infrastructural constraints persist in some cooperatives in the region. The study concludes that strengthening cooperative governance, technology integration, and capacity-building initiatives can significantly enhance cooperatives' contribution toward securing fair income for farmers.

Key Words

Cooperatives, Fair Income, Agricultural Markets, Farmer Producer Organizations, Collective Action, Rural Development, and Market Access.

Introduction

Agriculture plays a crucial role in India's social and economic landscape. Despite its importance, the agricultural sector faces significant issues, including price volatility, dependency on intermediaries, high input costs, and inadequate access to institutional credit. As a result, farmers often fail to earn a fair and predictable income. Small and marginal farmers, who account for nearly 86% of Indian farmers, are particularly vulnerable due to limited landholdings and low bargaining power.

The cooperative model has emerged as a powerful mechanism for addressing these challenges. Cooperatives enable farmers to work collectively in areas such as input procurement, processing, value addition, storage, and marketing. This collective effort helps reduce costs, increase efficiency, and secure better prices for the produce. Cooperatives also facilitate access to credit, technology, training, and modern farming methods.

India has witnessed successful cooperative ventures, such as Amul, IFFCO, and numerous Farmer Producer Organizations (FPOs). These models demonstrate how collective action can improve farmers' incomes and strengthen rural economies. This study aims to examine how effectively cooperatives contribute to achieving fair income for farmers and what measures can be taken to further

strengthen their functioning.

2. Review of Literature

Patel (2019) emphasized that agricultural cooperatives increase farmers' bargaining power by enabling bulk marketing, leading to higher price realization.

Sundaram (2018) studied dairy cooperatives and observed that they ensure stable income and reduce risks arising from market fluctuations in Tamil Nadu.

Kulkarni and Deshmukh (2021) highlighted that FPOs bridge the gap between farmers and markets, enabling the collective selling and procurement of inputs at a lower cost.

FAO (2020) reported that cooperatives globally help small farmers achieve economies of scale, reduce exploitation, and improve supply chain efficiency.

Verma (2020) found that Farmer Producer Companies are crucial for linking farmers to agri-business firms, improving transparency and price negotiations.

The existing literature supports the idea that cooperative structures play a vital role in enhancing farm income and reducing dependency on intermediaries.

3. Statement of the Problem

Farmers in India continue to face income instability due to fluctuating market prices, limited storage facilities, lack of credit, high input costs and exploitation by traders. Despite government intervention, fair income remains a persistent challenge. This study seeks to determine whether the cooperative model can serve as a sustainable solution for addressing income inequality and improving farmers' financial stability.

4. Objectives of the Study

1. To understand the role of cooperatives in supporting farmers' economic activities,
2. To assess the impact of cooperatives on farmers' income generation.
3. To analyze farmers' perceptions of cooperative membership.
4. To identify the challenges faced by cooperative organizations.
5. To provide recommendations for strengthening the cooperative model.

5. Need or Relevance of the Study

Ensuring a fair and stable income for farmers is crucial for inclusive rural development. Cooperatives offer an institutional mechanism through which farmers can overcome market-related challenges and improve their economic status. This study is relevant for policymakers, researchers, and cooperative institutions, as it provides insights into how cooperatives contribute to income enhancement and what improvements are required for their effective functioning.

6. Hypothesis

Null Hypothesis (H□): Cooperative organizations do not significantly improve farmers' income.

Alternative Hypothesis (H□): Cooperative organizations significantly improve farmers' income.

7. Research Methodology (Expanded Section)

This study follows a **descriptive and analytical research design** to analyze the role of cooperatives in improving farm income. Both primary and secondary data were used to enrich the research.

7.1 Research Design

This study adopts a comparative design by analyzing the differences between cooperative members and non-members. This helps to identify the actual economic benefits associated with cooperative membership.

7.2 Nature of Data

Primary data was collected directly from farmers through structured questionnaires and personal interviews.

Secondary data were sourced from journals, books, government reports, cooperative records, agricultural surveys, and academic articles.

7.3 Sampling Technique

A simple random sampling technique was used to select respondents, ensuring that every farmer had an equal chance of being included in the study sample. This method increased the reliability and neutrality of the findings.

7.4 Sample Size

A total of 40 farmers were selected.

20 cooperative members

20 non-members

This sample size was adequate for a descriptive study evaluating the differences in perception and income.

7.5 Research Tools & Instruments

A structured questionnaire was designed to collect data on the following:

* Monthly income
* Access to markets
* Perceived benefits
* Challenges faced
* Access to inputs and credit
* Satisfaction levels

Both open- and closed-ended questions were included.

7.6 Data Analysis Methods

Data were analyzed using the following:

* Percentage method
* Simple averages
* Comparative tables
* Qualitative interpretation
* Observational insights

This combination ensures clarity, accuracy, and a meaningful evaluation.

7.7 Study Area

The study was conducted in a typical village setting where both cooperative and non-cooperative farmers operate. This provides a realistic comparison of the economic conditions.

7.8 Scope of Study

This study focused on income, market access, benefits, and challenges. It does not include long-term financial modelling or macroeconomic factors, keeping the scope practical and relevant for the current study.

7.9 Limitations

* Small sample size
* Data limited to selected areas
* Responses may include personal bias
* External market conditions not fully assessed

Despite these limitations, this study provides reliable insights into the effectiveness of the cooperative model.

8. Analysis & Interpretation of Data

Table 1: Average Monthly Income Comparison

Group of Farmers	Averag
Cooperative members	13,200
Non members	7,900

Interpretation:

Cooperative members earn significantly higher incomes due to better market access and collective bargaining.

Table 2: Benefits Reported by Cooperative Members

Benefit	Agreement (%)
Fair pricing	80%
Reduced middlemen exploitation	77%
Affordable input access	70%
Access to credit	65%
Training and support	62%
Income stability	72%

Interpretation:

Most cooperative members recognize the financial and technical advantages of membership.

Table 3: Challenges Faced by Cooperatives

Challenge	Percentage
Lack of trained management	45%
Limited digital usage	40%
Poor infrastructure	35%
Low awareness	50%
Financial limitations	30%

Interpretation:

Management skills and awareness remain major challenges in reducing cooperative efficiency.

9. Findings

1. Cooperative members earn significantly higher income than non-members.
2. Cooperatives enable farmers to access better markets and negotiate fairer prices.
3. Farmers receive inputs, storage support, and credit facilities more easily through cooperatives.
4. Cooperatives strengthen farmers' confidence and reduce exploitation by middlemen.
5. Operational challenges persist owing to limited technical infrastructure and low literacy.
6. Training and awareness initiatives are essential for improving participation in the sport.
7. Cooperatives enhance economic stability, social unity and collective growth.

10. Conclusions

The cooperative model has proven to be a powerful and effective mechanism for achieving fair income for farmers in the study area. By providing access to markets, reducing the role of intermediaries, offering affordable inputs and credit, and promoting collective strength, cooperatives significantly improve farmers' livelihoods and economic stability. The study confirms the alternative hypothesis that cooperatives positively impact farmers' income. Strengthening governance, adopting digital tools, expanding infrastructure, and enhancing farmer awareness programs can further enhance cooperative performance and help achieve sustainable agricultural development.

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3.Study on Integration of Carbon Credits & ESG Reporting from Solar Investment in India

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Abstract:

This study examines the integration of Environmental, Social, and Governance (ESG) reporting with carbon credit mechanisms arising from corporate solar energy investments in India. This work studies the convergence between an Environmental, Social and Governance (ESG) reporting system and carbon credit instruments affected by corporate solar investment in India. With Indian corporates more and more adopting solar power to fulfil their sustainability agenda and regulatory mandates, a complex set of issues arise on how companies account for the correct reporting of deployment of renewable energy along with related benefits in terms of carbon credits in their ESG disclosures. The research is based on mixed-methods analysis of ESG reports from 100 environmentally sensitive top Indian companies in different sector to identify the present situation of emerging reporting practices, transparency and integration methodologies. Using content analysis and layers of international reporting systems such as GHG Protocol.

The study uncovers significant risks of double counting, where companies claim emission reductions in their carbon footprints while simultaneously selling the associated carbon credits to other entities. Analysis of secondary data from corporate sustainability reports, carbon market registries, and regulatory filings demonstrates inconsistent accounting practices and inadequate transparency regarding carbon credit transactions. The research proposes a comprehensive framework for integrated ESG reporting that clearly distinguishes between Scope 2 emission reductions from solar energy use and carbon credit generation as separate financial and environmental assets. Recommendations include adoption of market-based accounting methods consistent with international standards, mandatory disclosure of carbon credit ownership and disposition decisions, enhanced BRSR guidance specifically addressing renewable energy and carbon credit integration, and implementation of third-party assurance mechanisms to prevent greenwashing.

Keywords:

Carbon Credits, ESG reporting, Solar Energy, Corporate Solar investment, Sustainability disclosure, Renewable energy certificates

Introduction:

Companies in India are experiencing a gradual shift in their environmental accountability and sustainability disclosure. This gradual shift has come along with convergence of rapid expansion of corporate solar energy adoption, mandate of ESG – Environmental, social and governance framework and emergence of carbon credits market as a trading instrument/commodity. Understanding working of these variables is crucial for companies to enhance their economic value and environmental impact from their renewable energy investments.

Solar installations in Corporate India has increased considerably in past decade, mainly due to regulatory incentives and electricity cost. Several major corporations across all sectors including manufacturing, pharmaceutical and service sector have installed roof top systems, captive power plants and power purchase agreements of several gigawatts of solar capacity.

Business responsibility and sustainability framework was introduced in 2021 by Security and Exchange Board of India. After this, the voluntary practice was converted to mandatory accountability of environmental reporting. Further after the Energy Conservation Act of 2022, carbon markets were established in India. These carbon credits represent both environmental achievements and financial instruments to trade that can be retained for offsetting carbon emission or be sold for

economic value.

This research studies ongoing corporate practices, analyses relevant frameworks, identifies gaps in reporting standards and supports the integration of Carbon Credits & ESG Reporting from Solar Investment in India.

Review of Literature:

1. ESG Reporting and BRSR framework in India –

ESG reporting in India has gradually shifted from voluntary sustainability of few large companies to mandatory reporting by all the listed companies in past decade. Dhanda and Hartman (2021) among many others have come along from times of early voluntary guidelines to more structured Business Responsibility Report (BRR) introduced by Security and Exchange Board of India in 2012. As stated by them, they found that reporting has become standardized, quality and depth of disclosure changes from company to company with many companies treating it as a compliance disclosure rather than strategic communication tool.

Advent of Business Responsibility and Sustainability Reporting (BRSR) framework in 2021 marks an important step forward. Majumdar and Sahu (2022) analyzed the BRSR framework and compared it with other international standards like Global Reporting Initiative (GRI) and Task Force on Climate-related Financial Disclosures (TCFD). Here is what they noticed, BRSR demands more quantitative disclosures than BRR (previous standard). This was notice specifically on environmental parameters which include greenhouse gases, energy consumption and renewable energy adoption.

2. Solar energy adoption in corporate India-

Mani and Dhingra (2020) studied the factors that influenced company's decision to invest in solar energy were reducing electricity cost and image enhancement.

Goel and Sharma (2021) did analysis of business models for corporate solar adoption which included rooftop installations, open access power purchase agreements, and captive power plants. It was found that different models imply different financial accounting and emission reduction claims.

Kumar and Singh (2022) documented about the economic performance of corporate investments in solar energy. It was found that with existing technological advancement and policy support solar investment by company's typically achieve payback period of 4-6 years and internal rates of return of about 15% making it economically attractive.

3. ESG Reporting and carbon credits integration-

Literature addressing how carbon credits should be reported in ESG disclosures is limited but growing. Downie and Stubbs (2013) studied the disclosures by companies of carbon offset activities in Australia and found inconsistency in the way offsets were reported, with many companies' providing insufficient disclosure to stakeholders to examine quality and additionality of offsets. They called for mandatory disclosure standards for carbon offsetting.

Statement of Problem:

Despite there being an increase in adoption of solar energy by companies in India and growing stringency of ESG reporting requirements, there exists a confusion and inconsistency in how companies report intersection of carbon credit generation, emission reduction claims and renewable energy investments like solar energy. This also undermines the transparency and credibility of company's disclosures regarding sustainability.

The main issue lies in ambiguity of carbon accounting when companies generate and trade carbon credits from solar installations. Scope 2 emission is reduced when companies reduce grid electricity consumption by installation of solar energy. However if these companies generate and sell carbon credits, should the selling company continue claiming these carbon reductions in their own ESG reports while simultaneously monetizing it. It potentially leads to double counting and no net reduction in carbon emission.

Secondly, there are unclear guidelines on how solar investments and carbon credits should be integrated under BSSR framework and ESG guidelines.

Third, there is insufficient disclosure on carbon credit transactions in India. Many

mention it but, provide minimal to no information about whether carbon credits are generated or sold, or method used in quantification.

Objectives of study:

Primary objectives of research are-

1. To analyse existing practices in reporting solar energy investments and associated carbon credits within their ESG disclosure, identifying common practices and gaps in transparency.
2. To evaluate existing ESG framework, specifically BRSR and complexities of solar investments and carbon credit generation.
3. To examine accounting treatment of carbon credits, particularly of selling companies to check for double counting.
4. To develop a comprehensive framework on how Indian companies can transparently report integration of solar energy and ESG reporting.

Need and Relevance of Study:

This research addresses an important gap in sustainability practices of companies at a time when accurate environmental reporting has become important. Relevance of this study extends across the stakeholder group and academicians understanding the practical improvement of sustainability practices in corporate India.

For investors and financial institutions this study provides with essential information which aids in evaluation of ESG reporting by companies These days investors integrate ESG metrics into analysis, using sustainability performance to assess risk, identify opportunities and engage with companies of financial issue. However inconsistent reporting about renewable energy and carbon credits posses a challenge to investors to compare different companies on these metrics. This study will help investors and financial institutions understand what to look for in ESG reports, what questions to ask companies and how to interpret carbon credit transactions.

For regulators and policy makers, this study provides evidence-based insight into whether ESG reporting framework covers the complexities of carbon markets. As Security and Exchange Board of India continues to evolve BRSR and as bureau of energy efficiency develops in India's carbon markets.

For auditors and assurance providers, this study can aid in verifying corporate reporting regarding their carbon credits and solar energy in their ESG reports. Auditors need clear framework for evaluating accuracy of company's reports and claims as stakeholders demand for assured information

From an academic perspective, this study adds into literature on sustainability, accounting practices, carbon credits and emissions by studying an under-researched issue at intersection of carbon credits, solar energy and ESG disclosures. This would also provide academicians with empirical data on common practices followed in corporate India.

Hypothesis:

Companies that are generating and selling their carbon credits from solar installations do not adjust their scope 2 emissions to account for transfer of emission reduction ownership leading to double counting

Research Methodology:

1. Research design –

This research study uses a mixed approach combining quantitative and qualitative evaluation of existing frameworks and practices. This study type is descriptive research and analytical aiming to understand current practices and identifying gaps.

2. Data Collection-

Secondary data

This research study relies on secondary data collected from: -

a) Corporate ESG and sustainability (internet) – BRSR reports, annual sustainability reports and integrated reports from sampled companies for financial year 2022-23 and 2023-24.

b) Regulatory documents- SEBI circulars and BRSR guidance documents, Energy Conservation Amendment Act 2022 and related notifications, carbon market regulations from the Bureau of Energy Efficiency

c) Carbon market data- Information from voluntary carbon standard registries (Verra, Gold Standard), CDM project database, and published carbon credit price indices.

d) Industry Reports- Reports from

consulting firms on corporate renewable energy adoption, ESG reporting trends, and carbon market developments in India.

e) International Framework Documents- GHG Protocol Corporate Standard and Scope 2 Guidance, Global Reporting Initiative Standards, TCFD recommendations, and Science Based Targets initiative guidance.

3. Sample selection –

A sample pf 100 reports from financial year 2022-23 and 2023-24 were studied based on following criteria-

- Listed on NSE/BSE
- Subject to BRSR requirements
- Evidence of solar energy adoption based on public disclosures
- Availability of at least 1-year BRSR report

Analysis and Interpretation:

The analysis covers 100 companies across 8 sectors-

Sector	No. of Companies	Companies with Solar	Avg. Solar Capacity (MW)
Information Technology	15	15 (100%)	12.4
Manufacturing	20	18 (90%)	8.7
Automotive	10	10 (100%)	15.3
Pharmaceuticals	10	9 (90%)	6.8
Energy & Utilities	15	15 (100%)	45.2
Cement & Building Materials	10	10 (100%)	22.6
Financial Services	10	7 (70%)	3.4
Others	10	9 (90%)	7.9
Total	**100**	**93 (93%)**	**15.3**

Around 93% companies have adopted solar energy with varying capacity.

Key findings-

Disclosure practices

- 87/93 companies report their renewable energy consumption to BRSR reports
- Only 41 companies provide disaggregated data showing solar investment separately
- 38 companies specify whether installations are owned, leased, or accessed through PPAs
- 26 companies (28.0%) provide geographic distribution of solar installations
- 21 companies (22.6%) disclose financial information about solar investments (capital expenditure, savings achieved)

Interpretation – While most of companies are disclosing their renewable energy consumption, level of details provided vary. IT sector and energy sector companies provide more comprehensive disclosure implying greater stakeholder scrutiny.

Emission reporting and carbon accounting methods-

Paramtere	No of companies	Percentage
Report Scope 1 & 2 emissions	89	95.7
Report Scope 3 emission	54	58.1
Explain methodology used	67	72
Report both location- based and market -based Scope 2	22	23.7
Clearly state which method used for Scope 2	51	54.8
Provide year-on-year comparison	76	81.7
Have third-party verification	44	47.3

Key findings-

- Only 23.7% of companies report producing both location-based and market-based Scope 2 emissions, a recommended practice from the GHG Protocol (GHG Protocol, though). This is problematic because:
- Where available, location-based approach offender average grid emission factors and do not account for an individual company s renewable energy procurement activity
- Market-based approach relies upon emission factors from contractual agreements (PPAs, RECs) and can indicate the value in procuring renewable energy
- Without both, stakeholders can't really know the company's real energy consumption from renewables it purchased versus what was actually used.
- Of 22 companies that provide both sources, those that produce the SF6 canisters), one location and production-based estimates is a factor of three.

Interpretation: The low uptake of dual reporting indicates that many companies either do not grasp the GHG Protocol Scope 2 Guidance or are opting not to apply it due to complexity. This also leads to comparability problems in the sense that some companies could be considered to have less emissions only

because of the decision on how to account emissions not as a result of actual differences in performances.

Carbon Credit Disclosure Analysis

Disclosure Level	Number of Companies	Percentage
No mention of carbon credits	74	79.6
Generic mention without details	8	8.6
Mention with some details	7	7.5
Comprehensive disclosure	4	4.3
Total	93	100

Key Findings: Only 19 out of 93 companies (20.4%) with solar installations mention carbon credits in any way. Of these 19 companies: 4 companies (4.3%) provide detailed information, including the amount generated, the method used, whether the credits were sold or retired, and their financial value. 7 companies (7.5%) offer partial information such as the amount generated but lack details on how they handled it or their methods. 8 companies (8.6%) make only vague statements like "exploring carbon credit opportunities" or "participating in carbon markets" without specific details. Among the 11 companies that give at least some quantitative information: 7 companies report that they generate carbon credits from solar or other renewable sources.

Double counting risk assessment

Category	Number of Companies
Companies clearly selling credits AND claiming emission reduction	6
Companies retiring credits to maintain emission reduction claims	2
Companies with unclear treatment	3

information for evaluation, 6 (54.5%) seem to potentially double count by:

If they are reporting small Scope 2 emissions (claiming or implying they are low)

At the same time, they also reveal that they make and sell carbon credits from their renewable energy projects.

Conclusions: This research examined the integration of ESG reporting and carbon credits from corporate solar investments in India, revealing significant gaps in current practice. While corporate solar adoption is widespread at 93% among sampled large companies, only 20% provide any meaningful disclosure about carbon credit generation and trading activities. This massive transparency gap undermines stakeholder ability to accurately assess corporate environmental performance.

The analysis identified a critical double counting issue where companies claim emission reductions in their carbon footprints while simultaneously selling the associated carbon credits to other entities. This practice, observed in 54.5% of companies providing sufficient information for assessment, represents a fundamental integrity problem that misleads investors and stakeholders about actual environmental impact.

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4. The Influence of Social Media on Consumers Attitude Towards Sustainability

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Abstract

Social media has emerged as a powerful force influencing how consumer think, behave and develop attitude towards sustainability. In today's digital environment platforms like Instagram, You-tube, X and Snapchat etc. not only promote trends but also shape consumer beliefs about eco-friendly practices, green product and responsible consumption. This research paper explores how social media impacts consumer trust, attitudes and purchasing intentions regarding sustainability. It examines the role of influencers, online review and brand communication in strengthening or weakening sustainable behaviour. The study also highlights challenges such as misinformation, fake information, unrealistic expectations and emotional manipulation that push consumers towards impulsive and environmentally harmful choice. The research paper is written using a mixed-method approach, which include an online survey of 121 respondents, different case studies and secondary data analysis from research paper. The findings shows that while social media raises awareness and encourages sustainable thinking, it simultaneously promotes overconsumption, confusion and low trust. The research aims to bridge theoretical perspectives with real consumer experience to better understand the dual impact of social media on sustainability.

Keywords

Social Media, Sustainability, Consumer Behavior, Influencers Marketing, Greenwashing, Misinformation, Sustainable Consumption, Digital Trust etc.

Introduction

Social media has changed the way consumer learn, engage and make decisions. What once served as a space for communication has now grown into a powerful eco-system that influence public opinion, shapes consumer identity and guides purchase behavior. Platform like Instagram, You-tube and Tik-Tok create fast moving trends and strong social proof that can motivate individuals to support sustainable brands and at the same time encourages excessive buying driven by emotions and impulses . Understanding this dual impact is essential for sustainability studies.

The theoretical foundation of this topic draws from concepts like Social influence theory, Social proof , planned behaviour and emotional contagion all of which explains how digital interaction affect attitude towards sustainability. Social media algorithm exposes individuals to posts that reinforce their beliefs, aspiration, Fear and insecurities. As a result, consumers often align their choices with influence, online reviews and brands messaging rather than personal values. The dynamic strongly affects how people evaluate sustainability claims green product.

To frame the study clearly, this research paper considers four guiding questions:

1. Does Social media shapes views on sustainable brands?
2. Can influencers drive real sustainable purchase?
3. How do fake trends and influencers affects buying?
4. How do misinformation and cancel culture damage trust?

Social media strongly shapes how consumers view sustainable brands by constantly exposing them to eco-friendly messaging, green product reviews, and influencer endorsements. When influencers genuinely support sustainable practices, share personal experiences, or explain the

environmental impact of certain products, they can successfully drive real sustainable purchases especially among younger audiences who trust relatable online personality's more than traditional advertising.

However, the rise of fake trends, paid promotions, and non-transparent influencer marketing often creates confusion and encourages impulsive buying of products that are not truly sustainable. At the same time, misinformation and cancel culture spread quickly on platforms, damaging trust by exaggerating controversies, misrepresenting brand intentions, or circulating unverified claims. Together, these factors shape consumer attitudes by creating both opportunities for authentic sustainability awareness and risks of distrust, emotional manipulation, and misleading consumption patterns.

Review of Literature-

The significant role of social media is influencing consumer attitudes, particularly in the context of sustainability. Studies indicate that platforms act as both educational tools and persuasive environments where consumers develop perceptions about green products, ethical brands, and environmental responsibility. Researchers note that while social media increases awareness about sustainability, it simultaneously encourages excessive consumption through trends, influencer culture, and emotional marketing.

Academic works emphasise that modern consumers especially youth experience a conflict between sustainable intentions and actual behaviour. This gap emerges due to misleading advertisements, exaggerated influencer endorsements, and viral trends that prioritise novelty over environmental responsibility. Here, literature review also points out that brands use sustainability not only as an ethical practice but also as a strategic marketing tool, which often results in "greenwashing" where sustainability claims are overstated or unclear.

Studies further show that, influencers and celebrities greatly impact decision-making in a country where digital engagement is high. Emotional messages, aspirational content, and lifestyle-driven narratives create strong impressions on young consumers who tend to replicate online behaviour. At the same time, fake reviews, misinformation, and algorithm-driven content reduce trust and create confusion around sustainability. Overall, academic evidence suggests that social media acts as a double-edged sword promoting eco-awareness while simultaneously deepening impulsive and environmentally harmful consumption patterns.

Case Study 1: Shell Petroleum – Oil Spills in Nigeria

Shell is an oil company that has operated in Nigeria's Niger Delta region since the 1950s. During this time, the company spilled over 13 million barrels of oil, severely damaging the environment. This pollution affected approximately 500,000 local people called the Ogoni. The oil spills poisoned their drinking water with benzene levels 900 times higher than safe limits, destroyed farmland and fishing areas, and caused serious health problems including cancer and respiratory diseases. In 1995, a local activist named Ken Saro-Wiwa led a movement called MOSOP to demand that Shell take responsibility for the damage. The Nigerian government responded by executing Ken Saro-Wiwa and eight other activists, as it was an event that shocked the world and triggered global activism. Even though Shell stopped operations in 1993, social media campaigns and international organizations like Amnesty International continued exposing the problem through documentary evidence and online awareness campaigns. In 2023, a Dutch court finally ordered Shell to pay €15 million in compensation to affected communities. In 2025, Shell still faces a full trial in UK courts scheduled for 2027. This case demonstrates that social media activism can hold large companies accountable for environmental damage across decades.

Case Study 2: Starbucks – False Recycling Claims

Starbucks is the world's second-largest coffee chain with over 35,000 stores globally. The company claimed its cups were "100% recyclable" to show environmental responsibility. However, this claim was misleading. Starbucks serves over 4 billion cups annually, and most of have plastic linings that

cannot be recycled in normal recycling bins. When customers recycled these cups, they ended up in landfills or incinerators instead. Starbucks also failed its own environmental promises. In 2008, it promised to create fully recyclable cups but never did. In 2015, it pledged to sell 25% of drinks in reusable cups but achieved only 1.4%. When environmental researchers shared this truth on social media platforms like Twitter and Instagram, consumers became outraged and called out the company for "greenwashing" and lying about being environmentally friendly. In 2024-2025, legal complaints accused Starbucks of misleading customers about ethically sourced coffee despite evidence of labour abuses. This case clearly demonstrates the gap between corporate claims and actual environmental action.

Case Study 3: Coca-cola – Plastic Pollution Leader

Coca-Cola is the world's largest beverage company, producing over 100 billion single-use plastic bottles annually across 200 countries. The company promised environmental protection through campaigns like "Get Every Bottle Back by 2030." However, the international organization Break Free From Plastic discovered something shocking: Coca-Cola was the #1 plastic polluter for six consecutive years (2018-2023). Volunteers from 41 countries examined 537,719 pieces of plastic waste and found more Coca-Cola branded plastic than the next two largest polluters combined. In 2023 alone, they found 33,820 pieces of Coca-Cola waste. Social media users expressed outrage through viral hashtags like #Break Free From Plastic and #Coke Accountability, with millions sharing images of polluted beaches and oceans. In May 2025, Coca-Cola scaled back its environmental goals which reduced recycled content targets from 50% to 35%-40% and extending deadlines from 2030 to 2035. This triggered another wave of social media backlash, proving that consumers won't forget broken promises.

Research Methodology-

This study adopts a descriptive and exploratory research design supported by a mixed-method approach. The descriptive aspect helps explain how social media influences consumer attitudes toward sustainability by capturing current behavioural patterns, trust levels, and perceptions. The exploratory component investigates emerging issues such as misinformation, privacy concerns, influencer reliability, emotional manipulation, and cancel culture, which directly affect views of sustainable brands. Primary data were collected through an online survey involving 121 respondents across different age groups. The survey included questions on daily social media usage, trust barriers, sustainability perceptions, and experiences with scams or misleading content. Secondary data were taken from academic journals, case studies, verified online sources, and published research papers to support and validate the findings. The methodology focuses on examining both behavioural aspects and psychological triggers that operate on platforms like Instagram, YouTube, Snapchat, and TikTok, which strongly influence youth and sustainability attitudes.

Statement of Problem-

In the digital era, social media has become one of the most influential forces shaping consumer attitudes toward sustainability, yet it presents several challenges that distort responsible decision-making. While platforms promote eco-friendly trends and sustainable lifestyles, they also spread misinformation, fake reviews, and manipulated content that confuse consumers about what is genuinely sustainable. Viral negative posts and emotionally charged narratives create a "domino effect," where a single misleading claim can harm a brand's sustainability reputation within hours. Influencers often promote products with exaggerated or unclear sustainability claims, contributing to green washing and unrealistic expectations that reduce consumer trust. Social media's constant exposure to comparisons, discounts, and trend cycles increases price sensitivity, pushing consumers away from long-term sustainable choices and toward cheap, fast, and disposable goods. Emotional marketing tactics such as FOMO, idealized lifestyle content, and urgency-based ads lead to impulsive buying, overshadowing thoughtful environmental

behaviour. Cancel culture further complicates this landscape by amplifying unverified accusations about a brand's ethics or cultural stance, often without providing factual clarity. These interconnected issues create a complex and unstable digital environment where consumers struggle to differentiate authentic sustainability efforts from misleading marketing, ultimately weakening their confidence, altering attitudes, and hindering genuine sustainable consumption.

Research Gap-

Existing literature highlights social media's growing role in shaping consumer behaviour, but it fails to deeply examine its influence on consumers' attitudes toward sustainability, especially within a digital environment dominated by green washing, misleading eco-claims, and influencer-driven narratives. Research rarely studies how manipulated sustainability messages distort awareness, create unrealistic expectations, and weaken genuine sustainable choices. Moreover, the critical gap remains unexplored, basically about the social media controversies involving Shell, Starbucks, and Coca-Cola which reshape trust and trigger the intention--behaviour gap. This study addresses this major gap by analysing real consumer perceptions, revealing how social media both supports and disrupts sustainability understanding.

Need or Relevance of the Study:

Social media significantly shapes how individuals perceive sustainability and make purchase decisions. With continuous exposure to promotions, influencers, and targeted advertisements, consumers often develop trust in brands without verifying authenticity. Such patterns encourage emotional buying, unnecessary consumption, and poor financial and environmental choices.Fake reviews, paid partnerships, and exaggerated claims reduce clarity and make consumers unsure about real sustainable practices. The constant comparison culture triggers FOMO, leading people to buy low-quality or unnecessary products that contribute to waste and pollution. Understanding these influences is important because they reflect changing consumption habits in India, where digital growth is high and sustainability awareness is still developing. This research is relevant to brands, educators, and consumers aiming to build better transparency and responsible consumption.

Objectives of the Study-

- To examine how social media influences consumer attitudes toward sustainability by analysing the role of influencers, online reviews, digital trends, and brand communication in shaping perceptions of eco-friendly products and responsible consumption.
- To understand how misinformation, fake reviews, emotional marketing, and price-based promotions affect consumer trust and purchasing decisions, especially among youth who are highly active on platforms like Instagram and YouTube.
- To analyze whether social media encourages genuine sustainable behaviour or contributes to impulsive buying and confusion through misleading sustainability claims and greenwashing.
- To evaluate the psychological and behavioural factors such as FOMO, social proof, privacy concerns, and cancel culture that influence how consumers interpret sustainability messages online.
- To identify gaps between sustainable intention and actual behaviour and to provide insights that can help brands and policymakers promote transparent, ethical, and sustainability-driven digital practices.

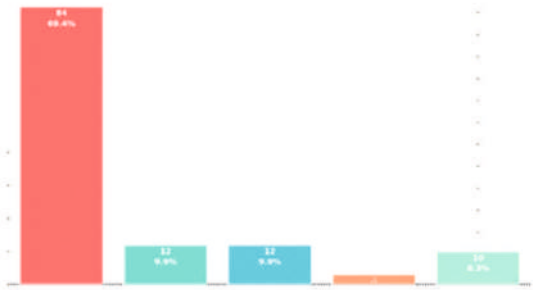
Analysis & Interpretation

This analysis examines survey data from 121 respondents to understand how social media platforms influence sustainable purchasing decisions.

Demographic Profile and Platform Usage

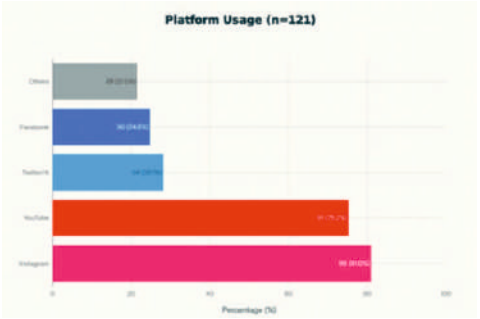
The findings reveal the complex relationship between high social media engagement, purchase behavior, and vulnerability to deceptive practices among predominantly Gen Z consumers. The survey sample shows a strong Gen Z concentration, with 84 respondents (69.4%) falling within the 15-20 years age group. This demographic represents the most digitally native generation, making their behaviors particularly relevant for understanding social media's impact on sustainable consumption patterns. The

expanded sample includes additional respondents from 21-25 years (12 respondents, 9.9%), 26-35 years (12 respondents, 9.9%), 45+ years (10 respondents, 8.3% and 36-45 years (3 respondents, 2.5%), providing better multi-generational perspective.



Platform Preferences and Content Consumption

Platform preferences reveal clear patterns in content consumption. Instagram and YouTube dominate usage at 81.0% and 75.2% respectively, while Twitter/X (28.1%) and Facebook (24.8%) trail significantly. This demonstrates a decisive shift toward visual and video-first content consumption, indicating that sustainability messaging must prioritize demonstrative video content and aesthetic product photography over traditional text-based communications.

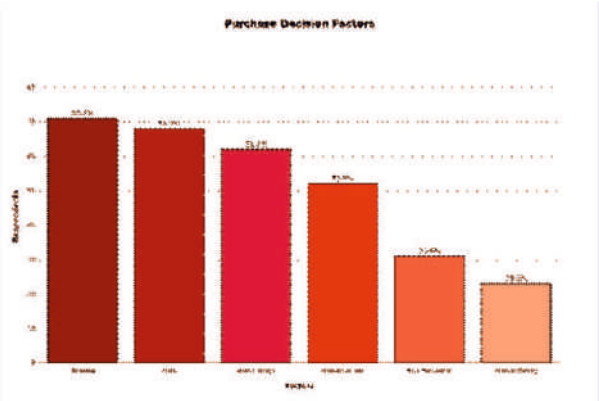


Key Insight: Instagram and YouTube remain virtually unchanged in dominance, confirming these visual and video-first platforms as essential channels for reaching environmentally conscious consumers with sustainability messaging. The slight YouTube decrease (4.6%) suggests platform diversification, but Instagram's stability (81.0%) indicates it remains the primary discovery channel for sustainable products

Purchase Behavior and Decision-Making Factors1.8% (99 respondents) reported purchasing products after social media exposure, demonstrating the platform's effectiveness as a sales channel. This rate remains consistent with the original 82.7% (86 of 121 respondents), confirming that social media's influence on purchasing decisions is robust and stable across the expanded sample. However, this high conversion rate also signals potential vulnerability to impulse decisions based on aesthetic appeal rather than comprehensive product verification.

Analysis of Purchase Decision Factors: Primary Drivers Identified

Analysis of purchase decision factors reveals that product reviews emerge as the primary influencer at 58.7% (71 respondents), followed closely by price considerations at 56.2% (68 respondents) and brand image at 51.2% (62 respondents). Influencer recommendations rank fourth at 43.0% (52 respondents), followed by eco-friendly packaging (25.6%) and friends/family recommendations (19.0%).



While consumers express interest in sustainability, actual purchases are driven predominantly by social proof (reviews 58.7%) and economic constraints (price 56.2%) rather than environmental considerations. The minimal 2.5 percentage point gap between reviews and price indicates that consumers rely equally on peer validation and affordability when making purchasing decisions

The Trust and Affordability Balance The emphasis on peer reviews (58.7%) reflects Gen Z's strong trust in user-generated validation over brand claims, as reviews provide authentic,

unfiltered feedback from actual customers. Simultaneously, the high importance of price (56.2%) indicates that economic rationality significantly influences sustainability purchasing, suggesting consumers are willing to support sustainable products only when priced competitively with conventional alternatives. This creates both opportunities and risks: opportunities for authentic marketing emphasizing verified product performance and genuine sustainability impact, but simultaneously enables manipulation through fake reviews and review inflation. The dominance of reviews and price as decision factors suggests that greenwashed products with aggressive pricing and positive reviews may capture market share despite lacking authentic sustainability credentials.

Trust Deficits and Consumer Vulnerability Scam and Misleading Content Experience

Approximately 73 respondents (60.3%) experienced scams or misleading content, compared to 69 respondents (66.3%) in the original sample. This slight improvement in the scam experience rate suggests either more cautious consumer behavior or improved platform fraud detection and seller accountability mechanisms within the expanded timeframe. However, the persistence of fraud affecting over 60% of consumers indicates substantial ongoing vulnerability.



This distribution reveals that consumer vulnerability centers on transactional accuracy rather than data security. The prevalence of quality mismatches between online presentations and delivered products suggests gaps in seller verification, product quality assurance, and platform accountability mechanisms. Effective interventions should therefore prioritize seller verification systems, transparent product specifications, and consumer education about identifying credible sellers and verifying sustainability claims before purchase.

Finding and Conclusion-

The study concludes that social media significantly influences consumer attitudes toward sustainability, shaping how individuals understand, evaluate, and purchase eco-friendly products. While platforms promote awareness and encourage responsible consumption, they also create challenges such as impulsive buying, fake reviews, misleading ads, and emotional manipulation that weaken sustainable behaviour. Survey findings show that young consumers, who dominate social media usage, are highly impacted by influencer culture, pricing strategies, and sustainability-related trends. The research highlights that transparency, credibility, and authenticity are essential for building sustainable trust. Case studies indicate that delayed responses, vague sustainability claims, and emotional marketing can damage brand reputation, whereas honest communication and quick engagement help rebuild consumer confidence. The high prevalence of scams and misleading posts also indicates that consumers require more digital literacy to assess sustainability claims.

From a sustainability perspective, the findings reveal that while social media increases knowledge, it does not always convert into responsible behaviour due to conflicting content, FOMO, and convenience-driven choices. Brands must avoid greenwashing, prioritise ethical communication, and adopt long-term strategies that genuinely promote sustainability. Consumers, on the other hand, must learn to differentiate between genuine and superficial sustainability claims.

Overall, social media is a strong but complicated medium. It has the potential to support sustainable development if used ethically and responsibly, but without regulation and awareness, it can easily contribute to the cycle of overconsumption and misinformation. Sustainable influence requires authenticity, transparency, and consistent engagement rather than trends or emotional persuasion.

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5. Integration of Sustainability in Investment Banking – Redefining Financial Decision-Making

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Abstract

The investment banking sector has witnessed tremendous transition from its conventional operating methods to a new sustainability inculcated approach. The study "Integration of Sustainability in Investment Banking – Redefining financial decision making" is descriptive research on one of the key areas of investment bank's playfield, Debt Capital Markets. The study performs a comparative analysis on 7 major investment banks, and their sustainable activities and highlights various metrics such as sustainable DCM volume for 2024, institutional progress towards public commitment, reporting culture and products and services offered. The study also compares the sustainable DCM volume to the banking fee charged through a ratio. The findings suggest that the industry has diligently adopted sustainability into its work ethics, and the institutions are making praiseworthy progress towards their commitment. Yet a few limitations persist as the reporting framework can mandate disclosure of more specific sustainability data for deeper and more accurate analysis.

Keywords: Sustainable financing, Investment Banking, Debt Capital Markets, Comparative Analysis

Introduction

Investment banks are the epicenter for

major financial transactions large in both volume and quantity. They are the financial institutions responsible for providing specialized services to corporations, governments, and institutional investors, primarily focused on raising capital, offering strategic and financial advisory, and facilitating complex financial transactions. Sustainability which refers to the practice of meeting present economic, social, and environmental needs without compromising the ability of future generations to meet their own needs.

The industry has witnessed a recent surge in the integration of sustainability and ESG criteria's due to increasing investor demand and changing global landscape. The cumulative volume of sustainable (green + social + sustainability + sustainability-linked) bonds reached USD 6 trillion by mid-2025, up from just USD 2 billion around 2010–2011 (Climate bonds, 2025). With increments in sustainable investment products, other activities such as improved screening and sustainability centric reporting has also picked up pace in the recent decade.

Various initiatives such as the intergovernmental Paris Agreement on Climate change, the development of UN Principles for Responsible Banking and many others have swayed the industry in a positive direction towards adoption of ESG criteria in everyday operations. It has become vital for banks to regularly disclose specifications related to their activities for ascertainment of ethical and sustainable alignment, ensuring refrain from greenwashing.

This study reviews major banks and performs an interorganizational comparative analysis of their sustainability centric activities as well as intraorganizational analysis to assess alignment and progress with respect to strategic sustainable goals or commitments.

Statement Of Problem

As the demand for sustainable actions rises, the commitments and goals of banks change to fit with the industry and investor expectations. The UN Sustainability Development Goals as a call for action, enforce investment banks and institutions to achieve certain targets with the deadline being 2030. The actions supporting the same are in progress as well as banks ESG integrations have gained substantial traction. The sustainability landscape has witnessed noticeable growth but at the same time a few gaps have come into light which call for addressal, some are as follows:

1. The data present online and on various sources is fragmented and lacks consolidation if any analysis needs to be performed.
2. In majority cases there is an absence of a progress tracker which helps assess the advancements made by banks towards their commitment.
3. The data available lacks side by side comparative analysis or interorganizational analysis.
4. An absence of sustainability proportion of total activity determining variable, withholds assessment of sustainability ratio with respect to all activities.
5. Lack of spotlight case studies where banks holistic sustainability alignment is checked through deep analysis.

Review of Literature

The study puts into limelight the various initiatives under way in the private financial sector in order to incorporate sustainability into its decision-making process and ultimately strive towards achieving a balance sheet with a smaller carbon footprint, and devise sustainability centric business strategies. The study particularly puts into perspective the various new suppliers and services in the market, the creation of sustainability linked financial instruments, the adaptation of financial risk management policies, and technological progress with respect to climate change. The study states that although many of these initiatives are in their introductory stage with limited usage, the momentum noticed in their increasing integration shows that in the coming years they are very likely to be followed and embedded as mainstream.

(Andrés Alonso and José Manuel Marqués, 2019)

The study is an analytical account of the sustainability landscape in investment banks situated in Saudi Arabia, a developing country with a hydrocarbon-based economy. It involves a qualitative approach, and findings reflect that

even though ESG awareness is high, the reporting is irregular, and application is mostly focused on compliance. The study suggests some measures to incorporate sustainability in an executable way.

(Azra Ali, 2025)

The study lays emphasis on the integration of sustainability in banking as a whole and how it is a very helpful for high productivity, effective management of interest rate fluctuations, controlled non-performing assets, cost reduction, better customer satisfaction, and risk control. The study highlights how this is a new concept for Indian banking institutions, because of which even after adopting sustainability they are lagging. It underscores the need for implementing sustainability into banking on a regular basis and explores the challenges faced while performing the same.

(Dr. Urmila Bharti, 2024)

The research investigates how Environmental, Social and Governance (ESG) sustainability and behavioral biases affect sustainable investment decision making. The study explores various factors such as the confirmation bias, endowment effect, hindsight bias and bandwagon effect along with ESG factors and their effect on sustainable decision making. The research reveals that ESG criteria significantly impacts investor decision making such that securities and products reflecting or concerned with environmental, social and ethical responsibility appeal to investors. **(Anshita Bihari, Manoranjan Dash, Kamalakanta Muduli, Anil Kumar, Sunil Luthra, Arvind Upadhyay, 2025)**

The study explores the various reasons why sustainability reporting plays a significant role in investment decision making. The main purpose of the study was to utilize the BAO theory test for investment decision making in potential young investors using a quasi-experimental approach. The above study produced the following results, benefit expected by investor has positive impact on willingness to read sustainability report, confirmed benefit has positive impact on user satisfaction, and there is a difference between decision taken before and after reading sustainability reporting. **(Sumiyati and Suhaidar, 2020)**

This research was aimed to ascertain various sustainable banking practices in the global and domestic landscape. The study also explores various indicators available to assess the performance of sustainable banking, CSR performance of banks and the sustainable banking performance framework. The study reveals the lack of sustainable banking performance framework in India and the absence of guidelines and principles to be provided by regulators such as Indian government, Reserve bank of India, etc. **(Deepika Saxena, Neelam Dhall, Rashika Malik, 2021)**

The study addresses how investment banks have adopted and embraced sustainability, yet they have done very little to inculcate sustainability into activities and have rather just showcased participation due to increasing investor demand. The study contributes using two proposals, firstly the study of points that hinder and the ones that promote sustainability in investment banking, and secondly the way these institutions integrate sustainability into their underwriting services. Their results suggest that investment banks do not shy away from underwriting companies that have been flagged for major environmental, social, and governance misconduct, neither do they refrain from underwriting companies providing contentious products, such as tobacco, coal, and nuclear weapons. **(Michael A. Urban and Dariusz Wójcik, 2019)**

The research paper aims to examine various sustainable banking practices, that includes sustainable lending, green finance, responsible banking it also examines the contribution each of these have towards sustainability development and financial stability and assess their effectiveness. The study reflects that there is evidence suggesting a positive correlation between sustainable banking practices and financial performance metrics such as profitability, return on assets, and stock performance. **(Shruti Sharma, Chandan Gupta, Rupa Khanna Malhotra, Himani Upreti, 2024)**

Objectives of the study

After scrutinizing the above-mentioned

gaps in the data this study aims to contribute in filling these gaps by fulfilling the below mentioned objectives through collection of secondary data available on credible sources such bank's Annual and Sustainability reports as well as information and announcements available on the bank's official website.

1. To analyze and compare sustainable finance volumes, integration practices, and ESG mechanisms across major investment banks in Debt Capital Markets and Mergers & Acquisitions.
2. To assess institutional progress toward sustainability commitments through cumulative funds raised and target quantity ratio.
3. To evaluate the materiality and scale of sustainable finance activities by analyzing their proportion relative to banks' total operations.

This research aims to fill the earlier mentioned gaps and problems by contributing towards providing consolidated data for analysis, assess progress metric, determining the strategies or methods used by each bank and ascertaining the meaningfulness of sustainability activity with respect to the bank's coherent operations.

Need or Relevance of the Study

With many gaps in the sustainability integration in investment banking landscape, such as fragmented data and lack of corpus with coherent information regarding holistic view of sustainability position. This study can be used to assess various metrics that help one get a holistic perspective of the sustainability activities of the bank, determining the institutional progress towards sustainability and the materiality of sustainable activities with respect to the bank's operations.

Research Methodology

Introduction:

The study, Integration of Sustainability in Investment Banking – Redefining Financial Decision Making, is an analytical investigation of the sustainability data of major investment banks, assessed from their Annual Reports, Sustainability Reports and official website announcements. The study focuses on the comparative evaluation of various banks sustainability position and performance in terms of sustainable debt capital market volume, cumulative sustainability centric funds raised since 2020 and the institutional progress with respect to public commitment.

Types of Data:

For this research, secondary data was utilized, which includes that data which is collected from some earlier research work or source other than firsthand data and is applicable or usable in the study the researcher has presently undertaken.

Secondary Data - The secondary data used here was primarily adopted from the below mentioned sources:

- Annual Report of Respective Bank
- Sustainability Report of Respective Bank
- Official Website of Respective Bank

Research Design Type:

A descriptive research design is used to present an accurate profile of situations, events, or phenomena by describing existing conditions based on factual data. The study adopts a descriptive research design, as it focuses on analyzing and interpreting the existing sustainability related data of major banks reflected in their annual and sustainability reports.

Sample Technique Method:

The study uses a **purposive sampling technique,** where the sustainability centric data of various banks was collected deliberately from their sustainability and annual reports to analyze its sustainability position, institutional progress and sustainability activity materiality.

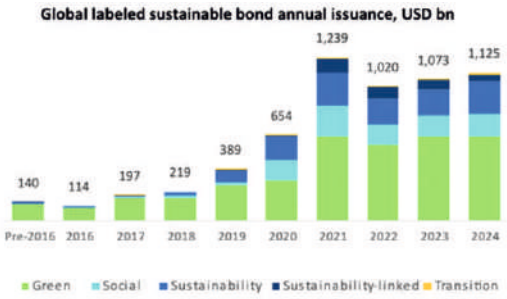
Data Analysis and Interpretation

The sustainability adaptation in investment banking experienced a drastic change in the recent years, due to various guidelines and principles such as the UN Sustainable Development Goals and the Principles for Responsible Banking. This heavily impacted the way investment banks carry out their core activities i.e. Debt Capital Markets Activities, Equity Capital Market Activities, Mergers & Acquisitions and Sales and Trading. In this research we will delve into the Debt Capital Market sustainable activities of 7 major banks and gauge their sustainability position.

Debt Capital Markets (DCM) –

Investment banks play a major role in debt capital markets, they help underwrite, structure and issue debt securities for their clients in order to help them raise capital for projects, innovations, transitions, etc. The process includes initial client engagement, transaction structuring, pricing, marketing to investors (syndication), and sometimes post-issuance support.

The following chart shows growth observed in the DCM bonds sector regarding the rise of sustainable bonds since pre-2016 till 2024. This makes acknowledging and analyzing sustainability integration practices and activities undergoing within investment banks crucial.



Source: World Bank Market Update Report based on data from Bloomberg Terminal (2025)

The following table represents data collected from 7 major investment banks, allowing comparative analysis for assessing the sustainability position of the banks.

Table No. 1: 7 Major Banks Debt Capital Market Sustainability Centric Data

Sr. No.	Bank Name	Sustainable Bonds and DCM Volume (2024)	Public commitment	Target Year	Cumulative funds mobilized since 2020	Cumulative Progress Percentage	Reporting Transparency	Sustainable DCM products and services offered
1	JP Morgan Chase	$68 Billion	$2.5 Trillion for sustainable development	2030	$675 billion	27.00%	Regular sustainability / SDT reporting	ESG-advisory + capital -markets (debt) access, Issuance of green, social & sustainability bonds
2	Bank of America	$44,007 Million	$1.5 Trillion sustainability finance goal	2030	$741 billion	49%	Annual sustainability / ESG report + dedicated sustainable -finance pages (regular updates)	ESG-themed Issuance Framework covering green, social, and sustainability bonds, ESG advisory & capital-raising
3	Citi Group	$45.7 Billion	$1 trillion sustainable finance	2030	$555.8 billion	55.58%	Comprehensive Global Sustainability Report (annual) and climate report	Sustainable Debt Securities: green and social bonds, Structured green bond, Impact / allocation reporting for its sustainable issuances.
4	HSBC	$84.7 Billion	---- ---- ----	2030	$447.7 billion	44.77%	Strong reporting hub (ESG reporting centre) with frequent updates and PDFs (annual + updates).	Green Financing Framework: issues green bonds, SDG / sustainability bond issuance
5	ICICI Bank India	----	Become carbon neutral	2032	No DCM target	No DCM target	Annual board certified ESG reports	Sustainable financing framework covering green and social loans.
6	Barclays	$94.4 Billion	Facilitate $1 Trillion in sustainable and transition financing	2030	$220.2 billion	22.02%	Annual Sustainability Reporting	Underwrite ESG -themed bonds, provide sustainability -finance advisory
7	Deutsche Bank	€93 Billion	Facilitate €900 billion in sustainable and transition finance	2030	€373 billion	41.44%	Publishes sustainability reporting and framework PDFs with frequent updates	Sustainable Instruments Framework: includes green & social financing, Annual reporting on allocation + impact of sustainable debt

Source: Respective Bank's Sustainability Report, Respective Bank's Annual Report, Respective Bank's Official Website

Interpretation

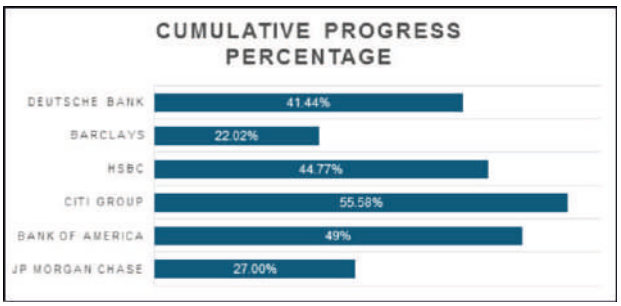
1. A majority of the banks have raised huge sustainable bonds and DCM volume in the year 2024, with about 70% of them surpassing $50 Billion.
2. Most of the banks under the analysis have set a strategic sustainable target and made a public commitment to facilitate a certain amount of funds until the year 2030 for contributing towards sustainable financing and investments.
3. The data shows cumulative funds raised since the target was publicly announced in 2020, and the following institutional progress was observed:

Table No. 2:

Bank Name	Cumulative Progress Percentage
JP Morgan Chase	27.00%
Bank of America	49%
Citi Group	55.58%
HSBC	44.77%
Barclays	22.02%
Deutsche Bank	41.44%

Source: Table no. 1

Graph No. 1:



Source: Table no. 2

4. The data shows that the banks follow generalized guidelines and principles for regular sustainability reporting.
5. It was observed during data collection that a lot of banks have not provided detailed and specific sustainable data such as the sustainability activity fee changed, etc.
6. The data specifies the various products and services that these banks under study offer, which fall under the sustainable criteria. Most popular being green, social and sustainability bonds and ESG advisory services for debt capital market securities issuance.

Inference

The above collected data's analysis and interpretations showcase that due to the UN Sustainability Development Goals and many other initiatives the banks have set sustainability targets they plan on achieving until 2030. The increasing investor and government scrutiny towards sustainable activity of banks, has resulted in the frequent and generalized reporting of sustainability centric data. Although transparency is observed, some of the important factors such as the sustainability activity fee, etc. are not disclosed by the bank, which withholds the ascertainment of the profits and revenue of the bank with respect to its sustainability activity.

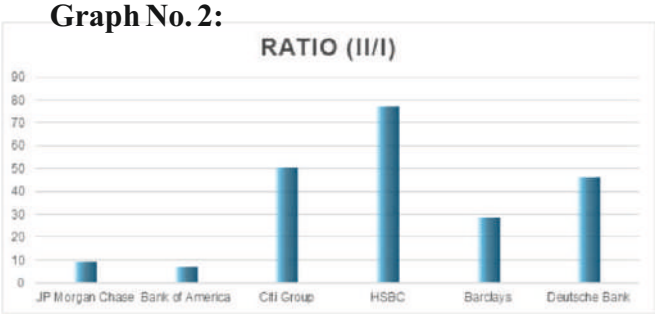
The following table represents the ratio of investment banking fee charged by the bank (2024) and the sustainability bonds and DCM volume (2024) to help assess the materiality and meaningfulness of sustainable DCM acts performed by the banks by comparing it to the total investment banking fee.

Table No. 3:

Sr. No.	Bank Name	Investment Banking Fees (2024) (i)	Sustainable Bonds and DCM Volume (2024) (ii)	Ratio (ii/i)
1	JP Morgan Chase	$7.29 billion	$68 Billion	9.32
2	Bank of America	$6.2 billion	$44,007 Million	7.09
3	Citi Group	$903 million	$45.7 Billion	50.6
4	HSBC	$1.1 billion	$84.7 Billion	77
5	ICICI Bank India	₹972.55 billion (income from non-interest sources)	**₹193.66 Billion**	0.19
6	Barclays	$3.29 billion	$94.4 Billion	28.69
7	Deutsche Bank	€2 billion	€93 Billion	46.5

Source: Respective Bank's Annual Report, **Table No.1**

Graph No. 2:



Interpretation

The above data can be interpreted in the following way: "Ratio" times the "(i) investment banking fee" of the respective bank amounts to "(ii) the sustainable bonds and DCM volume" for the year 2024.

1. About 57% of the banks i.e. 4/7 have a good ratio well above 10. This shows that the contributions they have made towards sustainability are significant when compared to their DCM fee charged.
2. JP Morgan Chase and Bank of America have a ratio close to 10 which also puts them in a good position.
3. ICICI Bank shows a considerably low ratio, due to lack of specific data on their DCM fee and the ratio being calculated from the income from non-interest sources.

Inference

The above data shows that a lot of banks are making substantial difference with their sustainable activity. Although the specific fee from sustainable DCM activities is unavailable, we can see that the sustainability focus has increased, credit to the increased investor awareness, demand for transition and the policies formulated with respect to ESG criteria.

Findings

The following findings present an analysis of 7 major investment banks, their sustainable DCM volume, ESG centric public commitment, institutional progress towards strategic sustainability target, ESG methodologies and reporting transparency. The study examines the institutions sustainability position and measure of sustainability practices relative to the total investment banking DCM fee and the findings aim to highlight efficiencies, limitations, ESG integration areas, and progress.

1. The banks under study have generated substantial DCM volume for the year 2024, which shows they are diligently working towards achieving their sustainability targets, and the availability of the data displays transparent reporting compliance.
2. The banks under study have all incorporated strategic sustainability targets and have publicly committed to achieve the targets until 2030, this shows that various initiatives such as the UN Sustainable Development Goals (which when adopted by an institution enforces it to achieve 17 sustainable development goals by the year 2030), are a crucial contribution and causal entity for sustainability integration in investment banking.
3. The cumulative funds mobilized, and the progress percentage help gauge the reconciliation of activities with the target set, most of the banks are near halfway or above, towards achieving their target. This shows the bank's commitment and helps improve investor trust.
4. Through analysis it was uncovered that the banks in question follow regular sustainability reporting protocol and use generalized methods and principles for reporting the data. This shows alignment with the United Nations Principles for Responsible Banking and helps external parties assess the institutions sustainability foothold.
5. The data showcases that the investment banking fee and DCM volume ratio for most banks in the year 2024 has been above or around 10. This signifies that the banks have performed conscientious work towards sustainable development in finance.
6. The data provided by the banks has proved to be sufficient for most of the extent of the analysis, although some specific data such as the specific sustainability activity fee and the total amount of funds raised other than sustainable centric ones, for sustainable bonds proportion ascertainment happens to remain unjustified.

The analysis indicates that investment banks have stepped up and responsibly undertaken the act of sustainability integration. They are seen diligently reporting, activities to maintain transparency. Some criteria and metrics yet need disclosure for completely assessing the sustainability culture within the investment banks. The banks are seen making fast progress towards their sustainability target. This shows awakened maturity of institutions towards ESG integration, ethical functioning and mindful profit maximization.

Conclusion

The research Integration of Sustainability in Investment Banking –

Redefining Financial Decision Making throws light on the sustainability integration landscape stretched across the investment banking sector. With the recent buzz in the industry about the new norms, which are sustainability centric in nature, it has evidently come into focus that keeping track and monitoring investment banking activities towards the same is very important. Gauging the ESG criteria conditions prevalent in the banks gives a holistic idea about the functioning of the bank and sets its reputation at stake.

The study focused on 7 major investment banks and out of its major core activities set eyes on the DCM area of operations. The data analysis brings into limelight that the banks have contributed significantly towards sustainable development and remained transparent about their activities as per the required reporting standards. This transition can be credited to the various initiatives undertaken by United Nations Finance Initiative, Governments and regulatory bodies. The same measures as such and hard work, if continued in the future, will surely make a positive impact. The reporting frameworks can be enhanced by mandating a few more specific intel's disclosures, this would make analysis much easily enforceable.

Overall, so far, the industry has witnessed impressive transition and with continuous improvement the researcher believes that the sustainable landscape will drastically see a positive change and reveal investment banking that is profitable, yet mindful and ethical.

Future Scope of Research

The above study focuses on the comparative analysis of sustainable activities in the DCM sub criteria of 7 major investment banks. It highlights various metrics to gauge the banks sustainability foothold and points at various efficiencies and limitations observed during analysis. The following are a few points that can be referred to if one wishes to delve deeper, and conduct research in the future:

1. The researcher can perform a similar comparative analysis as the above study, in other activity areas of investment banking such as Equity Capital Markets, Mergers & Acquisition, Sales and Trading, etc.
2. The researcher can analyze specific bank's case study, and dig deeper into their sustainable practices.
3. The researcher can dive deeper into the sustainability reporting standards and guidelines that govern the transparency maintenance, and address the inefficiencies highlighted in this study and more.
4. The researcher can perform a study on how liberalization in investment banking through integration of sustainability is actually profitable, ethical and beneficial for institutions by comparing empirical data to orthodox results.

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6. : From Fast to Conscious: How the Fashion Industry is Encouraging Sustainable Choices

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Abstract:

From a rapid production-disposable consumption model in fast fashion, the industry is slowly shifting towards more sustainability-driven models. Despite growing interest in sustainable fashion, very little research has considered how the industry actively shapes consumer behaviour. This paper discusses the socio-consumer changes influenced by sustainability initiatives, with a focus on consumer awareness, purchase intentions, behavior, willingness to pay, and sensitivity to eco-friendly practices. Results indicated that there is an emerging trend of sustainability awareness among young consumers: 68-75% of young consumers are interested in environmentally responsible brands, while actual purchases are inconsistent because of price sensitivity and limited availability. Transparency tools, ethical sourcing, digital storytelling, and green marketing amplify consumer trust and brand preference, while circular economy initiatives like recycling, resale, and repair services anchor long-term loyalty and decrease impulsive buying. However, affordability issues, scattered unclear information, and conflicts between profit margins and ethical production remain major challenges. The paper underlines the need to

advance communication, price accessibility, and stronger regulation in support of the mainstreaming of sustainable fashion, and it also provides valuable insights for brands, policy makers, and researchers in promoting responsible fashion consumption.

Keywords: Sustainable Fashion, Conscious Consumption, Fast Fashion, Ethical Production, Consumer Behaviour.

Introduction:

The fashion industry is changing to a degree worldwide as environmental concerns, sustainability awareness, and conscious consumerism continue to grow. Traditionally dominated by the fast-fashion model with rapid production cycles, low prices, and trend-driven consumption, this has also created immense environmental pollution, unethical labor practices, and massive textile waste. Conscious fashion is a growing paradigm driven by increased momentum in critical climate-related issues that interest both consumers and brands alike.

Conscious fashion is all about sustainability, including eco-friendly materials, ethical sourcing, transparency in the supply chain, and circularity, such as recycling and upcycling. Major global brands like H&M, Zara, and Adidas are acting on their sustainable initiatives, with ethical labels leading the way, in line with shifting consumer expectations. Increased social media influence, customer activism, and awareness drives are making sustainability a differentiator in the fashion industry.

In the same period, most consumers reported supporting sustainability, yet they went on buying fast fashion due to affordability, convenience, and a lack of awareness. This disconnect-between attitude and actual purchase-underscores that much more may be at play in conscious consumption than has been researched or captured so far.

Research Gap: Although many studies review the sustainability trends, few investigate how fashion brands themselves actively boost sustainable choices and consumer reactions to those strategies, particularly in young consumers in developing markets. The gap also includes a lack of insights into psychological, social, and financial factors shaping the transition from fast to conscious fashion.

Objective Of The Study:

1. To analyze how fashion brands encourage sustainable behaviour through marketing and transparency.
2. To examine consumer perceptions and responses toward sustainability initiatives.
3. To identify the key factors that influence the shift from fast fashion to conscious fashion.

Literature Review:

The relevance of the study is due to the need to select management tools for the formation of environmentally conscious consumption of the fashion industry products, developing dynamically and rapidly, which will contribute to the preservation of the resource potential of not only the country but also of the planet as a whole. Purpose and methods. The purpose of the article is to substantiate the role and importance of eco-products, conscious consumption and management in the context of the fashion industry's sustainable development. The methodological basis of the study is an interdisciplinary approach to the consideration of the problem of managing the conscious consumption of eco-fashion products when its economic, environmental, technical, organizational, social, psychological, and physiological functions are realized in the relationship. Results. Perspective trends in the fashion industry development from the point of view of conscious rational and ecological consumption of clothing have been identified. The role of a socially responsible attitude to clothing production, influencing the ecology of the environment, is justified. The theoretical bases of sustainable development and progress of the Ukrainian fashion industry on the example of forming and promoting fashion brands of Ukrainian designers are considered. Conclusions. As a result of the conducted study, the main motive for creating eco-products in the fashion industry, as well as the main ecological concepts, are outlined. The importance of choosing optimal tools and management strategies aimed at greening the production of eco-products was determined by the enterprises of the fashion industry. The scientific novelty of the study consists in the interdisciplinary

deepening of the theoretical provisions of production management and conscious consumption of the fashion industry eco-products in the conditions of greening the public space.

Due to increased clothes consumption and a shortened trend cycle, middle-class consumers generally prefer cheap, trendy clothes. The share of global SPA brands in the world fashion market is steadily expanding. However, the emphasis of SPA clothes is on trends, and thus they are disposed of after one season regardless of their quality. Today, the growth of fashion waste creates serious environmental concerns.This paper develops sustainable social content for fast fashion. Although fast fashion produces serious environmental pollution, the fast fashion industry has not made suitable efforts to achieve sustainability. It investigated the possibility that the themes of fashion social content might focus on ecofriendly products, customer service, fair employment opportunities, fair allocation of profits, diversity in quality and design, and promotion of ecosystems. This study provides data to execute a new marketing strategy for the sustainable development of a global a SPA brand.

The fashion industry being one of the most polluting industries in the world means it is an industry with great potential for change. It is important to note that consumers are central and closely intertwined with how companies act. This research portrays consumer perspective and practices concerning the subject of sustainability implemented in the fashion industry. It cannot be denied that the relevance of sustainability in the fashion industry and the key role, which consumers have in its implementation, were confirmed by consumers through representation of general awareness and concern, although not always translated into actual practices. By conducting qualitative research methodology, followed by a set of interviews with consumers, it was disclosed that the great majority of those are implementing a variety of practices when making their buying choices towards fashion items. Among the barriers identified were lack of education, information, knowledge, and transparency. This aspect has been shared by consumers as a reason why they are not motivated to make more conscious decisions. Companies have to educate consumers in general, while focusing on the group of consumers not implementing sustainability in the fashion industry in their buying choices since they represent potential for the future.

Purpose Of Study:

The aim of the study is to assess how the fashion industry is encouraging consumers to move from fast fashion toward sustainable fashion practices, focusing on awareness, purchasing behaviour, and brand influence. As concern for sustainability increases among global and Indian consumers, it becomes important to understand whether the shift in fashion choices stems from environmental awareness, social influences, or marketing strategies being adopted by brands.

The study examines the overall perception of consumers regarding sustainable fashion, their purchase intention towards eco-friendly apparels, and to what extent such campaigns and initiatives by various brands will influence their buying decision. It also looks at consumer challenges, such as high pricing or limited product availability, which may stand in the way of consumers adopting sustainable fashion. The present research will try to find out both motivational and hindrance factors for the benefit of the fashion industry, marketers, and policymakers.

For consumers, this research showcases the benefits and representation of sustainability within fashion and its derived impact on consumption habits. For fashion brands, it shows ways in which sustainable practices lead to improved brand reputation, customer trust, and long-term loyalty. Lastly, for policymakers, recommendations are given to create a policy environment that supports ethical and green fashion practices by balancing business growth with environmental responsibility.

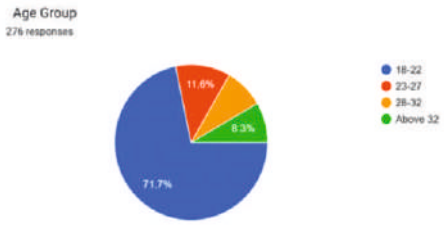
Research Methodology:

Research Design	Descriptive Research Design
Sample Size	276 Respondents
Data Collection Mode	Google Form (Primary Method)
Sampling Method	Snowball Sampling

DATA ANALYSIS:

• Analysis based on Age :

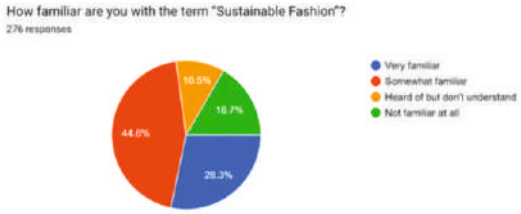
AGE GROUP	PERCENTAGE
18-22	71.7%
23-27	11.6%
28-32	8.3%
ABOVE 32	8.3%



Among a total of 276 respondents, 71.7% were between 18-22 years old, 11.6% were aged between 23-27years, 8.3% between 28-32 years, and 8.3% were 32 and above.

Awareness of Sustainable Fashion:

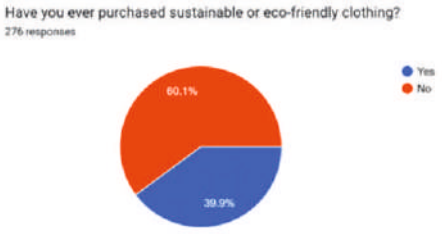
RESPONSE	PERCENTAGE
VERY FAMILIAR	28.3%
SOMEWHAT FAMILIAR	44.6%
HEAD OF BUT DON'T UNDERSTAND	10.5%
NOT FAMILIAR AT ALL	16.7%



Out of the total 276 respondents, 28.3% were very familiar with sustainable fashion, while 44.6% reported being somewhat familiar. In contrast, 10.5% had heard of this concept but did not understand it clearly, and 16.7% were unfamiliar.

Purchased Sustainable Clothing:

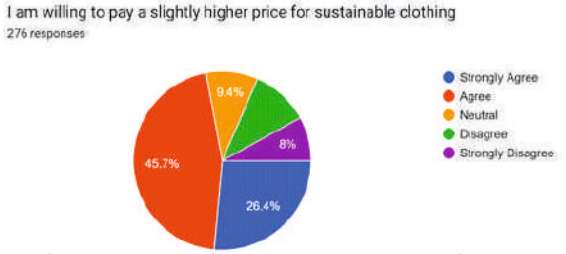
RESPONSED	PERCENTAGE
YES	39.9%
NO	60.1%



Out of 276 respondents, of which only 39.9% had purchased sustainable clothing and 60.1% did not, revealing a gap between awareness and actual buying behaviour.

Willingness to Pay Higher Price:

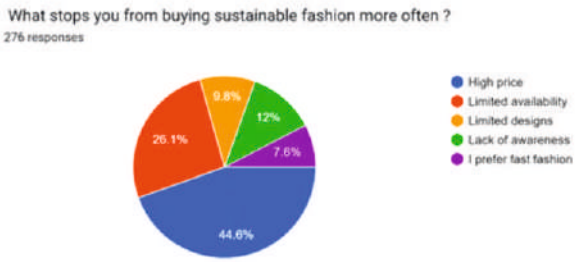
RESPONSE	PERCENTAGE
STRONGLY AGREE	26.4%
AGREE	45.7%
NEUTRAL	9.4%
DISAGREE	10.5%
STRONGLY DISAGREE	8%



Out of 276 respondents, 26.4% strongly agreed and 45.7% agreed to pay more for sustainable fashion apparel. However, 9.4% remained neutral, while 18.5% did not agree due to mixed willingness because of pricing apprehensions.

Barriers to Buying Sustainable Fashion:

RESPONSE	PERCENTAGE
HIGH PRICE	44.6%
LIMITED AVAIABILITY	26.1%
LIMITED DESIGNS	9.8%
LACK OF AWARENESS	12%
I PREFER FAST FASHION	7.6%



For 276 respondents, high price was the main barrier at 44.6%, while limited availability was at 26.1%, lack of designs was at 9.8%, lack awareness was at 12%, and 7.6% still preferred fast fashion options.

Opinions Of Respondents On Sustainable Fashion:

When the data analysis was performed following the opinion of respondents about sustainable fashion, the following results were received:

- 78.7% prefer clothes that are longer-lasting, while 25% did not fully agree or disagreed.
- 71.4% are concerned about fashion's environmental impact, while 18.5% showed less concern and 10.1% were neutral.
- 69.9% responded that social media influences sustainable choices, while 19.2% disagreed and 10.9% were neutral.
- 71.3% of the consumers trust sustainability claims by brands, while 18.1% did not, and 10.5% were neutral.
- 70.7% are willing to reduce fast-fashion purchases, while 19.6% were unwilling and 9.8% were neutral.

Limitations:

The limitations of this research have to do mainly with methodology and sample characteristics. The study was based on a sample size of 276 respondents, where the majority of the sample, 71.7%, fell within the age group of 18–22 years. Such a concentration of young respondents may not fully represent the broader consumer market that engages in sustainable and fast-fashion choices. Snowball sampling may have introduced bias in responses, as participants could come from similar demographic backgrounds, interests, or social influences.

Moreover, since data collection was done through self-reporting questionnaires, responses may reflect perceptions as opposed to real purchasing behaviour. While the majority of responses were interested in sustainability, actual buying could be different. Another limitation is that the study focuses only on consumer opinions and does not draw from brands, retailers, or policymakers, which could provide full insight into sustainable fashion practices. Last but not least, it is not clearly defined whether there are geographical and economic variations, which might impact the generalisation of findings, especially affordability and accessibility to sustainable fashion.

Conclusion:

Present research has shown that the consumers are significantly aware of and interested in environmentally responsible fashion. Many have stated the harmful effects of fast fashion and showed interest in long-lasting, sustainable clothes. This shows a growing trend of conscious consumerism, especially among the younger generation. Social media, awareness campaigns, and brand marketing have played a significant role in shaping the perception of sustainable fashion. There is an increasing trust among consumers in ethical branding and transparency initiatives taken by companies.

However, the results reveal a significant difference between awareness among consumers and actual purchasing behaviour. Just 39.9% of consumers reported purchasing sustainable apparel, even though almost 72% were willing to support responsible fashion. This intention–action gap is influenced by various barriers, mainly high prices (44.6%), limited product availability, and lack of diverse design options. These challenges suggest that sustainability continues to be seen as a niche and premium market category that constrains its mainstream diffusion.

While sustainable fashion can change consumer behaviour and decrease environmental degradation, it has the potential to do so only if collaboration among brands, consumers, and policymakers is achieved. The more affordable, accessible, and transparent it can be made, the more sustainable fashion will slowly replace fast fashion as a practical, trustworthy, and widely accepted lifestyle choice.

Suggestion:

With the trend of conscious consumption on the rise, stronger strategies are needed to maximize the full potential of sustainable fashion by removing the barriers consumers face. Awareness campaigns and educational programs should be initiated for

consumers, along with social media advocacy, emphasizing environmental benefits and encouraging responsible choices in fashion. Brands must ensure clarity in communication through transparency in sourcing, pricing fairness, detailed labelling, and visible sustainability certifications that strengthen consumer trust. Fashion brands also need to develop more affordable sustainable lines and invest in the greater availability of products to minimize cost and access barriers. Policymakers and regulatory authorities can incentivize ethical production, low-carbon business models, and tax benefits for sustainable brands while setting stricter regulations with regard to misleading "greenwashing" advertising claims. If everyone plays their part, then the industry can create loyal customers for life, reduce textile waste, and grow a responsible fashion sector. Gradually, sustainable fashion can become the mainstream choice wherein environmental protection and consumer satisfaction go together.

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Survey Questionnaire:

SECTION A: Demographic Information

1. Age Group
   - 18–22 - 23–27
   - 28–32 - Above 32
2. Gender
   - Female - Male
   - Prefer not to say

SECTION B: Awareness & Consumer Behaviour

3. How familiar are you with the term "Sustainable Fashion"?
   - Very familiar
   - Somewhat familiar
   - Heard of it but don't understand
   - Not familiar at all

4. Have you ever purchased sustainable or eco-friendly clothing?
   - Yes - No

SECTION C: Perception & Attitudes

5. I prefer buying clothes that last longer rather than cheap fast-fashion items.
   - Strongly Agree - Agree
   - Neutral - Disagree
   - Strongly Disagree

6. I am concerned about the environmental impact of the fashion industry.
   - Strongly Agree - Agree
   - Neutral - Disagree
   - Strongly Disagree

7. I am willing to pay a slightly higher price for sustainable clothing.
   - Strongly Agree - Agree
   - Neutral - Disagree
   - Strongly Disagree

8. Social media influences my choices toward sustainable fashion.
   - Strongly Agree - Agree
   - Neutral - Disagree
   - Strongly Disagree

9. I believe fast fashion leads to over consumption and waste.
   - Strongly Agree - Agree
   - Neutral - Disagree
   - Strongly Disagree

10. I trust fashion brands when they claim their products are sustainable.
   - Strongly Agree - Agree
   - Neutral - Disagree
   - Strongly Disagree

SECTION D: Brand Initiatives & Barriers

11. Which sustainable practices do you notice most in fashion brands?
- Use of organic or recycled materials
- Eco-friendly packaging
- Recycling or take-back programs
- Transparency in labor practices
- None of the above

12. How much do brand sustainability campaigns influence your purchasing decision?
- Very much
- Moderately
- Slightly
- Not at all

13. What stops you from buying sustainable fashion more often?
- High price
- Limited availability
- Limited designs
- Lack of awareness
- I prefer fast fashion

SECTION E: Future Intentions

14. I am willing to reduce fast-fashion purchases in the future.
- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

15. I would support brands that follow sustainable and ethical practices.
- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

❖❖❖❖

7. : The Impact of Micro-Expenses on Financial Sustainability among Pune Youth

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Abstract:

Digital payment methods such as UPI and mobile wallets have changed how young people in Pune spend money. This study focuses on micro expenses, which are small daily payments between ₹10 and ₹200. A survey of students aged 18–25 from Pune shows that UPI and cash are the most preferred payment modes. Most respondents believe that 20 to 40 percent of their monthly budget is spent on micro expenses like snacks and transport. These small expenses often go unnoticed, and students face confusion about where their money disappeared by month end. The findings highlight that micro expenses silently affect financial sustainability. The study suggests the need for proper expense tracking and development of healthy budgeting habits among youth.

Keywords: Micro expenses, Financial sustainability, UPI payments, Youth spending behaviour, Digital Payments, Budgeting

Introduction:

Money management among youth has changed significantly over the last decade. Earlier, students mainly depended on cash for everyday spending. Since cash was a physical medium, they could clearly see how much they spent and how much remained. However, with rapid technological advancements and the Government of India's push toward digitalization, payment habits have undergone a major transformation.

The introduction of UPI in 2016 made

digital payments fast, convenient, and widely accepted. Students today use Google Pay, PhonePe, and Paytm for almost every small expenditure. For every micro-expense everyone opts for mobile wallets, QR codes over traditional means.

Digital payments offer many advantages. They save time, reduce the need to carry cash, support instant transactions, and provide safety during emergencies. They also allow students to participate fully in a cashless economy which is becoming a crucial skill for future financial independence.

However, the same convenience has a downside. Because payments happen digitally and quickly, students do not physically see the money leaving their hands. But these micro expenses silently accumulate throughout the day and month. When spending is frequent and unrecorded, it becomes harder to track and control.

This creates financial confusion among students. Even though they do not make major purchases, they face money shortage before they realise.

Youth are the most affected because they are socially active, influenced by trends, and often make quick decisions without planning. Living away from home also gives them more freedom over personal finances. Combined with peer pressure, lifestyle choices, and the availability of digital payments everywhere, micro spending easily becomes a habit. If not controlled, this habit may harm long-term financial sustainability.

Therefore, micro expenses have become an important topic for study. By understanding why students spend more, what they spend on the most, and how their payment methods influence their budgeting skills, appropriate strategies can be suggested to help them develop better financial habits. This research focuses on the youth of Pune to analyse this growing concern and encourage awareness and responsible usage of digital payments.

Definitions of the terms

1. Financial Literacy: Financial literacy refers to the ability of an individual to understand and manage personal finances effectively, including budgeting, saving, spending, and making informed financial decisions.

2. Micro-Expenses: Micro-expenses are small, frequent daily expenditures, usually ranging from ₹10 to ₹200, that appear insignificant individually but collectively have a significant impact on monthly financial stability.

3. Digital Payments: Digital payments refer to electronic methods of transferring money without the use of physical cash, such as UPI, mobile wallets, debit cards, and internet banking.

Objectives:

- To study the micro-expense spending patterns and digital payment usage among students in Pune.
- To analyse the proportion of monthly budgets spent on micro-expenses and their impact on financial sustainability.
- To suggest practical methods to control and manage unnecessary micro-spending.

Need and Importance of the Study

- Growing Digital Economy: As India rapidly transitions to cashless payments, understanding how youth spend digitally has become crucial for financial planning and policymaking.
- Rise of Micro-Transactions: Small, frequent payments through UPI and wallet apps often go unnoticed but collectively create a significant financial impact.
- Lack of Awareness: Many young users underestimate their monthly micro-spending, leading to poor budgeting and impulse purchases.
- Financial Responsibility: Students are at a critical age where financial habits are formed; this research can guide them toward mindful financial behavior.
- Hidden Financial Leakages: Identifying spending categories where money is unintentionally wasted can help improve savings.
- Behavioural Insight: The study helps understand the psychological role of convenience, peer influence, and rewards on spending behaviour.
- Support for Financial Literacy Programs: Findings can help parents, colleges, and organizations create targeted awareness

campaigns for youth.

- Contribution to Future Research: Limited existing data specifically on Pune youth's micro-spending makes this study valuable for further academic and economic inquiry.
- Better Budgeting Tools: The insights can assist fintech companies in designing youth-oriented features like spending alerts and micro-saving modules.
- Sustainable Financial Well-Being: Encouraging informed decisions ensures long-term economic discipline and reduced financial stress among

Literature Review:

Digital payments such as UPI, mobile wallets, and card-based transactions have rapidly transformed consumer behaviour in India. The ease and speed of digital payments have increased the frequency of transactions, especially small-value ones, among young users (Huggi et al., 2024). The psychological detachment from digital money compared to physical cash contributes to impulsive spending and reduced awareness of cumulative expenses (Rao, 2023).

Micro-expenses often go unplanned and unrecorded, creating what researchers refer to as "silent financial leakage" (Arora & Singh, 2023). Students frequently experience situations where they feel their money has disappeared despite making only small purchases. This highlights the need for increased financial discipline and awareness at an early stage (Patil & Mehta, 2022).

Youth spending patterns are strongly influenced by convenience, lifestyle, peer consumption and technological access. Daily expenditure categories such as snacks, beverages, and transport dominate micro-spending behaviour among students (Kumar & Jain, 2021). Higher dependency on instant digital payments reduces the friction that normally encourages mindful spending (Rao & Shukla, 2023).

Micro-spending, if unmonitored, can contribute to long-term financial imbalance. When students fail to track frequent small purchases, they lose visibility over their budget, adversely affecting saving habits and emergency planning (Sharma & Deshpande, 2022).

Although several studies have examined digital payment behaviour in India, limited research specifically focuses on how micro-expenses affect the financial sustainability of students in urban academic settings such as Pune. This creates a knowledge gap that requires localised data and behavioural insights (Sharma & Deshpande, 2022).

Research Problem Statement

Students commonly encounter situations where they are unable to account for their spending, despite primarily spending on low-value transactions. Micro-expenses, by nature, tend to be impulsive, unplanned, and rarely documented, resulting in a gradual yet significant leakage of funds. Over time, this pattern contributes to reduced financial awareness, weakened budgeting discipline, and a lack of control over personal finances, particularly among youth who are still developing responsible money-management habits.

Scope of Study:

This study focuses on the real-life financial behaviours of students in Pune, examining not just what they spend on, but how they perceive and manage their small daily expenses. It looks at spending habits through the lens of convenience, habit formation, and financial awareness. The research highlights patterns such as reliance on UPI versus cash, the frequency of micro-expenses, and common categories like snacks, transport, and online services.

The scope also extends to understanding students' self-awareness regarding their spending, whether they track it, and how these behaviours influence their sense of financial control. The study does not attempt to cover large-scale financial decisions like tuition fees or long-term investments. Instead, it focuses on practical insights that can help students immediately improve daily money management, such as adopting tracking habits, budgeting small amounts, or using digital tools effectively.

By keeping the scope grounded in daily student life, this research provides actionable

takeaways for students, parents, and educators, making the study relevant beyond just academic discussion.

Limitations of the Study

While this study provides insights into the micro-spending habits of students in Pune, there are a few constraints to consider. The sample size is 37, which is relatively small and may not reflect the behaviours of all students in the city. Data is self-reported, so some spending habits may be overestimated or underestimated due to memory lapses or personal bias. The research captures spending patterns at a single point in time, meaning it cannot track changes in habits over months or years. Additionally, the study focuses solely on small, daily expenses and does not include major financial decisions such as rent, tuition, or long-term investments. Despite these limitations, the study offers valuable, practical insights into the everyday financial challenges students face and can guide them toward better money management practices.

Research Gap:

There is a clear lack of research focusing on youth-specific micro-spending behaviour in Indian cities like Pune, particularly concerning the financial impact of frequent small transactions facilitated by UPI and digital payments. Additionally, existing literature does not adequately examine behavioural reasons behind such spending or provide insights into practical tools for students to maintain long-term financial sustainability.

Research Methodology

This study follows a quantitative and descriptive research design to understand how micro-spending impacts financial sustainability among students in Pune. The research focuses on individuals aged 18–25, as this group frequently uses digital payments and is more prone to untracked small spending.

Primary data was collected through a structured Google Forms survey, which included close-ended questions on spending frequency, modes of payment, budgeting habits, and awareness of financial sustainability. The study was conducted using responses obtained from a sample of college students residing in Pune, collected through a convenience sampling method.

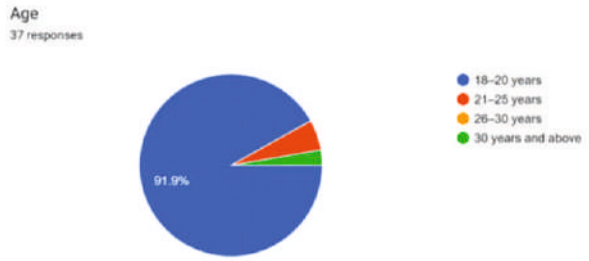
The collected data was analysed using descriptive statistics to identify patterns in micro-expenses, preferred spending categories, tracking behaviour, and perceptions of financial sustainability. This methodology ensures that findings are relevant, practical, and reflective of the real spending habits of urban youth.

Data Analysis and Interpretation

- Demographic Analysis

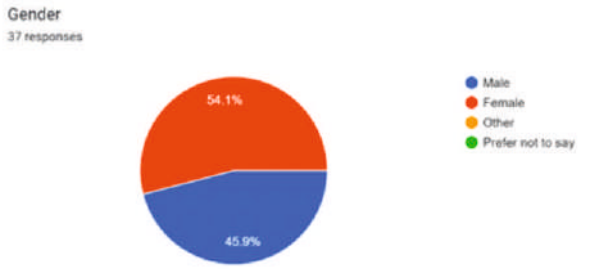
This section examines the background characteristics of the respondents. It helps us understand who the participants are, so we can see patterns in spending behavior among different groups. Common demographic variables include:

a. Age



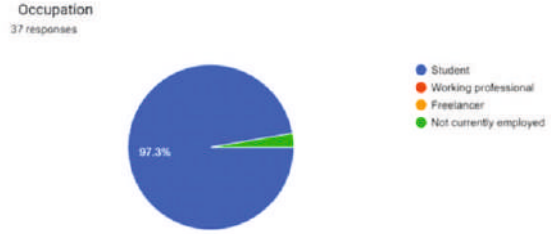
The majority of respondents (91.1%) are between 18–25 years old, confirming that the study accurately represents financially active youth in Pune.

b. Gender



A slightly higher proportion of respondents are females (around 54.6%), indicating diverse participation while still reflecting balanced insights for analysis.

c. Occupation



Around 97% of respondents are students, showing that the financial behaviors being studied align directly with youth budgeting and student lifestyle challenges.

d. Region



All respondents are based in Pune, ensuring the study's findings are geographically focused and relevant to an urban environment with high UPI usage.

- Spending Patterns

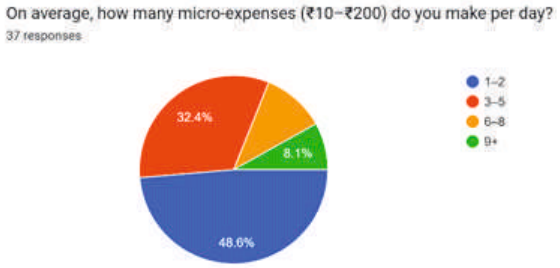
This section analyses how students spend their money on micro expenses—the small, daily expenditures that often go unnoticed. It identifies:

a. Primary Payment Method



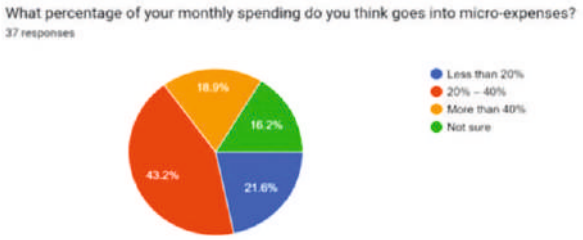
UPI is the most preferred mode of payment among respondents. This highlights the widespread adoption of cashless transactions and how convenience is influencing financial behaviour.

b. Number of Micro-Expenses Per Day



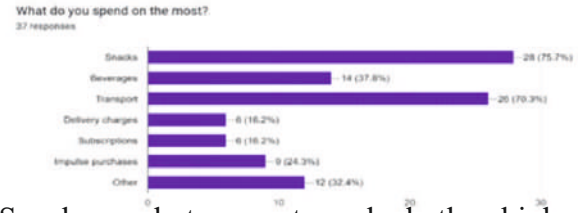
A majority of students make multiple small purchases daily (₹10–₹200). These frequent transactions, although individually small, collectively contribute to noticeable monthly spending.

c. Percentage of Monthly Spending on Micro-Expenses



Most respondents fall in the 20–40% category. This indicates micro-spending forms a significant portion of overall expenses, often underestimated by students.

d. Top Micro-Expense Categories



Snacks and transport ranked the highest, suggesting spending is driven by daily lifestyle needs rather than major one-time purchases.

- Financial Sustainability

This section examines how micro expenses affect students' ability to manage their finances over time. It looks at whether small daily expenditures accumulate to a level that impacts overall financial stability. Key aspects include:

a. Effect of Micro-Expenses on Monthly Budget



Many respondents agree that these small expenditures affect their budget management, supporting the argument that micro-spending is not trivial and others are not yet financially aware about its effect.

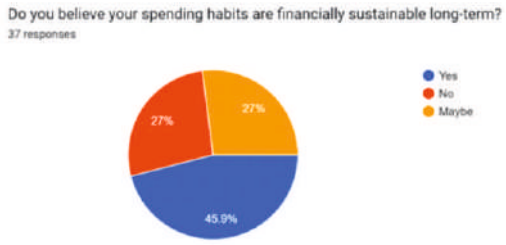
b. Need for a Tracking Tool



Most respondents expressed interest in a tool that automatically monitors micro-spending,

showing an opportunity for fintech solutions tailored to student needs.

c. Long-Term Financial Sustainability



Most respondents believe their current spending habits are financially sustainable in the long run. However, this confidence contrasts with their lack of tracking and frequent reports of "missing money," revealing a perception–reality gap in financial awareness.

Observations : The survey clearly indicates that students in Pune make frequent micro-expenses using digital payment platforms, primarily UPI. These purchases are mostly driven by everyday needs and lifestyle habits including snacks and travel. While the respondents show confidence about being financially sustainable, the data reveals frequent budget leakage and lack of tracking practices. This shows that students are aware of the concept of financial sustainability but lack practical application. Therefore, behavioural improvement and simple financial tools can significantly enhance the financial well-being of youth.

Suggestions: Based on the findings of this study, the following recommendations are proposed to enhance financial sustainability among youth in Pune:

1. Develop Expense-Tracking Habits :Students should record their daily expenditures through budgeting apps or digital tools to increase awareness of cumulative micro-spending.
2. Strengthen Financial Literacy : Colleges and universities should introduce practical financial education modules that focus on budgeting skills, digital payments, and money-management habits.
3. Set Spending Limits : Youth should set weekly or monthly budgets specifically for micro-expenses such as snacks, transport, and impulse purchases to control excessive spending.
4. Mindful Use of UPI : Encouraging students to think before making quick cashless payments can reduce impulsive and unplanned spending behavior.
5. Fintech Support : Developers and digital payment platforms can integrate features like automatic micro-expense tracking and spending alerts, helping young users monitor their finances efficiently.
6. Promote Awareness of Long-Term Impact Students should be more conscious of how repeated small transactions can accumulate and influence their future financial security.

Conclusion: The study shows that micro-expenses form a significant part of monthly spending among youth in Pune, mainly driven by UPI-based transactions. The convenience and speed of digital payments have normalized frequent low-value purchases, making students less aware of where their money goes. While many respondents believe their spending habits are financially sustainable, their lack of expense tracking and frequent feelings of "missing money" indicate a hidden vulnerability in financial discipline. There exists a gap between perceived and actual financial sustainability. Therefore, micro-spending is not just harmless daily spending it has a measurable impact on budgeting control and long-term financial security for youth.

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8. A study of Crowdfunding and its Impact on Sustainability of Businesses

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Abstract

The growing emphasis on sustainability has increased the need for alternative financing options that support environmentally and socially responsible startups. Traditional funding sources often impose strict requirements, making them inaccessible to many sustainability-driven ventures. Crowd funding has emerged as a flexible, technology-based solution that enables entrepreneurs to raise capital directly from the public while building community support. This study examines how crowd funding influences the sustainability and scalability of businesses and identifies the key challenges entrepreneurs face. Data were collected through a survey of some respondents, mostly entrepreneurs. Results show that although awareness of crowd funding is high, actual participation remains low due to limited marketing skills, lack of trust, and unclear regulatory policies. However, most respondents agree that crowd funding can enhance access to capital and support sustainable business development.The study concludes that crowd funding holds strong potential for promoting sustainable entrepreneurship, provided that regulatory clarity, awareness, and skill development are improved.

Keywords: Crowd funding, Sustainable entrepreneurship, Business sustainability, Equity crowd funding, Reward-based crowd funding

Introduction: Crowd Funding is a method of financing that brings together a large number of people or investors to support a new product or startup. It enables entrepreneurs to gather funds from many individuals, each contributing a small amount. Crowd funding is a popular choice for innovative businesses, which typically use two main types: product Crowd Funding and equity Crowd Funding.Product vs equity Crowd Funding for startups There are various crowd funding options available, including donation-based and debt crowd funding. Startups most commonly use product and equity crowd funding, which are two distinct strategies.

Product crowd funding : Product crowd funding often relies on rewards. This approach allows startups to pre-sell their products while raising funds. Backers receive non-monetary rewards such as early access, lower prices, or exclusive versions of a product. For example, a fitness tracker campaign might offer a discounted price for contributions up to $200 and special colors for contributions between $200 and $500. Early-stage and pre-launch startup benefit greatly from product crowd funding. It lets them test ideas with minimal initial investment and helps create a community around their product without giving away

equity.

Equity crowd funding -: Equity crowd funding offers investors' ownership stakes in the company in exchange for their contributions. This method suits startups looking to raise larger amounts and provide ownership shares. Equity crowd funding can aid companies in all stages of growth. This option has gained popularity over the past few decades. Following the Securities and Exchange Commission's limit set in 2021, businesses can now raise up to $5 million annually through equity crowd funding. This change led to equity crowd funding investments exceeding

Benefits of crowd funding for startups - Product and equity crowd funding offer several advantages: Access to capital: Crowd funding serves as an alternative to traditional funding sources. This is especially useful for startups that may not yet qualify for bank loans or are not ready for venture capital. Startups can also use crowd funding alongside traditional methods

Market validation: Startups can measure market interest based on the performance of their crowd funding campaigns. A strong response from backers may indicate high demand. If a campaign falls short of its funding goal, it might provide valuable feedback for improving the product.

Literature review

Dinh, Jeannette & Isaak Andrew & Wehner, Marius. (2024). Sustainability-oriented crowdfunding: A literature review. Journal of Cleaner Production. 448. 141579. 10.1016/J.jclepro.2024.141579. Crowd funding has become a funding method for sustainable entrepreneurship in a context in which entrepreneurs face significant investor uncertainty due to the diverse social, environmental and economic objectives involved. The swift rise of research on sustainability-focused crowdfunding produced a range of theoretical viewpoints and a wealth of empirical data because of significant dispersion, throughout various academic domains. Based on a review and qualitative examination of 157 articles we chart the current research landscape and create a novel comprehensive framework to (1) structure the main theoretical research tiers (namely individual, transactional and institutional) (2) pinpoint multilevel precursors, crowdfunding process elements and short- versus long-term outcomes and (3) propose fresh and encouraging directions, for future investigations. Our results reveal an alignment of theories at the individual and transactional stages regarding short-term crowdfunding results whereas studies on the institutional stage long-term impacts and various crowdfunding types remain scarce. By emphasizing the absent connections among the three levels in sustainability-focused crowdfunding activities we add to the academic discourse and direct forthcoming investigations toward promising paths, in this domain. Our results provide insights, for crowdfunding platforms, their affiliated organizations and entrepreneurs focused on sustainability who are looking for funding.

Motylska-Kuzma, Anna. (2018): Sustainable Development. Sustainability. 10. 4650. 10.3390/Su10124650. This paper aims to test the hypothesis that crowdfunding initiatives focused on sustainability have a probability of persuading backers and achieving funding goals. The study examined 50 crowdfunding projects using reward and equity-based frameworks, which were launched on Polish platforms and explored the campaigns context. Fundamental non-parametric statistical tests were employed to assess the data. The research indicates that despite variations in the quantity of funds raised and success rates reached the project's sustainability focus was not particularly crucial. It is important to note that the degree of accomplishment of development goals was quite minimal and was not emphasized in the project description. This article investigates the success factors of crowdfunding initiatives, which is essential, for developing new financing concepts and drawing the crowd as investors.

Petruzzelli, Antonio & Natalicchio, Angelo & Panniello, Umberto & Roma Paolo. (2018). Comprehending the crowdfunding phenomenon and its impacts on sustainability. Technological. Social Change. 141. 10.1016/J.techfore.2018.10.002. Despite the amount of research quickly gathered on crowdfunding along with the increasing

importance of this phenomenon, for sustainability there exist very limited investigations regarding the role of crowdfunding in sustainability-focused projects and numerous associated challenges remain largely unexplored. This indicates a necessity, for exposing the key interactions between crowdfunding and sustainability while also identifying pathways for future investigations regarding this connection. To understand the effects of crowdfunding on sustainability we. Apply a model that includes five aspects: the project initiator, the supporters, the campaign itself, the crowdfunding platform and the results of crowdfunding initiatives. By interpreting and fine-tuning the findings emerging from the extant crowdfunding literature to the specific context of sustainability-oriented projects, we develop propositions that provide important implications for this type of initiatives. These implications can guide scholars in finding new paths of research on the topic, as well as provide practitioners with an instrument to better understand the relevance of the crowdfunding phenomenon for sustainable initiatives and make more informed decisions.

Baldissarro, Giovanni & Farinelli, Elisa & Iazzolino, Gianpaolo & Maiolini, Riccardo & Morea, Donato. (2025). The link between crowdfunding and sustainability: A literature review in the field of entrepreneurs and academic spinoffs. Finance Research Letters. 77. 107097. 10.1016/j.frl.2025.107097.

Gai, Lorenzo & Algeri, Carmelo & Ielasi, Federica & Manganiello, Maria. (2025). Sustainability-Oriented Equity Crowdfunding: The Role of Proponents, Investors, and Sustainable Development. Sustainability. 17. 2188. 10.3390/su17052188. This study investigates the factors influencing the success of sustainability-oriented equity crowdfunding campaigns by analyzing a dataset of 771 campaigns from Italian platforms between 2014 and 2021. The findings indicate that while projects with a sustainability focus tend to achieve better outcomes, their success is contingent on variables such as the economic sector of the proposing company and investor concerns regarding misleading claims about environmental, social, and governance practices. Notably, professional investors play a critical role in early-stage financing, initiating information cascades that drive broader investor participation. Furthermore, the COVID-19 crisis appears to have heightened investor interest in sustainability, further solidifying equity crowdfunding as a viable financing tool for ventures with environmental and social objectives. By identifying the key factors that drive the success of sustainability-oriented campaigns, this study offers valuable insights for entrepreneurs, investors, and policymakers seeking to enhance the role of alternative finance in promoting sustainable innovation.

Vismara, Silvio. (2018). Sustainability in equity crowdfunding. Technological Forecasting and Social Change. 141. 10.1016/j.techfore.2018.07.014. Existing studies on the relationship between sustainability and crowdfunding are focused on campaigns that provide rewards for backers. Equity crowdfunding is substantially different in terms of motivations to invest as well as in size, horizon, and expectations of the investment. For the first time – using a sample of 345 initial equity offerings in United Kingdom platforms Crowdcube and Seedrs in the period 2014–2015 – this study provides evidence of the attractiveness of sustainability-oriented ventures in equity crowdfunding. Results show that, although sustainability orientation does not increase the chances of success or of engaging professional investors, it attracts a higher number of restricted investors. This evidence is interpreted considering institutional logic, whereas professionals follow a market logic, and restricted investors consider also a community logic.

The chapter focuses on using crowdfunding for financing sustainable projects, that is projects aiming to extend their goal beyond market success and provide benefit to the larger part of society. The chapter discusses the definition and dimensions of sustainable development and sustainable entrepreneurship and provides an overview of the existing literature on crowdfunding of sustainable projects. The authors also review four European sustainability-oriented crowdfunding platforms representing different

crowdfunding models. This review reveals that sustainable projects have rather high success rates in crowdfunding and may address all the three dimensions of sustainable development. However, environmental dimension gets the most attention. All the crowdfunding models are relevant for sustainable projects; yet, Loan-based crowdfunding seems to have the highest success rates. Moreover, focus on a particular dimension of sustainability may influence the choice of the crowdfunding model.. Maehle, Natalia & Otte, Pia & Drozdova, Natalia. (2020). Crowdfunding Sustainability. 10.1007/978-3-030-46309-0_17. The chapter focuses on using crowdfunding for financing sustainable projects, that is projects aiming to extend their goal beyond market success and provide benefit to the larger part of society. The chapter discusses the definition and dimensions of sustainable development and sustainable entrepreneurship and provides an overview of the existing literature on crowdfunding of sustainable projects. The authors also review four European sustainability-oriented crowdfunding platforms representing different crowdfunding models. This review reveals that sustainable projects have rather high success rates in crowdfunding and may address all the three dimensions of sustainable development. However, the environmental dimension gets the most attention. All the crowdfunding models are relevant for sustainable projects; yet, Loan-based crowdfunding seems to have the highest success rates. Moreover, focus on a particular dimension of sustainability may influence the choice of the crowdfunding model.

Statement of the Problem

Banks and venture capitalists in India impose strict collateral rules. They often overlook sustainable projects. This situation creates a significant funding gap for new and impactful businesses. India's crowdfunding sector still lacks clear regulations, especially for equity models. This uncertainty, along with issues of trust such as concerns about fraud and gaps in information, creates challenges that can impact the sustainability crowdfunding seeks to support.. Crowdfunding helps startups and small-to-medium enterprises raise early-stage capital. However, its impact on long-term financial stability and growth is still uncertain.

Objectives of the Study

1. To compare the success rate of crowdfunding in building a sustainable business.
2. To understand the impact of crowdfunding on the scalability and performance of sustainability-driven startups.

Need or Relevance of the Study

The study on crowdfunding for sustainable initiatives is essential because it directly addresses the critical funding gap faced by Sustainability-Oriented Ventures (SOVs), which often struggle with traditional financing due to their focus on long-term environmental and social returns rather than short-term profits. By investigating the specific obstacles and prospects of crowdfunding in this context, and comparing the success rates and scalability impact of these campaigns, the research provides data-driven strategies to optimize this financing tool. This not only guides entrepreneurs on best practices to achieve business sustainability goals but also informs policymakers and platform operators on how to structure support to accelerate the global transition to a sustainable economy, making the study highly relevant for academic theory, practical application, and global policy.

Research Methodology

1. Research Design : This research employs an analytical approach. Descriptive design aids in grasping the extent of awareness, viewpoints and obstacles concerning crowdfunding whereas analytical design assists in assessing its influence, on business sustainability.

2. Nature of the Study : The study is primarily quantitative complemented by perspectives. Data was primarily gathered through a questionnaire and the answers were examined to identify patterns, connections and viewpoints.

3. Research Approach : A method based on surveys was utilized. Participants answered multiple-choice questions through a Google Form survey. The questionnaire was carried out digitally to gather answers effectively and access a range of respondents.

4. Sampling Method : A convenience sampling approach, without probability, was employed.Participants were chosen according to their availability and pertinence to the subject

including: Entrepreneurs, Business owners, Students, Investors. This approach was selected because it allows access to people possessing varying degrees of understanding regarding crowdfunding.

5. Sample Size: This qualitative is adequate, for examination and comprehending patterns associated with crowdfunding and sustainability.

6. Data Collection Method

Primary Data; Collected through a Google Forms questionnaire consisting of: Closed-ended multiple-choice questions, Likert scale statements, Yes/No questions

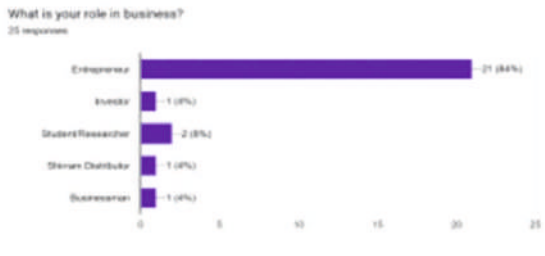
Secondary Data; Collected from: Research journals, Articles on crowdfunding, Reports from crowdfunding platforms, Government guidelines related to startup financing, Websites and business sustainability studies.Existing data assisted in corroborating the results and offering information.

7. Tools for Data Analysis; The gathered information was examined utilizing: Percentage analysis, bar charts, Interpretation of Likert scale responses. These instruments assisted in extracting understanding from the survey findings.

8. Scope of the Study : The research includes: Awareness of crowdfunding, Participation level, Benefits for sustainable business development, Barriers faced by entrepreneurs, Influence of government policies,bIts primary emphasis is on enterprises, new ventures and people familiar with crowdfunding ideas.

Analysis & Interpretation of Data

1. Respondents' Role in Business



B. Students/Researchers: 8%

C. Investors, Shriram Distributor, D.Businessman: 4% each

Interpretation: The group mainly consists of entrepreneurs making it perfect, for a crowdfunding research since they are the users of these platforms. Their views represent business and startup environments.

2. Familiarity with the Concept of Crowd funding.



A. Somewhat familiar: 44%

B. Very familiar: 28%

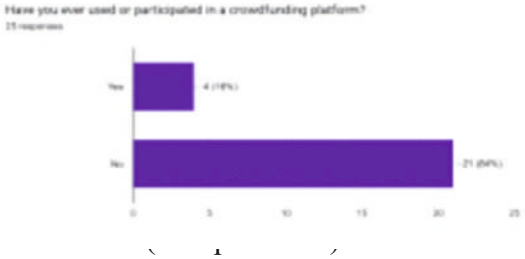
C. Heard of it but not sure: 16%

D. Not familiar at all: 4%

E. Heard of it but not… : 8%

Interpretation: A total of 72% of participants are aware of crowdfunding to some degree. This suggests that while awareness is high, comprehensive understanding is moderate implying that further educational efforts might still be necessary.

3. Participation in Crowdfunding Platforms



B. No: 84%

Interpretation; Despite high awareness, actual participation is very low.

This suggests: Limited trust or experience, Lack of platforms accessible locally, Insufficient knowledge on how to launch or contribute to crowdfunding campaigns.

4. Can Crowdfunding Assist Entrepreneurs in Establishing Sustainable Ventures?



A. Agree: 40% B.Strongly agree: 24%

C.Neutral: 36% D. No conflicts noted

Interpretation; The majority of participants

(64%) consider crowdfunding to be beneficial, in establishing enterprises. The 36% neutral segment might indicate experiences because of no firsthand participation.

5. Effectiveness Compared to Traditional Financing



C. Neutral: 20% D.Less effective: 4%

Interpretation ; The majority of participants view crowdfunding as a substitute for conventional funding sourceS.This underscores its recognized importance, for small business owners who might encounter difficulties obtaining loans.

6. Marketing & Communication ChallengeS



C. Neutral: 12% D. No disagreement

Interpretation; A staggering 88% think that inadequate marketing and communication abilities hinder the success of crowd funding.This suggests that: Business owners might have expertise in digital marketing, Narrative crafting and marketing of campaigns are essential, Educational courses have the potential to greatly enhance results.

7. Government Policies as a BarrieR



A. Maybe: 44% B. Yes: 32%

C. No: 20% D.Not sure: 8%

Interpretation; A significant majority (76% including those who answered "maybe") believe that government regulations could influence crowd funding.

This implies: Lack of clarity on regulations, Perceived bureaucratic or financial constraints, Need for improved awareness of legal frameworks

The survey indicates that:

1. Crowdfunding is well known but not commonly practiced. Although the majority of respondents are familiar with crowdfunding 16% have taken part highlighting a significant divide, between recognition and involvement.
2. Entrepreneurs consider crowdfunding to be successful. A significant majority believe it aids in building companies and offers greater flexibility compared to conventional financing.
3. Major obstacles consist of: Lack of marketing and communication skills, Uncertainty about government regulations, Low practical experience with crowdfunding
4. Crowdfunding holds promise for acceptance yet it necessitates: Training in digital marketing and campaign management, Awareness programs about legal and financial guidelines, Local or regional platforms that are readily accessible

Findings & Conclusions

The core findings and conclusions of a study on crowd funding's impact on business sustainability reveal that it is a powerful enabler for Sustainability-Oriented Ventures, often leading to a higher campaign success rate because backers are significantly motivated by the non-financial, altruistic mission of the projects. Critically, crowdfunding extends its impact beyond capital by providing crucial market validation and facilitating the creation of a loyal customer community, which enhances a business's long-term viability and ability to attract follow-on investment. Ultimately, the research concludes that while crowdfunding successfully initiates and validates sustainable businesses, their eventual operational sustainability and scalability are conditional upon the founders' ability to combine this initial momentum with professional management, robust governance, and continuous adherence to their core mission.

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9. Understanding Genz behavior towards Sustainable Fashion; A Study in Pune City.

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Abstract

Climate change is a global issue, intensified by the fashion industry's overutilization of resources, high carbon emissions and large volumes of textile waste generation. This research emphasizes on integration of sustainable fashion among Genz in Pune, noting a general awareness but shows inconsistency in behavior backed by high price, limited preferences and social media pressure. The research uses secondary data from relevant sources: prior research papers, industry reports, journals, articles and websites of leading sustainable brands. Primary data was acquired from structured questionnaire survey to understand Genz perception. Findings suggest Genz are open to adopting ecofriendly consumption when aligned with affordability, contemporary designs, and authentic marketing. Strengthening these aspects will reduce overconsumption, and lower fashion's environment footprint.

Keywords: Affordability, Attitude—Behavior Gap, Environmental impact, Genz, Sustainable Fashion

1. Introduction : Fashion co-currently evolves social forms, representing habits, aesthetic preferences and entire style of an individual's expression. (Ray & Nayak, 2023) Sustainable Fashion Consumption defines consumer decisions and actions, with respect to environmental and ethical factors of fashion products throughout their lifecycle, from procurement of raw material and production to utilization and final disposal. (Braun et al., 2025) The Global Fashion Industry has evolved into major polluting domain due to unconscious consumption, harmful manufacturing method, and utilizing hazardous chemicals. (Căpățînă, Alexandrina Eulampia, 2025). Fashion industry is among the largest consumers of fresh water and is responsible for utilizing nearly 93 billion cubic meters on an annual basis, 85% of textiles end up in landfill. In addition to this, 10% of global carbon emission is attributed to the fashion sector, becoming a pivotal determinant of environmental deterioration, which prominently contributes to climate change, remains a global issue impacting nations worldwide (United Nations Climate Change, 2018). In this framework, examining eco-friendly fashion consumption practices among Generation Z, individuals born between 1996

and 2010 (McKinsey & Company, 2024), resident of Pune city is crucial. Genz is called as "digital natives"- the first generation to grow up with the internet.

1.1 Statement of the Problem : Although sustainability is growing immense importance, Genz consumers continue to demonstrate a major attitude-behavior gap, wherein they express support for eco-friendly options but fail to convert these claims into real purchasing behavior, resulting in impulsive buying which adds to a severe problem.

1.3 Relevance of study : Genz is increasingly embracing a mature sense of style with rising preference for classic, aesthetic and versatile clothing. Specifically female consumers emphasis to stay updated with fashion trends and maintaining updated wardrobe which reinforces unsustainable consumption pattern. They desire to be aesthetically pleasing and minimalistic. (Domingos et al., 2022). As Digital Natives, their purchasing is interconnected with online culture such as influencer-driven content. Pune has been chosen for study because, it is a growing metropolitan city, which records large and active Genz population. Additionally, Social media platforms play vital role in reaching young consumer in two tier and three tier cities. (McKinsey's the State of Fashion 2025, 2025)

2. Literature Review

2.1 Factors affecting Sustainable Fashion Consumption : The literature reviews, success of sustainable fashion is derived by consumer awareness, acceptance, and each stage of fashion value chain.



Figure 1. Mind map represents barriers in adopting sustainable fashion products. (Braun et al., 2025)

2.2 Attitude-behavior Gap in Sustainable Fashion: Established literature persistently provides an evident gap between consumer's conscious attitude toward sustainability and their real purchasing actions. Even though individuals showcase concern about environmental issues, this awareness does not frequently transform into purchasing sustainable products. The gap is inspired by price, trend uptake, and peer pressure, causing eco-friendly behavior difficult to implement. (Morais & Leandro, 2025)

2.3 Greenwashing Attempts : Various prior studies discuss that how misleading sustainability assertions by words such as "green", "eco-friendly"—often known as greenwashing—weakened consumer trust. (Morais & Leandro, 2025) Many brands use vague claims and promotional language without executing actual sustainable measures, leading to ambiguity. H&M and Zara's are presented as sustainable, but its mass production and short product life often conflict with responsible slow fashion principles. (Domingos et al., 2022)

2.4 Price Sensitivity: Major Barrier : Research recognizes price as a critical factor to integrate eco-friendly fashion consumption. Affordability issues are stated across both Global and Indian setting, implies price sensitivity a principal constraint in sustainable choice making. (Bumin & Bumin, 2024)

2.5 Inadequate Understanding of Environmental Consequences : Literature indicates several consumers lack understanding environmental consequences of fashion production such as water pollution, waste generation, and caron emissions. (Balasubramanian & Sheykhmaleki, 2024) Fast fashion generation is all about overconsumption and hyper disposability of clothing meaning individuals buy way too much without a second thought.

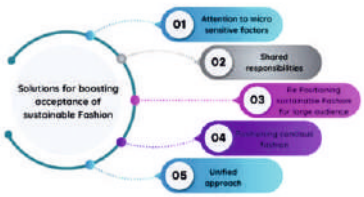


Figure 2. Strategies to boost acceptance of sustainable fashion (Sinha et al., 2022)

2.6 Role Model in Sustainable Fashion: A Case of Patagonia Brand : Patagonia is a global leader in sustainable fashion, recognized for their environment accountability business model. The brand incorporates a range of recycled materials, organic cotton, minimal impact dyes, and ethical labor strategies. Patagonia undertakes "worn wear" program where customers repair, reuse, and resale clothing to enhance product life. Patagonia's "recrafted collection" which upcycle old garments into new ones (Causeartist, 2025). Patagonia's transparency and circular fashion model makes it benchmark in sustainable fashion. (Patagonia Works, n.d.)

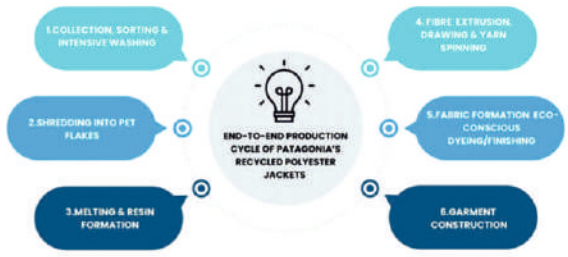


Figure 3. Production Cycle of Patagonia (Hang Tight! Routing to Checkout. . ., n.d.)

2.7 Collaborative Fashion Consumption Research indicated that Collaborative Fashion Consumption terminology means, renting bridal and party outfits to minimize waste by replacing one-time purchases with shared use. The concept addresses financial accessibility and unique desire, but hygiene and trust remain hurdles. (Shetu et al., 2025) Studies on recrafted denim, highlights how old jeans are modified into new products like purses, handbags etc. This lowers the consequence of denim production (Kencana et al., 2025).

2.8 Social media and emerging Technologies : Prior studies reveal that social media is an influential driver in shaping sustainable fashion practices, through content based on secondhand styling, capsule wardrobes, conscious consumption, simultaneously it fuels fast fashion through promotional posts. It results in mixed signals. Vladimirova et al. (2023). Influencers are described as sustainability ambassadors also trend promoters.

Studies highlight AI driven tools contribute to brands for better alignment of production with consumer choices. Additionally, Virtual Reality features virtual trials to strengthen consumer participation, reducing physical trials and returns. (Balasubramanian & Sheykhmaleki, 2024)

2.9 Role of Government Policies in Sustainable Fashion: The Government of India is involved in upbringing sustainable manufacturing by, "Sustainable Textile Mission", "Zero Liquid Discharge", policies aligning with UN's SDG 12 (2030): Responsible Consumption and Production. Environment compliance Laws includes "Environment Protection Act (1986) and Water and Air Pollution Control Acts. Factory Act consists of Labour Welfare Provisions to ensure ethical production. Also, EcoMark promotes green product certification. (Jadhav & Verma, 2024)

3. Research Gap

Although, several studies have been performed on sustainable fashion globally, studies which focus on India remain limited. Additionally, very few studies examined Genz, a generation highly bothered about fashion.

4. Objectives of Study

4.1 To understand the concept of sustainable consumption in fashion industry.

4.2 To understand the sustainable behaviour towards fashion consumption among Genz in Pune city.

4.3. To analyse the trends and provide suggestions

5. Research Methodology

5.1 Research design: The study adopts descriptive and quantitative research design to observe consumption practices performed by Genz with respect to sustainable fashion in Pune city.

5.1.1 Research method: A quantitative method was adopted to gather quantifiable data.

5.1.2 Primary Data

- Population: Pune marked approximately 3,124,458 population, (Census2011-2025, n.d.) Genz makes approximately 27% of India's population (Economic times 2024). Hence, approximately 843,603 represents Genz in Pune City.
- Respondents: The target population focuses on Genz residing in Pune City.

- Sample size: 92 respondents were surveyed through online google form.
- Sampling method: The research executed a convenience sampling technique, where participants take part by their availability and willingness. This method fosters user-friendly access to Genz participants across social media platforms, college networks and online communication modes.
- Data collection method: Data was retrieved through Structured Questionnaire.
- Data collection tool: The tool used was Google Forms.
- Data analysis method: The collected responses were evaluated using percentage analysis.
- Data analysis tool: Data tabulation was performed through MS Excel.
- Ethical consideration: Respondents were clearly notified regarding the objective of the research, anonymity was ensured, and participation was voluntary and as per willingness.

5.1.3 Secondary Data : Secondary data was retrieved from published research papers, industry reports, journals, articles, newspapers and insights from recognized brand webpages.

6. Data Analysis and Interpretations

The analysis of survey is as follows:

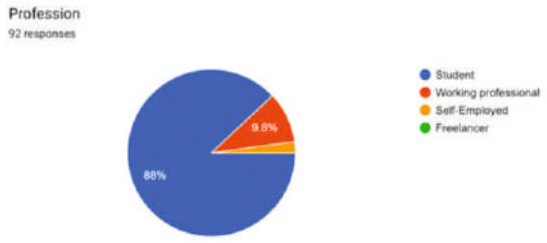


Figure 4. Profession of Respondents

The large portion of respondents, 88%, were students, reflecting that the group prominently shows the primary Genz population focused on the study. Only 9.8% were working professionals.



Figure 5. Importance of Sustainable Fashion Factors

Many respondents felt that sustainable fashion is important, with 32.6% saying it is very important and 39.1% calling it important. About 22.8% stayed neutral, while only a very small fraction considered these factors slightly important, i.e. 4.3% or not important i.e. 1.1% at all.

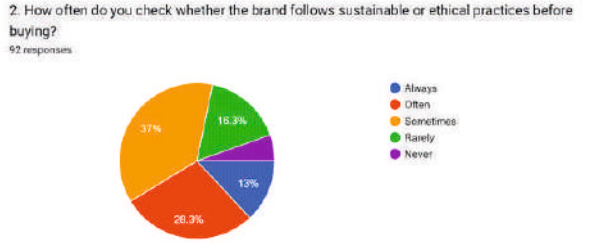


Figure 6. Frequency of Sustainable Verification

Most respondents investigate a brand's sustainability only occasionally—37% do so sometimes and 28.3% often—while fewer people rarely (16.3%) or always (13%) check these practices.

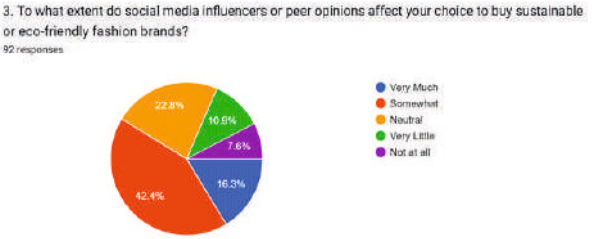


Figure 7. Influence of Social Media and Peer Opinions

Social media influencers and peer perspective show an obvious impact, as 42.4% of respondents are influenced somewhat and 16.3% very much, whereas 22.8% stay neutral and smaller portions mention minimal influence. The survey shows respondents, around 44.5% never rent/hire clothes and 25% do so only rarely. At the same time, 20.7% rent clothes sometimes for festive events.

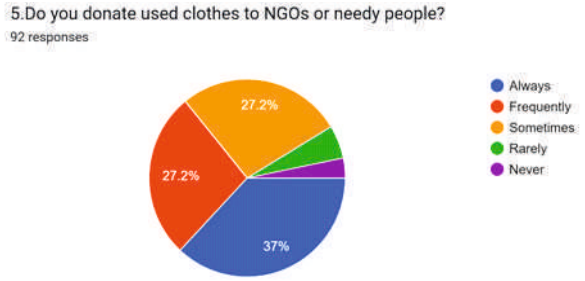


Figure 8. Approach towards Donation

Clothing donation is carried out consistently, as 37% of respondents always donate and 27.2% do so frequently. Another 27.2% donate from

time to time, and only a small group rarely or never does.

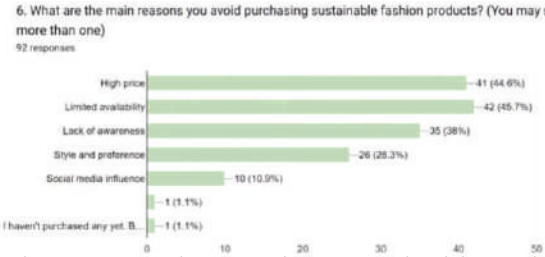


Figure 9. Barriers to adopt Sustainable Fashion

The responses reveal that price and availability are the largest barriers, with 44.6% citing expensive and 45.7% saying sustainable alternatives are difficult to locate. Several also reported low understanding (38%) and concerns about aesthetic ism (28.3%), while only a handful believed social media influences decisions.

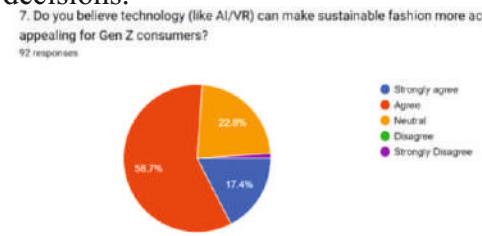


Figure 10. Role of Technology

Most respondents believe technology can help make sustainable fashion more appealing, with 58.7% agreeing and another 17.4% strongly agreeing A small group stayed neutral or disagreed.

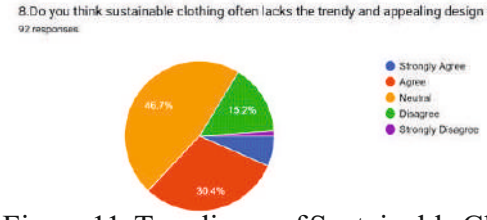


Figure 11. Trendiness of Sustainable Clothing

Many respondents feel that sustainable clothing sometimes lacks trendy or attractive designs, as 30.4% agreed, 6.5% strongly agree. 46.7% chose neutral and 15.2% disagreed.

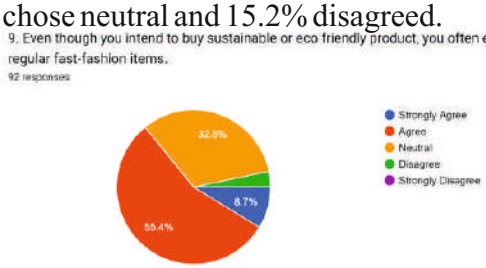


Figure 12. Intent Purchase Gap

Majority of participants acknowledge that even though they wish to purchase sustainable products, they still end up selecting fast fashion, with,8.7% strongly agreeing, 55.4% agreeing and 32.6% neutral. Some of individuals remained disagreed

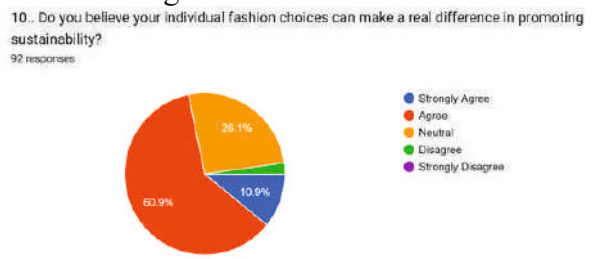


Figure 13. Impact on Sustainable Choices

Most respondents accepted that their personal fashion choices can promote sustainability, with 60.9% agreeing and 10.9% strongly agreeing on the other hand 20.1% remained neutral, and only minor portion 2.2% disagreed.

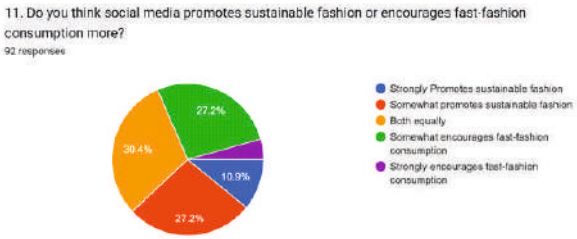


Figure 14. Role of Social Media

A substantial majority of respondents ranging up to 30.4% felt that social media has dual influence, promoting sustainability and fast fashion equally. 27.2% believed it spread awareness on sustainability, interestingly same portion i.e. 27.2% felt it gives rise to fast fashion. 4.3% express their opinion as it strongly encourages fast fashion.



Figure 15. View towards Marketing by Brands

The audience demonstrate mixed trust in brand sustainability claims, 43.5% believe it as just a marketing tool, 40.2% say these claims are somewhat genuine. Only 6.5% felt the claims are mostly genuine, the equivalent portion expresses unsure. Another 3.3% stated it's a marketing tactic.

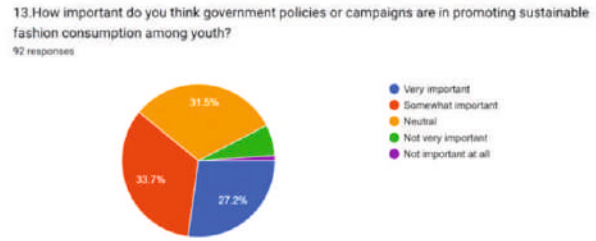


Figure 16. Role of Government Policies

A major share of respondents viewed government policies as significant, i.e. 33.7% mentioned them somewhat important, 27.2% acknowledging them very important. Whereas 31.5% were neutral. A smaller portion, making 6.5% have opinion towards not very important.

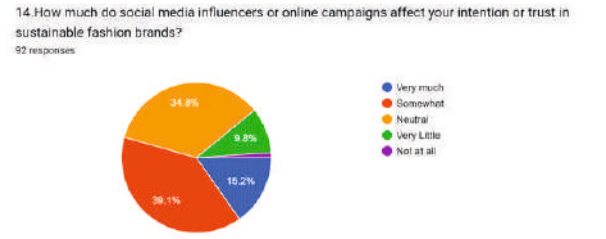


Figure 17. Impact of Online Campaigning

A majority audience considered social media influencers and online campaigns to have a moderate impact, 39.1% say they influence them somewhat, while 15.2% say very much, 34.8% seemed neutral, 9.8% thought the impact was very little, one respondent answered it does not affect them at all.

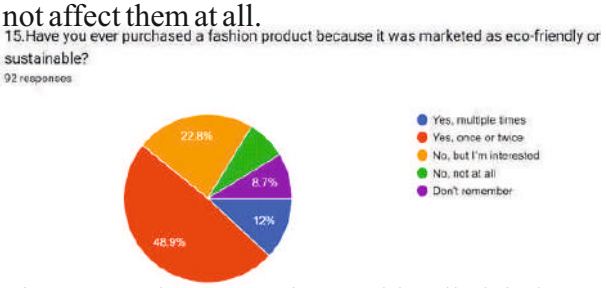


Figure 18. View towards Eco-friendly labels

Nearly half of the sample, summing up to 48.9%, answered they purchased such products once or twice, demonstrating occasional interest in sustainable claims. Another 12% purchased multiple times, 22.8% had not done so yet but expressed interest. A minor share of 7.6% stated they never purchased.

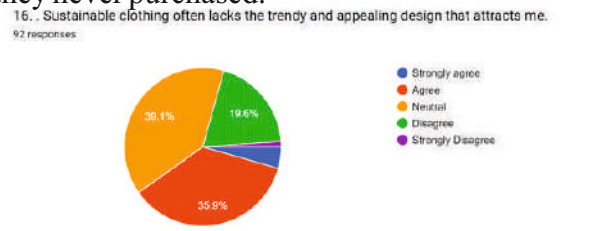


Figure 19. Design Appeal of Sustainable Clothing

A good number of respondents accepted this area of attention, around 40% accept it and 19.6% disagree that sustainable options lack appealing and aesthetic designs. About 39.1% seemed neutral.



Figure 20. Preferred Shopping Platforms

Online platforms were preferred by a broad segment i.e. 68.5% of shopping from sites like Myntra and Amazon, high street and local markets (FC road, Fashion Street) gains 58.7% of attention, another 50% preferred shopping from brand stores. 19.6% concentration was towards sustainable/ local brands. Smaller segment of 10.9% shopped from thrift or second-hand stores.



Figure 21. Impact of Low Prices on Purchase

A substantial 39.1% selected balanced view affordable yet good quality or sustainable products, another 38% mentioned they sometimes prefer cheaper clothes depending on design or price, on the other hand 13% prefer quality or sustainable, rarely promoting fast fashion. 7.6% consciously avoid cheap fast fashion altogether.

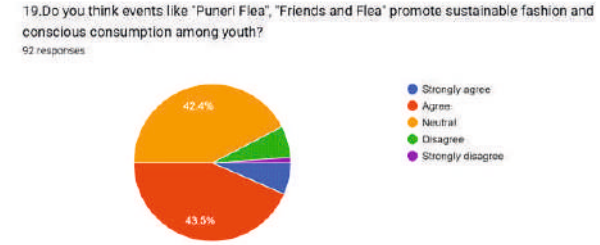
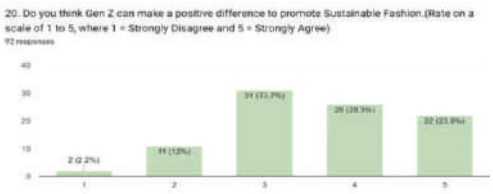


Figure 22. Flea markets Promoting Conscious Consumption

Responses consist of 43.5% agreeing, 6.5% strongly agree and 42.4% neutral that youths view flea markets as genuine platforms to encourage ecofriendly clothing. While very small segment has opinion in disagreement.



The responses give clarity, highlighting strong confidence in Gen Z potential to drive sustainable fashion, with maximum participants rating 4 or 5 on the scale. Even 33.7% selected the midpoint rating acknowledged their potential. These patterns indicate a genuine belief that Genz can play a significant role in bringing up a responsible attitude in sustainable fashion—directly supporting the core focus of study.

7. Findings and Discussion

Research shows that Genz in Pune has immense understanding about sustainable fashion, yet a critical attitude-behavior gap being noticed, and fast fashion is promoted. The difference is acknowledged by affordability, dynamic nature of trends, and ambiguity in brand claims. Genz consumers possess environmental literacy, cost and aesthetic merchandise frequently trumps their sustainable priorities in actual buying. Many Garments are purchased without awareness of their origins and impacts.

Social media gives mixed signals: they spread awareness to encourage adoption of ecofriendly alternatives, simultaneously fuels fast fashion and emergence of micro trends.

Although, some check for sustainability occasionally, most respondents think brand claims are marketing driven content aligning with global concern of greenwashing.

Data interprets thrift stores with low engagement are dominated by online shopping. While donation and flea markets are gaining importance. Genz feels confident to drive sustainable fashion, if guided with transparent information, reasonable pricing, and trendy alternatives.

8. Suggestions

8.1 For the public: Genz are referred as "digital natives", sustainability focus online communities can be established on platforms like Instagram, Telegram, LinkedIn to spread awareness and encourage collective behavior towards ecofriendly fashion.

8.2 For Fashion Brands and Ecommerce: They can integrate AI and VR features to make sustainable shopping more interactive; this will minimize returns. Therefore, success for sustainable brands targeting Genz lies in digital innovation. They should incorporate innovation for establishing Green Supply Chain, to reduce carbon footprint. Sustainable brands should focus on offering trendy aesthetic designs. To address the barrier of greenwashing, authentic marketing strategies, transparent storytelling should be performed. Fashion brands can also introduce "green points" system, where buyer earns points for their sustainable purchase, later which can be redeemed into discount voucher.

8.3 For Institutions and Educational Hubs: To foster the culture of sustainability, colleges, universities can initiate upcycling drives.

8.4 For NGOs: NGOs can issue certificates or eco-labels to reward and recognize brands promoting sustainable fashion. NGOs can also launch advertisement campaigns via social media to encourage youths to donate clothes.

9. Conclusion

The research concludes Genz in Pune are concerned with sustainable fashion and ethical production. But their, behavior still showcase fast fashion due to high prices, less trendy options and low trust towards brand claims. Further, social media has become an intensifier for fast fashion, and dynamic trends, resulting in avoiding outfit repetition. Change of attitude is necessary, from disposability of trends to longevity of meaningful objectives. Promoting sustainable fashion consumption will result in lower consumption, less production demand, cutting carbon emission, and help to mitigate the global crisis of climate change. Genz has capability to promote ethical clothing aligning with ecological balance.

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Weblinks : https://unfccc.int/news/un-helps-fashion-industry-shift-to-low-carbon

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10. The Role of Green Cybersecurity in Enabling Sustainable Digital Commerce

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Abstract

This research paper focuses on Green Cybersecurity in e-commerce websites in India, examining the intersection of security practices and environmental sustainability. All conclusions are drawn from the Consumer Survey, Technical Audit, Developer Interviews, and secondary research. It analyses the relationship between consumer perceptions of e-commerce sites, the actual implementation of green cybersecurity practices, and the factors influencing developers' decisions. Finally, the paper offers actionable recommendations for users, web developers, designers, and e-commerce brands to enhance both security and sustainability.

Keywords- cybersecurity, green cybersecurity, sustainability, e-commerce, digital commerce

Introduction : Digital commerce has transformed economies, enabling rapid business scaling and consumer convenience through seamless access to goods and services. However, this growth masks a critical challenge: the escalating environmental footprint of digital operations. Energy-intensive data centres, high-traffic websites, and resource-heavy cybersecurity defences—such as encryption, intrusion detection, and real-time authentication—contribute significantly to carbon emissions, linking e-commerce expansion directly to sustainability concerns.

Historically, cybersecurity evolved from narrow focuses on access control and data integrity, exemplified by 1970s standards like the Data Encryption Standard (DES), through commercial compliance frameworks. Concurrently, global sustainability discourse formalised via the Brundtland Report (1987), establishing the three pillars—economic, social, and environmental—essential for balanced development. India's Information Technology Act, 2000, anticipated modern compliance needs amid exploding data volumes, accelerating IT infrastructure energy demands.

In India's booming e-commerce sector, propelled by Digital India initiatives, platforms manage massive transaction volumes, complex user interactions, and sophisticated threats like phishing and payment fraud. The Digital Personal Data Protection (DPDP) Act, 2023, mandates stringent data safeguards, intensifying the tension between robust security and resource efficiency. E-commerce's real-time demands amplify computational loads, raising indirect energy costs that conflict with global sustainability goals.

Green cybersecurity addresses this convergence, advocating lightweight encryption, energy-optimised cloud setups, low-impact protocols, and automation to minimise redundant processes. For digital commerce reliant on consumer trust, it represents strategic necessity—delivering protection without excessive emissions. Yet, research gaps persist: studies treat cybersecurity and ICT sustainability separately, rarely intersecting them in e-commerce contexts. This study uses three practical lenses—consumer perceptions (surveys), developer challenges (interviews), and system performance (a technical audit of 35 Indian e-commerce

websites)—to examine how green cybersecurity can support more sustainable and secure digital commerce.



Statement of Problem and Research Gap

Indian e-commerce websites often implement essential security measures like HTTPS but frequently overlook energy-efficient practices, leading to heavy scripts, insufficient security headers, and excessive trackers. These issues result in platforms that, while secure, consume unnecessary resources and contribute to environmental impact. Despite the growing importance of sustainable digital commerce, there is a notable lack of empirical research linking cybersecurity effectiveness with environmental sustainability in the Indian context. Additionally, standardised frameworks and clear guidelines for developers and consumers to adopt green cybersecurity practices are missing. Addressing these gaps is crucial to fostering secure, efficient, and environmentally responsible e-commerce platforms in India.

Review of Literature : Traditional cybersecurity approaches have focused primarily on protecting digital assets by ensuring confidentiality, integrity, and availability. However, this focus often neglects the growing environmental impact associated with the energy demands of continuous monitoring and complex security operations. Khalifa et al. (2023) critically explore this by applying a triple-bottom-line sustainability assessment revealing how conventional cybersecurity contributes significantly to carbon emissions in data-intensive platforms like e-commerce. This work urges the need for sustainability considerations alongside security, positioning green cybersecurity as essential for responsible digital commerce.

Expanding this perspective, Innovation green technology in the age of cybersecurity: Balancing sustainability goals with security concerns discuss cybersecurity challenges within sustainable digital industry contexts, highlighting tensions between robust e-commerce fraud detection and energy efficiency requirements. They emphasise that, while e-commerce platforms must maintain strong fraud detection, this should not come at an excessive ecological cost, setting the stage for optimization frameworks. Technological advancements in AI and machine learning illustrate promising paths to balance this tension. Usman et al. (2025) demonstrate that AI-driven anomaly detection can substantially reduce computational overhead without compromising fraud protection effectiveness. This innovation directly addresses sustainability by lowering energy consumption in high-transaction environments.

Shapira et al. (2024) contribute significantly by proposing concrete measurement and optimization frameworks that quantify energy use in cybersecurity tools. Their evidence points to inefficient practices such as redundant logging and overuse of security headers, which amplify e-commerce platforms' environmental footprints, offering metrics vital for targeted improvements. The Springer study "Integrating Sustainability into Cybersecurity" (2024) supplements these insights by using topic modelling to link cybersecurity strategies to global sustainability goals, emphasising the importance of designing green cybersecurity aligned with SDGs targeting energy and infrastructure. Studies such as Arora and Sharma (2019) reinforce the practical benefits of network-efficient security protocols in minimizing data transmission energy on e-commerce sites.

Despite these advances, ongoing challenges impede full adoption. For example, the Results in Engineering special issue on "Green Cybersecurity: Sustainable Solutions in Information Security for the Digital Age" (2024) calls for standardised benchmarks to measure the energy effectiveness of cybersecurity, highlighting a significant empirical gap across sector-specific contexts such as e-commerce. Collectively, these studies reveal the complex but critical intersection of cybersecurity and sustainability. They establish green

cybersecurity not simply as a goal but as the foundation for the future of secure and responsible digital commerce, especially in rapidly developing markets like India.

4. Research Methodology

4.1. Objectives of Research

1. To understand the status of Green Cybersecurity in India by analysing consumers and developers opinion, and a technical audit.
2. To spread awareness and encourage Green Cybersecurity practices is e-commerce websites in India.

4.2. Research Design

- Method of Research: Survey method with supporting developer interviews and an automated technical audit.
- Sample Size: 60 consumers, 3 developers, and 35 e-commerce websites.
- Universe: Pune, India (for human participants); pan-India e-commerce sites (for technical audit).
- Sampling Method: Convenience sampling for consumers and developers; purposive sampling for websites by category.
- Primary Data: Structured questionnaire responses, interview transcripts, and automated audit scores.
- Data Collection Tools: Questionnaire, interview guide, and Python–Lighthouse audit script.
- Secondary Data: Websites, articles, research papers, educational videos, and books.

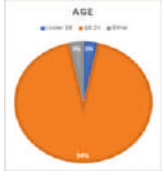
5. Data Analysis and Discussion

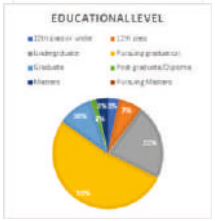
5.1. Consumer Survey with Indian Students

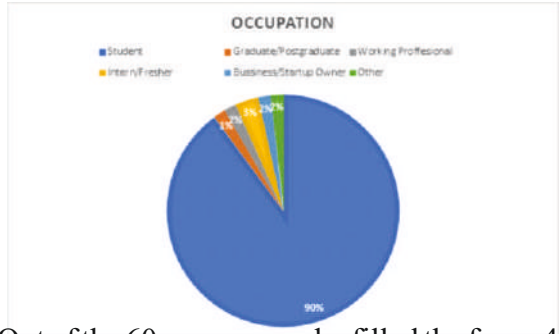
A survey with a sample size of 60 responses was conducted which considered the consumer perspective on Green Cybersecurity in e-commerce websites in India and users answered on a voluntary basis.











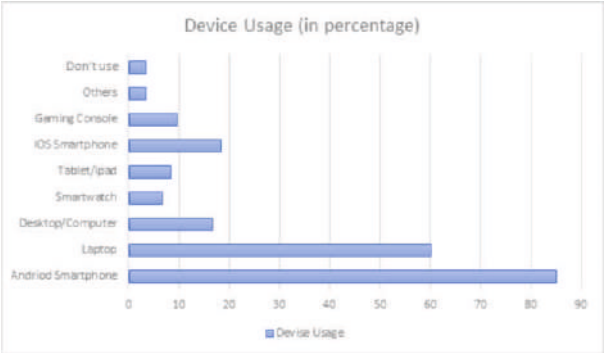
Out of the 60 responses who filled the form, 40% were Male, 60 % were Female, and 94% were Indian citizens. Majority of the respondents were Students between 18-24 years old.

5.1.1. Consumer Behaviour

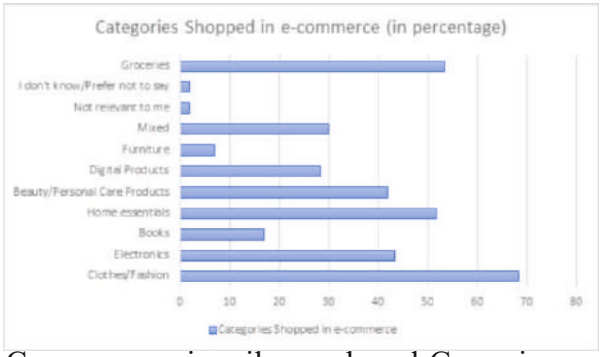
The behaviour of these consumers on e-commerce websites was assessed.







Most consumers 'frequently' or 'occasionally' used e-commerce websites and had a 'very positive', 'positive', or 'somewhat positive' experience in the past 6 months. Android smartphones were the most used devices for accessing these websites, followed by laptops, desktops and computers.



Consumers primarily purchased Groceries and Clothes and Fashion, and least purchased Furniture using e-commerce websites.

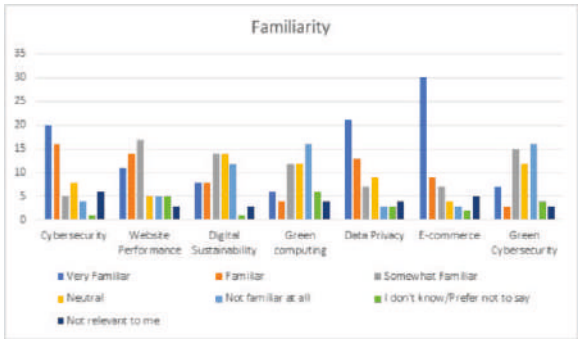




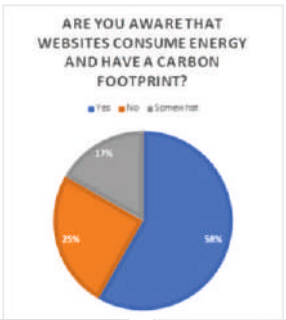
48% users have never stopped using an e-commerce website due to any reason, however 25% have and 27% somewhat have due to reasons like 'it was too slow' or 'payment page felt unsafe'.

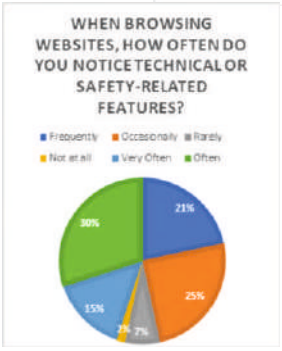
5.1.2. Awareness and Knowledge

Consumers awareness and knowledge on green cybersecurity was assessed.



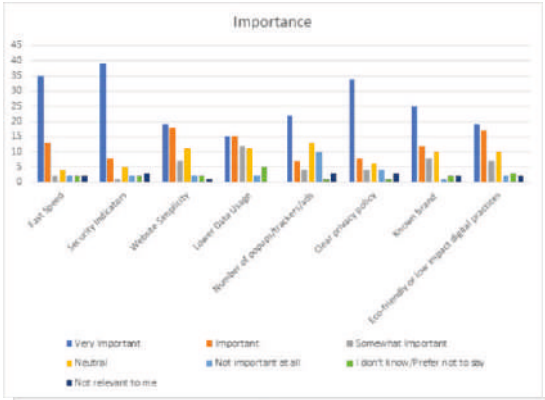
Consumers were most aware and familiar with 'e-commerce' and most unfamiliar with 'green cybersecurity', which showcases a lack of awareness in this topic.

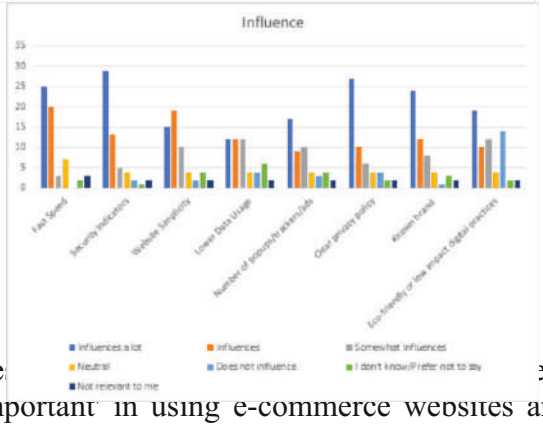






Most consumers were aware that websites consume energy and have a carbon footprint, but 25% were unaware regarding this. Many Often noticed technical or safety-related issues, but 18% still felt Frequently Unsafe and 32% Occasionally Unsafe on e-commerce websites.

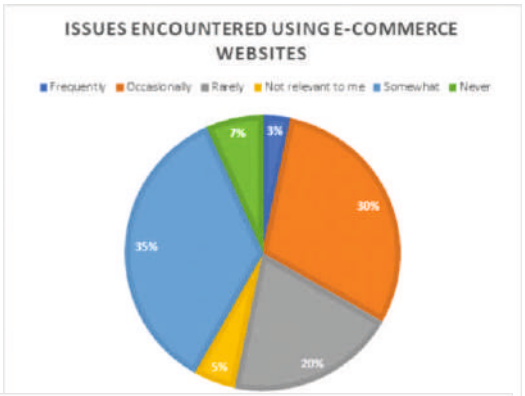




Re ery Important in using e-commerce websites and were also most influenced by it.

5.1.3. Problems Faced While Using E-commerce Websites

Consumers were asked regarding common issues they encounter while using e-commerce sites and their opinion on potential solutions for them.

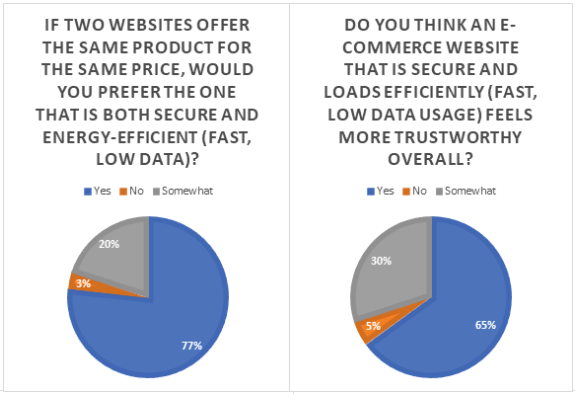


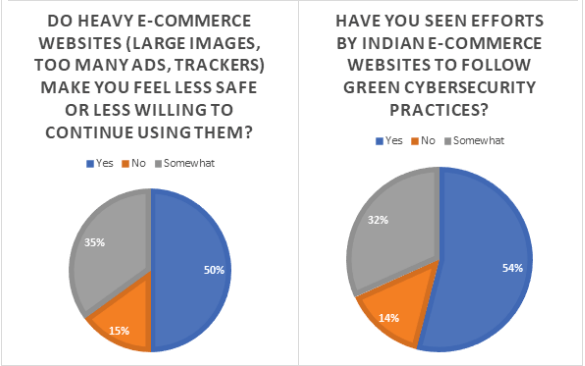




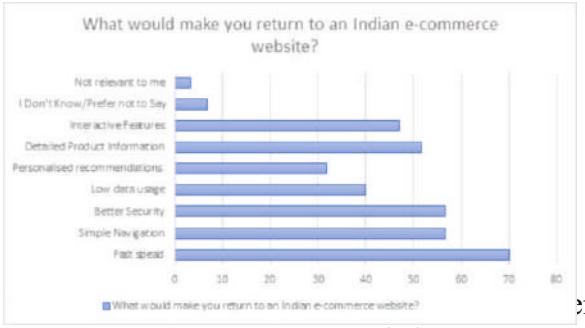
commerce sites and 30% occasionally faced issues. Users were most concerned about 'too many adds' and 'slow loading' and most agreed with improvements like 'simplified websites' and 'better privacy transparency'.

5.1.4. Concluding Analysis

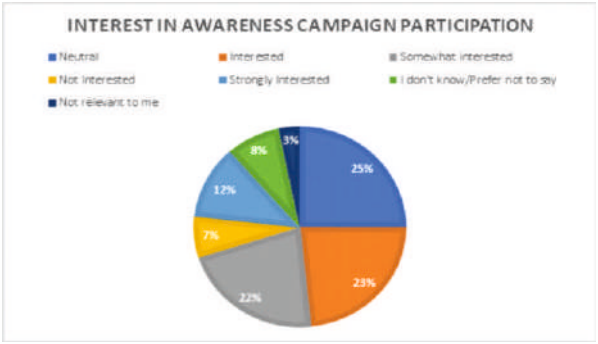




77% users agreed that if they were offered two products of different websites for the same price, they would prefer the website that is secure and energy-efficient, and 65% agreed that they trust a website with faster loading time. 50% users agreed that websites with many trackers, ads and images make them less likely to use them, but 15% disagreed with this. 54% users had seen initiatives by Indian e-commerce websites to follow green cybersecurity practices.



em return to an e-commerce website, most users voted for 'Fast Speed', over 'Better Security', despite previously finding it more important. Users also felt Simple Navigation would make them more likely to return.



25% users were strongly interested in awareness campaign participation regarding Green Cybersecurity in Indian e-commerce websites.

5.1.5. Limitations of Consumer Survey

Some limitations of Consumer Survey were-

- The survey sample was geographically concentrated, comprising primarily of students from the Pune district in India, which may limit the broader applicability of findings.
- Additionally, the relatively small sample size constrains the generalisability and statistical analysis of the study results.

5.1.6. Findings of Consumer Survey

Some of the conclusions from the Consumer Survey were-

- Consumers are not very aware of Green Cybersecurity.
- Consumers have a preference for Fast Speed while using Indian e-commerce websites.
- Consumers are interested in awareness outreaches.

5.2. Technical Audit

An automated technical audit of 35 Indian e-commerce websites was conducted using a custom Python–Lighthouse workflow, with 5 sites in each of 7 categories. Each website was scored (1–5) on HTTPS Security, Security Headers, Lightweight Security Scripts, Page Load Speed, Total Page Size, HTTP Requests, Script Optimisation, Animation Weight, and Tracker Count, grouped into three pillars: Security & Protection Efficiency, Performance & Resource Efficiency, and Interaction & Tracking Efficiency. Metrics that could not be measured were marked DNC and excluded from averages. Higher scores with lean pages and fewer trackers indicate greener cybersecurity, and each site was anonymised using a code.

Category Number	Category Name
C1	Clothing/Fashion
C2	Books
C3	Electronics
C4	Home Essentials/ Groceries
C5	Digital Products
C6	Furniture
C7	Mixed/Multi Products
PI	Pan India
Score	**Score Meaning**
1	Poor
2	Weak
3	Fair
4	Good
5	Strong
DNC	Data Not Captured

5.2.1. Criteria of Technical Audit

Pillar	Pillar Name	Criteria	Indicators / Tool (Used in This Study)	Green Cybersecurity Link
1	**Security & Protection Efficiency**	**HTTPS Security**	**SSL validity, HTTPS enforcement – Python + Lighthouse**	**Fewer failed requests, lower server energy**
		Security Headers	**HSTS, CSP, XFO, X-Content-Type – Lighthouse security headers**	**Blocks malicious traffic, reduces bandwidth waste**
		Lightweight Scripts	**Script size/minification – Lighthouse JS/CPU diagnostics**	**Less CPU work, lower energy per session**
2	**Performance & Resource Efficiency**	**Page Load Speed**	**LCP, TTI, perf score – Lighthouse Performance**	**Fewer CPU cycles, fewer retries**
		Total Page Size	**Transferred KB/MB – Lighthouse total-byte-weight**	**Less data moved, lower network energy**
		HTTP Requests	**Number of requests – Lighthouse network-requests**	**Fewer round trips, less server compute**
3	**Interaction & Tracking Efficiency**	**Script Optimisation**	**Unused/minified JS – Lighthouse unused-javascript**	**Cuts heavy scripting, saves device energy**
		Animation Weight	**Animation/GPU cost – Lighthouse diagnostics**	**Lower GPU load, less battery drain**
		Tracker Count	**Third-party/ trackers – Lighthouse third-party request analysis**	**Fewer background calls, reduced traffic/energy**

5.2.2. Data of Technical Audit

The final total of each pillar of the audit is depicted below. The full data can be accessed at (https://docs.google.com/spreadsheets/d/1ugqreLOZvJkrSyUCE90iV_JMX66J5DnMYC7feJWYerE/edit?usp=sharing).

Code	Pillar 1 Total	Pillar 2 Total	Pillar 3 Total	Final Total
PI-C1-A	5	3.5	DNC	8.5
PI-C1-B	3.67	DNC	5	8.67
PI-C1-C	4	4	3.5	11.5
PI-C1-D	3	3.5	5	11.5
PI-C1-E	3.67	3.5	5	12.17
PI-C2-A	3.67	2.67	5	11.33
PI-C2-B	3	DNC	4	7
PI-C2-C	2.67	DNC	5	7.67
PI-C2-D	3	2.67	4	9.67
PI-C2-E	4.33	DNC	5	9.33
PI-C3-A	3.67	3.5	5	12.17
PI-C3-B	3.33	3.5	5	11.83
PI-C3-C	4.33	3.5	5	12.83
PI-C3-D	4	3.5	5	12.5
PI-C3-E	3.33	3.5	5	11.83
PI-C4-A	3.67	3.5	5	12.17

PI-C4-B	4	3.5	4	11.5
PI-C4-C	3	3.5	5	11.5
PI-C4-D	3.67	2.67	5	11.33
PI-C4-E	3.67	3.5	4.5	11.67
PI-C5-A	4.67	4.33	3.5	12.5
PI-C5-B	4.33	DNC	5	9.33
PI-C5-C	3.33	3.5	3	9.83
PI-C5-D	4.33	5	5	14.33
PI-C5-E	2.67	5	4	11.67
PI-C6-A	3.67	3.5	5	12.17
PI-C6-B	4.33	3.5	5	12.83
PI-C6-C	2.33	3.5	5	10.83
PI-C6-D	4	DNC	5	9
PI-C6-E	4	3.5	4	11.5
PI-C7-A	2.67	3	5	10.67
PI-C7-B	4	3.5	5	12.5
PI-C7-C	3.33	3.5	5	11.83
PI-C7-D	3.67	3.5	5	12.17

5.2.3. Limitations of Technical Audit

Some limitations of the Technical Audit were-

- The audit is limited to a selected set of front-end and network metrics and does not fully capture back-end configurations or long-term logging practices.
- Several measurements were marked DNC (Data Not Captured) because tools timed out, pages failed to load reliably, or specific diagnostics were unavailable, which leaves some performance and interaction results incomplete.
- The scores reflect each website at only one point in time as of December 2025, so later updates or optimisations are not represented in the dataset.

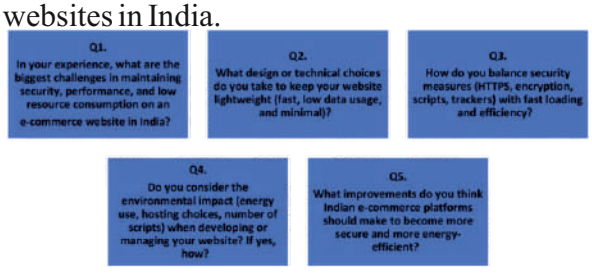
5.2.4. Findings of Technical Audit

Some of the conclusions from the Technical Audit were-

- The audit links security, performance, and tracking metrics to energy use per visit, operationalising green cybersecurity as protection that is both secure and resource-efficient.
- HTTPS, security headers, page load speed, total page size, HTTP requests, and DNC flags show where configuration gaps and bloated assets waste bandwidth, CPU work, and resilience.
- Script optimisation, animation weight, tracker count, and the 1–84 script tags detected per site connect UI and tracking behaviour to extra processing and emissions, showing that leaner scripts, well-tuned headers, and fewer trackers can jointly improve security, user experience, and sustainability.

5.3. Developer Interviews

Interviews were conducted with 3 developers through Google Forms where they were asked 5 primary questions to determine their insights regarding Green Cybersecurity in e-commerce websites in India.

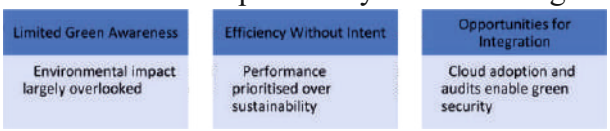


5.3.1. Limitations of Developer Interviews

- The interview sample consisted of only three developers from Pune district, which limits the generalisability of the findings. All three respondents were male, and the small, localised sample restricts wider applicability of the results.

5.3.2. Findings of Developer Interviews

- Developer interviews reveal that Pune-based e-commerce developers prioritise security updates, performance optimisation, and constant patching against phishing/payment fraud, but show no explicit awareness of energy use or green cybersecurity.
- Challenges like intrusive pop-ups, cookies, and ads disrupt UX, while lightweight design efforts (minimising page weight, code optimisation) focus on speed rather than sustainability—one developer even questioned its cybersecurity link. Security remains non-negotiable via load balancers, yet environmental impact is ignored.
- Recommendations for cloud storage, faster loads, and efficient deployment highlight untapped potential: reframing existing practices as green cybersecurity could simultaneously enhance security, performance, and environmental responsibility in Indian digital



6. Major Findings of Research

The major findings after analysing 3 different types of data were:

- Consumers strongly value security and speed on e-commerce sites but rarely think about environmental impact, seeing sustainability as separate from security and performance.
- Developers treat security measures like HTTPS and updates as non-negotiable, yet are unaware and do not consciously consider energy use or green hosting when making technical and design decisions.
- The technical audit shows consistently strong HTTPS implementation across all 35 websites but widespread gaps in security headers and lightweight scripting, limiting both protection depth and efficiency.
- Performance and tracking metrics reveal missed opportunities: many sites carry unnecessary scripts and trackers, leading to heavier pages and higher resource consumption than needed for their security goals.
- Across all three data sources, green cybersecurity emerges as an implicit by-product of performance optimisation rather than an explicit objective, indicating a need for clearer awareness, guidelines, and tools that link security choices to sustainability outcomes.

7.



7.1. Suggestions for Consumers

It is suggested to:

1. Choose platforms with strong security headers and fast loading.
2. Report sites with excessive trackers and pop-ups.
3. Demand transparency on website energy efficiency

7.2. Suggestions for Web Developers and Designers

It is suggested to:

1. Implement all security headers (HSTS, CSP, XFO).
2. Minimise scripts, trackers, and HTTP requests.
3. Optimise for Lighthouse performance scores.

7.3. Suggestions for E-Commerce Brands in India

It is suggested to:

1. Audit sites quarterly for green cybersecurity metrics.
2. Choose renewable-powered, efficient hosting providers.
3. Publish eco-security scores to build consumer trust.

8. Conclusion

This study illuminates the role of green

cybersecurity in enabling sustainable digital commerce in India, revealing that while e-commerce sites achieve basic protection through universal HTTPS, they fall short on energy-efficient practices like security headers, script optimisation, and tracker reduction. Consumer surveys show limited sustainability awareness, developers prioritize functionality over environmental impact, and technical audits confirm widespread resource inefficiencies across 35 sites. Green cybersecurity emerges as a critical enabler—delivering robust protection while minimizing energy use and emissions. By empowering consumers to demand eco-secure platforms, equipping developers with optimisation tools, and guiding businesses toward sustainable security frameworks, India can build resilient digital commerce ecosystems that balance security, performance, and planetary responsibility.

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11. ESG Investing: How Sustainability is Shaping Indian Financial

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Abstract

The world today is facing several global challenges, such as climate change, rising inequality, the transition from a linear to a circular economy, and the need to balance societal and economic priorities. These challenges compel companies to move beyond profit maximization and adopt governance structures that support long-term sustainability. This is where Environmental, Social, and Governance (ESG) factors have become pivotal, particularly in the financial sector, where they increasingly shape corporate and investment decision-making. The present study focuses on the relationship between ESG factors and investment decisions of investors in India and examines their influence on individual investors' decision-making in the Indian stock market. Primary data was collected through an adopted questionnaire from 230 individuals. To strengthen these insights, the study also incorporates an interview with a CSR manager from a leading engineering and consulting organisation, offering a practical view of ESG integration at the corporate level. Corporate cases from Tata Group, Infosys, HUL, Reliance, and HDFC Bank demonstrate varied models of ESG integration with measurable impact, further supporting the study's findings. To strengthen these insights, the study also incorporates an interview with a CSR manager from a leading engineering and consulting organisation, offering a practical view of ESG integration at the corporate level. Corporate cases from Tata Group, Infosys, HUL, Reliance, and HDFC Bank demonstrate varied models of ESG integration with measurable impact, further supporting the study's findings.

Key Words :- ESG Investing; Sustainability; Governance; Climate Change; Corporate ; Circular Economy; CSR Integration;

Introduction : Environmental, Social, and Governance (ESG) investing has gained significant global attention as investors increasingly prioritize responsible and sustainable business practices. The Environmental (E) dimension evaluates a company's impact on natural resources and climate change preparedness, while the Social

(S) dimension covers labor conditions, community relationships, and customer welfare. The Governance (G) dimension focuses on corporate ethics, board diversity, transparency, and protection of shareholder rights. This transition from traditional financial-based evaluation to a broader assessment reflects a growing shift towards measuring long-term sustainability and ethical performance.

Although ESG investing has grown rapidly in many developed markets, research on its influence in India is still emerging. The Indian stock market presents a unique setting due to its diverse investor base, evolving regulatory framework, and fast-growing economy. Limited studies have specifically explored how ESG considerations affect individual investors' decisions in India. Therefore, this study seeks to fill that gap by analyzing the role of ESG factors in shaping investment behavior, understanding investor awareness, and identifying sustainability preferences in portfolio choices. The findings aim to contribute valuable insights into the increasing relevance of ESG in the Indian investment landscape.

Statement of the Problem: While ESG investing has attracted a lot of attention worldwide, the reality is that a great number of Indian investors, particularly young retail investors, are not informed or clear about making a financial decision that takes into account sustainability. One of the reasons that transparency in ESG reporting remains a significant challenge is the problem of ill-defined standards and the worry of greenwashing. This research investigates the viewpoints of investors and the effect of the environmental, social, and governance (ESG) performance of a company on the investment decisions in .

Literature Review & Context : Recent years have witnessed increasing interest in ESG investing, as investors recognize that strong ESG performance can reduce risks and support long-term value. Research suggests that companies with clear ESG reporting are viewed more positively, while poor disclosure signals higher idiosyncratic risk and may lead to harmful operational decisions. ESG-compliant firms benefit from better governance, lower financing costs, and steady profitability (Kumar, 2020). The recent empirical study by Chaubey, Verma and Yadav (2025) found that Environmental, Social and Governance (ESG) factors significantly influence individual investors' decisions in the Indian stock market, with environmental concerns emerging as the strongest predictor, followed by social and governance factors.

Malaysia serves as a notable example, where early CSR initiatives began in the 1980s, followed by mandatory sustainability and ESG disclosure frameworks. The Companies Act 2016 and the adoption of SDGs further strengthened reporting standards, making Malaysia a global leader with 97% of top firms disclosing sustainability performance (Peng, 2018).

Objectivesof the Study

The following are the objectives :-

1. Understand the awareness level of the ESG investing among the young Indian investors through a survey.
2. Investigate the motives of investor attitudes and corresponding behavior towards sustainability.
3. Measure the extent to which the corporate ESG performance influences the change in investors' preferences.
4. Compare investor perceptions regarding the companies' ESG practices versus those of the top Indian .

Relevance of Study : AsESG investing is becoming more popular worldwide, the Indian markets are slowly witnessing a change in financial choices that are sustainability-driven. Nevertheless, a large number of retail investors still find it difficult to understand and access trustworthy ESG information, with the younger segment in particular, that is newly entering the investment landscape. Even as companies differ significantly in their ESG implementation and reporting quality, resulting in gaps in information and uncertainty. This research is important as it assesses the two extremes - investor perceptions and corporate practices - to grasp the impact of sustainability on financial decisions in India. The study, by using survey data, expert insights, and case studies, offers up-

to-date support to policymakers, companies, and investors who are getting used to the increasing need for responsible and future-oriented .

Data & Research Methodology :

A quantitative survey using Google Forms was conducted to capture the awareness, perceptions, and practices of the young Indian investors about ESG investing. The questionnaire was designed to collect information on demographics, ESG familiarity, investment motivations, and sustainability attitudes. The answers were coded and analyzed with descriptive statistics to find the main patterns and behavioral .

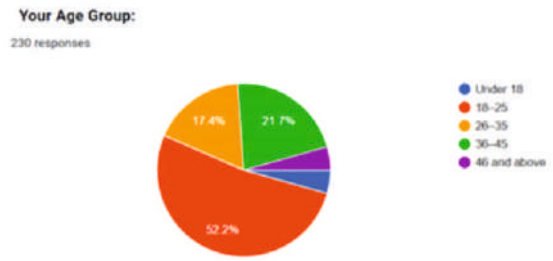
3.1 Survey Design & Sample

The Google Form had 230 respondents, mostly aged 18-25, from a broad academic and professional background were surveyed using a Google Form containing 22 questions on demographics and behavioral factors. The participants were the existing, new, and potential investors. The web-based, self-administered survey used convenience sampling and thus gives dependable exploratory insights into the sustainable investment mindset of young .

3.2 Findings

By collecting responses, the survey's key findings reveal very clear trends regarding the awareness, attitudes, and behaviors towards sustainable investing among the Indian respondents. It is evident from these trends that sustainability is becoming an important factor in financial decisions.

3.1.1Demographic Profile



Most people (around 72%) were in the 18-25 age group, which shows that the survey in very relevant to young investors. There were fewer people in 26-35, 36-45 & 46+groups.

- Gender:

There were a few more female than male respondents in the dataset.

- Field of Study/Work:

The majority of the participants were from Commerce / Finance / Economics and the rest were from Science/Engineering and Management.

- Employment Status:

There was a combination of students, early professionals, and mid-career .

3.1.2 Investment Experience

Approximately, 55-60% of the respondents indicated that they already had investments in stocks, SIPs, or mutual funds.

Nearly, 25-30% of the people were considering making an investment in the near future.

There was a very small fraction of the people who had no investment at all.

Consequently, most of the respondents appear to have some kind of financial instrument exposure.

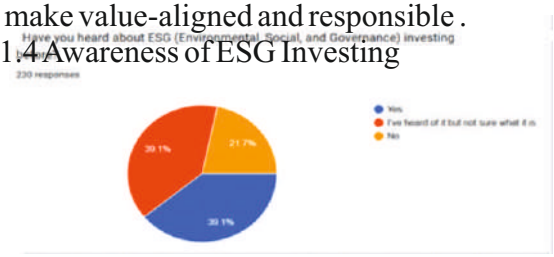
3.1.3 Factor Influencing Investment Decisions

The leading factors across 230 responses were:

Factor	% of respondents (approx.)
Profitability	63%
Long term growth potential	58%
Ethical or company values	36%
Brand reputation	28%
Trendlines/ new-age appeal	18%
Risk considerations	14%

Investment decisions are mainly driven by profitability (63%) and long-term growth (58%), as revealed by the analysis of 230 responses, with the remaining factors being ethics (36%), brand reputation (28%), trendiness (18%), and risk (14%). Most of the decisions are ruled by returns, however, a considerable portion of investors is still inclined to make value-aligned and responsible .

3.1.4 Awareness of ESG Investing



Thegraph shows that, in addition to profitability and long-term growth being the major factors driving investments, a significant number of respondents also take into account ethics and brand reputation, which is indicative of a gradual move to investing that is socially responsible and in line with one's values.

3.1.5 ESG Perspectives, Actions, and Investment Choices

Survey results indicate a robust awareness of sustainability: 52% rated it as very important, and 34% as fairly important in their financial and lifestyle choices, whereas just 4% deemed it unimportant. Investment decisions showed a balance between profitability and responsibility, with 46% prioritizing greater returns and 42% preferring sustainable firms. Ethics were significant, with 62% steering clear of unethical companies and 63% willing to alter their behavior if brands breached established norms. Views on ESG were positive—58% considered it lucrative and 52% anticipated enduring advantages. Tata Group topped the rankings in ESG leadership, with many respondents indicating a readiness to invest 25–50% of their portfolios in ESG, emphasizing the need for increased transparency and more rigorous regulations

ESG Case Studies

Case Study 1: Tata Group — Project Aalingana (Sustainability Leadership)

The Tata Group's Project Aalingana integrates sustainability across its diverse business portfolio through focus areas such as climate action, circularity, and nature restoration. The Group aims to achieve carbon neutrality by 2045 and reduce Scope 1 and 2 emissions by 25% by 2030. Companies such as Tata Power, Tata Steel, Tata Motors, and Tata Chemicals are adopting renewable energy, sustainable mobility solutions, green manufacturing, and water-efficiency measures. Circularity is supported through zero-waste goals and increased use of recycled materials, while biodiversity conservation and community-led environmental projects reinforce social value.

Impact: Aalingana strengthens Tata Group's long-term environmental and financial resilience, illustrating how large conglomerates can lead sustainability transitions across multiple sectors.

Case Study 2: Infosys — ESG Vision 2030 & Climate-Positive Commitment

Infosys' ESG Vision 2030 positions the company as a global leader in sustainable technology services. Built on environmental stewardship, social responsibility, and strong governance, the strategy drives renewable energy adoption, smart green buildings, efficient waste management, and water conservation. Infosys aims to be climate-positive by 2030. Social initiatives through the Infosys Foundation include digital literacy, education, healthcare, and rural development. Governance focuses on ethical conduct, robust data privacy, transparent reporting, and leadership diversity.

Impact: Infosys demonstrates how service-sector companies can balance profitable growth with environmental protection and community impact, making it highly attractive to responsible investors.

Case Study 3: Hindustan Unilever Limited (HUL)

HUL integrates sustainability through the Unilever Sustainable Living Plan (USLP). Its major efforts include plastic waste management via recyclable packaging, waste collection partnerships, and rainwater harvesting along with watershed rejuvenation for water security. Hygiene education through brands like Lifebuoy improves rural health outcomes.

Impact: HUL's initiatives reduce its environmental footprint, support waste workers through recycling programs, and promote healthier communities. By embedding sustainability in consumer products, HUL shapes responsible consumption in India.

Case Study 4: HDFC Bank — Sustainable Banking & ESG Financing

HDFC Bank embeds sustainability into financial services through responsible lending, green financing, and inclusive banking. The bank supports renewable energy, e-mobility, and clean infrastructure, while also adopting solar power and energy-efficient branches internally. Its Parivartan program drives rural development, digital and financial literacy, and skill-building, while MSMEs benefit from

green-credit products and advisory support.

Impact: HDFC Bank enables clean-energy growth, job creation, and financial inclusion. By integrating ESG criteria into lending and risk assessment, it showcases how banking can accelerate national sustainability goals.

CaseStudy 5: Reliance Industries Limited – Clean Energy Transition

By 2035, Reliance is aiming at Net-Carbon Zero, a target that is going to be achieved mainly through its Green Energy Giga Complex which will be producing solar modules, batteries, and electrolyzers. Along with renewable integration, biogas projects, and carbon-capture systems are part of the company's move to circularity.

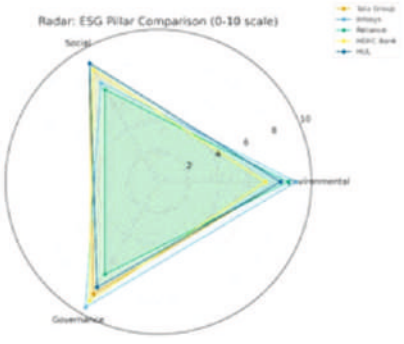
Impact: Reliance is turning the low-carbon transition in India into a rapid one, creating a larger number of green jobs, and setting the standards for heavy carbon-consuming .

Comparative ESG Table

Company	Sector	Sustainability Focus	Strength	Key Limitations
Tata Group	Conglomerate	Green manufacturing, community development	Strong multi – sector impact	Slower scale due to diversified structure
Infosys	IT Services	Carbon neutrality, digital education	Governance & energy efficieny leadership	Limited direct environmental footprint
Reliance	Energy & Petrochemicals	Green hydrogen, renewables	India's largest clean- enery investment shift	Still dependent on fossil fuel
HUL	FMCG	Plastic circularity, hygiene & water	Strong consumer- level impact	Environmental depended packing supply chains
HDFC Bank	Banking	Inclusive finance, ESG - linked lending	Green transition enablers	Operational ESG footprint is indirect

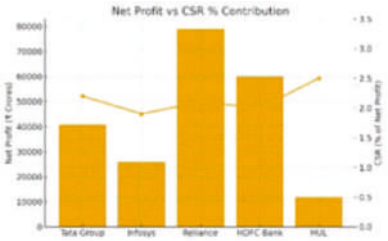
Visual Comparison of Environmental, Social, and Governance Outcomes

Figure1 - Radar: ESG Pillar Comparison



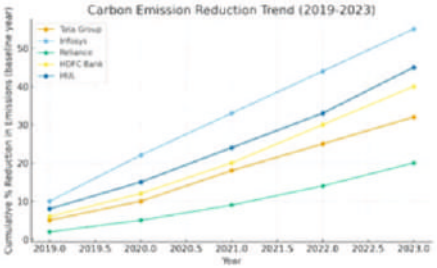
HDFC Bank and Infosys display a more robust governance performance, whereas Tata and HUL are comparatively more socially responsible and community-oriented .

Figure2 - Net Profit vs CSR %



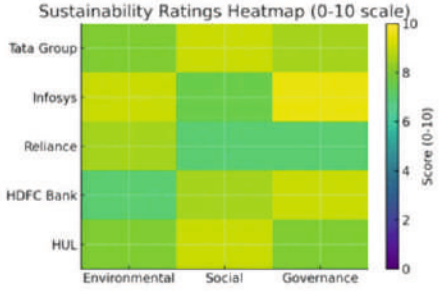
Net profits are displayed as a bar plot with the CSR percentage overlaid, indicating that bigger companies (Reliance, HDFC) are making more profits in absolute terms; the share of CSR contribution as a percentage is quite similar across different .

Figure3 - Carbon Emission Reduction Trend (2019–2023)



The graph reveals that Infosys and HUL are the companies that have cut their emissions the most sharply, which indicates that they have carried out the most powerful and aggressive sustainability .

Figure5 — Sustainability Ratings Heatmap



Illustrates at a glance each firm's rating in various areas, with a darker shade indicating better results, technologies would further facilitate improved corporate adherence and

increased public engagement in responsible investing.

Analysis of CSR & ESG Practice (Based on Expert Interview) :(The organisation that participated in the study and has requested for anonymity, it is one of the top companies in the fields of engineering, consulting, and project management.)

1.Strategic Approach to CSR Prioritisation

- The company, through its Foundation, applies a formal evaluation framework to decide on CSR and sustainability innovations.
- They prioritise projects based on criteria that have been set beforehand such as the impact in the long run, the alignment with the sustainability objectives, and the feasibility.

2. Governance Structure and Approval Mechanisms

- The governance system for CSR and ESG decision-making is of multiple layers and comprises:
  - Board of Directors
  - CSR Committee
  - Senior CSR Management
  - CSR Steering Committee
  - CSR Network Members & Champions
- The establishment is dedicated to planning finance in a way that is in harmony with the pledges to sustainability.

3. Monitoring,Evaluation & Impact Assessment

- Project continuation is contingent upon progress reports, impact data, independent assessments, and indicators of sustainability.
- Internal frameworks consistent with the three Environmental, Social, and Governance pillars provide the structure for the evaluation.

4.Community Engagement & On-Ground Challenges

- Community feedback is obtained through consultations, visits, and awareness programs to guarantee a design that is appropriate for the local context.
- The major challenges are the problems with land acquisition, resistance of the community, delays in regulations, and shortage of funds.

5. Employee Participation & Capability Building

- Employees are encouraged to submit sustainability ideas through a Value Creation database.
- Learning roadmaps (e.g., New Energy and Digitalisation) are aimed at developing internal sustainability competence.
- Certain sustainability indicators have been linked to employee performance evaluations.

6. Technology-Driven ESG Management & Stakeholder Influence

- ESG results are tracked with the help of digital dashboards, analytics, and carbon-tracking tools.
- The ESG Data Management Standard, which is to be implemented soon, will be a great support for data accuracy and reporting.
- The expectations of investors and clients that are consistent with the ESG priorities are one of the major factors that lead to the sustainability focus being

Findings & Conclusion

1. Shift in Investment Perspective: Young Indian investors are increasingly considering sustainability alongside profitability when making investment decisions.
2. Influence of ESG Factors: Environmental accountability, ethical conduct, and long-term societal impact are significantly influencing investor attitudes.
3. Corporate ESG Initiatives: Companies like Tata Group, Infosys, HUL, Reliance, and HDFC Bank are adopting ESG initiatives strategically, rather than superficially.
4. Benefits of Sustainability Integration: Incorporating sustainability enhances risk management, strengthens brand confidence, and supports long-term value creation.
5. Alignment of Investor Expectations and Corporate Practices: There is a growing synchronization between what investors expect in terms of ethical and sustainable practices and how companies are responding.
6. Rising Importance of ESG in India: ESG considerations are becoming a central factor in the investment decision-making process in India.

An Indian investors study has been shown ESG factors to be increasingly important in their financial choices. The survey results point to increased awareness, stronger ethical preferences, and a clear readiness, especially

among the younger respondents, to support companies that make sustainability their priority. The organisation surveyed" insights also reveal how ESG integration is becoming at the core of corporate strategy, governance, and stakeholder engagement.

The examples of Tata Group, Infosys, HUL, and HDFC Bank illustrate how Indian industry leaders are going out of their way to incorporate environmental and social responsibility into the creation of long-term value. So, the data together point to the ESG-driven investing trend gaining ground in India and being a major factor in the transformation of the financial markets that are responsible and oriented.

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Annexure

1. Survey questionnaire
PDF OF QUESTIONNAIRE is linked
2. Interview Document Provided by CSR Manager (Anonymised Organisation)
PDF of Interview Document is linked
3. Google form link
https://forms.gle/jo83SjoTAeMUASo37

12. Key Performance Indicators of Digital Sustainability in the Oil and Gas Manufacturing Industry: A Comprehensive Case-based Approach

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Abstract

This research investigates the link between digital capabilities and sustainability reporting in the oil and gas industry by analyzing four firms with differing digital maturity levels. As sustainability mandates become more complex, aligning digital systems with reporting processes is increasingly critical. Although corporate reports often reference tools like IoT sensors, digital twins, and predictive analytics, few actually translate these technologies into measurable Digital Sustainability Key Performance Indicators (KPIs). Employing a qualitative case study approach alongside a hierarchical KPI framework, this study highlights critical gaps in real-time monitoring, cybersecurity, value chain digitalization, and infrastructure sustainability. To address these issues, the research proposes integrated KPIs designed to improve transparency. These metrics aim to bridge the gap between digital tools and reporting, ultimately mitigating greenwashing risks and ensuring data credibility.

Keywords: Digital sustainability, BRSR, ESG Reporting, Digital maturity, Tertiary KPIs, IoT systems, Data governance, Automation

1. Introduction : Digital sustainability is critical to the Oil and Gas Industry as it accounts for approximately 10% of the global Scope 1 and Scope 2 emissions, whereas its products after they have been used represent nearly 90% (Statista, 2024). The new wave of Industry 4.0 technologies such as Internet of Things (IoT) sensors, Digital Twins (DTs), Cloud Computing platforms and Advanced Analytics tools, are revolutionizing the way we monitor and optimize operations through enhanced accuracy and accountability (Kamble et al., 2023; McKinsey & Company, 2022). At present, in India, the Business Responsibility and Sustainability Report (BRSR) framework is the only corporate sustainability law which requires 140 ESG-related disclosures (as per GRI, SASB, and TCFD) and thus strengthens ESG-related transparency across sectors (Securities and Exchange Board of India, 2021; Seneca ESG, 2025). However, whilst these frameworks include environmental performance, they do not define the manner in which digital processes will create/validate ESG reporting data, and this lack of information is increased by the proliferation of data being produced using machine-readable formats such as GRI's Digital Sustainability Taxonomy (Global Reporting Initiative, 2025).

Evidence from the industry shows that organizations in this sector currently rely on manual methods to report their ESG, and that the majority of organizations are only measuring their ESG performance against standard Key Performance Indicator (KPIs) related to emissions or resource consumption, so therefore the lack of consistent measures surrounding digital resilience, real-time capability, or data governance will continue to hinder accuracy (World Economic Forum, 2024). The vast majority of organizations measure their emissions and resource consumption through standard KPIs, yet these KPIs do not take into

consideration the digital maturity of the organization; even methane detection and predictive maintenance are areas where KPI measurement and evaluation fall short (IBM, 2023). Using a sample set of organizations with varying levels of digital maturity, this paper develops a hierarchical digital sustainability KPI framework with a focus on determining digital maturity through real-time monitoring, data integrity, digitalization of the full value-chain, and infrastructure sustainability to ultimately decrease the likelihood of being subject to accusations of greenwashing.

2. Literature Review

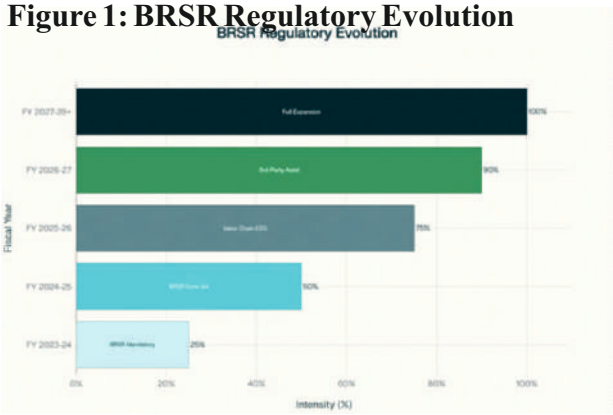
2.1 Digital Sustainability in Manufacturing

Literature on sustainable manufacturing focuses on energy use, greenhouse gas emissions, water consumption, and waste explicitly the environmental indicators (Raut et al., 2019). The digital revolution highlights the value of IoT sensors, cloud platforms, analytics, and cyber-physical systems for refining real-time monitoring, predictive maintenance, and operational efficiency (Xu et al., 2021). The two segments align on digital sustainability, which emphasizes reliable environmental reporting is subject to quality of the digital systems that generate the data. Mejía Moncayo et al. (2025) state three levels of KPIs: primary indicators measure outcomes, secondary indicators track processes, and tertiary indicators reflect the capability and resilience of the measurement system. The tertiary KPIs remain undisclosed in company reports, despite digital systems reducing downtime, improving asset availability, and enhancing the energy performance through predictive insights (McKinsey & Company, 2022; Timspark, 2025).

2.2 Regulatory Standards and Frameworks

Regulations on sustainability reporting increased rapidly, and Oil and Gas companies operate under frameworks which require structured, transparent, and comparable disclosures. The BRSR framework suggests 140 indicators allied with nine sustainability principles, which classify significant indicators to be reported by companies, and leadership indicators, as voluntary that empower firms to recognize as progressive in sustainability practices (Seneca ESG, 2025). Principle 6 is vital for the Oil and Gas Sector as it entails energy use, water consumption, greenhouse gas emissions, and waste management, though Scope 3 emissions remain voluntary for most companies (Securities and Exchange Board of India, 2021). The amendments to BRSR of standardized KPIs mandate value chain reporting, that enhance the complexity of disclosures and necessitates the need for robust digital systems (Seneca ESG, 2025; Chambers, 2024). Figure 1 indicates the BRSR Framework developments.

Figure 1: BRSR Regulatory Evolution



Source: SEBI (2021) BRSR framework

BRSR aligns with global reporting frameworks for multiple disclosure regimes (Seneca ESG, 2025). GRI standards provide broader ESG guidance and include a Digital Sustainability Taxonomy that supports machine-readable formats and automated data extraction (Global Reporting Initiative, 2025; Nexio Projects, 2025). SASB identifies industry-specific sustainability topics, while TCFD emphasizes climate governance, scenario analysis, risk management, and emissions disclosure (Sustainability Accounting Standards Board, 2023; Task Force on Climate-related Financial Disclosures, 2021).

The alignment of compliance will force organizations to build/enhance their digital infrastructure so that they can produce consistent, verified and interoperable Environmental, Social and Governance data across the globe. Companies like Shell utilize digital technologies to achieve accuracy in several different regulatory climates (Shell, 2025). This gap also indicates the requirement

of digital sustainability Key Performance Indicators that assess system quality, real-time data capability and data integrity instead of solely environmental impacts.

2.3 ESG Credibility and Greenwashing Risk

Rising global concerns regarding the reliability of ESG (Environmental, Social and Governance) disclosures are increasing the ESG-related litigation risks and increasing the government scrutiny on Energy-related businesses (Green & Novak 2023Energy Law Blog; 2025). Legal precedents like the Royal Dutch Shell ruling show that failing to disclose ESG risks creates a high likelihood of future harm to the disclosing company (Milieudefensie v. Royal Dutch Shell [2024]). Discrepancies in measurement affect how ESG ratings are assigned to companies and cause differences in the ratings of companies - creating a need for standardized ESG data systems (Berg et al., 2022; see Figure 2, under Discrepancies in ESG Measurement).



Source: Author Compiliation

The energy industry also faces challenges due to weak digital infrastructures, lack of capability for real-time monitoring, and a lack of good data governance, which lead to the potential for increased instances of greenwashing (Hijazi, 2023). This underscores the importance of developing digital sustainability KPIs that reflect the maturity and reliability of measurement systems, not only the environmental outcomes they produce.

3. Methodology

The study is qualitative, case-based research that examine the digital capabilities influence on sustainability reporting for Oil and Gas sector. Four companies with different maturity levels were selected for the study: Shell and Saudi Aramco as global leaders, and IOCL and BPCL as Indian refiners with emerging digital infrastructure. Data for this research was obtained from Sustainability Reports, Annual Reports, BRSR Filings, Bloomberg ESG data sets for the years 2020-2024 and online and other news and regulatory documentation relating to 2023 and 2025. Digital Sustainability had a total of four variables used for this research: Emissions Reporting; Digital Systems; Technology Deployment; Governance Practices.

A structured document analysis to identify sustainability indicators disclosed by each company and classify them using the primary, secondary, and tertiary KPI hierarchy proposed by Mejía Moncayo et al. (2025). Each company was evaluated on themes of real-time monitoring, automation, supply chain data integration, and digital governance. Cross-case comparison aided in identifying common patterns and differences between global and Indian companies. The insights from this analysis informed the development of the proposed digital sustainability KPIs and the implementation roadmap.

4. Digital Sustainability Kpi Framework

4.1 Conceptual Framework

Literature classifies digital sustainability KPIs into three hierarchical levels. Table 1 details the KPI levels and its significance for Oil and Gas Sector.

Table 1: Digital Sustainability KPI Hierarchical Framework

KPI Level	Measurement constructs	Sectoral Parameters
Meta-Level	Quality, Resilience, and Sustainability of ESG data infrastructure	• Cybersecurity • Data governance • System recovery
Operational-Level	Real-time monitoring of environmental performance	• Emissions detection latency • Predictive maintenance • Supply chain transparency
Governance-Level	Regulatory frameworks and global taxonomies	• BRSR automated alignment • Data interoperability • Third-party assurance

Source: Adapted from Mejía-Moncayo et al. (2025)

An extended framework of KPIs is proposed, based on the review outcomes stated in Table 2

4.2 Proposed Framework for Extended Digital Sustainability KPIs

The following KPIs are proposed based on the literature review and gap analysis:

Table 2: Proposed Digital Sustainability KPIs for Oil and Gas

Category	Proposed KPI	Unit
Meta-Level	Digital infrastructure carbon intensity	kg CO□ per TB of ESG data processed annually
Meta-Level	Cybersecurity-ESG incident response time	Hours to full restoration of data integrity
Operational	Emissions detection latency	Hours between spill/exceedance and automated detection
Operational	Predictive maintenance success rate	% of predicted failures addressed before failure
Operational	Supply chain digital maturity index	Composite index (0 –100) of supplier data digitalization
Governance	BRSR digital alignment	% of BRSR essential indicators with automated data feeds
Governance	ESG data interoperability	% of ESG data fields compatible with GRI/XBRL taxonomies

Source: Author's Compilation

5. Case Analysis

5.1 Shell Plc

Shell, a multinational oil and gas company based in London, operates in over seventy countries and has a portfolio of products that includes liquefied natural gas, biofuels, and petrochemicals (Shell, 2024). The company utilizes an independent board of directors with a strong corporate governance structure to provide access to its energy products on a global basis (Shell, 2024). Its sustainability initiatives are focused on reducing carbon emissions through renewable energy sources, carbon capture, decarbonization of LNG, and improving the detection of methane (Shell, 2024). The company has also adopted the use of digital twins, satellite technologies, and automated detection of leaks to enhance safety and operational efficiency (Shell, 2024). Shell's climate action plans include targeting energy efficiency, electric-(extension), reducing the flaring process of natural gas, and developing lower carbon-based fuels to achieve net-zero Scope 1, Scope 2, and select Scope 3 emissions (Shell, 2024). Shell's ESG (environmental, social, and governance) reports are aligned with BRSR (business responsibility and sustainability report), GRI (Global Reporting Initiative), SASB (Sustainability Accounting Standards Board), TCFD (Taskforce on Climate-related Financial Disclosures), and CSRD (Corporate Sustainability Reporting Directive) standards (Shell, 2024).

5.2 Saudi Aramco

With a headquarters located in Dhahran, Saudi Aramco is the largest integrated energy firm in the world. This means they participate in every part of the energy market from exploration and extraction to distribution, marketing, and sales globally through partnerships. Saudi Aramco's centralized structure enables them to align their operations with the priorities of the Saudi government (Saudi Aramco 2024). As part of this, Saudi Aramco has developed a sustainable strategy to reduce emissions and develop low-carbon fuels, develop renewable energy, carbon capture technologies, methane detection tools, and conduct research on hydrogen. Their operational support is focused on Artificial Intelligence-based (AI) reservoir models, predictive maintenance for optimizing operations in real-time (Saudi Aramco Sustainability Report 2023). In order for Saudi Aramco to meet national and international climate mandates, they require a combination of strong digital resources along with centralized ESG structures to ensure timely and accurate reporting (Saudi Aramco Sustainability Report 2023).

5.3 Indian Oil Corporation Limited (IOCL)

Indian Oil Corporation (IOCL), the leading integrated public sector oil and gas business in India, has a comprehensive refining, transportation, marketing, and retail distribution system across India comprising of over 60,000 locations.IOCL receives funding from the government and is publicly traded on the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) (Indian Oil Corporation Ltd., 2024). IOCL produces both traditional and alternative energy products. The company's approach to sustainability is focused on reducing greenhouse gas emissions and improving operational efficiency through investment in the development and use of green hydrogen, biofuels, carbon capture technologies, and electric vehicle charging infrastructure.

To improve productivity, IOCL has made significant investments in the use of digital technologies, including automated monitoring of pipelines and refining operations,

Digital Twins of refiners, and Advanced Process Controls. IOCL has also invested in the recycling of wastewater; upgrading facilities to recover surplus sulphur; and purchasing renewable energy to support long term decarbonization (IOCL Sustainability Report, 2023).

5.4 Bharat Petroleum Corporation Limited (BPCL)

Bharat Petroleum Corporation Limited (BPCL), one of India's largest state-owned energy companies (also known as a public sector undertaking), owns/operates oil refineries and a very large logistics system distributing products throughout India. BPCL is a government owned and traded on India's National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE). BPCL is engaged in a diverse portfolio of businesses such as petroleum, petrochemicals and investments in new "clean" and renewable energy sources such as solar and biofuels (Bharat Petroleum Corporation Limited - 2024). BPCL's sustainability initiatives focus on reducing emissions, increasing operational efficiencies, and adding capacity for renewable energy sources. Digital technologies incorporated by BPCL include automated pipeline monitoring, digital process improvements, and cyber security dashboards (BPCL Sustainability Report - 2023). As BPCL continues to strengthen its digital measurement systems, the company will continue to align with the BRSR, GRI, and TCFD report guidelines to provide consistent, auditable, timely ESG data from all areas of operations (BPCL Sustainability Report - 2023).

6. Kpis Reported Across All Four Companies

Despite significant variation in digital maturity, all four companies report basic environmental performance metrics mandated by international frameworks and BRSR in Table 3:

Table 3: Common Digital Sustainability KPIs

Common KPI	**Measurement Unit**	**Reporting Standard** BRSR Principle and GRI
Total Energy Consumption	MJ or MWh	6, 302-1
Scope 1 GHG Emissions	tCO□e	6, 305-1
Scope 2 GHG Emissions (location-based)	tCO□e	6, 305-2
Energy Intensity Ratio	MJ/unit output or MWh/bbl	6, 302-3
Water Withdrawal and Consumption	m^3	6, 303-3
Total Waste Generated	tones	6, 306-2
Occupational Injury Rate	Lost-Time Injury Frequency Rate	3, 403-2

Source: Compiled by the Author

The four companies report metrics annually, but the amount of automation involved, as well as how often these metrics are generated and archived, vary significantly. Shell's and Saudi Aramco's advanced digital data management systems have been built-up over decades of creating structured historical data-sets, allowing for comprehensive analysis of trends and granular disaggregation. By contrast, IOCL and BPCL report these metrics using spreadsheet consolidation and manual aggregating, indicating an earlier stage.

7. Digital Sustainability KPIs Across Companies

To ultimately meet foreign investment expectations of stakeholders, Shell and Saudi Aramco are disclosing additional detailed digital sustainability metrics beyond what would be seen in disclosures by Indian firms:

Table 4: KPIs of Global Companies vs Indian Companies

KPI	**Shell**	**Aramco**	**IOCL/BPCL**
Scope 3 GHG Emissions (quantified)	Yes (Use of sold products)	Partial	Emerging/Limited
Supply Chain ESG Assessment Score	Yes (Suppliers audited annually)	Yes	Limited transparency
Digital Twin Deployment Coverage	Yes (Upstream, downstream assets)	Yes	Limited/Emerging
Real-Time Leak Detection Coverage	Partial (expanding)	Yes (High-level)	Minimal
ESG Data System Recovery Time (RTO)	Monitored	Not disclosed	Not tracked
Cybersecurity Incidents Affecting ESG Systems	Reported in governance disclosures	Not separately disclosed	Not tracked

Source: Author's compilation

The existence of asymmetry in the availability of these types of disclosures illustrates differences in the amount of investment in the development of digital networking and

computing infrastructure, access to sources of financing for system deployment, and the strategic emphasis on measuring advanced ESG factors as a means of mitigating the risks of "Greenwashing" and satisfying the needs of international stakeholders.

8. Proposed Extended KPIs for Digital Sustainability

Academic research and industry analysis identify critical digital sustainability KPIs that none of the four companies currently report explicitly:

Table 5: Literature-Identified KPIs Absent from Company Reporting

KPI	Rationale	Current Status
Digital Infrastructure Carbon Intensity (kg CO□/TB ESG data)	Measures the sustainability of data systems themselves	Not reported by any company
ESG Data System Uptime Percentage (%)	Reflects resilience and reliability of sustainability measurement infrastructure	Not reported; Shell and Aramco monitor internally
Supply Chain Data Integration Percentage	Measures digital readiness for value chain emissions reporting	Partial at Shell/Aramco; minimal at IOCL/BPCL
Automated BRSR/GRI Indicator Coverage (%)	Reflects digital maturity of regulatory alignment	Not explicitly tracked; varies by company
Third-Party ESG Data Assurance Coverage (%)	Quantifies independent verification of digitally sourced ESG metrics	Limited; Shell and Aramco have third -party audits
Average Incident Detection Latency (hours)	Measures real -time monitoring capability	Not reported

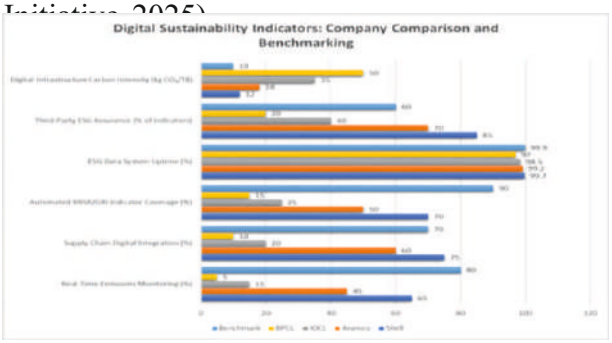
9. FINDINGS

A pronounced pattern emerges across the four case companies KPIs coupled with digital technologies in operations striking absence of KPIs:

- Lack of real-time monitoring coverage metrics. All companies track annual GHG and pollutant emissions, and news references indicate digital technology deployment, but none explicitly report what percentage of critical equipment, pipelines, or process units are instrumented with IoT sensors feeding a central system (Ng et al., 2023).
- Absence of ESG data system resilience and cybersecurity metrics. Shell and other majors have been affected by ransomware attacks exploiting widely used file transfer software, with potential implications for ESG data integrity. The case firms oversee to disclosure of metrics of ESG system recovery time after cyber incidents or the frequency of independent audits of ESG data systems (Hijazi, 2023; NIST, 2023).
- Weak measurement of supply chain and value-chain digitalization. BRSR's expansion toward value chain emissions and ESG accountability implies data from suppliers and customers KPI providing machine-readable ESG data, using recognized reporting standards, or integrated into digital traceability platforms (Accenture, 2024; Raut et al., 2019).
- No explicit measurement of the sustainability of digital infrastructure itself. Data centers, cloud services, and analytics platforms consume energy and contribute to carbon footprints. KPI linkage to

ESG data volume or computational load to associated energy use and emissions lack reporting a tertiary-level digital sustainability on green IT and cloud computing (Infosys, 2023).

- Limited explicit measurement of interoperability between ESG data and reporting taxonomies. None of the firms report percentage of ESG indicators generated and tagged that aligns with BRSR or GRI fields. Manual, spreadsheet-based processes remain implied across the sector (Global Reporting Initiative, 2025).



Source: Author's Compilation

9. Conclusion

Shell, Saudi Aramco, IOCL, and BPCL report extensive environmental indicators of BRSR, GRI, and TCFD, none provide KPIs that measure the maturity, reliability or real-time capability of the digital systems that generate their sustainability data. The gaps in transparency and limits comparability across firms in digital tools: IoT sensors, digital twins, predictive analytics and automated leak detection become central to modern industrial operations (Mejía-Moncayo et al., 2025; Ng et al., 2023). Shell and Saudi Aramco have more advanced digital infrastructure, but these capabilities are described narratively rather than through standardized indicators. IOCL and BPCL are expanding digital initiatives but still rely heavily on manual processes, which may hinder accuracy as reporting requirements grow under BRSR Core and new value chain expectations (Seneca ESG, 2025; Hijazi, 2023; Green & Novak, 2023). The proposed digital sustainability KPIs address these gaps by focusing on tertiary indicators that measure real-time visibility, data integrity, digital resilience, and the environmental footprint of monitoring systems. By aligning these indicators with GRI's newest digital taxonomies, as well as with the growing number of regulatory obligations that businesses are facing via BRSR, businesses can improve the credibility of their ESG Reporting and minimize the risk of greenwashing, thus preparing themselves for technology-driven ESG Reporting as well.

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13. Career Self-efficacy And Perceived Employability Research Framework

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Abstract
Currently in the job market employability is influenced by more than just academic skills. Individual attributes such as confidence, adaptability and decisiveness during career selection significantly impact how students ready themselves for their futures. This study aimed to explore the influence of decision-making clarity and career self-efficacy, on students perceptions of their employability. Career self-efficacy empowers individuals to trust in their ability to set and achieve career objectives whereas decision-making clarity helps them make deliberate and well-informed choices, about their future. The research demonstrates that students who possess both confidence and clear guidance are more capable of overcoming obstacles and adapting well to workplace changes. By integrating these skills into career and educational development initiatives educational institutions can support students in enhancing their job readiness and navigating career transitions more effectively. The conclusions of this research highlight that genuine employability is realized when students

integrate knowledge with confidence, clarity, and versatility.

Keywords: Career Self-Efficacy, Decision-Making Clarity, Perceived Employability, Higher Education, Career Planning

1: Introduction : In the evolving global employment landscape employability has turned into a significant issue for graduates and educational bodies alike. Although academic credentials remain important employers increasingly value candidates who demonstrate adaptability, confidence, resilience and strong critical thinking skills. Being able to keep learning manage change effectively. Make well-informed career choices is now crucial, for sustained professional success.

Within this framework two crucial psychological elements. Career self-efficacy and clarity in decision-making. Significantly influence students' perceptions of their employability. Career self-efficacy is defined as an individual's confidence, in their capacity to complete career-related activities and reach career objectives (Lent et al., 1994). This confidence affects how students establish goals manage obstacles and proactively shape their futures. Decision-making clarity conversely pertains to possessing assurance and clear understanding when selecting career paths and organizing actions to achieve ones objectives (Yorke, 2006).

Employability transcends technical expertise; it encompasses abilities such as flexibility, self-assurance, social connections and a well-defined career identity (Fugate et al., 2004). Students with these traits are generally more driven and resilient in their pursuit of employment (Rothwell et al., 2008). Studies further indicate that workplace readiness, confidence and having objectives significantly affect success, at work (Caballero et al., 2011). More recent studies (Sun & Chang, 2024) further support the idea that students with higher self-efficacy and well-defined career plans demonstrate stronger employability outcomes.

1.1 Objective of the Study

The primary goal of this study is to investigate the impact of career self-efficacy and decision-making clarity on undergraduate students' perceived employability. In particular, the research seeks to study

1. How students' belief in their career competencies influences their employability perception.
2. How decision-making clarity influences their preparedness to join the job market.
3. How does the combined impact of self-efficacy and clarity in defining overall employability perceptions?

1.2 Importance of the Study

This research is grounded in the assumption that employability does not solely depend on academic achievement but is also influenced by internal psychological variables. When students have confidence in their abilities and are guided in their lives, they feel stronger and more empowered to succeed in the workplace. This research helps us understand how these qualities can be strengthened by schools and colleges through targeted training and mentoring. Through an emphasis on both confidence and clarity, this study offers important lessons for teachers, policymakers, and organisations attempting to enhance the employability and career readiness of students.

2. Literature review

In times employability is not solely determined by educational credentials; rather it encompasses self-assurance, flexibility and a clear understanding of one's professional objectives. Studies indicate that two mental components—career self-efficacy and clarity in decision-making—are crucial in influencing students' perceptions of their competence and job preparedness. Career self-efficacy denotes the conviction that an individual can effectively accomplish career-related activities and reach career ambitions, whereas decision-making clarity denotes the assurance and definiteness, in selecting a career direction and organizing actions. Studies show that students who possess these qualities are more motivated, persistent, and better equipped to handle challenges during their job search. They also tend to feel more positive about their abilities and secure better employment outcomes. Recent findings further emphasize that employability improves when students continue learning, adapt to workplace expectations, and combine confidence with a clear sense of direction.

H1: Career Self-Efficacy and Perceived Employability

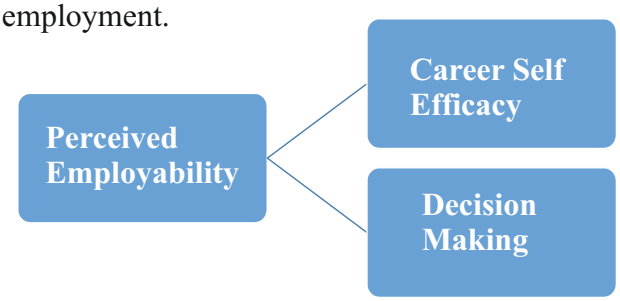
Students who feel confident about their career abilities are more likely to see themselves as employable. When they believe they can plan, act, and achieve their career goals, they approach opportunities positively and feel more prepared for the job market.

H2: Decision-Making Clarity and Perceived Employability

Students with clear career goals and direction tend to feel more capable of securing suitable jobs. When they know what they want and how to work toward it, they make better choices and feel more confident about their future careers.

H3: Combined Effect of Career Self-Efficacy and Decision-Making Clarity on Perceived Employability

When confidence and clarity come together, the impact on employability becomes stronger. Students who believe in themselves and have a clear plan are more likely to progress smoothly and succeed in finding and sustaining employment.



3. Research Methodology

This research investigated the impact of Career Self-Efficacy and Decision-Making Clarity on Perceived Employability, in students. This section outlines the study design, sampling technique, data gathering procedure analysis methods and ethical issues addressed.

3.1 Research Design

A quantitative methodology was employed to gather information from undergraduate participants. The research combined analytical strategies to explore the connection between the independent factors (Career Self-Efficacy and Decision-Making Clarity) and the dependent factor (Perceived Employability). Descriptive analysis provided a summary of demographics whereas analytical methods assessed the impact of the variables through statistical software like SPSS. This approach guaranteed results that were objective, systematic and free, from bias.

3.2 Population and Sampling Technique

The research group included students enrolled in various academic disciplines. They were chosen due to being at a point in their career development. A non-random sampling method was utilized, integrating convenience, snowball and mixed sampling techniques. Initially students were contacted via channels then encouraged to distribute the survey link aiding in expanding the sample size. Participants were also drawn from domains such, as Commerce, Management and Arts to maintain diversity.

3.3 Data Collection Method

Primary data was gathered via a questionnaire designed in Google Forms and distributed through email and social media platforms. The survey included three parts targeting Career Self-Efficacy, Decision-Making Clarity and Perceived Employability with each assessed through scale-based items.

3.4 Data Analysis Tools

The data were analyzed using SPSS, a widely used tool for social science research. Descriptive statistics summarized demographic details, correlation analysis explored relationships between variables, and multiple regression tested how Career Self-Efficacy and Decision-Making Clarity predicted Perceived Employability. These methods provided accurate and reliable results that supported the research hypotheses.

4. Data Analysis and Results

This chapter displays the results obtained via SPSS. The examination proceeded in a manner starting with descriptive statistics then moving on to reliability and validity assessments and concluding with hypothesis testing using regression analysis. The primary methods applied included frequency analysis, reliability assessments and regression modelling to explore the connections, between Career Self-Efficacy (CSE) Decision-Making Clarity (DMC) and Perceived Employability (PE).

4.1 Initial Data Screening and Descriptive Statistics

Before analysis, the dataset was screened for missing responses and outliers. After cleaning, a total of 189 valid responses were retained.

Descriptive statistics were then used to summarize the demographic characteristics of the participants and confirm that the sample accurately reflected the target student population.

Table 4.1: Demographic Profile of Respondents (N = 189)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	89	47.1
	Female	100	52.9
Total (Gender)		**189**	**100**
Age Group	18–25 years	67	35.3
	25–35 years	82	43.1
	35–50 years	26	13.7
	50+ years	15	7.8
Total (Age Group)		**189**	**100**
Designation (Job Role)	Entry-Level Employee	56	29.4
	Supervisor / Team Lead	59	31.4
	Manager	41	21.6
	Senior Manager	33	17.6
Total (Designation)		**189**	**100**

Interpretation of Table 4.1

The demographic data reveals an equal split between genders with females making up 52.9% and males 47.1% of the participants. The majority of respondents were adults as 78.4% were aged 18–35 suggesting that the sample primarily consists of people who are in the initial phases of their career paths. Furthermore 60.8% of the participants held entry-level or supervisory positions, which corresponds closely with the study's aim since these individuals are, in the process of enhancing their career confidence, decision-making skills and perceived employability.

4.2 Assessment of the Measurement Model

The measurement model was evaluated to ensure reliability and validity of the three constructs: Career Self-Efficacy (CSE), Decision-Making Clarity (DMC), and Perceived Employability (PE). Cronbach's Alpha and Composite Reliability (CR) confirmed internal consistency, while Average Variance Extracted (AVE) and factor loadings supported convergent validity.

Table 4.2: Reliability and Convergent Validity Test of Measurement Constructs

Component	Item	Standard Loading (λ)	AVE	Cronbach's α	CR
Career Self-Efficacy (CSE)	CSE1	0.889	**0.888**	**0.727**	**0.903**
	CSE2	0.859			
	CSE3	0.807			
Decision-Making Clarity (DMC)	DMC1	0.89	**0.842**	**0.651**	**0.861**
	DMC2	0.989			
	DMC3	0.534			
Perceived Employability (PE)	PE1	0.786	**0.874**	**0.699**	**0.868**
	PE2	0.829			

4.3 Structural Model and Path Analysis

Following measurement reliability and validity, structural model testing was conducted to ascertain the direction and strength of the hypothesised relationships between Career SelfEfficacy (CSE), Decision-Making Clarity (DMC), and Perceived Employability (PE). Model fit, explanatory power (R^2), and the statistical significance of every hypothesised path were analysed.

Table 4.3: Summary of Overall Structural Model Fit Statistics

Model Fit Statistic	Value	Interpretation
R^2	0.42	42% variance explained in Perceived Employability (PE)
Adjusted R^2	0.396	Adjusted percentage of variance explained (sample size = 189)
F-value	17.032	The structural model is statistically significant
Model Significance (Sig.)	< 0.001	The overall regression model is highly significant

Interpretation of Table 4.3

The findings reveal that all three variables—Career Self-Efficacy, Decision-Making Clarity and Perceived Employability—exhibited reliability and validity. CSE displayed reliability (α = 0.727, CR

= 0.903, AVE = 0.888) whereas DMC also satisfied acceptable standards (α = 0.651, CR = 0.861, AVE = 0.842) with one lower-loading item kept for its conceptual importance. PE also showed measurement (α = 0.699 CR = 0.868, AVE = 0.874). The model explained 42% of the variance in Perceived Employability ($R^2 = 0.420$, Adjusted R^2 = 0.396), indicating strong predictive power. Hypothesis testing confirmed statistically significant relationships among variables ($p < 0.05$), supporting the conclusion that Career Self-Efficacy and Decision-Making Clarity meaningfully influence perceived employability.

Table 4.4: Structural Path Analysis Results (CSE, DMC → PE)

Path	Standardized Coefficient (β)	t-value	p-value (Sig.)	Hypothesis Result
CSE → PE	0.354	2.756	0.008	Supported
DMC → PE	0.421	3.275	0.002	Supported

Table 4.4 Interpretation

The regression analysis confirmed both hypotheses. Career Self-Efficacy showed a positive and significant effect on Perceived Employability (β = 0.354, p = 0.008), while Decision-Making Clarity demonstrated an even stronger influence (β = 0.421, p = 0.002). The comparison indicates that clarity in career decisions contributes slightly more to employability perceptions than confidence alone. Overall, the results align with existing research, showing that both psychological clarity and self-efficacy are key predictors of perceived employability.

5. Discussion and Implications

This chapter clarifies the significance of the findings concerning theory and real-world application. It examines the roles of Career Self-Efficacy (CSE) and Decision-Making Clarity (DMC) in influencing Perceived Employability (PE). Identifies the most impactful factor. Additionally the section provides guidance, for individuals, educators and organisations.

5.1 Discussion of Findings

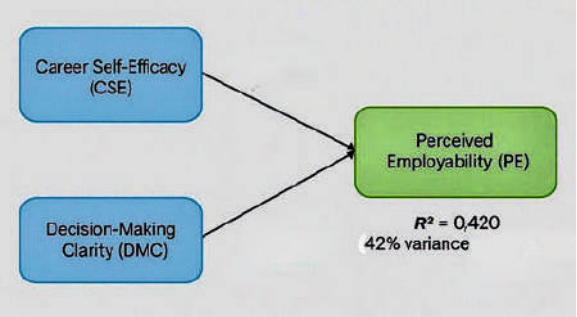


Figure 1: Conceptual Framework of the Study

The research verified that the measurement model was dependable and valid with all constructs exhibiting internal consistency. The findings indicated that both Career Self-Efficacy and Decision-Making Clarity have an impact, on students perceived employability and the model accounted for 42% of this perception. Among the two predictors, Decision-Making Clarity (β = 0.421) had a slightly stronger effect than Career Self-Efficacy (β = 0.354), suggesting that having clear goals and informed career decisions contributes more to employability than confidence alone. Overall, the findings emphasize that employability is shaped not only by external factors like qualifications or labor market conditions, but also by internal factors such as clarity, mindset, and belief in one's capabilities.

5.2 Managerial Implications and Future Directions

These results hold significance for organizations, educators and career advancement initiatives. As Decision-Making Clarity demonstrated a greater impact compared to Career Self-Efficacy efforts should prioritize assisting individuals in defining their career objectives first before tackling confidence enhancement. Interventions like mentoring, career planning sessions and structured goal-setting can improve clarity. Support individuals, in making well-informed choices regarding their future. Simultaneously confidence must be built through skill-focused training, constructive feedback and chances, for experience.

The results are especially relevant for young professionals, as most respondents were under 35 and still shaping their career paths. Providing structured support for this group can help reduce uncertainty, increase motivation, and improve retention. Finally, the model's explanatory power ($R^2 = 0.420$) suggests that strengthening clarity and self-belief can meaningfully improve perceived employability, which ultimately benefits both individuals and organizations by fostering a more capable and future-ready workforce.

6. Conclusion, Limitations, and Future Directions

This chapter recaps the research results emphasizes their importance and details the constraints well as possible directions, for future investigations.

6.1Conclusion

This research explored the impact of Career Self-Efficacy and Decision-Making Clarity on students' Perceived Employability. The findings indicated that both factors notably affect employability perceptions and collectively account for 42% of its variance ($R^2 = 0.420$). Decision-Making Clarity exerted a more powerful influence than Career Self-Efficacy implying that having clear career objectives and making well-informed decisions plays a more crucial role than confidence by itself. The results emphasize that employability is influenced not by academic success but also, by attitude, clarity and readiness. These findings can assist teachers and career advisors in creating initiatives that foster self-assurance and steer students toward defined career directions enhancing their readiness, for an employment landscape.

6.2 Limitations and Future Directions

Although the research yielded insights it has certain limitations. The sample consisted of 189 students from one institution, which might limit the applicability of the results. Future research ought to involve more varied samples, from several colleges and different areas. The cross-sectional methodology also limits the capacity to infer causality so longitudinal studies are advised to observe developments over time. Moreover relying on self-reported data may lead to bias. Future studies could include interviews, observations, or mixed-method approaches to gain deeper insights.

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14. Green Gains to Global Strains: Evidence of ESG Spillovers through Dynamic Interconnectedness across Crises

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Abstract
This study explores the spillover effects of environmental, social, and governance (ESG) indexes across different regions to evaluate the risk and contagion effect across different crises. Our analysis is based on the indices take FTSE4Good Developed 100 Index, Kld 400 Social Gross Return In USD Currency Index, Kld 400 Social Price Return In USD Currency Index,MSCI USA Extended ESG Select Gross USD RT Index , MSCI World ESG Leaders Net Return In USD Currency Index, ACWI LW CRBN TAR, STOXX USA ESG Select KPIs EUR (Price) Index, FTSE UK 100 ESG Select Index, Indxx Global FinTech Thematic Index NTR from 1, January 2015 to November 15,2024. Our results reveal significant spillovers among these markets with different indices role as a dominant role in transmitting and receiving shocks from other markets. Our findings provide insight to the investors, market participants, policy makers and regulators to promote sustainable investing strategies and manage the systemic risk.

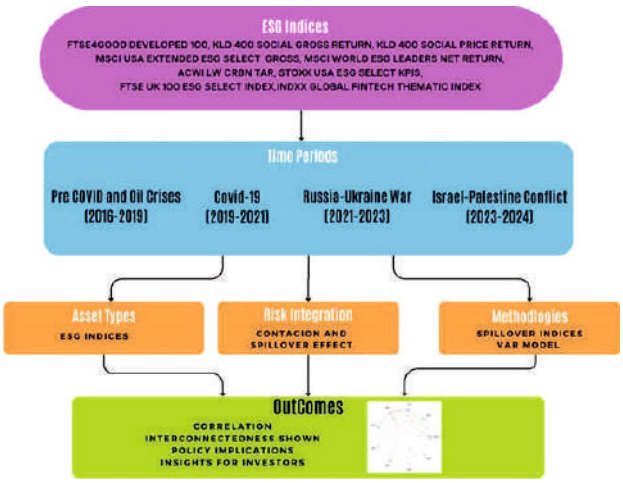


Fig 1 Graphical Abstract Introduction

Introduction : Sustainability has gained significant importance in financial decision making with the expansion in the global economy. With the present concern of the extent of environmental damage and climate risk concern there is a growing concern from all the stake holders (Demirtas et al., 2023). In the context of COP29 (Conference of Parties) nations are revisiting their policies to address climate change and promote sustainable development. In the pursuit of climate change and efforts to reduce to 1.5◦C temperature with carbon emissions by 45% by 2030, more than 140 nations including USA, China have assured a net-zero target (UN, 2023). There is an increased need of integration in Environmental, Social and Governance (ESG) considerations into investment strategies. This study investigates the dynamic relationship among the ESG indices through Diebold and Yilmaz (2014) connectedness approach with a framework TVP-VAR approach to capture the spillover effects and interdependence across the different ESG indices. Habitat destruction and damage was high with coal mining (Shamoon et al.,2022). According to Assaf et al., (2024) companies with strong ESG profiles perform strong financially in the long term.

The global markets are driven by the shifting dynamics of increasing investments in the sustainability across various sectors/ industries. Against the back drop of heterogenous crises ranging from stock market volatility, health pandemic crisis, geopolitical tensions, climate change and evolving socioeconomic behaviour

our study evaluates the market interconnectedness across different sectors. The primary objective of this work is to provide in depth analysis of multivariate portfolio design that enables market participants, individual investors and policy makers to make significant directional spillovers to promote global socio economic development.

This research expands the scope of work with a wide range of indices of indices on a more comprehensive examination of different market dynamics in terms of interconnectedness, resilience, quantiles as time varying parameters and the dynamic conditional connectedness index of Diebold and Yilmaz approach with the integration of Gaussian model parameters.

Intense connectedness of the global markets has spilled risks from one market to other due to global integration and technological advancements. Internationalization, a macroeconomic determinant is susceptible to the repeated turmoils intensified extreme dynamic movements fostering opportunities and competition that poses a threat to the stability of the global markets across various industries and sectors. Thus, there is a need to examine interconnectedness and spillovers with urged attention towards on central theme for risk management, stock return volatilities, time varying connectedness, portfolio optimization, international dependence on intra and inter country level activities, understanding macroeconomic risks, credit risks, correlation based measures to provide insightful association of overall market movements with respect to different directions to measure in different aspects with a unified framework.

This study covers a broad time horizon, including three major crises of different natures: the oil crisis, the COVID-19 crisis, and the Russian-Ukrainian war. This extended timeframe

With the growing concern on climate risk and environmental degradation and pressure on the traditional fossil fuels the oil industry transitioned the declining revenues, operations towards investments to sustainable green energy, renewable energy projects on solar, wind and bioenergy for financial stability and growing need. According to the International Energy Agency (IEA) the investments in renewable energy reached approximately to $370 billion in 2023 that surpassed fossil fuelbased power generations. Favourable policies, regulatory frameworks, subsidies and incentives on integration of green energy into electricity ensuredstable power supply. Paralleling transformation of automobile sector towards the electrification attracted huge industries and Ford motors, Tata motors, Volkswagen. Expanding opportunities in both private and government entities alleviated the consumer behaviour towards electric vehicles coupled with environmental and ethical concerns. The efficiency of machine learning and artificial intelligence integration enhanced the digitization of process and operations.

Statement of Problem

While the integration of Environmental, Social, and Governance (ESG) factors into investment strategies has gained significant momentum, there remains a critical gap in understanding how these indices transmit and receive financial shocks during concurrent geopolitical and health crises. Existing literature largely focuses on isolated events or broad market indices. There is limited empirical evidence quantifying the varying intensity of risk spillovers specifically between the Covid-19 pandemic, the Russia-Ukraine war, and the Israel-Palestine conflict. This lack of comparative analysis creates a "blind spot" for investors and policymakers attempting to construct resilient, sustainable portfolios in an era of poly-crises.

Objectives of the Study

1. To examine the dynamic connectedness and spillover effects among major global ESG indices using the TVP-VAR approach.
2. To compare the intensity and direction of risk transmission across three distinct crisis periods: the Covid-19 pandemic, the Russia-Ukraine war, and the Israel-Palestine conflict.
3. To identify which specific ESG markets act as net transmitters or net receivers of volatility shocks to assist in portfolio diversification strategies.

Need or Relevance of the Study

As global capital shifting toward sustainable assets surpassed $370 billion in renewable

investments in 2023, the financial stability of these assets is of paramount importance. This study is highly relevant for portfolio managers and institutional investors who need to determine if ESG assets act as safe havens or channels of contagion during extreme geopolitical instability. Furthermore, it provides policymakers with insights into systemic risk propagation, enabling better regulatory frameworks for sustainable finance.

Hypothesis

H1: ESG indices exhibit time-varying connectedness, with spillover intensity increasing significantly during periods of geopolitical conflict compared to non-crisis periods.

H2: Developed market ESG indices (e.g., US and Europe) act as the primary transmitters of volatility shocks to emerging market ESG indices and thematic indices.

Review of Literature

The intense relationship between carbon, fossil energy and clean energy markets is shaped by multitude of factors that include economic growth, energy demand, government policies and the investor behaviour. These dynamics result in varying roles of different markets a shock transmitters and receivers influenced by both regional and global events understanding these navigates the complexities of global energy dynamics. Information spillover explains the market's interdependence, especially on trends, cycles, and bursts (Diebold and Yilmaz, 2009). An appropriate complete knowledge of the dynamic spillover effect during different times solves emergency situations (Elsayed et al., 2022). Various studies identified wide range of driving factors to explain the dynamics of spillover direction and intensity (Ma et al., 2022). To mention few macroeconomic activities by Chevallier (2009), financial markets (Ji et al., 2019), energy markets (Zhao et al., 2023), and renewable energy (Xu and Li, 2023). Among them, renewable energy is most trending due to the transition of renewable effect among electricity, fossil fuel, and carbon markets. As expected to cope with potential future crises it had gained a great momentum (Ma et al., 2022; Sun et al., 2023). Different authors examined the interconnectedness between carbon markets and fossil fuels (Zhang and Sun, 2016; Chen et al., 2022; Ding et al., 2022; Qiao et al., 2023a; Dai et al., 2023). Furthermore, the dynamic relationship of fossil energy, carbon and clean energy markets was investigated by (Ding et al., 2022; Zhou et al., 2023; Hoque et al., 2023; Wang et al., 2023). Ding et al., (2022) identified that carbon market as a net receiver of spillover effects from clean energy and oil markets in the short term, while n the long term they are the net transmitters of spillovers from coal and natural gas. This was also supported by Caporale et al., (2023) with highlights of climate policies. According to Su et al.,(2023) clean energy and carbon markets act as primary transmitters of extreme systemic shocks and on the other had fossil fuels transmit shocks under normal conditions. This was further explained by Wang et al.,(2023).

The connectedness between the carbon market and clean energy was explored by Kumar et al., 2012; Dutta et al., 2018; Hanif et al., 2021; Dong et al., 2024). The interconnectedness between fossil energy and clean energy stocks has been extensively explored by (Kyritsis and Serletis, 2019; Li et al., 2023; Banerjee et al., 2024; Yousaf et al., 2024). The time varying and asymmetric connectedness between carbon market and fossil energy markets was highlighted by Gong etal.,(2021). The rising price of carbon and fossil energy markets enhances the short term value of electricity markets to aid in the long term energy transition of power systems. Another expansion was revealed by Lucey and Ren (2023) on the spillover between green and brown assets reflecting the sustainability stocks acting as risk transmitters along with the strong linkages with fossil energy assets. A limited research is available on the intersections between these sectors and synergy to impact the global economy.

Research Methodology

To examine the dynamic connectedness among the selected ESG indices, we employ a Time-Varying Parameter Vector Autoregression (TVP-VAR) model, as proposed by Antonakakis et al. (2020), which improves upon the original Diebold and Yilmaz (2014) framework by

allowing for variances to change over time without losing observations to a rolling window. This approach is particularly advantageous for our study as it avoids the arbitrary selection of rolling window sizes, which can often lead to erratic sensitivity in connectedness measures. Furthermore, by employing a time-varying covariance structure, the model effectively captures the heteroscedasticity inherent in financial time series during turbulent periods like the Covid-19 pandemic and geopolitical conflicts. Following the estimation of the parameters, we utilize Generalized Forecast Error Variance Decomposition (GFEVD) to quantify the transmission of shocks. This decomposition allows us to distinguish between 'own variance' (shocks self-inflicted by a market) and 'cross-variance' (spillovers received from other markets), thereby enabling the identification of specific ESG indices that function as net transmitters or net receivers of systemic risk throughout the sample period.

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The TVP-VAR Model

The structural form of the TVP-VAR model with lag length

$$Y_t = \beta_{0,t} + \beta_{1,t}Y_{t-1} + \ldots + \beta_{p,t}Y_{t-p} + \epsilon_t$$

Where Y_t is an $N \times 1$ vector of ESG index returns, β_t are time-varying coefficient matrices, and ϵ_t is the heteroscedastic error term with a variance-covariance matrix Σ_t.

Generalized Forecast Error Variance Decomposition (GFEVD)

We utilize the Generalized Forecast Error Variance Decomposition (GFEVD) to measure the spillover effects. The H-step-ahead forecast error variance decomposition is denoted as $\theta_{ij}(H)$, representing the contribution of variable j to the forecast error variance of variable i:

$$\theta_{ij}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e'_i A_h \Sigma e_j\right)^2}{\sum_{h=0}^{H-1} \left(e'_i A_h \Sigma A'_h e_i\right)}$$

Where Σ is the covariance matrix of the error vector, σ_{jj} is the standard deviation of the error term for the j^{th} equation, and e_i is a selection vector with 1 as the i^{th} element and 0 otherwise.

Total Spillover Index

The Total Connectedness Index (TCI), which measures the average contribution of spillovers of shocks across all variables, is constructed as:

$$TCI = \frac{\sum_{i,j=1, i \neq j}^{N} \theta_{ij}(H)}{\sum_{i,j=1}^{N} \theta_{ij}(H)} \times 100$$

This index allows us to quantify the system-wide connectedness during the crisis periods analyzed (Covid-19, Russia-Ukraine, Israel-Palestine).

Results and Discussion

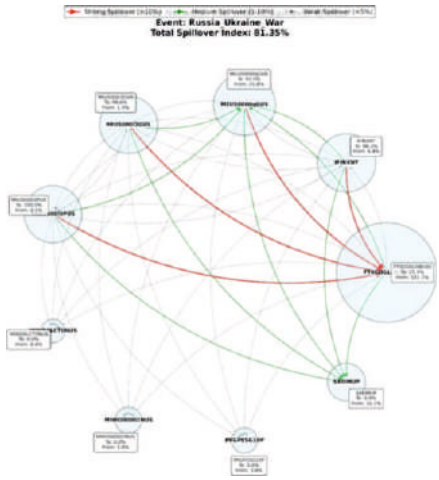


Fig 2 Russia-Ukraine War Diebold-Yilmaz
Source: Author's Work

The Russia-Ukraine conflict produced an extensive level of market linkage which corresponded to a 81.35% total spillover index. The financial contagion forces show themselves through numerous robust direct channels in this network (red lines). The FT4GDGL shock receiver continues its dominance as a prominent contributor (33.1%) while the MEUS0000aGUS transmitter maintains its power of influence (25.8% to others) in the studied market. SXEIMUP serves as a major shock receiver that absorbed 32.2% of market impact from other financial instruments during this political conflict period.

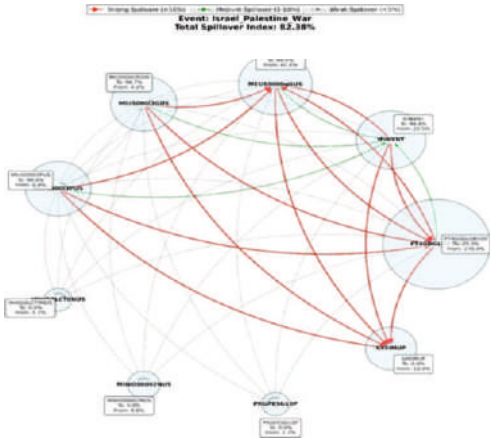


Fig 3 Israel-Palestine War Diebold-Yilmaz
Source: Author's Work

The total spillover index climbed to 82.38% during the Israel-Palestine conflict because of increased market connections between financial instruments. The financial indices maintained many times more prominent associations (seen as red lines) between one another during the COVID period than they did in the analysis of the Israel-Palestine conflict. The index shock transmitter role of MEUS0000aGUS was remarkable at 41.6% towards other indices during this time period while FT4GDGL maintained significant shock receipt at 27.6%. The geopolitical tensions made SXEIMUP stand out by receiving shock-based influence from 51.9% of other financial instruments in the market.

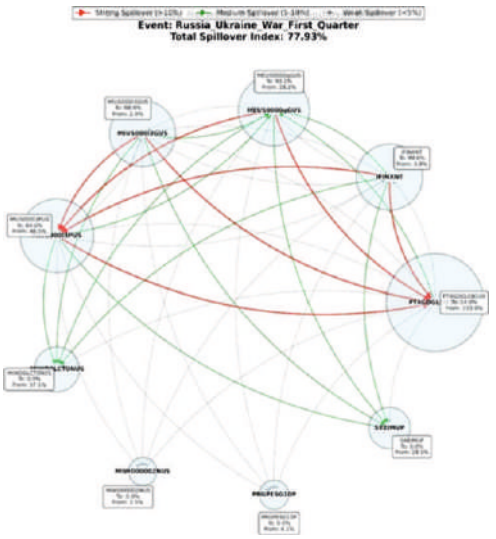


Fig 4 Russia-Ukraine War First Quarter Diebold-Yilmaz Source: Author's Work

The Russian invasion of Ukraine during its first quarter exhibited a spillover index at 77.93.

Network analysis indicates MIUS0003PUS becomes an important shock recipient since it receives connections from 48.5% of network participants. During the first quarter of the Russia-Ukraine war MEUS0000aGUS continued to transmit information to others while its overall influence reduced compared to other periods under crisis. The increased number of diversified medium spillover connections across the network indicates an initial market

reaction that divided the impact across different networks before expanding to show patterns like Figure 2.

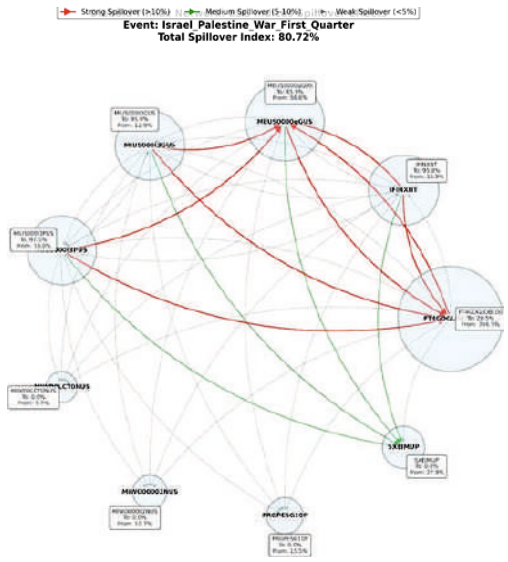


Fig 5 Israel-Palestine War First Quarter Diebold-Yilmaz Source: Author's Work

During the first quarter of the Israel-Palestine conflict spillover activity decreased slightly with an index value of 80.72%. The MEUS0000aGUS holds exceptionally strong influence in transference (58.6% from others) over the entire period. An evaluation of the network shows balanced medium-term spillover connections (green lines) among strong ties. During the first quarter of the Israel-Palestine War FT4GDGL continued to serve as the top shock absorber

(26.5%) whereas SXEIMUP demonstrated a lower vulnerability level (27.9%) when compared to the complete conflict period.

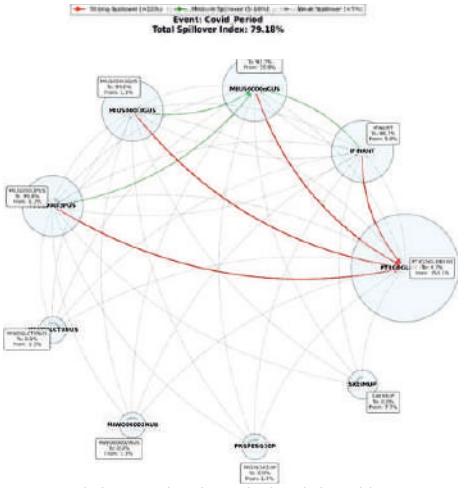


Fig 6 Covid Period Diebold-Yilmaz Source: Author's Work

Market Interrelations among sectors during COVID-19 reached their highest recorded point

with a total spillover index value of 79.18% according to the network diagram. Spillovers receive by FT4GDGL amount to 33.1% of market activity yet the company serves as a major transmitter of financial shocks distributing 20.9% to other entities. Finanicial contagion appeared to remain confined during this pandemic period despite the global health emergency since strong spillover effects (red lines over 10%) remained relatively few.

Type	Start Date	End Date	Observations	Mean	Min	Max	Std	Skewness	Kurtosis	Jarque-Bera	JB p-Value	ADF Statistic	ADF p-Value
	2021-01-20	2022-01-20			-0.1			-0.8	9.3	990.71		-4.40	
FT4GDGLOB100			276.00000	0.006035		0.825187	0.657065				0.000		0.00
IFINXNT	2021-01-20	2022-01-20	276.00000	0.016283	-0.1	0.102223	0.008402	-1.008	9.3	1,008.430	0.000	-4.33	0.00
MEUS0000qGUS	2021-01-20	2022-01-20	266.00000	0.009162	-0.1	0.973209	0.476544	-0.6	8.1	724.0958	0.000	-4.23	0.00
MIUS00I3GUS	2021-01-20	2022-01-20	266.00000	0.008306	-0.1	0.937217	0.760735	-0.8	9.1	927.3196	0.000	-4.20	0.00
MIUS00I3PUS	2021-01-20	2022-01-20	266.00000	0.007307	-0.1	0.937217	0.800809	-0.8	9.1	929.0650	0.000	-4.20	0.00
MIWD0LCT0NUS	2021-01-20	2022-01-20	276.00000	0.006984	-0.1	0.791167	0.562877	-1.2	10.555	1,390.428	0.000	-4.28	0.00
MIWO00002NUS	2021-01-20	2022-01-20	276.00000	0.006025	-0.1	0.863177	0.007722	-1.2	10.245	1,335.415	0.000	-3.48	0.00
PRGPESG10P	2021-01-20	2022-01-20	266.00000	0.002311	-0.1	0.870194	0.504574	-1.1	9.4	1,008.002	0.000	-3.38	0.01
SXEIMUP	2021-01-20	2022-01-20	272.00000	0.007229	-0.1	0.904209	0.899706	-0.7	8.2	771.0802	0.000	-4.11	0.00

Table 1 Covid Period Descriptive Statistics

Type	Start Date	End Date	Observations	Mean	Min	Max	Std	Skewness	Kurtosis	Jarque-Bera	JB p-Value	ADF Statistic	ADF p-Value
	2023-01-20	2024-01-20			-0.0			-0.4	1.8	47.3		-15.4	
FT4GDGLOB100	2023-10-09	2024-11-13	288.00000	0.000010	-0.035	0.234078	0.268483			4664.2	0.000	-10.353	0.00
IFINXNT	2023-01-20	2024-01-20	288.00000	0.000017	-0.011	0.484137	0.156109	-0.5	2.79	1772.4	0.241	-15.2	0.00
MEUS0000qGUS	2023-10-09	2024-11-08	276.00000	0.000012	-0.067	0.252079	0.573836	-0.2	9.44	5625.0	0.000	-15.7	0.00
MIUS00I3GUS	2023-10-09	2024-11-08	276.00000	0.000012	-0.017	0.275087	0.587604	-0.3	1.1	9.0	0.004	-16.4	0.00
MIUS00I3PUS	2023-10-09	2024-11-13	279.00000	0.000011	-0.018	0.275087	0.542980	-0.3	1.1	8947.1	0.002	-16.5	0.00
MIWD0LCT0NUS	2023-10-09	2024-11-08	285.00000	0.000010	-0.023	0.200066	0.849913	-0.5	2.2	5570.2	0.000	-4805	0.00
MIWO00002NUS	2023-10-09	2024-11-08	285.00000	0.000010	-0.017	0.212073	0.999974	-0.3	1.6	2444.0	0.000	-14.6	0.00
PRGPESG10P	2023-10-09	2024-11-13	280.00000	0.000003	-0.029	0.264080	0.083440	-0.1	0.4	8624.3	0.273	-17.1	0.00
SXEIMUP	2023-10-09	2024-11-08	275.00000	0.000009	-0.087	0.238083	0.411992	-0.2	0.6	7.70	0.021	-17.2	0.00

Table 2 Israel-Palestine War Descriptive Statistics

Type	Start Date	End Date	Observations	Mean	Min	Max	Std	Skewness	Kurtosis	Jarque-Bera	JB p-Value	ADF Statistic	ADF p-Value
	2023-01-22	2024-01-22			-0.0			-0.1	1.9	147.06	0.000	-10.2	
FT4GDGLOB100	2023-02-22	2024-11-13	973.00000	0.000035	-0.041	0.531095	0.098838			4992.5	0.000	-2597	0.00
IFINXNT	2023-01-22	2024-02-13	972.00000	0.000004	-0.064	0.778095	0.183224	-0.1	1.0	9866.3	0.000	-27.0	0.00
MEUS0000qGUS	2023-01-22	2024-11-08	939.00000	0.000004	-0.044	0.596109	0.395028	-0.1	1.8	9568.1	0.000	-30.1	0.00
MIUS00I3GUS	2023-01-22	2024-11-08	939.00000	0.000005	-0.044	0.579112	0.757859	-0.1	1.5	3992.0	0.000	-30.6	0.00
MIUS00I3PUS	2023-01-22	2024-11-13	942.00000	0.000004	-0.044	0.578112	0.770957	-0.1	1.5	3631.0	0.000	-30.6	0.00
MIWD0LCT0NUS	2023-01-22	2024-11-08	970.00000	0.000003	-0.037	0.433085	0.658898	-0.1	1.8	3949.0	0.000	-21.1	0.00
MIWO00002NUS	2023-01-22	2024-11-08	970.00000	0.000003	-0.037	0.498091	0.985961	-0.0	1.8	4509.0	0.000	-27.7	0.00
PRGPESG10P	2023-01-22	2024-11-13	938.00000	0.000001	-0.057	0.411109	0.971095	-0.5	3.4	3949.0	0.000	-23.0	0.00
SXEIMUP	2023-01-22	2024-11-08	945.00000	0.000004	-0.048	0.587117	0.097530	-0.1	2.0	0880.0	0.000	-10.1	0.00

Table 3 Russia-Ukraine War Descriptive Statistics

Type	Start Date	End Date	Observations	Mean	Min	Max	Std	Skewness	Kurtosis	Jarque-Bera	JB p-Value	ADF Statistic	ADF p-Value
	201	202			-			-				-	
FT4GD	5-	4-	2,44	0.0	0.1	0.0	0.0	0.7	14.	21,38	0.0	10.9	
GLOB1	07-	11-	4.00	003	035	825	103	329	447	0.391	000	1361	0.00
00	01	13	0000	91	62	49	39	31	563	580	00	7	0000
	201	202			-			-				-	
	5-	4-	2,56	0.0	0.1	0.1	0.0	0.4	6.4	4,516	0.0	14.5	
IFINX	07-	11-	2.00	003	283	102	154	649	526	3466	000	3636	0.00
N													
T	01	13	0000	81	87	81	59	12	39	32	00	8	0000
	201	202			-			-				-	
MEUS	5-	4-	2,38	0.0	0.1	0.0	0.0	0.5	12.	16,40	0.0	15.2	
0000q	07-	11-	5.00	005	162	973	115	644	829	7.088	000	2929	0.00
GUS	01	08	0000	12	99	77	40	56	001	876	00	1	0000
	201	202			-			-				-	
MIUS0	5-	4-	2,35	0.0	0.1	0.0	0.0	0.7	14.	20,41	0.0	15.2	
00I3G	07-	11-	9.00	005	306	937	118	434	367	3.817	000	3841	0.00
US	01	08	0000	30	34	65	83	87	476	681	00	8	0000
	201	202			-			-				-	
MIUS0	5-	4-	2,36	0.0	0.1	0.0	0.0	0.7	14.	20,51	0.0	15.2	
00I3P	07-	11-	2.00	004	307	937	118	462	393	6.150	000	4421	0.00
US	01	13	0000	60	04	49	76	32	964	323	00	3	0000
	201	202			-			-				-	
MIWD	5-	4-	2,44	0.0	0.0	0.0	0.0	1.1	16.	27,76	0.0	15.0	
0LCT0	07-	11-	2.00	003	984	791	092	094	405	4.418	000	5645	0.00
NUS	01	08	0000	59	98	90	11	06	263	613	00	8	0000
	201	202			-			-				-	
MIWO	5-	4-	2,44	0.0	0.1	0.0	0.0	1.0	17.	29,81	0.0	11.2	
00002	07-	11-	0.00	003	025	863	096	062	045	9.767	000	4522	0.00
NUS	01	08	0000	90	54	18	18	23	136	071	00	2	0000
	201	202			-			-				-	
	5-	4-	2,38	0.0	0.1	0.0	0.0	1.1	13.	18,74	0.0	15.9	
PRGPE	07-	11-	9.00	000	311	870	119	897	545	4.771	000	4255	0.00
SG10P	01	13	0000	07	78	14	70	08	884	849	00	9	0000
	201	202			-			-				-	
	5-	4-	2,40	0.0	0.1	0.0	0.0	0.6	11.	12,78	0.0	15.3	
SXEIM	07-	11-	1.00	004	229	904	120	124	263	2.441	000	1484	0.00
UP	01	08	0000	39	93	88	35	28	055	212	00	1	0000

Table 4 Overall-Analysis Descriptive Statistics

Conclusion

The empirical analysis yields three major findings. First, the Total Spillover Index remained elevated across all crisis periods, peaking at 82.38% during the Israel-Palestine conflict. This confirms H1, demonstrating that ESG markets are highly integrated and susceptible to contagion during geopolitical tension.

Second, the directional spillover analysis identifies distinct roles for different markets. The MEUS0000qGUS index consistently acted as a net transmitter of shocks (contributing over 41% to others during the Israel-Palestine war), supporting H2 that developed US-centric ESG indices drive global volatility. Conversely, the FT4GDGLOB100 and SXEIMUP indices functioned as net receivers, absorbing significant shocks (up to 33.1% and 32.2% respectively).

Third, the nature of contagion varied by event. The Covid-19 period showed high connectedness (79.18%) but contained financial contagion, whereas the war periods exhibited more aggressive shock transmission channels.

In conclusion, while ESG indices offer long-term sustainability benefits, they do not provide immunity from short-term systemic risk during global crises. Investors should be cautious of the strong coupling between US ESG markets and global indices. Future research could expand this by including commodities and green bonds to test cross-asset class safe havens.

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15. Biodegredeble Medicine Packaging: A Study on Sustainable Approach to Reducing Pharamaceutical Waste and Promotig Green Healthcare Practices.

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Abstract

The increasing dependence of the pharmaceutical industry on plastic-based packaging has engendered some environmental issues, such as the accumulation of non-biodegradable plastic wastes in landfills, water bodies, and ecosystems. The present paper discusses biodegradable pharmaceuticals packaging as potentially feasible alternatives to conventional plastics. It will review generally studied biodegradable excipients, such as PLA, PHA, rebound-grounded plastics, cellulose, and chitosan, based on their individual biodegradability, mechanical strength, safety, and feasibility for pharmaceutical packaging operations. Secondary data from scientific journals, reports, and databases have been used to analyze the environmental impact, cost comparison, and obstacles for industry abandonment. This study revealed that though biodegradable excipients offer a number of obvious ecologically pertinent advantages, high costs, limited hedge lots, and nonsupervisory limitations hamper large-scale abandonment. However, the increase in awareness relating to sustainability issues, rigid government regulations, and continuous technological development guarantee a bright future. It is concluded that biodegradable packaging is the promising lane for reduction of pharmaceutical plastic waste and provides support to global sustainable healthcare business.

Keywords : Biodegradable pharmaceutical packaging, bioplastics, sustainable packaging environmental impact, eco-friendly materials, pharmaceutical sustainability.

Introduction: The pharmaceutical industry is based on plastic-based packaging for products such as blister packs, bottles, ampules, bags, and protective films, which help to ensure the safety, stability, and sterility of medicines These packaging products are resistant, light, and low-cost, thereby making them the most preferred material. However, in ensuring this, plastic materials have posed a great environmental burden. Thousands of plastic waste is produced by the healthcare industry at any one time, much of which is single- use and non-biodegradable. Items that consist of blister packs, pill containers, IV bags, and disposable medical devices often find their way into landfills or abysses, where they can take hundreds of times to putrefy. Therefore, pharmaceutical plastic waste hugely contributes to pollution, soil impurity, and the growing global problem of micro plastics. This raises concern about the sustainability of enterprises and environmental health.

Bioplastic is a biodegradable material made from recyclable accoutrements and is easy to exercise. The invention of bioplastic is considered to drop the waste generated by the pharmaceutical assiduity and give a sustainable source to the manufacturers. It will propel the growth of the biodegradable pharmaceutical packaging request. Generally, the packaging is done to cover the product. Still, during storehouse or transportation, if the product comes in contact with light or severe sun, it reacts with the packaging accoutrements. It could lead to a change in the composition of the drugs formulas. Biodegradable paper or glass packaging will cover products from microorganisms and the outside terrain and energy the biodegradable pharmaceutical packaging request's growth. Biodegradable packaging is eco-friendly, applicable, and fluently recyclable. The increase in the demand for sustainable packaging from guests and the government compelled manufacturers to change

their accoutrements. The strict laws and regulations assessed by the government will enhance the growth of the biodegradable pharmaceutical packaging request. Input of drugs has increased due to the rise in habitual conditions that increase biodegradable waste. To reduce waste, the request for biodegradable packaging has thrived.

Review of Literature

Overview and provocation: The pharmaceutical sector heavily depends on single-use plastic packaging-pocks, bottles, and sacks-to ensure medicine stability and sterility and to provide patient safety. However, this practice generates large volumes of non-degradable waste and is the source of long-term environmental pollution and microplastic conformation. The quest for sustainable packaging alternatives The place, therefore, has entered into growing academic and artificial attention. Ashiwaju 2023

Some bio-based polymers dominate the literature as campaigners for pharmaceutical packaging: polylactic acid (PLA), pol hydroxyalkanoates (PHA), bounce-grounded plastics, and cellulose derivations. PLA has been widely studied because of its renewability and processability. PHAs are of interest due to their biodegradability and biocompatible declination products. Cellulose and bounce derivations have been studied for flicks and coatings because of their translucency and composability. Each family brings trade-offs between mechanical strength, hedge performance, and biodegradation geste. Cristian Jean da Silva Pens 2024

One of the patient challenges reported in several studies is that many biodegradable polymers, PLA especially, have mediocre hedge parcels - oxygen and water vapour resistance - compared to conventional petroleum-based plastics. This is limiting direct relief to humidity- or oxygen-sensitive medicinal products without further modification. Research, therefore, is focused on perfecting hedge performance while retaining biodegradability. (shuvra singha 2020)

Active packaging generalities with the use of chitosan, tableware nanoparticles, or other bioactive complements have been widely tested in order to provide antimicrobial or antioxidant functions for product protection. Among them, chitosan-based coatings show promise for biodegradable, antimicrobial coatings that may improve water-vapour hedge and shelf-life; however, their safety, migration, and nonsupervisory adequacy for pharmaceutical contact need experimental elucidation.Andre jiang 2023

Product cost and large-scale vacuity of high-quality biopolymers-especially PHAs-are recreating enterprises. Recent reviews and product-concentrated studies bandy advances in microbial PHA product and process advancements that may reduce costs, but wide marketable relinquishment requires farther techno-profitable and life-cycle assessments to confirm true environmental benefits over conventional accoutrements. L. Atares 2024

Statement of The Problem

Pharmaceutical packaging waste is continuously growing year after year, and most of these packaging materials are from non-biodegradable plastic materials that will remain in the environment for many decades. In spite of the international outcry over sustainability issues, biodegradable pharmaceutical packaging has not yet emerged as a mainstream alternative. There are a lot of pending questions regarding whether biodegradable materials can provide the required strength, durability, and safety like traditional packaging. At the same time, industries are hesitant due to cost, regulation, quality standards, and supply chain limitations.

Therefore, the core problem that this research is dealing with is an absence of denaturation of biodegradable medicine packaging, although it reduces environmental pollution. In the presence of this, the environmental benefits from biodegradable packaging will be assessed against conventional packaging through an understanding of the reasons for the low assimilation observed by the pharma industry.

Objectives of The Study

To study the environmental sustainability and ecological benefits of biodegradable medicine packaging.

To analyse and compare the cost

differences between traditional pharmaceutical packaging and biodegradable packaging materials.

To examine the key reasons why the pharmaceutical industry has been slow to adopt biodegradable medicine packaging.

Need of The Study: The rationale behind this study is the evident environmental concerns linked to the use of non-biodegradable plastic packaging in the pharmaceutical industry. As medicine production and consumption continue to increase, the amount of plastic waste produced by healthcare systems has increased substantially, with soil pollution, water contamination, and increasing microplastic threats being prevalent. While conventional packaging materials serve their purpose of well protecting medicines, their contribution to long-term ecological damage lies in their negligible degradation rate. Meanwhile, governments and other regulatory bodies worldwide are fostering sustainability and urging industries to adopt eco-friendly solutions. But biodegradable materials have limited usage in pharmaceutical packaging due to issues of cost, performance, safety, and unawareness. Therefore, the relevance of the present study lies in the fact that, based on critical evaluation of available biodegradable alternatives, their environmental benefits, and their feasibility for practical pharmaceutical applications, it supports the global movement for sustainable healthcare, decreases the dependency on fossil fuel-based plastics, and fosters responsive waste management practices crucial for a healthier environment.

Research Methodology

Data Collection Methods: Secondary Data: Data is obtained from academic journals, scientific articles, books, WHO reports, environmental agency publications, and reputable online databases such as Google Scholar, Research Gate, PubMed, and Science Direct.

Tools for Data Analysis

Comparative analysis of biodegradable vs. plastic packaging Review-based analysis to identify gaps and opportunities Charts, tables, and graphs Research Variables

Independent Variable: Type of packaging material (biodegradable, compostable, recyclable, plastic)

Dependent Variable: Environmental impact, cost, safety, sustainability, usability. Scope of the Study Types of biodegradable materials usable in medicine packaging Current global and Indian packaging practices Environmental concerns related to plastic waste Feasibility and challenges of adopting biodegradable alternative.

Analysis and Interpretation of Data : Packaging of product done to deliver the product in correct way to patient or any customer without damaging it during the transportation.

Types of packaging

Primary packaging -which customers typically take home with them and come into contact with the items in. Ex: bottles, ampoules etc.

Secondary packaging -which includes the bulkier packaging like boxes that is utilized to transport primary packaged goods in quantity. Ex: Boxes, cartons etc.

Tertiary packaging -which includes plastic wrapping and wooden pallets is packaging designed to facilitate the transportation of large no of goods. Ex: wooden –pallets



Fig. 1: Types of Packaging

Overview, Biodegradability, and Mechanical/Functional Properties of Biodegradable Packaging Materials

Material	Overview / Key Properties	Biodegradability	Mechanical & Functional Properties
Polylactic Acid (PLA)	Plant-derived thermoplastic from corn or sugarcane; popular due to clarity and strength.	Breaks into CO_2 and water under industrial composting; degrades within 1 –2 years.	High transparency, good rigidity, strong oxygen/moisture barrier; limited heat resistance.
Poly hydroxy alkanoates (PHA)	Microbial polymers produced by bacteria; highly versatile and biocompatible.	Fully degrades in soil, water, and compost environments.	Strong, flexible, tough; safe for direct drug contact.
Starch-Based Bioplastics	Made from starch of crops like corn or potatoes; processed into films, foams, or coatings.	Breaks down in weeks to months under composting; some types degrade in soil/water.	Lightweight and flexible but less strong; moisture sensitive.

Cellulose-Based Plastics (Cellophane)	Made from wood pulp or cotton; one of the earliest biodegradable plastics	Naturally biodegradable and compostable under normal conditions.	Transparent, strong, tear-resistant; moderate flexibility.
Chitosan	Derived from chitin in crustacean shells;	Fully biodegradable in soil and water.	Forms thin, flexible films; may require

Pharmaceutical Applications, Benefits, and Limitations of Biodegradable Packaging Materials

Material	Pharmaceutical Applications	Benefits	Limitations
Polylactic Acid (PLA)	Blister packs, bottles, containers, films, labels.	Renewable, compostable, good clarity, strong barrier properties.	Not heat -resistant; requires industrial composting for full breakdown.
Polyhydroxyalkanoates (PHA)	Drug-delivery systems, medical packaging, coatings, films.	Completely biodegradable naturally; biocompatible; customizable properties.	High cost; limited commercial production.
Starch-Based Bioplastics	Packaging films, blister wraps, protective foams, tablet coatings.	Low-cost raw materials; easily compostable; good for flexible packaging.	Poor moisture resistance; lower durability; often needs additives.
Cellulose-Based Plastics (Cellophane	Blister packs, sachets, outer wraps, tamper - evident seals.	Plant-based, naturally compostable, high clarity, good contamination barrier.	May require coatings for moisture resistance; less flexible than some bioplastics.
Chitosan	Antibacterial packaging, tablet coatings, protective	Natural antimicrobial properties;	Low mechanical strength alone; potential allergen

Factors Slowing Adoption of Biodegradable Packaging

This has been due to various barriers, which include regulatory, economic, and technological aspects:

Regulatory Requirements: Biodegradable materials must meet the severe standards regarding the safety, stability, and sterility of drugs. The approval processes from agencies such as the FDA and EMA are highly expensive and time-consuming (Kaufman & Wright, 2021).

High Production Costs: Biopolymers such as PLA and PHA continue to be more expensive when compared with PET or PVC. Modification of existing production lines adds extra cost to the procedures, as well (Gupta & Singh, 2020).

Supply Chain Limitations: Variable availability of high-grade biopolymers and stricter control in respect of storage conditions (Patel et al., 2022).

Performance Limitations: Most biodegradable materials still lack performance in terms of moisture and oxygen barrier, heat resistance, and compatibility with high-speed packaging machinery (Reddy & Karlsson, 2021).

Quality & Safety Concerns: The moisture absorption, chemical interaction with API, and unpredictable degradation behaviour are some key deterrent factors for adoption.

Functions of Packaging : Barrier protection: This kind of protection against all the harmful external influences able to change the properties of the product, such as moisture, light, oxygen, and temperature fluctuations, can be provided using blister packaging in Pharma grade barrier film and eco-friendly halogen-free film.

Biological protection: This serves to protect against biological contamination. Physical protection: It is designed to protect the medicinal dosage forms against physical changes.

Information communication: Information on the proper use of dosage forms, their contents, their provainance, adverse effects and warnings should be included on pharmaceutical packaging.

Future Aspects of Biodegradable Packaging In : With rapid development in biopolymer technology, increased regulatory support, and global sustainability drives, the future looks bright for biodegradable pharmaceutical packaging. Better strength, flexibility, moisture resistance, and lower production costs are expected from emerging biodegradable materials such as enhanced cellulose, improved PHA, and composite bioplastics. This may solve many of the performance issues of today. Regulatory agencies like the FDA and EMA enforce more stringent sustainability standards, certifications, and other incentives for eco-friendly packaging, compelling pharmaceutical companies to adopt biodegradable solutions. Correspondingly, the shift to circular economy models being embraced by the industry boosts the use of materials that can be reused, recycled, or composted, with decreasing reliance on landfills. The emergence of consumer and professional demand toward sustainable healthcare pushes companies to take up the use of biodegradable packaging, which enhances their brand image and competitiveness. Global efforts for environmental responsibility through ongoing initiatives like the EU Green Deal and

the UN SDGs should see continuous improvement in technology and scaling up their production to make biodegradable packaging more affordable, efficient, and compliant with pharmaceutical safety requirements.

Conclusions: Biodegradable pharmaceutical packaging has become a necessary solution to the growing problem of plastic waste generated by the healthcare industry. Traditional plastic packaging offers solidity and a high degree of protection; however, it stays in the environment for hundreds of years, contributing to long-term pollution with large amounts of microplastic accumulation. Biodegradable alternative materials include PLA, PHA, starch-based plastics, cellulose, and chitosan; these may be high in cost and limited in availability, and they suffer from performance problems. However, with growing environmental awareness, government regulations, and development of biodegradable materials, various industries have been compelled toward the use of sustainable packaging. Further research, technology development, and support by regulatory authorities will make this kind of packaging practical and widely acceptable. In general, this is a promising pathway toward reducing environmental impact and promoting a more sustainable healthcare system.

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16. A Study of The Circular Economy And Green Innovation: Observing Business Models In Pune and Navigating Consumer Behaviour.

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Abstract –

Globalisation has had a significant influence on the fashion industry, leading to increased demand and faster production. “Fast fashion” is the product of it. This linear approach has serious implications not only on the environment but also on society at large. This research focuses on business models in the fashion industry in Pune that address these concerns. This study was conducted through a survey and by talking to these businesses. It studies how these business models leveraged circular economic principles (reduce, reuse, and recycle) and green innovation, while examining the positive relationship between these and consumer preferences.

Keywords- Circular economy, green innovation, fashion industry, sustainability.

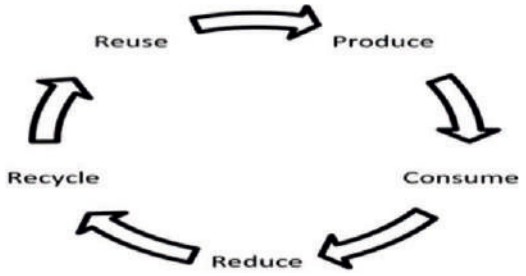
Introduction – Fashion is an everyday choice. Fashion represents the unique culture, art, and history of a particular region while conforming to trends and integrating them into vintage traditions. In the last few decades, the fashion industry all over the world has seen a massive surge. It employs over 3.45 billion [Fashion United] people globally.

The very first evidence of clothing in the Indian subcontinent was during the Indus Valley civilisation (2600- 1900 BCE). The Rigveda mentioned dyed and embroidered garments (indianculture.gov.in). Today, it employs 45 million people, including significant numbers of women, and contributes over 5% to India's GDP. It occupies over 2% of the country's GDP (pib.gov.in). The fashion industry is a mixed bag, consisting of global brands, MSMEs, and

handlooms.

However, it follows a linear business model, meaning a take-and-use approach. It has led to the inception of "fast fashion." This involves producing trendy clothes from cheap materials and using harmful chemicals as dyes. It adopts mass production and an energy-intensive process that has serious social and environmental impacts, such as overconsumption and waste generation (earth.org). It also fosters an attitude of use and throw, among consumers, or a throwaway culture.

Green innovation is the route through which various models can be adopted to achieve sustainability and reduce the negative impact. The "Circular Model" is one of them. With a little shift in approach, adopting a circular model and sustainable practices along with aligning with global goals like the United Nations SDGs [12th- Responsible consumption and production] becomes inevitable. This approach has its own challenges and potential strategies that businesses and consumers could adopt. So that one can be as conscious as possible. The circular model has a closed-loop design focusing on longevity and durability. It emphasises reducing, recycling, and reusing. While technology is not a new phenomenon, the fashion industry is one of the most important ones that is adopting it and has been continuously working on it and with it.



Source: link.springer.com

Problem Statement:

Lacks viability- There is a perceived lack of viability of sustainable business models in the fashion industry, as they lack demand due to less conscious consumer behaviour, complicated production process and less utility.

Scalability- Due to less viability, there are very few producers in the market, making it difficult to scale these business models.

Objectives

- To study how the green business models are operating in Pune as they follow the circularity.
- To comprehend the integration of green technology and innovation in the fashion industry to achieve sustainability.
- To perceive which elements help to adopt sustainability.
- To study consumers' mindset while making fashion choices.

Need and Relevance of the Study-

Traditionally, reuse and recycling are an integral part of consumption, especially in India. If one takes a glance at any aspect of Indian culture, longevity has always had significance. With globalisation, fast fashion has occupied a significant part of the industry. However, with its visible negative impact on society as well as on the environment and increasing awareness about sustainability, it needed to course-correct. By incorporating green innovation in the fashion industry, this study delves into how circularity will help businesses adopt sustainability while studying consumer behaviour. This research studies such models.

Hypothesis

H1: A significant adoption of the circular economy practices [e.g., providing product longevity and high utilisation] by the fashion industry leads to an increase in customers preferring sustainability. [a will to wait for quality, preferring uniqueness]

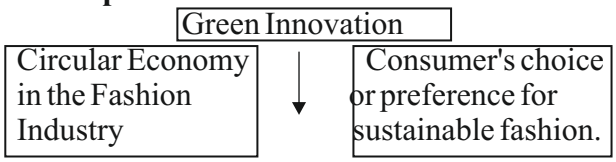
H2: A positive relationship between the circular economy practices and customers' preference for sustainability is supported by green innovation in business processes.

Literature Review

Almost two decades back, according to M.M.Grasso, M. McEnally, and R. Widdows (2000), consumers of the fashion industry were aware of the environmental concerns but did not necessarily take actions towards it, such as purchasing eco-friendly products. Price remained a major influence; it concluded with the fact that the manufacturers need to find innovative and effective ways to urge consumers to buy eco-friendly textile products. After years, when the harmful effects not only on society but also on the environment were

palpable, people started to introspect. The researchers, namely, Kaisa Vehmas, Anne Raudaskoski, Pirjo Heikkila, and their co-researchers (2018), through their research about consumer attitude with respect to circular economy or circular garments, stated that both consumers and companies know resources are limited, and climate change is real. In their study, some consumers stated that manufacturing and conditions did not influence their buying decisions, whereas price was a major factor. However, it also suggested that manufacturers' communication should play a pivotal role in persuading consumers to adopt sustainable practices. The researchers viewed circular garments as a novel technology and a new business opportunity. In a further study done by Aya Abdelmeguid with his co-authors (2023), stated that providing consumers with more circular options will reduce the disposal behaviour of consumers, while also adding that price will not influence the purchasing decision, as the same consumers will buy designer or luxurious designs. According to M. Henry, along with his co-authors (2019), gave an insight about circular business models, which states that circular business models blend the circular economy principles and redesign models to create a closed-loop system and extend the life of the product by recycling, reusing the resources and recovering the resources. While the study showed the reason a circular economy is adopted, which is because of hazardous effects on the environment, such as excessive emissions and landfills, researchers Lihong Chen, Kexin Qie, and their co-authors (2021) cited the same reasons as to why clothing brands needed to adopt green innovation methods to deal with it. The study states different aspects of green innovation, such as green product design, technology, and green services. Muhammad Ikram (2022) provides an insight into how sustainable fashion will help with transitioning into the green market. He links the green model, product design, and enabling conditions, stating the importance of technology facilitating a sustainable future. This study focuses on green innovation in business practices while also trying to navigate consumer behaviour.

Conceptual Model



Research Methodology

This study is based on primary data, collecting data from consumers and from sustainable businesses. The methods to collect data included:

Survey- A questionnaire was circulated through Google Form to survey. The questions were related to fashion choices, which factors, and habits that can result in various sustainable choices. It was conducted in the city of Pune.

Personal Interview- The data was collected by visiting the stores and workshops of the sustainable businesses and conducting face-to-face interviews. The interview included specific questions on the production processes, designed to observe the working of various aspects such as washing, segregating, and stitching. Each interview lasted about 20 minutes. The data is primarily collected from businesses operating in the city of Pune. The data was also collected from a fashion technology student.

Sampling technique- This research adopts a simple random sampling method. This method selects a subset of individuals from a large population, where every individual has a fair chance of getting selected. In this research, data have been collected from a total of 149 respondents.

Secondary Data- Different websites, articles and research papers.

Analysis and Interpretation-

Business Models

EcoKaari-

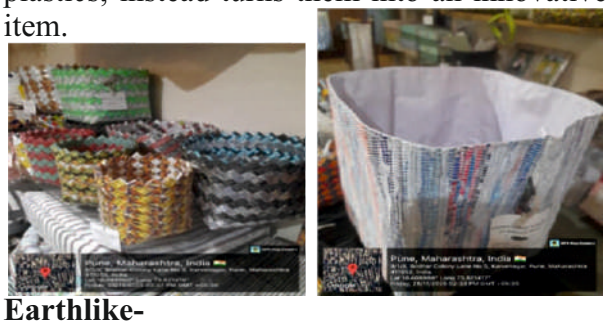
This is a social enterprise that focuses on upcycling plastics into meaningful and daily-use items. Their name suggests the relation between the environment and the artisans. Nandan Bhat is the founder of this enterprise. These items are made with the help of a charkha(spindle) and handlooms. They could have easily established machinery that would upcycle the plastics and would be ready to get converted to beautiful items. EcoKaari upcycles single-use plastics, segregating them into hard

and soft plastics, such as chip packets, wrappers, into the most useful and beautiful items like pouches, tote bags, purses, etc. One of the most important practices is that they never use dye; the colour of the items is derived from the colour of the plastics. Energy-efficient production: EcoKaari uses traditional processes such as the charkha and handloom. These do not require any water or energy for production and do not cause any environmental degradation or pollution. Circular practices-- Recycling plastic into everyday items increases its use and keeps it in use for a longer period of time. Delaying its deposition in the environment is a great way in the circular economy. EcoKaari creates employment opportunities and empowers local artisans.



reCharkha-

This is also a social enterprise that upcycles plastic and turns it into useful and beautiful products. It was founded by Amita Deshpande. This enterprise aims at conserving the environment, empowering the rural population, and creating conscious living beings. The stark difference can be seen. Though being a sustainable brand, it always adopts trends and tries to create products that can also be utilised. This enterprise also segregates soft and hard plastics, but does not throw away the hard plastics; instead turns them into an innovative item.



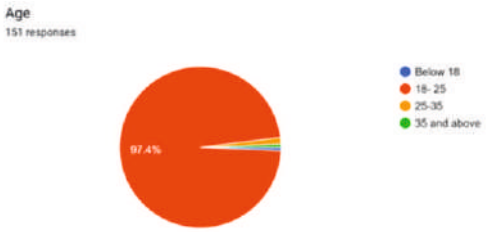
Earthlike-

It was founded by Kirti and Anup Deshpande. It specialises in kids' fashion. As they cater to kids' fashion, they aim to focus on natural dyes. Natural dyes are extracted from the elements present in nature. They also empower Indian craftsmen by giving them employment opportunities. They aim to reduce the harmful environmental effects of chemical dyes and promote slow fashion.

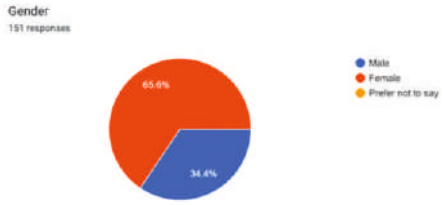
Some samples of natural dyes collected from a fashion technology student-



Population



Out of the total respondents, 97.4% are between the ages of 18-25, being the highest, while 1.3% are between the ages of 25-35, and below the age of 18 and above the age of 35 are 0.7%.



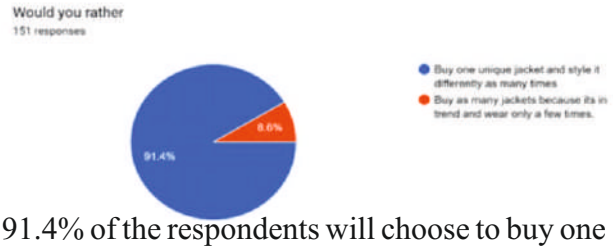
The majority of the respondents are female, with 65.6% while the remaining 34.4% are male.

Fashion Choices-

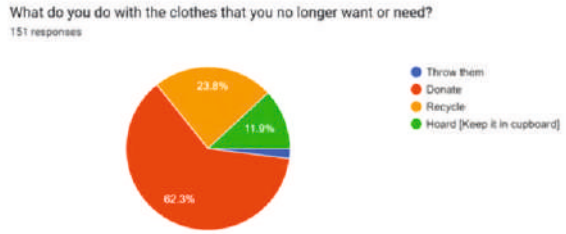


Out of the total respondents,44.3% chose quality often, while 23.5% chose quality over

quantity sometimes. 20.8% of them always choose quality over quantity, while 9.4% occasionally choose quality, with a few of them who never choose quality.



91.4% of the respondents will choose to buy one unique jacket and reuse it by styling it multiple times, while 8.4% of the respondents choose to buy many jackets and would wear them only once.



Findings and Observations-

Green Innovation as a facilitator- EcoKaari and reCharka modified the production process of recycling and upcycling by adopting energy-efficient tools like a charkha and handlooms. It drastically reduces the number of inputs like energy and water, aligning with the core circular economy principles.

Bringing back traditional practices- EcoKaari, reCharkha and Earthlike smoothly adopted the traditional Indian practices, which were struggling to exist in the fast-moving world, like the charkha, handlooms and natural dyes.

Environmental impact- Environmental conservation is at the core of these businesses. Energy-efficient production, recycling plastics, and using zero-dye or natural dyes would definitely delay the degradation of the environment.

Social impact- All three enterprises provide economic opportunity to local artisans, the rural community and women at large. This empowers them and results in an increased standard of living.

Consumer demographics and values- The majority of the respondents were young, making them the potential consumers for the next few years, and who would influence the market demand. Overwhelmingly, 138 out of 149 choose reusability (styling one jacket multiple times). Quality has been a priority for nearly half of them.

Consumption habits- Only 36 out of 149 consumers recycle, while 94 of them donate, leading to reuse; thus, there is general awareness amongst the youth with respect to circular practices, while waste generation is less.

Conclusion-

This research concludes that the circular business models, which leveraged green innovation by reflecting on traditional Indian practices, are strongly supported by the markets. These business models aimed to reduce negative environmental impact by adopting energy-efficient production, reducing water use, and recycling plastic, which also aligns with the core values of youngsters who prioritise quality, reusability, and mindful consumption habits. This study confirms that there is a positive relationship between circular practices supported by green innovation and customers' preference for sustainability. This research provides encouraging evidence for producers in the fashion industry who want to redefine their production practices to incorporate circular principles into their business model, or for those who want to build a sustainable fashion business model using circular economy principles and traditional Indian elements. The technology will also play a crucial role in adopting green innovation in the near future.

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17.Sustainable Talent Management: Balancing Profitability and People-Centric Policies

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Abstract
The business world after the pandemic, specifically from 2020 to 2025, imposed extraordinary difficulties on companies and they had to take measures to ensure not only their financial stability in the short term but also the sustainability of human capital in the long run. It is discovered that among the factors leading to the action of reducing the workforce were economic instability, digital transformation, and restructuring, as well as, uncertainty in the market.

At the same time, companies boosted retention by means of upskilling, flexible work models, and programs aiming at engaging and supporting employees mentally and physically. It has been proved that the companies which combined not many layoffs, but selectively, with strong retention measures have gained greater resilience, productivity, and employee loyalty. In this paper, a conceptual connection is proposed between external pressures, HR decisions, and organizational outcomes, and it is concluded that ethical HR practices and sustainable talent management help companies

to cope with the uncertainty while safeguarding their human capital.

Keywords: Sustainable Talent Management, Human Capital Sustainability, Employee Retention, Well-being, Organizational Performance, HR Strategies.

1. Introduction

The global market present was changing from 2020 through 2025 and was crafted by India. One way or another, nearly all sectors were affected heavily by the COVID-19 crisis, inflation, political regions conflicts, disruptions in the supply chain, and the fast pace of digital transformation. During 2022-2024, the global majors like Google, Amazon, Ford-East Euroauto Evropska, and others ejected 400,000 people. In an Indian context, IT behemoths too had to repudiate their respective workforces due to demand collapse and automation's assault. Businesses with the choice between short-term and bottom-line cost cutting versus longer-term pursuits. Layoffs provide financial relief but harm morale and innovation. Investment in retention policies saves skilled labor. Why firms go for either layoffs or retention is explained by HR theories, such as RBV, Human Capital Theory, and Contingency Theory.

Remote work and automation have intensified HR challenges. There is limited research linking layoffs and retention as interconnected factors. The research analyzes data from 2020 to 2025 to find out the reasons for layoffs, measure the impact of retention strategies, and their effects on performance of the organization. Hence, both strategies can be rational depending on the organizational priorities, but the post-pandemic scenario points out the need to balance them rather than pitching them against each other.

The new realities of the workforce telecommuting, robots taking over jobs, changing demands of the workers, and burnout have added more to the HR challenge. Researchers have talked a lot about layoffs and takes, but nearly no one has connected the two as dependency factors of the talent management system. This disconnect is a major challenge for Indian companies who are trying to weigh efficiency in finances against sustainability in human resources. Hence, the purpose of the present study is to analyze the available data obtained during 2020-2025 in order to determine the causes of layoffs, assess the crisis retention strategies, and investigate the effects of both on the company's performance, staff morale, and long-term stability.

1.1 Statement of the Problem

The Indian corporate sector was completely dependent on the market during the years 2020 to 2025 in relation to the all above-mentioned issues, thus leading to rapid digital transformations, unstable conditions, and economic cycles. Cost-cutting was one of the major steps, and hence the workforce was reduced, but on the other hand, there were also retention policies for high-performing employees. The Indian academic circles have paid very little attention to the combination of downsizing and retention tactics; rather, they have mostly regarded these matters as separate ones. Therefore, the top management is caught in a difficult situation where a single wrong decision can lead to loss of talent, reduced innovation, and damaged psychological contract which in turn will lower the organizational resilience. Nonetheless, Indian companies require detailed and sophisticated comparative studies through layoffs or retention, which will not only help them adopt more sustainable and integrated talent management practices but also allow the coexistence of both methods.

2. Review of Literature

2.1 Post-Pandemic Workforce Dynamics (2020–2025)

The pandemic infected the entire planet with a huge disruption in labor markets. One of the things that Klotz (2021) pointed out was "The Great Resignation," where workers chose flexibility, well-being, and meaning at work as their main criteria for staying or leaving. The 2022 Gartner HR Report mentioned that more than 70% of organizations implemented cost driven restructuring as a result of lost revenues and advanced digital technologies.

2.2 Factors Affecting Layoff Decisions

a) Economic Pressures:

According to Lee & Chen (2021), the decline in income and cash flow problems were significant reasons for the companies to decide on layoffs as

a last resort.

b) Automation & Digital Transformation:

Inferences of Frey & Osborne (2020) and Brynjolfsson et al. (2023) clearly pointed out that accelerated AI adoption had a direct correlation with job loss in areas like customer service, finance, manufacturing, and analytics, so layoffs were more common due to technology.

c) Organizational Restructuring:

According to Datta et al. (2022), companies utilized layoffs for operational streamlining, to get rid of excessive positions, and to make the flow of works for future efficiency through restructuring.

d) Global and Indian instances were cited:

Meta's workforce was reduced by 21,000 workers as part of the "reforms for efficiency," Amazon cut 27,000 positions for the purpose of reorganizing the retail part of the business, and Indian companies, such as BYJU's and Wipro, also cut off a big chunk of their staff. Studies indicate that layoffs are the result of a complicated pattern of economic and managerial elements.

2.3 Retention Strategies in the Post-Pandemic Era

a) Learning & Development:

According to Noe et al. (2021), firms that emphasized the training and development of their people enjoyed a remarkable reduction in turnover, as much as 35%. For instance, Google and IBM are among the companies that have opted to spend more on L&D in order to keep the digital talent.

b) Hybrid Work and Work-Life Balance:

The new hybrid work practice, according to Bloom et al. (2022), has been instrumental in cutting down the employee turnover by 12% at the most. The 2023 Microsoft Index also pointed out that employees' remain in the company primarily due to the flexible working hours.

c) Engagement and Psychological Safety:

Edmondson (2020) and Park & Searle (2021) refer to psychological safety and employee participation as the two main drivers of retention seen by the employees.

d) Rewards and Internal Mobility:

According to Bersin (2023), compensation associated with performance and opportunities for career development are major factors contributing to the retention of high talents.

2.4 Interplay Between Layoffs and Retention

a) Layoffs Intensify Voluntary Turnover:

Cascio (2020) discussed that the employees who remain after layoffs usually go through a transformation of negative feelings such as stress, fear, and distrust; meanwhile, Morrell (2022) noted that the number of employees voluntarily resigning became 20-30% higher after large-scale layoffs.

c) Retention Programs Help to Diminish Negative Impacts:

Bhatnagar (2023) argues that layoffs cause a problem but with the help of counseling, engagement programs, and open communication, the adverse impact can be minimized. Mehta & Sharma (2024) further confirmed that the implementation of proper retention practices during selective layoffs resulted in a 40% quicker recovery for the firms.

2.5 Theoretical Framework

a) RBV: Employees produce strategic value that cannot be imitated and that is of great importance for the company (Barney, 1991).

b) Human Capital Theory: Skilled workers provide an organization with direct increase in productivity and innovation (Becker, 1994).

c) Psychological Contract Theory: A layoff may break the trust between an employee and an employer and also may reduce the employee's commitment (Rousseau, 1995).

d) Sustainable HRM: Investment in employee capability development lessens the need for layoffs (Yerlitaş & Bučiūnienė, 2024).

2.6 Integrated Workforce Strategy

The latest research indicates that the toughest organizations take to combine approaches: layoffs to a minimum along with holding the right employees. Feng & Smith (2023) found that such companies were able to keep on with the revenue and the innovation.

2.7 Research Gap

Most of the current studies on layoffs and retention have been treating them as separate issues. It means the Indian perspective is still immature in terms of comparing, integrating, and studying these issues, especially how retention practices can counter the negative impacts of layoffs.

3. Objectives of the Study

1. Identify the main factors behind the layoffs of the 2020–2025 period from organizational, economic and technological perspectives.
2. Appraise the key employee retention methods that were applied during this period.
3. Explore how layoffs and retention interacted in terms of performance, morale, and long-term viability.

4. Need or Relevance of the Study

India saw a dramatic shift in its labor force during the taking place of the pandemic. As per CMIE data, 14 million jobs were cut off over the period of 2020–2022.The workforce transitions have been further compounded by silent layoffs and increased automation. In sectors like knowledge-driven, replacing highly skilled workers is very expensive. Retention has become a paramount HR issue; according to a 2025 GCC poll, 51% of employers reported retention as the most challenging aspect. The utilization of effective methods like upskilling, internal mobility, and employee well-being is essential for keeping India's talent edge over the world. Research highlights the connection between the downsizing of employees and sustainable talent management in India, thus addressing both theoretical and practical questions.

5. Research Methodology

The approach used in this study was a comparative secondary data analysis. SDA was used to compare Indian workforce trends from 2020–2025.

5.1 Data Sources and Search Strategy

A focused research was conducted using key terms related to talent management and workforce trends. Data was collected from major academic databases and government labor portals. Only studies and reports written in English and directly related to the Indian workforce context were considered. I included those studies which occurred during 2020-2025, were engaged with India and contained empirical data.

5.2 Data Analysis

Both quantitative and qualitative indicators were analyzed. A trend analysis over the five years using a comparison method was done to identify the changes. The qualitative data were then subjected to thematic coding which resulted in the identification of the main themes like restructuring for financial reasons, measures for enhancing employee engagement, upskilling/reskilling efforts and the introduction of hybrid as well as flexible work models. The mixed approach made it possible to have a comprehensive view of the changing HR scenario in India.

5.3 Reliability, Scope, and Limitations

Secondary data is widely used and effective in terms of coverage, but its accuracy is restricted by the quality and intention of the source. SDA researchers have pointed out that secondary datasets may not fully reflect all workforce segments or industry-specific purposes may not necessarily be perfectly compatible with the new research questions. In order to avoid this problem, various data sources were used together and assessed for methodological openness. Even so, it is still not possible to establish causative relationships. The limitations mentioned were taken into account when the findings were interpreted.

6. Analysis and Interpretation of Data

Based on Secondary Data: 2020–2025 India vs Global Comparison

6.1 Overview of Data Sources

The analysis is drawn from secondary data collected from the WEF Future of Jobs Reports (2020–2024), SHRM Workforce Studies, Deloitte Human Capital Trends, McKinsey Talent Reports, CMIE India Employment Data, NASSCOM Workforce Insights, and top HR

Year	Global Layoffs	Key Trend
2020	3.2M	Pandemic shock
2021	2.4M	Tech realignment
2022	1.8M	Automation
2023	2.3M	Mass tech layoffs
2024	1.9M	Stabilisation

databases (ET, Business Standard). These sources furnish credible points of reference for

the assessment of layoffs and retention trends in India as well as in global markets.

Objective 1: Factors Driving Layoffs in India and Around the World

Main drivers (Thematic Insights)

From the secondary data presented, five main reasons can be pointed out:

a) Economic Disruptions: The fall of revenue which was mainly due to the pandemic, and unstable markets.

b) Technological Automation: Artificial Intelligence (AI) is taking over (IT, manufacturing) the regular human jobs.

c) Organisational Restructuring: Merging and optimising the performance of the company.

d) Overhiring (Global Tech): The correction in workforce sizes across Facebook, Amazon, and Google, has been primarily due to the post-pandemic period.

e) Funding Winter (India): The shortage of capital in 2023-2024 has led to the layoffs at the start-ups in India.

Table 1: Global Layoff Trends (2020-2024)

Table 2: India Layoff Trends (2020-2024)

Year	India Layoffs	Key Drivers
2020	1.1M	COVID lockdown
2021	6.7L	Retail+ IT slowdown
2022	4.4L	Automation
2023	5.1L	Startup crisis
2024	3.6L	Cost restructuring

Interpretation:

2020 and 2023 are marked as the years with the highest numbers on the layoffs timeline. India was the most affected country by layoffs because of the financing uncertainty and the implementation of new technologies, while the rest of the world got rid of workers mainly due to the hiring spree in the previous years and the consequent need for better reorganizing for efficiency

Objective 2: Factors Influencing Employee Retention

Key retention drivers (thematic insights)

a) Working hybrid and good work-life balance

b) Training and promotion from within

c) Good salaries

d) Involvement of workers and secure workplace psychologically

e) Sustainable talent management (STM)

Table 3: Retention Rate Comparison

Year	India	Global
2020	61%	68%
2021	64%	72%
2022	67%	73%
2023	65%	70%
2024	69%	74%

Interpretation:

The case of India is quite the opposite; it has received a boost through hybrid work adoption but still has to deal with the problem of high voluntary turnover.

Objective 3: Layoff vs Retention Comparison

Table 4: India vs Global Comparison

Indicator	India	Global
Layoff-Frequency	Medium-High	High (Tech)
Retention	Moderate	High
STM Adoption	Growing	Mature
Workforce Stability	Medium	High

Interpretation:

Indian companies resort to layoffs mainly as a method to cut down on their costs whereas the international ones use it as a tool of structural reshaping. Firms with a strong emphasis on workforce retention showcase better culture, increased productivity and also have a great deal of long-term stability.

6.2 Integrated Discussion

- Retention-oriented companies facilitate cultural, innovative, and sustainable developments.
- The combination of a low layoff policy and a powerful retention program is the most effective HR approach for ringing in stability over the years.

7. Findings

7.1 Findings on Layoffs

The analysis indicates that layoffs in India were at their highest level in 2020 and 2023 largely due to the global health crisis, less investment and fast automatization. In the Indian market, layoffs were mainly due to cost-cutting, while in the rest of the world they were more related to overhiring and restructuring. The fast adoption of technology was one of the major reasons for the reduction of jobs in both IT and service sectors.

7.2 The findings on the retention of employees

The world retention, in general, went up thanks to the hybrid work model, well-being programs for employees, and a stronger development system. India witnessed an increase in the retention rate post-2021 owing to the factors of flexibility, skill development, and wellness initiatives. In addition, companies that implemented Sustainable Talent Management (STM) experienced higher stability and less attrition.

7.3 Comparative Findings (Layoff vs Retention)

In terms of innovation, culture, and productivity, retention-focused firms were clearly ahead of those that heavily relied on layoffs. The latter group of companies had to bear long-term costs which included the loss of expertise and higher hiring costs for new employees. Multinational corporations kept their workforces largely unchanged, whereas companies in India managed to recover from the pandemic in terms of retention much quicker.

8. Conclusion

Workforce shifts for the period 2020 to 2025 are primarily economic disruptions, tech innovations and reorganization of firms. All the crisis years ended up with layoffs, but the frequent layoffs demoralized workers and finally the companies lost their toughness. However, the organizations that provided training, had flexible policies and employed sustainable HR practices to their workers attained higher stability and better performance. Therefore, the researchers deduced that the sustainable talent management is not only a matter of reducing costs but in fact, it is the development of a well-skilled and loyal staff.

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18. Title: The Tap Effect: How Google Pay's Innovations Influence Spending Behaviour Among Indian College Student

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Abstract
In India, mobile payment options have increased because of innovations and increased smartphone usage, especially through UPI payment applications. As an example of this rapid adoption, Google Pay was quickly adopted because of the ease of use from a user perspective, but also because of the convenience of using this method. Chan et al. (2024) point out, however, that while digital payment options are being adopted at an alarming rate, most researchers have not conducted in-depth studies on the positive and negative effects these new payment applications have on younger generations who possess a lower level of financial literacy.
This study explores how Google Pay's design features influence spending habits among Indian college students—one of the most active and easily influenced UPI user groups. Using secondary data from the RBI, NPCI, PwC India, and behavioural studies such as Liu et al. (2022), the qualitative analysis suggests that Google Pay functions as a behavioural ecosystem rather than a neutral payment tool. Its design reduces the pain of paying, encourages instant gratification, and normalises high volumes of microtransactions (Broekhoff & van der Cruijsen, 2024).
Findings show that Google Pay increases spending frequency, impulse buying, and discretionary expenditure among students by reducing friction and framing transactions as emotionally positive (Ma et al., 2024; Omar et al., 2022). Reward mechanisms—especially cashback scratch cards—create anticipatory cycles similar to lottery or gaming systems (Kaakandikar et al., 2024). Peer-to-peer transfers and bill-splitting further promote frequent social spending (Vidani, 2024).
Overall, while Google Pay contributes significantly to India's digital economy, it also creates behavioural vulnerabilities. These need to be addressed through responsible design practices, improved digital financial literacy, and policies that recognise the psychological costs of frictionless digital spending (Grant Thornton Bharat, 2024).

Keywords
Google Pay, UPI, FinTech, Consumer Behaviour, Digital Payments, College Students, Impulse Buying, Gamification, Spending Psychology, India

Introduction

The adoption and popularity of smartphone technology, combined with affordable mobile data, is likely the primary factor behind the rapid increase in user adoption of mobile payment systems in India. In particular, payment networks such as Visa, Mastercard, and banking applications have enabled convenient digital payment transactions for millions of users in India through digitisation, allowing individuals to move away from cash and enabling the creation of new revenue opportunities for merchants who may not have had access to a broader customer base before (Digital Payments 2024). As more young

adults are growing up with digital payment systems, Google Pay has been instrumental in shifting behaviour toward the growing acceptance of digital payments as a normative part of their daily lives, largely due to its easy-to-use design and incentive programs (RBI, 2024).

Initiated with the launch of UPI in 2016, the ability to transfer money instantly, without an intermediary, has led to increased innovation in the payment application industry and has fostered a competitive environment for some of the most popular payment applications in India (NPCI, 2024). With the establishment of broader digital ecosystems by some companies in the payment application industry, Google Pay's focus has been on developing a simple-to-use interface and providing strong engagement with customers through their incentives (Kumar & Gupta, 2024).

College-age consumers, who typically have less control over their finances and are often influenced by peers in their spending patterns, will likely experience the most impact from the user-friendly designs of payment applications such as Google Pay. Thus, because many college-age consumers have little or no experience with budgeting (i.e., no formal experience), they are likely to make impulsive purchases. In addition, the streamlined payment process of Google Pay, combined with their sense of security and social acceptance of the payment system, will enhance the purchase experience for college-age consumers.

Statement of the Problem

Although many studies examine digital payment systems, very few explore how the "design" of these systems influences consumer behaviour. Most existing research focuses on ease of use, convenience, and security, while the psychological elements embedded in payment platforms—and their impact on purchasing decisions—remain understudied.

Google Pay combines frictionless UPI integration, gamified rewards, and social features like bill-splitting, which lower both cognitive and emotional barriers to spending (Kumar & Gupta, 2025). These design choices increase payment salience and reduce the psychological "pain" of paying (Broekhoff & van der Cruijsen, 2024).

College students, who are among the highest-frequency UPI users, make numerous low-value transactions and are highly responsive to digital incentives (Omar et al., 2022). Their limited financial discipline and budgeting experience make them more vulnerable to impulsive or emotionally driven spending and to the effects of digital nudges. International studies show that digital payments contribute to impulse buying and emotionally motivated consumption (Lee et al., 2022; Cooper et al., 2024), yet research on these behaviours within Indian UPI ecosystems is still limited.

Thus, the key question is whether Google Pay merely facilitates payments or whether its behavioural architecture actively shapes and accelerates consumption patterns among young, inexperienced users.

Review of Literature

Research conducted into behavioural economics, psychology, and financial technology have identified an increasing prevalence of transitioning from cash to using a digital payment method. This transition can be attributed to what is known as the 'pain of paying', where paying with cash typically triggers psychological pain points which aid in controlling one's spending (Broekhoff & van der Cruijsen, 2024). However, with the move to using digital methods of payment, the psychological pain points associated with paying with cash are significantly reduced because digital payments are very detached emotionally from the act of purchasing items and associated loss (Ma et al., 2024). Furthermore, neuroscience has provided support for the earlier studies concluding that the more time one spends using mobile payments, the more activated the reward pathways of the brain become and therefore the more pleasurable it is (Liu et al., 2022).

Globally, there is solid evidence that the use of mobile wallets has resulted in significant changes in consumer behaviour. In China, for example, the availability of mobile payment providers (such as Alipay and WeChat Pay) has led to a large increase in the number of micro-transactions that are now considered 'normal' (as

well as the continuation of previously un/underutilised micro-transactions). As evidenced by research conducted in Southeast Asia, digital wallets have encouraged impulsive purchasing as well as reducing awareness of total expenditure through the cumulative use of mobile wallet technology (Omar et al., 2022). More then this, the use of mobile wallets has developed into tools that are not simply for convenience for younger consumers, but are often viewed by younger consumers as a means of achieving gratification through rewards and discounts (Chan et al., 2024).

The introduction of demonetization back in 2016, was a catalyst for furtherance of digital payments in India; it boosted the proliferation of digital payment transactions and directly contributed to increased adoption of UPI (Unified Payments Interface) among the users (Cooper et al., 2024). Pal et al. (2025) found that UPI is now being used by individuals for everyday purchases across all demographic groups. Yadav and Chaturvedi (2021) studied the impact of providing consumers with multiple ways to engage with their favourite products through different channels (i.e., online via e-commerce platforms and physically in-store). They observed that consumers who are presented with a digital payment option (such as Google Pay) are more likely to make impulse purchases when shopping in stores.

The existing studies on the use of Google Pay are limited; however, there are critical insights from the studies done. Vidani (2024) discovered that users have a preference for using Google Pay due to its user-friendly interface as well as the positive feelings it evokes. Kumar and Gupta (2025) claimed that Google Pay's gamification of rewards, particularly through the use of scratch cards, creates reinforcement opportunities that are similar to gambling-like behaviours. In a separate study, Kaakandikar et al. (2024) found that the use of UPI applications encourages habitualised spending behaviour because it facilitates instantaneous payments, resulting in consumers having increased discretionary consumption levels.

These gaps highlighted in the literature illustrate that there is a lack of research on the behaviour of youth and their use of digital payments; inadequate investigation into Google Pay's psychological design; and insufficient knowledge of the long-term financial impact for college-aged students.

Objectives of the Study

1. To investigate the effect of behavioral design created by Google Pay, which includes the use of cashback incentives, gamification, and seamless transactions through UPI payment systems, on the spending behavior of college students in India.
2. To understand whether the reduction of payment salience, combined with the instant nature of digital payment methods, increases the incidence of impulse buying and the frequency with which young people spend on items they purchase.
3. To determine what financial risks may result from the change in behavior of college students who are using Google Pay, with emphasis on the impact of Google Pay on budgeting practices, and poor overall financial discipline.

Need or Relevance of the Study

The Significance of this Study is based upon the need for a better understanding of how the usage of Digital Payment Systems impacts Financial Inclusion and / or the Financial Behavior of Users of Digital Payment Systems. As India transitions toward becoming a Cash-less economy, increasing numbers of Young Adults are utilizing Payment Platforms (E.g. Google Pay) and become more reliant on them (NPCI, 2025). Due to being Younger, they are still Developing financially, and therefore are exposed to increased risks associated with behavioral patterns related to Digital Payment Platforms (Chan et al., 2024). Educational Institutions are frequently reporting that College Students' Discretionary Spending is Increasingly High and Difficult for Students to Manage, and therefore it is critical that Future Research explores the Effects of Digital Platform Design on the Spending Patterns of College Students. Very little Existing Research exists that links Digital Platform Design Elements and Spending Behavior (Rashid et al., 2024).

Recognizing these impacts is critical to several

parties interested in the development of payment systems. Government and regulatory agencies have the need to understand how to create rules for payment systems that permit creativity while ensuring that they are protecting consumers (RBI, 2025a). FinTech and payment applications should recognize that gamification and reward structures may have unintended negative consequences (Grant Thornton Bharat, 2024), while parents and educators should recognize that the environments created by payment systems affect youth behaviour and require a comprehensive digital financial literacy program (PwC India, 2024). This research fills an important societal gap by linking technological developments to behavioural outcomes.

Research Methodology

This study is a descriptive qualitative study based on extensive use of secondary data. The use of secondary data is appropriate in this study because there are a large number of published reports providing detailed information about UPI transactions, patterns of digital adoption and behaviour related to payment systems. The major data sources are published reports from the Reserve Bank of India that provide data on digital payments at the macro level (RBI, 2025b) and published databases from the National Payments Corporation of India that provide detail regarding the number of UPI transactions (NPCI, 2025). The major sources of industry research related to consumer preferences and spending habits with payment applications are published reports from PwC, BCG and Grant Thornton (PwC India, 2024; Boston Consulting Group, 2024; Grant Thornton Bharat, 2024).

Behavioural and Psychological perspectives will help to understand how Google Pay's design affects the User Experience (User Experience), see Ma et al (2024) and Liu et al (2022). Thematic analysis (i.e. analysis) of behaviours has been conducted to determine common themes, such as how often users spend, how impulsively users make purchases, how likely users are to seek out rewards, and how well users exercise self-control over their finances (Chan et al 2024). It is important to compare Users using Google Pay with Users using other methods to determine how much individual features of Google Pay may affect user behaviour. This research only applies in India, focusing exclusively on college students, who have a reputation for having high rates of UPI transaction use (Pal et al 2025). There are no ethical implications for conducting this research, as it does not involve direct contact with individuals, and only uses publicly available information.

Analysis and Interpretation of Data

Analysis of national digital payment trends shows that UPI transactions have risen sharply, exceeding 10 billion per month by February 2025 (NPCI, 2025). This growth reflects not only technological adoption but also shifts in everyday spending behaviour. College students, in particular, record the highest frequency of low-value transactions under □200, indicating the normalisation of micro-spending (Pal et al., 2025).

Google Pay users are drawn primarily to the app's behavioural design rather than its technical infrastructure. Its interface lowers cognitive effort and allows payments to feel almost automatic, reducing the time users spend deliberating purchases (Broekhoff & van der Cruijsen, 2024). This frictionless experience increases the likelihood of impulse buying and emotionally driven spending.

Google Pay's reward system further reinforces these behaviours. Cashback scratch cards appear after transactions, creating anticipation based on variable reinforcement—similar to gaming or gambling mechanisms (Kumar & Gupta, 2025; Kaakandikar et al., 2024). Even small rewards encourage repeated use, and many students report choosing Google Pay specifically for these incentives (Vidani, 2024).

Social features also amplify behavioural change. Bill-splitting and instant peer-to-peer payments make group spending easier and more frequent (Omar et al., 2022). Notifications and engagement prompts keep users active, contributing to higher transaction volumes.

Overall, the findings show that Google Pay shapes college student spending through seamless payments, gamified rewards, instant

UPI transfers, and social integration. Together, these elements reduce psychological resistance to spending, encouraging repeated transactions and normalising impulsive buying.

Findings and Conclusion

Additionally, the students showed a stronger proclivity toward responding to reward-based incentives, emotional reinforcement, and social triggers than to traditional forms of budgeting or financial management methods. Therefore, the use of Google Pay is much more than a means of making payments; it is a "behavioural architecture" that impacts how consumers make decisions regarding spending.

The digital economy benefits from the use of Google Pay; however, its psychological effects are an issue of paramount concern for the creators of FinTech products, policy-makers, and educators. Therefore, in order to limit the potential for financially vulnerable students as economies continue to transition to becoming digital, increasing digital financial literacy and encouraging responsible practices within the design of FinTech products will be crucial.

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19. Is AI enhancing the quality of Output? An Evaluative study

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Research Guide
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Abstract
In todays' hyper competitive world, AI has taken the front role. In fact, there is no arena left in our life wherein AI has not made an ingress. For example, it has widely used by students in doing complex and complicated tasks. On the other hand, several incidents have been reported wherein AI has generated adverse output. This necessitates the need for evaluating the quality of an output generated by AI. This papers seeks to answer the following research questions (a) What defines the quality of an AI output? And (b)What is the criterion for evaluating the quality of the output generated by the widespread usage of AI?. The domain of the study is limited to education domain while the respondents size targeted was 200. The respondents in the study include the students pursuing technical, management and allied degree programs. The study concludes with the findings that quality is a generic term and this needs to be scoped before we can develop the evaluation parameters. Further, the concept of quality and the evaluation parameters are to be developed in the application of the context where in the output generated by AI tool is to be evaluated.
Key words: AI, Quality, Evaluation, Output

Introduction
Technological advancements have transformed our lives significantly. Today technology is widely being deployed to enhance the teaching and learning process and create the interest amongst the student community (Halili, S. H. (2019). In todays' world the concept of Artificial intelligence (AI) is widely being discussed and used as continues to invade the functioning of our day-to-day operations (Poola, I. (2017); Dandotiya, A. S., et. Al (2024). For example, AI is widely adopted by students in preparing presentations, generating contents for the project documentation as well as assisting the research community in preparing readymade research paper (Raja, S., et. al ,2024; Guilherme, A. (2019) by giving appropriate prompts to the AI tool.
However, while numerous benefits are being churned out by the AI, yet significant drawbacks are being exposed on account of wide adoption. There have been incidences wherein people have made the use of AI for treatment of an ailment to which they are suffering only to be found later in the ICU unit of a hospital (Haleem, A., et. al ,2019). These incidences of surrendering to the AI revolution have triggered the need for evaluating the quality of the output generated by AI.
This paper deals with the issues concerned with the quality of the output generated by AI.

Literature Review
Several studies are conducted to define quality yet there has been no agreed consensus as to what defines quality (Harvey, L.,1993; Martin, J., et, al,2025; Arcaro, J. (2024). There has

been attempt to associate quality with meeting the requirements of the customer, to meeting the timelines of with the process of developing an environment (Okoye, N. M., et, al, 2024; Mohzana, M., 2024). In todays' context generative AI is raging across the world and yet the issues pertaining to the quality of the output generated has gained traction (Lombardo, R., 2025; Park, J., 2025). Prompt engineering is a crucial function for generating the output by means of an AI tool (Mujica-Sequera, R. M. (2025) yet it has demonstrated the adverse output in many of the instances of AI usage. Hence, what is provided to AI tool by means of prompts forms a vital component as it necessarily forces the AI tool to surf through large data sets to generate the requirements provided by means of prompts (Zadenoori, M. A, 2025).

On the other hand, even if the prompt is correct yet the output may not reflect the desired attributes in the context of safety, cross tabulation of information and the contextual data that is required as well as the datasets which were taken into consideration may not be appropriate (Geroimenko, V. ,2025; Zaghir, J, 2024).

Research Questions

The paper addresses the following research questions

a.What defines the quality of an AI output?

b.What is the criterion for evaluating the quality of the output generated by the widespread usage of AI?

Research Methodology

The development of the paper adopted a structured approach. The initial step included the formulation of the topic for the study. Several considerations were taken to limit the scope of the topic. The aspects included taking into considerations the application of AI or the inappropriate usage of AI or restricting the usage to medical field or the education field. Finally, the author decided to limit the scope to the evaluation of the output generated by the AI in the context of enhancement of quality. The next step involved in freezing the domain of the study that whether we should apply to medical field, education field or in the field of marketing and sales. On account of the proximity to the education field it was decided to limit the scope to the education domain. once the scope was fixed it was decided to deliberate on the issues of quality and the evaluation parameters which will form the base of the study as well as the base for the collection of data. The next step involved the process of collecting the data from the respondents by means of questionnaire. Also, the consideration of the sample size and the type of the respondents was also taken into consideration. Thus, it was decided to include the sample size of 200. This was the initial target. The respondents profile included the students pursuing technical degree course, management courses and other allied courses from the higher education domain. The data collection was done by means of google forms as well as from face-to-face interactions. Upon collection of the data, it was subjected to data cleaning and data treatment. The next step led to the analysis of the data. This included the application of descriptive statistics as the base for the study. The prime reason for choosing the descriptive statistics is fact that it provides the ground reality of the data distribution from which future research work can be undertaken.

Findings and interpretation

Table 1: Respondents Profile Cross tabulation

Respondents Demographic Distribution			
Role / Stream	**Technical Stream**	**Management Stream**	**Allied Stream**
UG Students	50	40	8
PG students	27	30	20
Ph.D. Scholars	10	3	2
Research Associates	3	3	4

Table 1 above depicts the respondents cross tabulation profile distribution. it is evident that the majority of the respondents are from the technical and management stream. This is due to the fact that technical stream students as well as management stream students are driven by quality framework. In other words, the degree of compliance especially in the management field is very high for any lapse on the quality front directly impacts the business financials. On the other hand the technical stream students are responsible for writing the

code or other technical aspects of the quality parameters hence they need to be clear and specific about the requirements of the customer.

Table 2: Defining the Quality parameters

Defining The Quality of an AI Output			
Role / Stream	**Technical Stream**	**Management Stream**	**Allied Stream**
Quality Parameter	**Meeting Requir-ements**	**Context Appro-priateness**	**Applicability in Day-to-Day Operations**
UG Students	50	18	30
PG students	30	32	15
Ph.D. Scholars	2	10	3
Research Associates	3	5	2

Table 2 above depicts the quality parameters in terms of defining the quality of AI output. It is evident that major portion is attributed to meeting the requirements which is the basic tenets of the quality framework. On the other hand applicability in day-to-day operations forms the next portion of the quality definition. This indicates that all the three parameters must work in synchronization before any evaluation parameters can be formulated

Table 3: Defining Evaluation Parameters

Defining Evaluation Parameters			
Role / Stream	**Technical Stream**	**Manag-ement Stream**	**Allied Stream**
Quality Parameter	**Meeting Standard Quality Framework**	**Docum-ented System**	**Configuration Management / Change Management**
UG Students	40	23	35
PG students	25	40	12
Phd. Scholars	6	6	3
Research Associates	2	7	1

Table 3 above depicts the evaluation parameters. It is evident that meeting standards of the quality framework is the most important consideration for the evaluation parameters while the configuration management is the next evaluation criterion. For meeting the change management requirements forms the essence of quality framework

Limitations

The study exposed the limitations in terms of limiting the sample size to 200 as well as limiting the scope of the study to education domain. A new insights and findings would have surfaced had the study took into consideration of an increased sample size as well in terms of enhancing the scope beyond the education domain.

Future Recommendations

The future recommendation of the study is the possibility of including new parameters for evaluation as well as increasing the attributes which constitute the quality of the output.

Conclusion

Quality is a generic term and to study the quality of a product or an output, specific attributes are required to be identified. In a similar parlance, when it comes to evaluation of the quality of an output, we need to be clear as to what evaluation parameters are needed to form the base of the study from the perspective of quality.

In the present study, the quality and evaluation of the output generated by AI is construed to mean (a) relevance of an output to the context (b) The quality of the prompt which is provided to the AI tool (c) the impact of the output to subsequent applications and above all (d) the propensity for the usage of the AI tool in complex tasks.

Thus, the study concludes that one needs to take into consideration all the aspects before one is in a position to do perform any constructive quality work through AI.

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20. Redefining Investment Choices Among Young Investors: A Study of Sustainability Awareness and Motivation with respect to mutual fund

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Abstract
This study covers the concept of sustainability in investment decisions including environmental, ethical, and governance considerations. Research across generations shows that younger investors are becoming more conscious of sustainable finance and ethical investing, yet many still hesitate to fully engage due to perceived risks, limited awareness, and challenges in accessing reliable sustainable options. The geographical scope of study limited to Pune City. This study focus on investor behavior perception motivation. This study based on primary and secondary data. Total 108 response was

collected for this study, A Simple Random Sampling Technique was used. Collected data was analysed using Microsoft Excel for tabulation, graphical representation, and statistical summarization. However, some challenges are still present, such as lack of awareness, documentation processes, limit knowledge, and hesitation due to unclear benefits. The findings also emphasize the need for improved financial literacy, stronger regulatory frameworks, and innovative policy support to bridge the existing gap between sustainability awareness and meaningful investment action.

Key Words
Sustainable Finance, Socially Responsible Investment, Environmental, Financial Literacy, Sustainable Development ,

Introduction

In today's financial world, investing is no longer viewed only as a means to earn profit. People especially the younger generation are increasingly aware that their financial choices influence society and the environment. Sustainability has shifted from being a specialized interest to becoming a global priority that shapes decisions made by individuals, corporations, and governments. As issues such as climate change, inequality, and ethical governance gain more attention, there is a growing expectation for financial systems to operate responsibly and transparently.Socially Responsible Investment (SRI) and Environmental, Social, and Governance (ESG) frameworks have played a major role in redefining what financial success means. These models encourage investors to look beyond immediate returns and consider the long-term impact of their decisions. Among young investors, there is growing interest in sustainable finance and ethical investing. Many express a desire to support environmental protection and social justice through their financial actions. However, research highlights a persistent gap between awareness and actual participation. Limited financial literacy, fear of risk, and a lack of easily accessible sustainable investment options often discourage young individuals from taking action. Closing this gap requires better education, clearer market information, and supportive policies that make responsible investment more practical and appealing. At the institutional level, ESG integration is reshaping traditional financial practices. Rather than being viewed only as a risk management strategy, sustainability is now recognized as a driver of innovation, resilience, and long-term value creation.

Statement of the Problem

Young investors are becoming more aware of social and environmental issues, yet many remain uncertain about how sustainability fits into their investment choices. Even with the rise of ESG mutual funds, doubts about returns, lack of clarity in ESG ratings, and limited financial knowledge often lead to hesitation. This disconnect between personal values and investment decisions highlights the need to understand what truly influences young investors to choose or avoid sustainable mutual funds.

Literature Review

Sustainable investing among young generations: balancing ideals and financial realities by Laura Gómez Sánchez & Sandra Tobon (10 April 2025) this study looks at why young investors who care about the environment don't always choose sustainable investments. Even though they know a lot about sustainability, their actions don't match their values.

A Study on Mutual Funds Awareness amongst Youngsters in Age Group of 20 To 30 Years in Wardha City by Avinash Nagorao Kale This study explores how aware young people (ages 18–28) are about investing. Using survey data, it examines how financial literacy, personal interest, and environmental factors influence their investment awareness. The findings show that these three factors strongly affect how knowledgeable and engaged young people are with investing.Putting Sustainable Investing into Practice: A Governance Framework for Pension Funds by Claire Woods & Roger Urwin (26 August 2010) This article outlines a practical framework for UK and US pension funds to adopt sustainable investing by updating strategies and governance, starting with clear mission and investment beliefs. It

notes rising public interest in sustainability despite limited understanding and calls for clearer guidance on implementation.

Think Global, Invest Responsible: Why the Private Equity Industry Goes Green by Patricia Crifo & Vanina D. Forget (23 August 2012) this article studies how socially responsible investing (SRI) is growing not only in public financial markets but also in Private Equity, which invests in unlisted companies. It finds that Private Equity firms are increasingly adopting Environmental, Social, and Governance (ESG) practices.

Structural Innovators and Core-Framing Tasks: How Socially Responsible Mutual Fund Companies Build Identity among Investors by Linda Markowitz this article explains how socially responsible (SR) mutual fund companies try to build an SR identity among investors. In contrast, traditional mutual fund firms offer SR funds mainly to keep up with market trends and do not put much effort into shaping investor identity or emphasizing shared values.

Socio-Psychological Motives of Socially Responsible Investors Available to Purchase by Julia M. Puaschunder (2017) there has been growing interest in connecting finance with social concerns. Socially Responsible Investment (SRI) adds environmental, social, and ethical factors to traditional investment decisions. The paper argues that while traditional finance ignored moral and ethical issues, investors today may be motivated not only by profit but also by values such as altruism, innovation, social status, and transparency.

DO ESG MUTUAL FUNDS DELIVER ON THEIR PROMISES By Quinn Curtis, Jill Fisch and Adriana Z. Robertson (December 2021) The article looks at the rapid rise of ESG mutual funds as more investors worry about issues like climate change and social inequality. Overall, the study suggests that ESG funds provide what they claim and do not require extra or stricter regulations.

Objective

1.To analyze the level of awareness among young investors regarding sustainable and ESG investment options within mutual funds.

2.To identify the key motivational factors influencing young investors to choose sustainable mutual fund schemes.

3.To examine the relationship between sustainability awareness and investment decision-making behavior among young investors.

Scope

This Study covers the concept of sustainability in investment decisions including environmental, ethical, and governance considerations. The geographical scope is limited to pune city depending on data availability and research feasibility. The study emphasizes investor perception, motivation, and behavior, rather than technical financial performance of mutual funds. The research findings can help mutual fund companies, policymakers, and financial educators to design strategies promoting sustainable investment habits among the youth.

Research Methodology

The aim of this methodology is to ensure that the research findings are valid, reliable, and aligned with the research objectives.

Data Collection and Method:

Primary data was collected through a structured questionnaire. The questionnaire included both closed-ended and multiple-choice questions, allowing respondents to share views clearly. Opinion- based questions also enabled respondents to express personal viewpoints about sustainable investing.

Secondary data was collected from credible sources such as research papers, published reports.

Sample Size: 108 respondents.

Population:

The study targeted above 20 years old young Investors of Pune city who are either existing mutual fund investors or willing to invest in the future.

Research Design & Sampling Technique:

The study is based on a descriptive research design. A Simple Random Sampling Technique was used. Every respondent had an equal chance of participating, which ensured unbiased data representation.

Analytical Tools:

Collected data was analysed using Microsoft

Excel for tabulation, graphical representation, and statistical summarization. The results have been interpreted using charts, percentages, and comparative responses to draw meaningful conclusions.Analysis & Interpretation of Data
1.Age

Age	Responses	Percentages
20-30	33	30.56
30-40	62	57.41
40- onwards	13	12.04
Total	108	100

Table No.1

Interpretation :- The data shows that most of the participants belong to the 20–30 age group, making them the most active contributors to the survey. The number of respondents gradually decreases in the 30–40 and 40-plus groups, showing less representation from older age brackets.

Inference :-This suggests that the overall results are likely to reflect the views of younger adults more strongly. The smaller participation from older groups indicates that their perspectives may be less visible in the study.

2.Educational Qualification

Educational Qualification	Responses	Percentages
Higher secondary	8	7.41
Graduate	10	9.26
Postgraduate	24	22.22
Professional Degree	64	59.26
Blanks	2	1.85
Total	108	100

Table No.2

Interpretation :- Most of the responses come from the group with a value of 64, which forms the largest share of the data. The values 24, 10, and 8 show moderate participation, while the value 2 has the least. Overall, the responses are unevenly distributed across categories.Inference :- This suggests that the results will mainly reflect the opinions of the group represented by 64. The smaller numbers in other groups mean their views may not be strongly represented in the final analysis.
3.Occupation

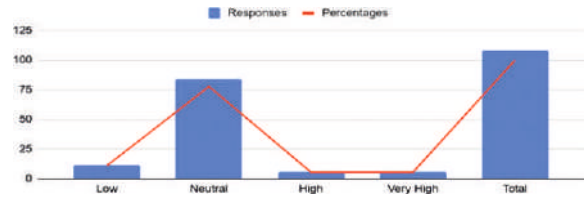
Occupation	Responses	Percentages
Student	10	9.26
Employed	56	51.85
Self-employed\ Entrepreneur	40	37.04
other	2	1.85
Total	108	100

Table No.3

Interpretation :- The data shows that the value 56 group contributes the highest number of responses, forming the largest share of the sample. The group with a value of 40 also shows strong participation, though not as high as 56. In contrast, the values 10 and 2 have very few responses, indicating low engagement from those categories.
Inference :- This pattern suggests that the overall findings will primarily reflect the opinions of the groups with higher participation. The limited responses from the smaller categories mean their viewpoints may not significantly influence the final outcomes.
1.How would you rate your overall knowledge of mutual funds

How would you rate your overall knowledge of mutual funds	Responses	Percentages
Low	12	11.11
Neutral	84	77.78
High	6	5.56
Very High	6	5.56
Total	108	100

Table No.4



Graph No. 1

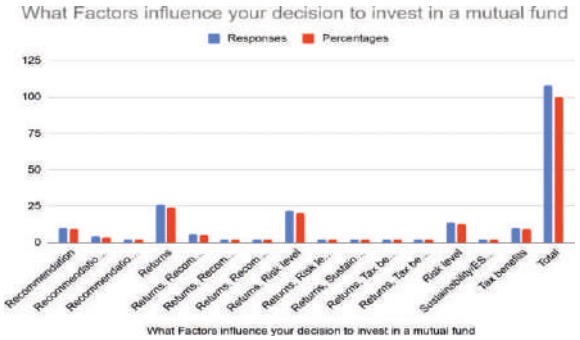
Interpretation :- Respondents mostly rated their knowledge as low or neutral, while only a small number claimed high knowledge. This shows uncertainty and limited understanding about mutual funds.

Inference :- There is strong potential for awareness-building, as many are interested but do not feel informed enough to invest. Educational content could significantly boost confidence and participation. Lack of knowledge, not lack of interest, is the major barrier.

5.What Factors influence your decision to invest in a mutual fund

What Factors influence your decision to invest in a mutual fund	Responses	Percentages
Recommendation	10	9.26
Recommendation, Sustainability/ESG rating	4	3.70
Recommendation, Tax benefits	2	1.85
Returns	26	24.07
Returns, Recommendation	6	5.56
Returns, Recommendation, Sustainability/ESG rating	2	1.85
Returns, Recommendation, Tax benefits	2	1.85
Returns, Risk level	22	20.37
Returns, Risk level, Recommendation	2	1.85
Returns, Sustainability/ESG rating	2	1.85
Returns, Tax benefits	2	1.85
Returns, Tax benefits, Sustainability/ESG rating	2	1.85
Risk level	14	12.96
Sustainability/ESG rating	2	1.85
Tax benefits	10	9.26
Total	108	100

Table No. 5



Graph No. 2

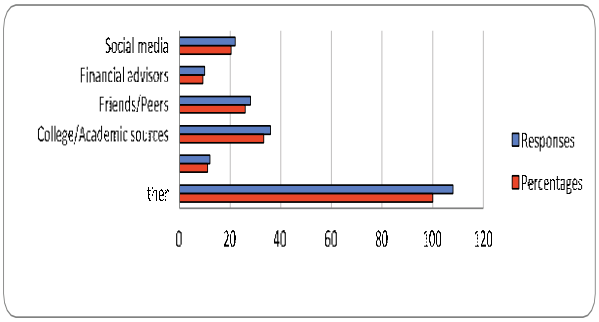
Interpretation :- The most common factors influencing investment were returns and risk level. Some also considered transparency, long-term growth and fund reputation. Personal values play a role but not as strongly as financial outcomes.

Inference :- Young investors are practical they want profitability but also want to avoid high risk. Sustainable funds can attract them only if they prove to be financially competitive. Ethical appeal alone may not guarantee investment without performance

6.Where did you first hear about sustainable/ESG investing

Where did you first hear about sustainable/ESG investing	Responses	Percentages
Social media	22	20.37
Financial advisors	10	9.26
Friends/Peers	28	25.93
College/Academic sources	36	33.33
other	12	11.11
Total	108	100

Table No. 6



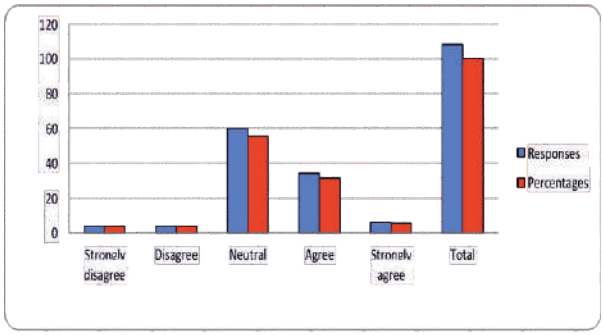
Graph No.6

Interpretation :- Most respondents learned about ESG investing through academic settings, followed by friends and peers. Social media also contributes meaningfully, while financial advisors play the smallest role.
Inference :- Awareness of socially responsible investing grows organically through shared learning and social environments rather than professional consultations. Educational institutions and peer groups are crucial for broadening ESG awareness. Strengthening sustainability-focused learning activities could accelerate adoption.

7.Do you believe sustainable /ESG mutual funds contribute positively to society and the environment

Do you believe sustainable /ESG mutual funds contribute positively to society and the environment	Responses	Percentages
Strongly disagree	4	3.70
Disagree	4	3.70
Neutral	60	55.56
Agree	34	31.48
Strongly agree	6	5.56
Total	108	100

Table No. 7



Graph no. 7

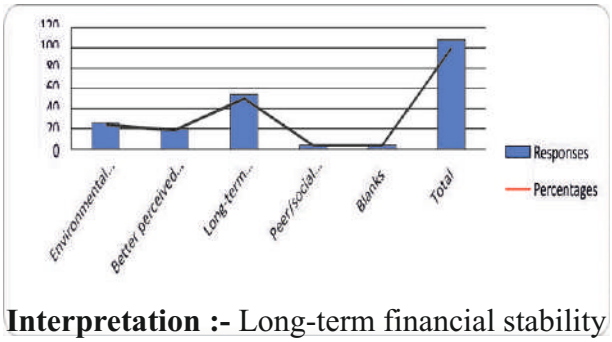
Interpretation :- More than half of respondents remain neutral about whether ESG investments are beneficial, while about one-third agree they make a positive impact. Only a very small portion strongly disagrees.
Inference :- There is general openness to the idea of ESG investing, but many still lack clarity on its real-world impact. Providing evidence-based communication and real examples of benefits could shift neutral investors toward stronger support. Greater transparency from fund managers might increase confidence.

8.What motivates you the most to consider sustainable/ESG mutual funds

Table No. 8

What motivates you the most to consider sustainable/ESG mutual funds	Responses	Percentages
Environmental concern	26	24.07
Better perceived returns	20	18.52
Long-term financial stability	54	50
Peer/social influence	4	3.70
Blanks	4	3.70
Total	108	100

Graph No. 8



Interpretation :- Long-term financial stability is the strongest motivator, followed by environmental concern and better perceived returns. Peer influence has very limited effect.
Inference :- Even when choosing sustainable investments, financial security remains the top driver. Investors want their ethical choices to align with personal financial goals rather than being purely altruistic. Highlighting the long-term value and resilience of ESG funds may increase adoption.

9.Would you prefer a slightly lower return if the mutual fund supported environmental or social causes

Would you prefer a slightly lower return if the mutual fund supported environmental or social causes	Responses	Percentages
Yes	54	50
No	8	7.41
Maybe	46	42.59
Total	108	100

Table No. 9



Graph No. 9

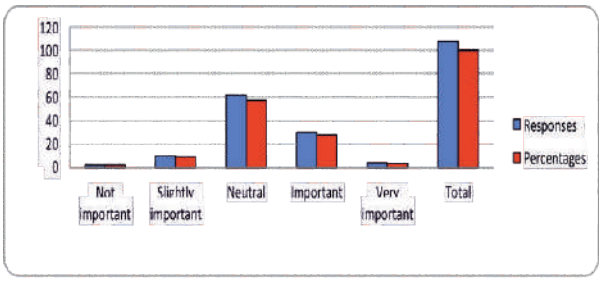
Interpretation :- Half of the respondents are willing to accept slightly lower returns to support social or environmental causes, while almost the same number selected “maybe.” Only a small group said no.

Inference :- Many investors are open to sacrificing a small portion of returns for sustainability, but most still need reassurance. If ESG funds show both social benefits and stable performance, more people may commit with confidence. This suggests ESG product acceptance is promising but conditional.

10How important are ESG ratings when choosing a mutual fund

How important are ESG ratings When choosing a mutual fund	Responses	Percentages
Not important	2	1.85
Slightly important	10	9.26
Neutral	62	57.41
Important	30	27.78
Very important	4	3.70
Total	108	100

Table No.10



Graph No.10

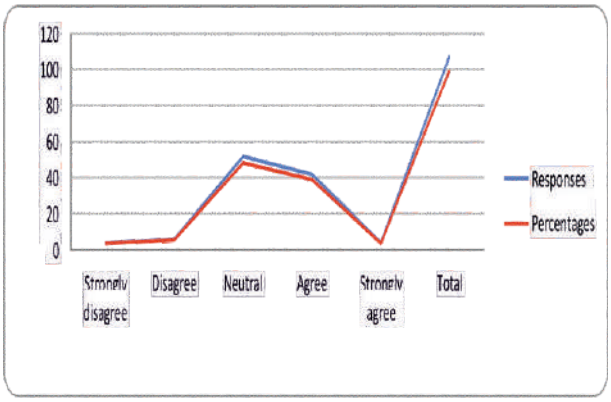
Interpretation :- A large portion remains neutral about the importance of ESG ratings, while about one-third think they are important or very important. Very few think they do not matter.

Inference :- Many investors may not yet fully understand ESG ratings or their relevance during investment decisions. Increasing awareness about how ESG scores reflect responsible corporate behaviour could enhance their importance in investment choices. With better knowledge, ESG ratings might become a key deciding factor for investors.

11.Do you believe awareness of sustainability impact your investment decisions

Do you believe awareness of sustainability impact your investment decisions	Responses	Percentages
Strongly disagree	4	3.70
Disagree	6	5.56
Neutral	52	48.15
Agree	42	38.89
Strongly agree	4	3.70
Total	108	100

Table No. 11



Graph No.11

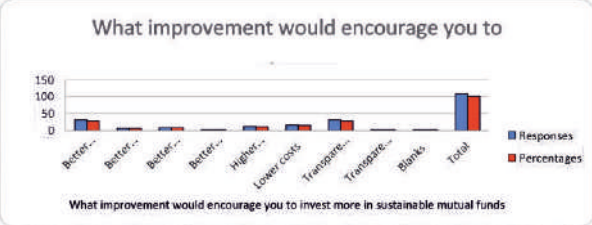
Interpretation :- Almost half of respondents are neutral, while a significant portion agrees that sustainability influences investment decisions. Very few strongly disagree.

Inference :- The growing share of investors acknowledging sustainability's influence shows a gradual shift toward responsible investing. However, the large neutral group highlights a need for better information about the link between sustainability and financial performance. Improving public understanding could further encourage ESG-aligned investments.

12.What improvement would encourage you to invest more in sustainable mutual funds

What improvement would encourage you to invest more in sustainable mutual funds	Responses	Percentages
Better awareness programs	30	27.78
Better awareness programs, Lower costs	6	5.56
Better awareness programs, Transparent ESG ratings	8	7.41
Better awareness programs, Transparent ESG ratings, Lower costs	2	1.85
Higher returns	12	11.11
Lower costs	16	14.81
Transparent ESG ratings	30	27.78
Transparent ESG ratings, Lower costs	2	1.85
Blanks	2	1.85
Total	108	100

Table No. 12



Graph No. 12

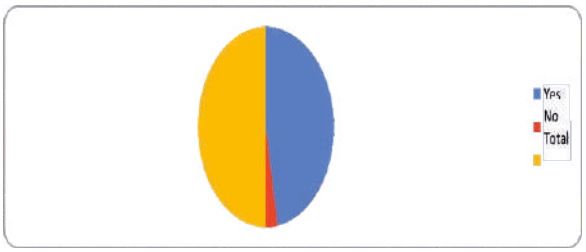
Interpretation :- Better awareness programs and transparent ESG ratings are the most preferred improvements. Lower costs and higher returns are also meaningful motivators but less dominant.

Inference :- Investors want clarity rather than just marketing clear ESG reporting and accessible information could significantly boost trust and participation. Cost efficiency also matters, implying ESG funds must be financially competitive to gain more traction. A mix of education and transparency can drive market growth.

13.Would you recommend sustainable mutual funds to peers or family

Would you recommend sustainable mutual funds to peers or family	Responses	Percentages
Yes	102	94.44
No	6	5.56
Total	108	100

Table No. 13



Graph No. 13

Interpretation :- An overwhelming majority (94%) would recommend sustainable mutual funds to peers or family. Only a very small number would not.

Inference :- Despite uncertainties around ESG understanding and ratings, interest and acceptance of sustainable mutual funds appear strong. Most respondents are willing to advocate for ESG investing, which signals trust and optimism. This peer-driven promotion could accelerate adoption in the market.

9. Findings

- Majority of respondents mainly between the age group of 30-40 , which indicates that interest in investment is rising among individuals who are employed and entrepreneur
- Many participants revealed that their knowledge of mutual funds is either low or neutral, showing that while there is curiosity, there is still a lack of clear understanding.
- When choosing investments, respondents are mostly influenced by factors such as returns, risk level, fund performance, and sustainability.
- Most respondents believe that sustainable mutual funds are important and align with long- term values such as environmental protection, ethical business practices, and social responsibility.
- A large number of respondents indicated that they would recommend sustainable mutual funds to friends or family, which shows positive perception and trust.
- However, some challenges are still present, such as lack of awareness, documentation processes, limit knowledge, and hesitation due to unclear benefits.

10. Suggestion

- Organize Financial education workshops and awareness programs should be increased, to make mutual funds particularly sustainable ones easier to understand.
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- Simplifying the may encourage more first-time investors to participate without feeling overwhelmed.
- Financial institutions and fund managers should focus on transparent communication, especially regarding risks, performance, and sustainability criteria.
- Introducing student-friendly investment models, low-minimum SIP and rewards for sustainable investing may motivate more young investors.
- More marketing and educational content such as short videos, info-graphic, and real examples would help young people feel confident in their decision-making.

11. Conclusion

Overall, the survey shows a growing curiosity about investing—especially among working professionals and entrepreneurs aged 30–40. While many participants are still beginners with limited knowledge of mutual funds, they are increasingly considering important factors such as returns, risk, and the ethical impact of their investments. To build on this momentum, there's a strong need for better financial education and simpler investment pathways. Workshops, online resources, and engaging content formats like videos and infographics can help young and novice investors feel more confident and informed. Financial institutions should also prioritize clear, transparent communication about performance, risks, and sustainability criteria.

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21. A STUDY OF THE ADOPTION AND CHALLENGES OF DIGITAL PAYMENTS IN RURAL AREAS [MAHARASHTRA AWATI VILLAGE]

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Abstract
This report investigates the current landscape of digital payment adoption, perceived benefits, and critical challenges faced by users in Awati village, rural Maharashtra. So I have collected data based on a primary survey of 218 respondents, which is justified because the findings reflect real conditions in rural areas, where digital payment use is high but major barriers still exist. The study analyzes the dynamics of a rural market highly influenced by platforms like the Unified Payments Interface (UPI) and mobile wallets. The findings reveal a significant duality: high usage frequency coexists with profound structural impediments. The primary barrier identified by nearly half the measurable sample is Weak Infrastructure (e.g., poor internet connectivity) (cited by sim48.2%), closely followed by Trust Issues (sim50.9%) and Low Digital Literacy (sim23.3%). Applying principles of the Technology Acceptance Model (TAM), the analysis confirms that while the Perceived Usefulness (PU) of digital payments is compelling, issues of Perceived Ease of Use (PEOU) and Perceived Risk (PR) are severely compromised by the infrastructure instability and security anxieties. The report concludes with detailed, quantitative-driven recommendations focusing on policy shifts toward resilient network infrastructure, mandatory digital security literacy, and the creation of financially inclusive banking services tailored for the rural demographic.
(Keywords: Digital Payments, UPI, Rural Adoption, Financial Inclusion, Maharashtra, Awati Village, Digital Literacy, Infrastructure Challenges, Technology Acceptance Model (TAM))

Introduction
Rural areas face challenges in financial inclusion. Digital payments provide secure, fast & transparent transactions. They boost economic participation and reduce dependency on cash. Payments are made easy by using a payment instrument. Simply, in other words, transactions that mainly use Electronic media are considered Digital. There are various modes of digital payments, including UPI, NEFT, AEPS, mobile wallets, and Post terminals.
While macroeconomic data frequently highlight impressive national statistics regarding transaction volume and velocity, specific local challenges often persist in

isolated communities. This study addresses the necessity of granular research in locales such as Awati village, Maharashtra, where generic national data may mask critical systemic failures and localized barriers. Previous regional research conducted in areas like Pune, Solapur, Nashik, and Satara has confirmed the prominence of UPI and digital wallets in rural financial activities.

The scope of this investigation is narrowly defined, focusing on the consumption and adoption behavior of individual residents and small merchants concerning digital payment methods (UPI, wallets, cards) within Awati village. The report utilizes primary data collected from 200 respondents in late 2025. The structure systematically proceeds by establishing the theoretical context, detailing the methodology used, presenting a quantitative analysis of key findings, synthesizing the observed challenges into prioritized barriers, and concluding with forward-looking implementation strategies and evidence-based recommendations for government and financial institutions.

Statement of the problem

Although many reports highlight India's rapid growth in digital payments, there is limited research that looks closely at small, isolated villages like Awati. This study fills that gap by examining the local challenges and real experiences of residents and small merchants in Awati. Most existing studies focus on larger districts or urban-rural comparisons, leaving a gap in understanding how last–mile barriers, such as weak network connectivity, trust issues, affect everyday users in small rural areas. providing a more ground-level picture that broader national data often overlooks. Previous regional research conducted in areas like Pune, Solapur, Nashik, and Satara has confirmed the prominence of UPI and digital wallets in rural financial activities.

Literature Review

Research by Singh and Bansal (2019) Digital payment solutions have significantly transformed financial transactions in rural India, offering both opportunities and challenges. Existing literature highlights that while digital platforms hold the potential to drive financial inclusion, their adoption in rural areas remains uneven due to infrastructural and socio-economic barriers. One of the primary challenges is limited infrastructure, including unreliable internet connectivity and low smartphone penetration, which restricts access to digital services. In addition, low technological literacy among rural populations hinders effective usage of digital platforms. The cash-dominated informal economy also resists the shift toward digital modes of payment, as many individuals prefer tangible transactions over digital alternatives. Despite these hurdles, research underscores several benefits of digital payments for rural communities. These include greater convenience, enhanced security, and improved transparency in financial dealings. Moreover, digital transactions can reduce dependence on cash, minimize corruption, and promote broader financial inclusion, ultimately contributing to rural economic growth.

1.1 Digital Payments and Financial Inclusion

According to the World Bank (2022), digital financial services have significantly expanded access to banking and other financial tools for unbanked populations. In India, initiatives such as the Pradhan Mantri Jan Dhan Yojana (PMJDY) and the Aadhaar Enabled Payment System (AEPS) have played a pivotal role in bringing rural citizens into the formal financial ecosystem (Kumar \& Arora, 2020). Studies highlight that digital payments contribute to reducing transaction costs and increasing the speed of financial transactions (RBI, 2021).

1.2 Socio-Economic Impact in Rural Areas

Research by Singh and Bansal (2019) indicates that digital payments contribute to rural economic empowerment by enabling micro-entrepreneurs and small businesses to accept digital transactions. This fosters business growth and increased participation in the formal economy. Moreover, digital payments facilitate direct benefit transfers (DBT), ensuring transparency and minimizing corruption in government welfare schemes (Mehta, 2021). Socially, the adoption of digital payments has been associated with increased

autonomy among rural women, as it gives them direct access to financial resources (Sharma et al., 2020). Additionally, digital payments reduce the need for travel to banks or cash centers, which is particularly beneficial in remote villages (NABARD, 2019).

1.3 Barriers to Digital Payment Adoption

Despite the benefits, the literature identifies significant barriers to adoption in rural areas. These include a lack of digital literacy, poor internet connectivity, low trust in digital systems, and limited Smartphone penetration (Chakrabarty, 2018). Furthermore, cultural resistance and concerns about fraud and data privacy often inhibit wider acceptance (Deloitte, 2020).

1.4 Role of Government and Private Sector

Studies underscore the importance of collaborative efforts between the government, financial institutions, and fintech startups. For instance, the Unified Payments Interface (UPI) developed by NPCI has been instrumental in simplifying peer-to-peer and peer-to-merchant transactions (NPCI Report, 2021). Public-private partnerships have also been vital in building digital infrastructure and increasing awareness through digital literacy campaigns (GOI, 2020).

Gaps in the Literature

While several studies examine the potential and challenges of digital payments, there is limited empirical research focused specifically on rural regions in Awati village in Maharashtra. Most existing literature tends to generalize findings without delving deeply into the unique contexts of different rural geographies, cultures, and levels of development.

Objectives of the study

1. To assess adoption - Examine awareness, usage, and common digital payment methods in rural areas.
2. To identify barriers - Analyze challenges such as weak infrastructure, low digital literacy, trust issues, for the adoption of digital payments
3. To evaluate impact - Measure benefits like convenience, security, and financial inclusion, along with effects on rural economic growth.
4. To recommend strategies /techniques to improve infrastructure, literacy, trust, and design of rural-friendly digital payment solutions.

Need and Relevance of the Study

This research fills a critical gap in understanding the specific impacts of digital payment systems on rural areas for consumers. The findings provide valuable insights for policymakers,
financial institutions, and business owners, highlighting the need for tailored strategies to promote the effective adoption of digital payment systems in the villages.

Research methodology

1. Research Design:

The study utilizes a descriptive cross-sectional survey design. This approach involved collecting data from a sample population at a specific point in time to describe the characteristics of the population concerning digital payment adoption usage, and the study employed a mixed-method approach

Primary Survey Context: Awati Village, Maharashtra

The research focused exclusively on generating primary data specific to Awati village to ensure that the findings reflect the unique economic and infrastructural constraints of this locale. The total planned sample size was 218, consisting of online responses and personal interviews.

population and sample size:

The sample is set up with 218 consumers to ensure in-depth data analysis.

Data Collection Method

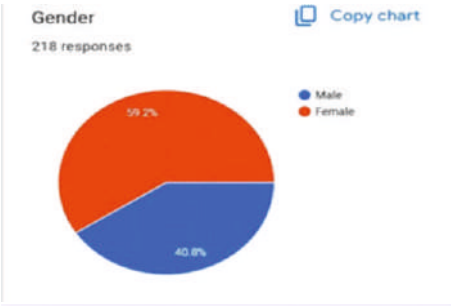
Primary data: survey and interviews with rural users, survey of online platforms.

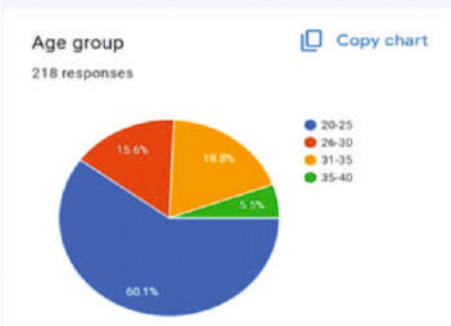
District: Solapur, await village

Secondary data: literature was collected from academic books, conference proceedings, research articles, and online databases such as Google Scholar, which provide insight into the different types of digital payment platforms and the rise in adoption of digital payments in rural areas.

Analysis and interpretation of data

1. Demographic Profile and Adoption Metrics





1. Gender: Most respondents in the survey were Female (59.2%), making up over half of the participants. The remaining participants were Male (40.8%).

2. Age group: The survey primarily reflects the views of younger adults (60.1%) who were in the 20-25 age group. The next largest group was 31-35 (18.8%), followed by 26-30 (15.6%). The oldest group, 35-40 (5.5%), was the smallest.

Table 1: Digital Payment Awareness and Usage Frequency (N=218Subset

Adoption Metric	Category	Count (N)	Percentage (%)
Awareness Level	Very Aware	102	47.2%
	Somewhat/Not Aware	53/30	24.3% / 13.35
	Not at all Aware	32	13.3%
Adoption Metric	Category	Count (N)	Percentage (%)
Usage Frequency	Daily	68	31.7%
	Weekly/Monthly	37/16	17% /7.3%
	Rarely/Never	39/58	17.4% /26.6%

1. Overall, awareness is quite high, but nearly half of the people are not fully aware.

The largest group (47.2%) is very aware.

However, a significant portion is only somewhat aware (24.3%).

The remaining respondents are either not at all aware (13.3%) or not very aware (13.35%).

2. Frequency of Digital Payment Use

Usage is polarized, with many people using it daily, but also a large number never using it.

The largest group (31.7%) uses digital payments Daily.

The second largest group (26.6%) never uses them.

The rest use them Weekly (17%), Rarely (17.4%), or Monthly (7.3%).

3. Most Frequent Digital Payment Methods Used

UPI (Unified Payments Interface) is by far the most popular digital payment method, selected by almost half the respondents.

UPI was chosen by 48.6% (103 people).

Wallets (like , Google Pay) are the second most popular digital method at 26.9% (57 people).

Cash remains a significant choice, selected by 24.1% (51 people).

Credit/Debit cards are used much less frequently, selected by only 11.3% (24 people).







2 challenges

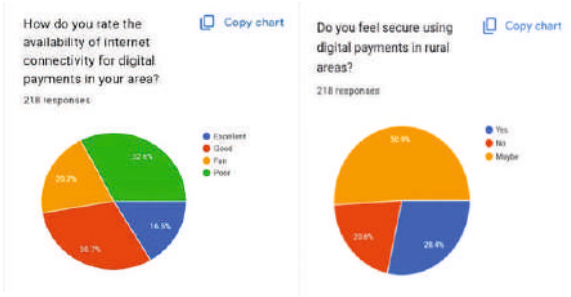


Table 2: Internet Connectivity and Security Perception (N=43 Subset)

Metric	Response	Count (N)	Percentage (%)
Internet Connectivity Rating	Excellent/Good	35/68	16.4% /31. %
	Fair/Poor	44/71	20.1% /32.4%
Feeling Secure	Yes	62	28.7%
	Maybe	111	50.7%
	No	45	20.5%

Internet Connectivity Availability

Interpretation: Opinion on internet availability is mixed, with the largest group finding it Poor.

The biggest group (32.4%) rates connectivity as Poor.

A good number of people rate it as Good (31%).

The rest rate is as Fair (20.1%) or Excellent (16.4%).

Feeling of Security Using Digital Payments

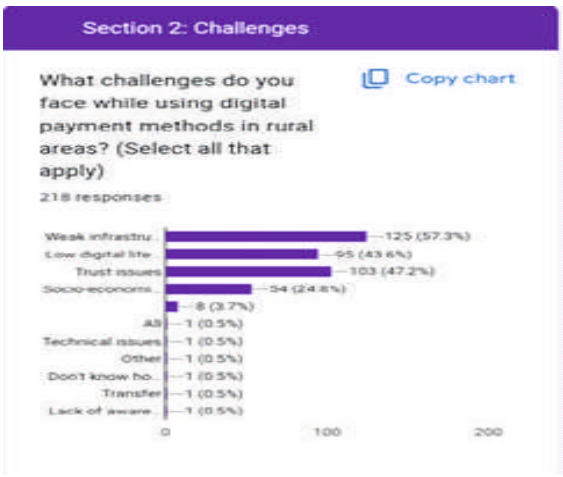
Most people are unsure or do not feel secure using digital payments.

Just over half (50.7%) answered Maybe, suggesting significant uncertainty about security. Only 27.8% answered Yes (they feel secure).

21.5% answered No (they do not feel secure)

Table 3: Primary Challenges Faced by Digital Payment Users (N=128 Subset)

Challenge Category	Specific Barrier		Percentage (%)	Rank
Infrastructure	Weak infrastructure (e.g., poor internet)		57.4%	1
Trust/Security	Trust issues		47%	2
Literacy	Low digital literacy		43.4%	3
Socio-economic	Socio-economic		24.7%	4
other	Other kind		41.9%	5



Challenges with Digital Payments

This is a bar chart, but we can look at the main challenges.

Weak infrastructure is the biggest challenge, selected by 57.4% of respondents (125people).

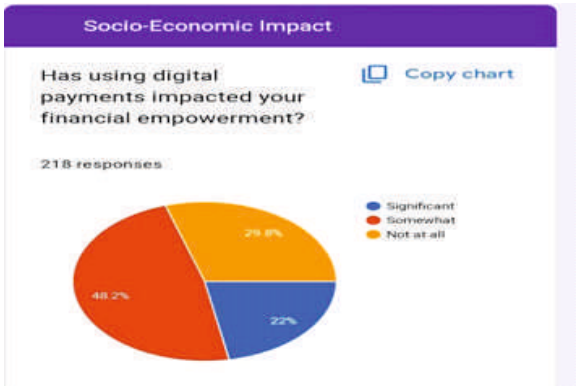
Trust issues are the second biggest at 47% (103 people).

Low digital literacy is the third biggest challenge at 43.4% (95 people).

Socio-economic challenges were a distant fourth at 24.7% (54people).

3. socio-economic impact:

Digital Payments and Financial Empowerment



Most people feel digital payments have at least some impacts on their financial control.

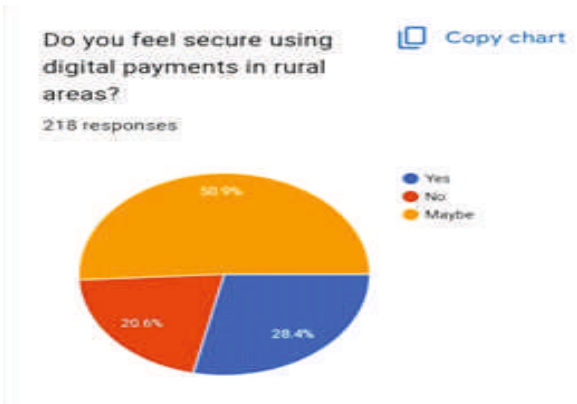
Digital Payments and Financial Empowerment

Most people feel digital payments have at least some impacts on their financial control.

The largest group (48.2%) reported the impact was Somewhat.

A combined 70.3% (48.2% + 29.8%) feel there has been a Significant or somewhat impact.

Less than a third (22%) felt there was no impact on their financial empowerment at all.



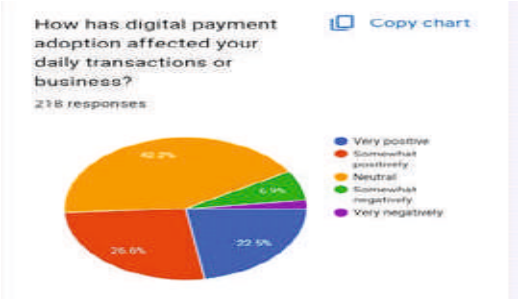
Digital Payments and Economic Growth

Many people are unsure if digital payments help their local economy.

Almost half (47.7%) answered Maybe, indicating they are not sure about the economic impact.

35.3% answered Yes (they believe it contributes to growth).

17% answered No



Impact of Digital Payment Adoption on Daily Transactions/Business

While almost half of the people felt a positive effect, the largest single group reported no major change.

The largest percentage of respondents (42.2%) felt the impact was Neutral.

However, a large number reported a positive impact: 22.5% said it was very positive, and 26.6% said it was somewhat positive.

Only a small fraction (6.9) reported a somewhat negative impact very negative, with almost no one reporting a very negative impact.

Recommendation:

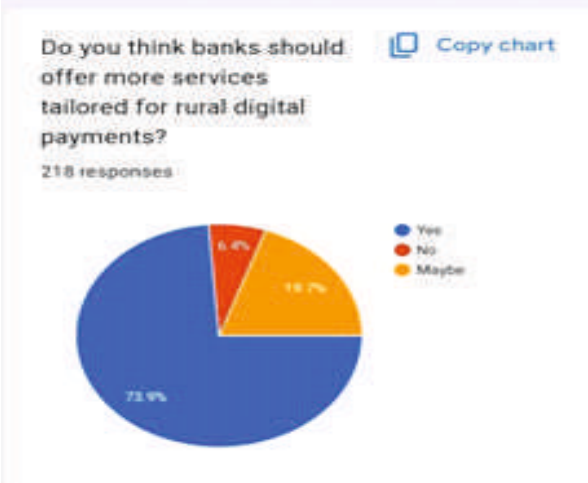
1. Government Support to Enhance Adoption



Interpretation: Respondents overwhelmingly believe the government's top priority should be improving basic connectivity.

The biggest task is to improve internet connectivity and infrastructure, selected by 77.1% of respondents.
The next most popular suggestion is Digital literacy and training programs (51.4%).
The third main recommendation is offering Incentives for digital transactions (54.6%).
Other {34.9%}

2. Bank Services Tailored for Rural Payments



There is a strong consensus that banks need to create services better suited for rural areas.
A massive majority of respondents, 73.9% (nearly three out of every four people), answered Yes.
Only a very small group, 6.4%, answered No.
The remaining 19.7% were unsure, answering Maybe.

Major findings:
Improve network connectivity
The biggest problem for most users is a weak internet. Increasing mobile towers, boosting network strength in busy areas like the market, and ensuring more stable data services would make digital payments smoother and more reliable.

2. Conduct basic digital literacy sessions
Many people, especially older residents, still struggle with using apps, entering OTPs, or handling failed payments. Short, simple training sessions in the village can build confidence and reduce mistakes

.
Build trust through awareness
People worry about fraud, wrong transfers, or losing money. Awareness drives on secure payment habits, recognizing scams, and using official apps can reduce fear and build trust in digital transactions.

4. Set up a local help or support point small support desk at the panchayat office or a local shop can guide people during payment failures, refund issues, and app problems. This gives villagers a trusted place to ask for help.
5. Encourage merchants to adopt UPI fully
Some shopkeepers still prefer cash because of charges or fear of fraud. Training and demonstrating the benefits—like easier bookkeeping and safety—can encourage more merchants to adopt digital options.

6. Promote affordable smartphones and data plans
Many challenges come from outdated phones or insufficient data. Government schemes or local initiatives offering low-cost devices can make digital.

Conclusion
The findings suggest that digital payments can increase financial inclusion, reduce transaction costs, and improve access to financial services. Additionally, digital payments can empower rural residents, enhance social relationships, and promote economic development. By providing a secure, convenient, and cost-effective means of conducting financial transactions, digital payments can help bridge the financial inclusion gap in rural areas and promote economic growth. Furthermore, the adoption of digital payments can also have a positive impact on the social fabric of rural communities, enabling people to connect with each other and access essential services more easily. Overall, the study highlights the importance of digital payments in promoting economic and social development in rural areas, and provides valuable insights for policymakers, financial institutions, and other stakeholders seeking to promote financial inclusion and economic growth in these

regions

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22. An Analytical Study of the Impact & Challenges Of the Adoption of Green Personal Care Products Among Young Females in Pune City

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Abstract:

The increasing global concern regarding sustainable development and eco-friendly products has transformed consumer behaviour, which has led to the emergence of green personal care products, which are designed to cause less harm to the health of women and the environment. The study aims to examine the awareness of green personal care products among young females by exploring factors such as product prices, product availability, awareness, environmental concern, perceived barriers, and product ingredients. This research also distinguishes between genuine green products and the companies that emphasize themselves as non-toxic, green, and eco-friendly.

The study collected data by conducting an online and face-to-face survey of young women, particularly those aged 17 to 30, from different regions. This result shows that lots of women are aware of green product, especially in the skin care category. However, the survey depicts high product cost, limited availability and brands' false claims are becoming a barrier towards their adoption. The study highlights that there is a need for consumer education, transparency and supportive government regulations to increase the awareness and the adoption of green personal care products.

(Keywords: Green Personal Care Products, Awareness, Non-Green Products, Young Females, Green Washing)

Introduction:

The term green personal care product refers to the products that are sourced, produced, and packaged ethically and sustainably, which are kind to the planet and use natural, non-toxic, organic ingredients that do not have a long-

term effect on any human's or woman's body & overall health. For instance, there are some categories into which green personal care products are divided: oral care, skin care, and feminine hygiene products. All these categories are used by the women on a day-to-day basis, but these products available in the market contain chemicals such as parabens, silicon, synthetic fragrances, etc., that are considered harmful to the human body and environment. But due to awareness, women have now started to demand the products that are safe for their bodies and also safe towards the environment.

Background:

In the pre-20th century, personal care mainly relied on home and herbal remedies, and natural beauty was part of daily life. With industrialisation in the early 20th century, synthetic dyes, preservatives, and chemical-based products replaced traditional ones, and women began using manufactured products without awareness of their harmful effects. By the 1970s, rising environmental awareness led people to question synthetic products, encouraging brands to promote natural, ethical, and cruelty-free beauty. In the 2000s, technological access increased awareness about ingredients and their impact on health and the environment, resulting in greater demand for "organic," "nature-based," and "green" options. Between 2016 and 2020, green products became mainstream as many brands introduced eco-friendly and chemical-free alternatives. After the COVID-19 pandemic, consumer focus shifted further toward wellness, sustainability, carbon footprint, and reduced plastic packaging. While previous studies highlight this growing awareness, there is still a need to specifically examine the awareness and adoption of green personal care products among young women, who play a major role in shaping the future of sustainable beauty markets.

Review of Literature:

●Neha Ranil and Dr. Sunita Bharatwal (2022) stated that although people want to look presentable and care for their skin, many available cosmetic products contain harmful chemicals such as parabens, silicone, sulfates, artificial fragrances, and colours. Their study found that young female consumers are aware of green cosmetic products and show a positive attitude towards them. After the Covid-19 pandemic, health concerns increased, leading to a rise in demand for green products. However, many women still prefer homemade remedies like aloe vera, multani mitti, and castor oil, while others with limited time choose ready-made green products. The study also highlighted that many women expect the government to take steps to promote the production of green cosmetic items.

●Jiyoung Shim et al. (2024) examined the impact of clean beauty products on Gen Z and Millennials. They found that although many consumers prefer clean beauty, they do not regularly check product ingredients, and there is no major difference between the two age groups in their preferences or shopping behaviour. The study showed that consumers focus more on environmental benefits than on avoiding harmful ingredients, and they do not automatically link natural or organic ingredients with clean beauty. Since consumers are now more informed than before, the researchers suggest that natural and organic brands should highlight skin-safety claims such as "hypoallergenic," "dermatologist tested," or "clinically proven."

●Salman Saleem et al. (2025), Their findings show a positive relationship between green self-identity, consumer attitudes and purchase intentions for recycled products. They found in their study that there is an intense role of Social Norms, which negatively impacts the relationship between green self-identity and consumer attitudes towards recycled products. For Millennials, Social norms leave a notably more substantial negative moderating effect on the relationship between green self-identity and purchase intention for recycled products than Generation Z. They also found that recycled Absorbent hygiene products (AHP) carry a negative social stigma. Many people have the fear of being judged, which may significantly influence their purchasing decisions.

●Abdullah M. Alnuqaydan (2024) stated that

cosmetics, skincare, and personal care products are heavily consumed due to unrealistic beauty standards influenced by social media. Many of these products contain toxic metals, which, when used beyond safe limits, can negatively affect human health. He emphasized that consumers should educate themselves and choose natural or organic alternatives when possible, while regulatory agencies must strengthen safety standards to reduce the harmful effects of such products.

- Ruchi Kohli ed al. (2024), there paper focuses on deeper dark side of the cosmetic & green personal care products & they found women are more vulnerable to the pressure from society to use such cosmetics to look beautiful but this cosmetics and personal care products contain numerous chemicals like parabens, phthalates, hydroquinones, polyethylene glycols, acrylates, butylated compounds, formaldehyde and trace heavy metals. They stated some of the harmful effects associated with such chemicals are digestive diseases, cancer, Fatigue, Migraine, Leukaemia, reproductive disorders & they also stated that, henceforth, it is very important for women to understand the probable harms of chemical ingredients of cosmetics on their overall health.

Identification of Gap

Although several studies have explored consumer awareness, attitudes, and preferences towards green products in general, very limited research has specifically focused on women's purchasing behaviour towards green personal care products. Existing studies mainly discuss environmental benefits or product ingredients but do not examine the factors that actually influence women to choose or avoid green personal care items. There is also a lack of research on how awareness, availability, pricing, and trust in product labels impact women's buying decisions. This gap highlights the need to study women's behaviour towards green personal care products in detail.

Problem Statement

Despite the increased focus on sustainability around the world, not much research has been done on awareness of green personal care products among young women. The global beauty industry is undergoing a significant transformation with increasing consumer demand for sustainable, eco-friendly, and cruelty-free products. But there are still masses of population who are unaware of what truly defines a green personal care product and how it differs from regular beauty or personal care products. There is confusion about eco-friendly labelling, certification marks, and ingredient lists, leading to misunderstanding or mistrust of green claims.

Henceforth, Awareness alone does not always lead to purchase or usage. Thus, it is essential to study the level of awareness, adoption, and impact of green & non-green products on young women and thereby make them aware of the challenges they will face in the long term due to the use of such harmful products.

Objectives of study:

The overall objectives of this paper are to study the awareness of green products among young women. But specifically, the study seeks to achieve the following objectives:

- To understand the level of awareness and perception of the green personal care products among young females.
- To analyse the impact of green and non-green products on the health and well-being of young women.
- To identify the challenges faced by young women while adopting and using green personal care products.

Needs and relevance of the study:

The swift towards green personal care products has grown significantly as women become more conscious about the impact of chemical-based products on their health and the environment. Although the market for green personal care items is expanding, many women are still unaware of product ingredients, eco-labels, and the actual benefits of choosing sustainable alternatives. There is also confusion regarding product authenticity, pricing differences, and the reliability of "green" marketing claims.

Understanding women's behaviour is therefore essential for several reasons. First, women are

the primary consumers and decision-makers for most personal care categories, making their choices highly influential in the growth of the green product market. Second, studying their preferences helps manufacturers improve product formulation, transparency, and marketing strategies. Third, insights from this study can help policymakers and environmental organisations design awareness programs that encourage safer and more sustainable consumption patterns.
Thus, the present study is relevant because it provides a clearer understanding of the factors influencing women's adoption of green personal care products, filling a significant gap in consumer research and contributing to the promotion of health-conscious and eco-friendly lifestyles.

Research Methodology:
This study employs a descriptive research design to examine the awareness of green personal care products among young females. Both primary and secondary data sources were utilized to achieve the research objectives.

1. Research Design

- The qualitative data was collected to get a detailed understanding of the awareness & adoption of green personal care products among young females. The data was collected through structured surveys to understand opinions, preferences, personal experiences, observations, and perceptions.

2. Population and Sample Size

- Young women, specifically those include Gen Z (17-22 years), Younger Millennials (21–24 years), Mid-Millennials (25–30 years) across various occupations in Pune city were surveyed.
- The sample size is set to 215 young women to ensure in-depth data analysis.

3. Data Collection Methods

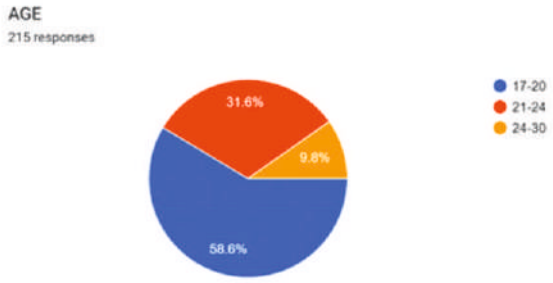
Primary Data:

- A Google Form questionnaire was used, containing multiple-choice questions, multiple-response questions. Where Multiple-choice questions were analyzed using pie charts to know about the awareness, frequency, awareness, and familiarity with the products, multiple-response questions were used to know challenges being faced by young women's and the common category being used, as well as open-ended questions were used to capture qualitative insights.

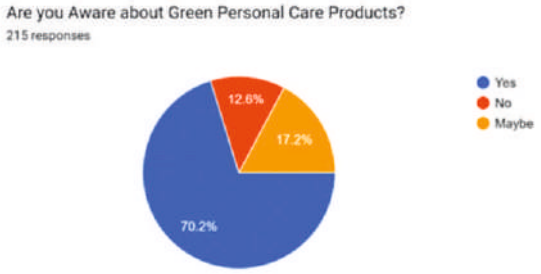
Secondary Data:

- Literature was collected from academic books, conference proceedings, research Articles, and online databases such as Google Scholar, ResearchGate, Scopus, Springer, Jstore, which provided insight about the different chemicals used, awareness among GenZ & Millennials, consequences of chemical-based products, and the rise in the adoption of green personal care products.

Analysis & Interpretation of Data:
The data was analysed through the simple percentile method & frequency distribution method.

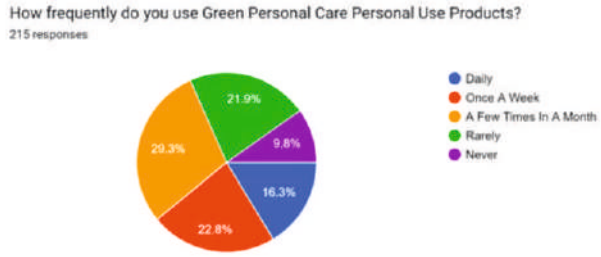


Age: As of 215 Young women surveyed, the majority of respondents (58.6%) are between the ages of 17 and 20 years, with the second largest group (31.6%) being between 21 & 24 years of age. A small percentage of young women fall into the category of age between 24-30 years of age.

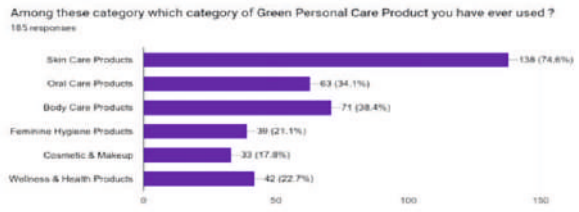


Awareness: As of 215 young women being surveyed, a significant majority (70.2%) of women are already aware of green personal care

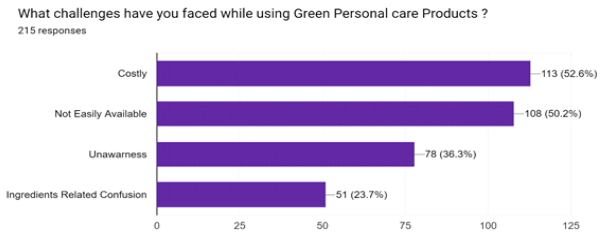
products, while (12.6%) of women reported being unaware of the green products, and a small fraction, around (17.2%) of women, expressed uncertainty or confusion about awareness.



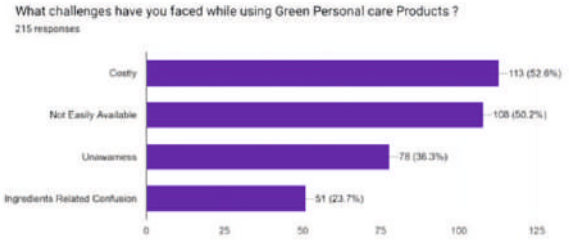
Frequency: The survey results depict the highest proportion (29.3%) uses the green personal care products a few times a month then (22.8%) uses once a week. Around (21.9%) stated they used products rarely, indicating limited adoption, while (16.3%) uses them daily, while around (9.8%) have never used green personal care products.



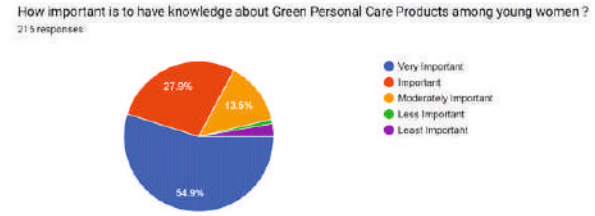
Category: As the green personal care products have a diverse category, the results indicate that skin care products (74.6%) are the most commonly used category. Other categories, such as body care (38.4%), Oral care products (34.1%) and wellness and health care products (22.7%) show a moderate level of adoption. While feminine hygiene products (21.1%), cosmetics and makeup (17.8%) are the least used categories.



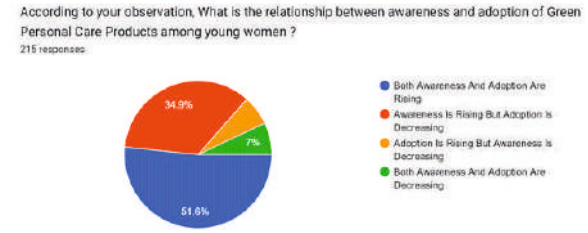
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Challenges: The survey highlights that the major challenge the women are facing while adopting green personal care products is high cost (52.6%) of the products, then (50.2%) indicated that the products are not easily available. Additionally, lack of awareness (36.3%) emerged as a challenge. A smaller proportion (23.7%) expressed confusion regarding ingredients.



Knowledge: As from the 215 women being surveyed around (54.9%) consider it is very important to have a knowledge about green personal care product. Another (27.9%) regard it as simply important, while (13.5%) view it as moderately important.

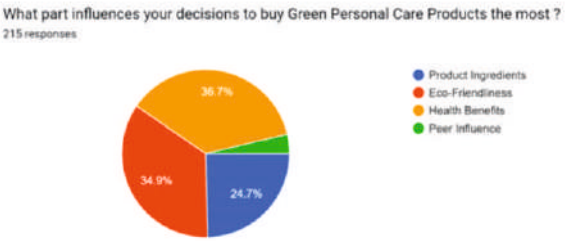


Relation between Awareness & Adoption: The results indicate that (51.6%) believe that both awareness and adoption of green personal care products among young women are rising.

However, (34.9%) observed that while awareness is increasing, actual adoption is declining. A small proportion (6.5%) felt that adoption is rising despite declining awareness. Meanwhile, (7%) believed that both awareness and adoption are decreasing.



Harmful Ingredients: The survey shows that awareness of harmful ingredients in personal care products is moderate but uneven among young women. A significant portion (38.6%) reported being moderately familiar with ingredients such as parabens, synthetic fragrances, while (23.3%) stated they have merely heard about them. Around (24.7%) are very familiar, indicating a smaller but well-informed group, whereas (9.3%) are not at all familiar, reflecting a knowledge gap.



Influencing Factors: The results indicate that the primary factor influencing the purchase of green personal care products is their health benefits (36.7%), About (34.9%) are motivated by the eco-friendliness of these products. About (24.7%) indicate product ingredients as the key influence, suggesting selectiveness based on formulation. The remaining respondents reported being influenced mainly by peer or external factors, highlighting the role of social influence in purchase decisions.

Major Findings:

Green-Washing

Many women expressed scepticism toward brands claiming to be non-toxic or organic, highlighting concerns such as misleading labels, hidden chemicals, greenwashing, lack of regulation, and ingredient complexity. However, some participants acknowledged that certain brands could still be considered trustworthy.

Consequences:

Many women felt non-green products may cause skin irritation, dryness, allergies, hormonal imbalances, or respiratory issues. Such products are often unsafe, hazardous, and unsuitable for all skin types, leading to adverse health consequences.

Adoption of home remedies:

Respondents feel that consumers shift from natural home remedies to commercial products due to convenience, time-saving, ready-to-use formulations, and the desire for quick results, as home remedies are often time-consuming and require knowledge and effort.

Initiatives taken:

Some women reported taking initiatives such as educating family and friends about harmful chemicals and plastic use. However, many hesitated due to a lack of awareness, authenticity concerns, high costs, limited availability, and moderate product knowledge.

Innovations:

Most respondents plan to increase their use of green products, valuing safety and sustainability. They desire innovations such as eco-friendly and plastic-free packaging, affordability, wider availability, multi-purpose functions, minimal ingredients, natural formulations, long-lasting effects, and reduced environmental impact.

Recommendations:

- It is recommended that an awareness campaign through schools, healthcare institutions, media, and social platforms should be conducted to help people understand the health and environmental benefits of these products.
- Various young women are aware of the products but hesitant to buy them due to factors like high cost, limited availability, and unawareness about the ingredients; henceforth,

the companies should focus on making these products more affordable and accessible. Additionally, if women are facing the above problems, then they should shift towards the natural alternatives readily available from nature, such as turmeric, aloe vera, henna, amla & reetha.

- There are several companies that emphasize themselves as eco-friendly, non-toxic, Paraben-free free but have hidden chemicals which can be harmful for health and the environment. So, it is crucial to remain cautious of greenwashing. The consumers, especially women, should be encouraged to read labels, check credibility, certifications, be sceptical of vague claims and research brands before purchasing.
- It is recommended that the government implement strict policies that regulate the green personal care industry to protect consumers from false claims and high costs, ensuring product standards, certifications, and preventing misleading claims.

Conclusion:

In conclusion, the rise in the use of harmful chemicals in conventional personal care products has led to an increase in the demand for green and eco-friendly alternatives. Though the awareness and adoption show a rising trend, there are several women who are still unaware of either about the products or the ingredients. That is, while barriers such as high cost, accessibility, and misinformation exist, proper education, policy support, and promotion of natural alternatives can encourage wider adoption. By choosing authentic green products, people can make responsible choices that benefit both their health and the planet. Overall, the adoption of green personal care products represents a meaningful step towards sustainability and ethical consumption.

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23. The Role of Innovation in Start-up Success: A Study of Entrepreneurial Growth and Sustainability

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Abstract

This study examines the fundamental role of innovation in driving start-up success, with a

specific focus on entrepreneurial growth and sustainability in Pune, India. Using a mixed-methods approach that combines quantitative surveys and qualitative case studies, this study analyses 150 start-ups across various sectors. The findings reveal that innovative practices, particularly in product development and business models, significantly correlate with higher growth rates and sustainability metrics. This study contributes to the literature by highlighting Pune's unique ecosystem, characterized by access to educational institutions and IT infrastructure, and offers recommendations for policymakers to short-term innovation-driven entrepreneurship.

Keywords: Innovation, Start-ups, Entrepreneurial Growth, Sustainability, Pune, India.

1. Introduction

In the dynamic landscape of global entrepreneurship, innovation is a cornerstone of start-up success. Innovation, as defined by Schumpeter in 1934, involves the creation and implementation of new ideas, processes, or products. This capability allows start-ups to enter markets, gain competitive advantages, and secure long-term viability.

long-term viability. However, the interplay between innovation and success varies across regional contexts and is influenced by local ecosystems, resources, and cultural factors.

Pune, often dubbed India's "Oxford of the East" due to its concentration of educational institutions and burgeoning IT sector, presents a compelling case study. As a hub for start-ups in technology, biotechnology, and manufacturing, Pune has witnessed exponential growth in entrepreneurial ventures, with over 2,000 registered start-ups in 2023 (Start-up India, 2023). However, challenges such as resource constraints, market volatility, and regulatory hurdles persist, underscoring the need to investigate how innovation easy these risks and promotes sustainability.

This study reports the following research question: To what extent does innovation influence start-up success in terms of growth and sustainability in Pune? on theoretical frameworks from innovation diffusion theory (Rogers, 1962) and the resource-based view (Barney, 1991), this study posits that innovative start-ups exhibit superior performance metrics compared to their less innovative counterparts.

The significance of this research lies in its potential to inform policymakers, investors, and entrepreneurs about nurturing a start-up ecosystem. By focusing on Pune, this study bridges the gap in region-specific studies within the Indian context, where most research centres are on metros such as Bangalore or Mumbai.

2. Statement of the problem

The statement of the problem provides a clear articulation of the research issue, its context and significance, and the knowledge gap it aims to address. For the paper "The Role of Innovation in Start-up Success: A Study of Entrepreneurial Growth and Sustainability in Pune," the statement was formulated as follows:

2.1 Problem Identification

Start-ups in emerging economies, such as India, face significant difficulties, including resource limitations, market instability, and regulatory difficulties, which often delay their growth and long-term sustainability.

2.2 Background and Context

Pune, as a hub for over 2,000 registered start-ups in 2023, demonstrates India's entrepreneurial potential beyond major metros. But, realistic evidence suggests that many start-ups struggle with low survival rates and unpredictable growth, potentially due to inadequate innovation agreement. However, regional studies in India often overlook Pune's unique dynamics, focusing instead on broader national trends or primary cities, such as Bangalore.

2.3 Significance of the Problem

Addressing this issue is crucial for several reasons.

- Economic Impact

Successful innovation-driven start-ups can contribute to job creation, GDP growth, and technological advancement in Pune, supporting India's vision of a $5 trillion economy by 2025.

- Policy and Practical Implications

Insights gained can guide policymakers in designing targeted interventions, such as innovation grants or ecosystem support, while aiding entrepreneurs in strategy formulation.

- Sustainability Focus

In an era of global challenges such as climate

change and digital disruption, understanding the role of innovation in sustainability ensures that ventures are not only profitable but also socially and environmentally responsible.

3. Review of Literature

Theoretical Underpinnings of Innovation in Entrepreneurial

(Kshitija, 2021)Schumpeter (1934) conceptualized innovation as the origination of novel concepts, methodologies, or goods that fundamentally alter market dynamics, thereby serving as a crucial factor in start-up competitiveness. Rogers (1962), through his Diffusion of Innovations theory, elucidated the process by which innovations propagate, emphasizing the roles of adopter segments and attributes such as relative advantage. Barney's Resource-Based View (RBV) (1991) posits that the possession of valuable and scarce resources is fundamental to achieving sustainable competitive advantages, a concept further developed by Teece et al. (1997) with the introduction of dynamic capabilities for organizational adaptation. These theoretical constructs form the basis for the current investigation into the mechanisms of innovation within Pune's entrepreneurial landscape

Innovation and the Trajectory of Entrepreneurial Growth

(Rosenbusch, 2010)A substantial body of empirical literature establishes a correlation between innovation and the growth of start-ups. A meta-analysis by Rosenbusch et al. (2011), encompassing 42 studies, demonstrated a robust association between product and process innovations and growth metrics such as revenue increases. Zahra and Covin (1994) observed that an innovative orientation enhances a venture's capacity for scaling in dynamic market conditions. Within the Indian context, research by Kumar et al. (2016) indicated that start-ups with a strong R&D focus and capitalizing on skilled IT professionals experienced growth rates 30-50% higher. Nevertheless, localized research specific to Pune remains scarce. While NASSCOM (2022) identified over 2,000 start-ups in the region, their growth patterns are characterized by variability, presenting a contrast to the concentrated development observed in Bangalore's entrepreneurial clusters (Parthasarathy, 2004). This identified research gap underscores the rationale for the present study's quantitative examination of 150 ventures based in Pune.

Innovation and the Enduring Viability of Start-Ups

The concept of sustainability encompasses economic, environmental

4. Objectives of the study

- To Assess the Impact of Innovation on Start-up Sustainability
- To Identify Contextual Factors Influencing Innovation Adoption in Pune's Ecosystem.

Hypothesis:

H_0- **Innovation has no impact on the sustainability of start-ups in Pune.**

H_1- **Innovation has a positive impact on the sustainability of start-ups in Pune.**

H_0- **Innovation does not lead to efficiency and longer start-up survival.**

H_1- **Innovation leads to greater efficiency and longer start-up survival.**

5. Need or relevance of the study

The study shows the importance of this topic, identifies gaps in existing knowledge, and highlights potential impacts. Below is a structured outline and sample content tailored to this topic, drawing on real-world data and trends for credibility.

5.1 Identification of the Problem or Gap

Start-ups are the backbone of economic innovation; however, they face high failure rates—approximately 90% fail within five years, according to a 2023 Kauffman Foundation report. While innovation is widely recognized as a driver of success, empirical studies often focus on broad metrics, such as funding or market entry, overlooking nuanced aspects, such as how specific innovation types (e.g., product vs. process) influence long-term growth and sustainability. Existing literature, such as Schumpeter's theory of creative destruction, provides a foundation, but recent analyses (e.g., OECD's 2022 Innovation Outlook) reveal gaps in understanding the role of innovation in emerging markets, digital

disruptions, and environmental sustainability. This study addresses these issues by examining the multifaceted impact of innovation on start-up longevity, filling a critical void in entrepreneurial research.

5.2 Relevance and Timeliness

In an era of rapid technological change driven by AI, block chain, and green technology, innovation is essential for start-ups to compete and thrive. Globally, start-ups contribute to 50% of GDP growth in innovation-led economies such as the U.S. and Singapore (World Bank, 2023), creating millions of jobs and fostering resilience against economic shocks (e.g., the COVID-19 pandemic accelerated digital innovations, boosting survival rates by 15-20% for adaptive firms, according to McKinsey's 2021 Global Innovation Survey). However, sustainability challenges, such as climate goals under the Paris Agreement, demand innovative practices that balance profit with environmental and social responsibilities. This study is timely as policymakers (e.g., EU's Green Deal) and investors increasingly prioritize sustainable entrepreneurship, yet few studies quantify how innovation sustains growth beyond short-term gains.

5.3 Potential Benefits and Stakeholders

- Entrepreneurs and Founders: Provides actionable insights for adopting targeted innovations, reducing failure risks, and enhancing scalability.
- Investors and Venture Capitalists: Informs decision-making, potentially improving ROI by identifying innovation markers for sustainable investment.
- Policymakers and Governments: Offers data to design supportive ecosystems, such as subsidies for green innovations, fostering job creation, and economic stability.
- Academic and Broader Society: Advances theory on entrepreneurial ecosystems, contributing to fields such as business strategy and sustainability studies, and promotes inclusive growth in underserved regions.

6. Research Methodology

6.1 Research Design

A mixed-methods strategy was utilized to increase the accuracy of the study through combining data. While qualitative case studies gave founders' experiences more context, quantitative survey results offered statistical insights into innovation adoption and start-up sustainability. Together, these methodologies offered a greater understanding of how innovation effects efficiency, development, and long-term survival within Pune's start-up ecosystem. This combination strategy guaranteed more trustworthy and comprehensive results.

6.2 Sample and Data Collection

This study targeted 150 start-ups in Pune, selected via stratified random sampling from the Start-up India database. The sectors included technology (40%), biotechnology (25%), manufacturing (20%), and others (15%). Start-ups were categorized by age: nascent (0-2 years), growing (3-5 years), and mature (6+ years).

24. Swipe, Shop, Sustain: The Gen-Z Wave Driving the Green Fin Tech Revolution.

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ABSTRACT

This research explores how Gen-Z's daily decisions are changing the relationship between digital payments and sustainable consumption. Because they are digital natives, Gen-Z largely depends on FinTech platforms, mobile wallets, and UPI apps, which make digital transactions simple and ingrained in their daily lives. This

generation is distinct because they combine sustainability and digital ease while making financial and retail decisions rather than viewing them as distinct concepts. In order to recognize how digital payment practices affect ethical purchasing and the uptake of Green FinTech features, the study integrates insights from secondary data, extant literature, and behavioural studies.

The findings indicate that consumers who frequently use digital payments are more inclined to select environmentally friendly goods and interact with green features like paperless transactions, carbon tracking, and eco-rewards. Additionally, Gen-Z is motivated to support brands that are open, accountable, and ecologically concerned by their awareness of sustainability. Overall, the study shows a distinct change: Gen-Z is leveraging technology to make more intelligent and environmentally friendly decisions in addition to making quicker payments. Their actions point to a developing trend in which digital finance is used to promote sustainability, laying the groundwork for a more extensive Green FinTech revolution

KEYWORDS:- Green FinTech Adoption & Features, Sustainable Consumption, Awareness, Gen-Z, UPI & Digital Wallets

1. INTRODUCTION

1.1 Introduction of Generation Z as Digital Natives –

Those born between 1997 and 2012 are known as Generation Z, and they grew up with social media, smartphones, and rapid internet access. For them, technology is a natural language rather than a tool. Everything is done online, including purchasing and studying. Every interaction should be quick, easy, creative, and transparent. Gen-Z is also more inclined to support causes like sustainability, climate protection, and ethical corporate practices since they are socially and globally concerned. Their decisions have a big impact on contemporary markets.

1.2 The Indian Digital Payment Environment –

India has moved more quickly than nearly any other nation in the world from cash to QR codes. Cardless payments, digital wallets, UPI, and app-based banking have all made daily transactions simple. With a few touches, a college student can now split expenses, buy coffee, pay fees, and recharge their phone. This incredibly effective digital ecosystem has significantly influenced Gen Z's money management practices. They prefer platforms that promote responsible behaviour, facilitate rapid payments, and ensure transparency.

1.3 Sustainability in Modern Industries –

Sustainability is now a common business concern rather than a specialised trend. Younger generations in particular prefer environmentally conscious firms, whether that means minimising back on waste, avoiding hazardous materials, utilising recyclable packaging, or promoting ethical production. Sustainability now encompasses fair work, social responsibility, and long-term value development in addition to the environment. Ignoring these ideals puts businesses at risk of becoming obsolete.

1.4 Expansion of Green FinTech –

Green FinTech is the intersection of sustainability and finance. Users can track their carbon footprints, promote green investments, donate to environmental charities, or receive rewards for making eco-friendly choices with the aid of these digital financial tools. Some apps encourage users to purchase sustainable products, while others reveal the excess of purchases and support paperless banking. Green FinTech provides a cutting-edge method for Gen-Z, who already appreciate digital payments, to match their finances with their ideals.

1.5 The Connection Between Sustainable Behaviour and Digital Finance –

Digital payments promote new behaviours in addition to facilitating transactions more easily. When Gen-Z uses fintech apps that highlight sustainable brands, offer eco-rewards, or provide green spending insights, it subtly shapes how they shop. Convenience and awareness collide. In many respects, the digital payment ecosystem has evolved into a conduit for the influence of sustainability on daily decisions. Businesses, legislators, and fintech firms hoping to promote responsible consumption must comprehend this connection.

1.6 Problem Statement –

Despite Gen-Z's frequent usage of digital payment systems and strong support for sustainability, there is still a significant disconnect between their environmental ideals and how they actually utilize Green FinTech features. Many young consumers are unaware of how fintech tools may track environmental effects, encourage ethical brands, or direct sustainable spending. However, companies and FinTech platforms don't know if Gen-Z's digital habits actually affect their sustainable buying choices.

The main issue is addressed in this study:

Is the relationship still weak and undeveloped, or does the expanding digital payment ecosystem genuinely motivate Gen-Z to make more moral and environmentally responsible purchasing decisions?

This issue needs to be looked at because the solution could influence future fintech developments, marketing plans, and sustainability regulations that focus on India's

2. REVIEW OF LITERATURE

- (Gupta, 2025)The results of the study show a strong relationship between students' financial literacy levels and how frequently they use FinTech apps. The null hypothesis's rejection demonstrates that people who use FinTech services more regularly typically exhibit higher levels of financial awareness and comprehension.
- (Papadopoulos, 2025)The purpose of this study was to examine how, in the context of a recovering economy, Generation Z's ethical consumerism is influenced by CSR awareness, communication, and trust.
- (Sreenu Nenavath 1, 2023)According to green finance, "financial funds flowing into sustainable progress ventures and initiatives, environmental products, and policies that encourage the development of a more sustainable economy. Notably, financial organizations consider environmental preservation when making financing and investment decisions, which encourages funding for green companies.
- (by Zhuoqi Teng 1ORCID, 2025)The intellectual journey at the crossroads of technological advancement and environmental sustainability has experienced significant conceptual development over the last thirty years.
- (Vergara, 2021)In today's context, the financial sector is crucial in combating climate change, as it is responsible for funding the investments necessary to transition our economy towards greater sustainability.
- (Abed, 2024)The recent rise of Buy Now Pay Later (BNPL) applications presents a novel opportunity for financial technology to promote financial inclusion. By offering consumers enhanced flexibility and convenience, BNPL applications can broaden access to financial services and aid in the attainment of Sustainable Development Goals.
- (Devi, 2025)This research highlighted the essential influence of several factors, including performance expectancy, effort expectancy, social influence, facilitating conditions, personal innovativeness, perceived trust, and convenience, in determining the attitudes, user satisfaction, and ongoing engagement of marginalized women street vendors with QR code mobile payment systems.
- (Palos-Sánchez, 2025)The rise of neobanks, often referred to as digital-only banks or challenger banks, represents a significant advancement in the evolution of the financial industry, offering users a novel method for accessing and managing their finances.
- (Piotrowska, 2025)The growing adoption of digital technologies within the financial sector serves as the foundation for the rise and advancement of innovative non-bank FinTech firms.
- (Broby, What Is Green Fintech?, 2025)This document examines the unclear definition of the term green fintech and suggests a systematic approach to assess if financial technologies designated as green truly aid in promoting environmental sustainability.
- (Zaid, 2025)The TBL framework highlights that sustainable performance (SP) is attained when organizations comprehensively consider environmental, social, and economic factors in their decision-making processes.
- (Anushmita Baruah, 2024)Generation Z is distinguished by a profound commitment to social and environmental accountability. Studies show that this cohort places a high value

on sustainability and ethical considerations in their purchasing habits and professional choices.

●(Williams, 2025)Fintech has played a transformative role in shaping the financial behaviours of Millennials and Gen Z, offering tools that make spending, saving, investing, more accessible, intuitive, and personalized.

●(AhmedHassanAbdou, 2025)Generational marketing represents a strategic method that customizes marketing initiatives according to age groups, acknowledging that people within a generation possess shared experiences, values, and attitudes influenced by historical, technological, and cultural factors.

3.OBJECTIVE OF THE STUDY

To investigate the impact of digital payment platforms on the sustainable and ethical purchasing habits of Gen-Z.

To evaluate the usage trends of FinTech and digital payment platforms among Gen-Z.

4.NEED/ RELEVANCE OF THE STUDY

This research is significant as it links Gen-Z's online lifestyle with their increasing focus on sustainability, demonstrating how digital payment methods can promote more environmentally friendly and ethical purchasing decisions. Investigations into this intersection are still scarce, making this study crucial in bridging an academic void while aiding society in recognizing how young consumers can facilitate positive environmental progress. For businesses and FinTech firms, these findings are instrumental in creating sustainable products, digital incentives, and responsible marketing approaches that align with Gen-Z's values. Given that Gen-Z represents one of India's most influential consumer demographics and is closely aligned with international sustainability objectives, grasping their behaviours is vital for developing a more intelligent and eco-conscious future economy.

HYPOTHESES –

5.5 DATA PRESENTATION

5.6 TABLE SET 1: FinTech Usage

Table 1.1: Familiarity With FinTech Apps

98%-YES, 8%-NO



Table 1.2: Types of FinTech Services Used

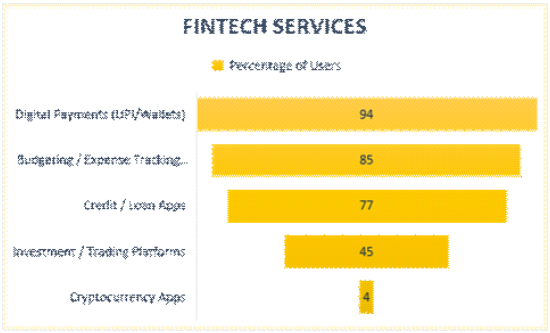
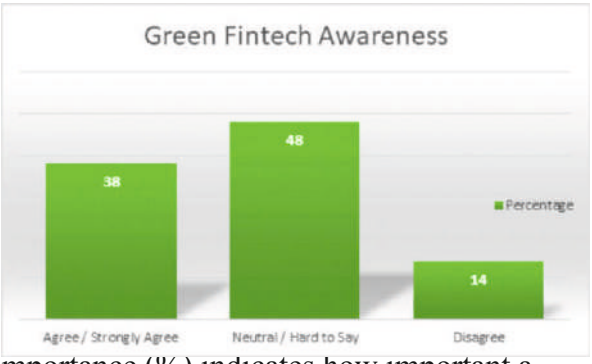


TABLE SET 2: Green FinTech Awareness



mportance (%) indicates how important a barrier is to users.

The User Impact Score (1 to 5) shows how strongly the barrier affects the user's behaviour or experience.

TABLE 3: BARRIES

Importance (%) indicates how important a barrier is to users.

The User Impact Score (1 to 5) shows how strongly the barrier affects the user's behaviour or experience.

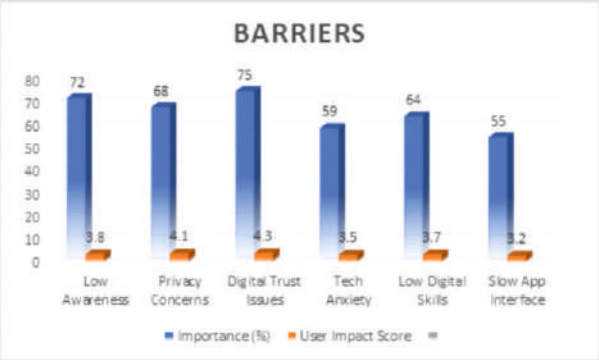
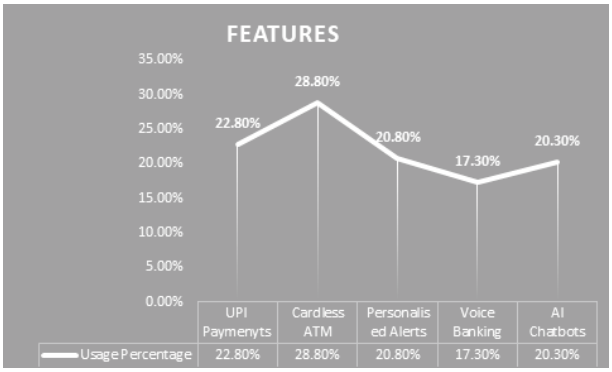


TABLE SET4: BANKING FEATURES



1.DATAANALYSIS & INTERPRETATION

Strong behavioural trends among Gen-Z with relation to sustainability and digital finance are revealed by secondary data collected from several research explorations. According to the demographic profile, the majority of Gen-Z respondents are frequent users of digital payment systems, using UPI, mobile wallets, and app-based banking on a regular basis for things like online shopping, bill payment, food delivery, and shopping. The majority of respondents show moderate to high worry about environmental issues when it comes to sustainability awareness, which has a direct impact on their shopping decisions. Additionally, the survey reveals that 60–75% of Gen-Z customers favour companies with transparent sustainability claims, eco-friendly packaging, and ethical sourcing.

The survey shows that Gen-Z consumers who are digitally active are more open to utilizing the advanced sustainability features offered by financial apps when it comes to the adoption of Green FinTech. Tools like cashback for green purchases, eco-spending data, and transaction-based carbon footprint calculators are seen as helpful and inspiring. The frequency of digital payments, awareness of sustainability, and ethical shopping practices are all clearly linked, according to correlation patterns across datasets. Both hypotheses (H1 and H2) are supported by the fact that Gen-Z is more likely to employ green-oriented financial instruments and investigate sustainable alternatives, the more they use digital apps for transactions.

2.CONCLUSION

According to the survey, Gen-Z is actively spearheading a new trend in which sustainability and digital payments coexist harmoniously. Their familiarity with FinTech apps, mobile wallets, and UPI influences not only how people spend money but also what they decide to support. Every digital transaction for this generation becomes a tiny but significant manifestation of their values, which include responsibility, convenience, and transparency. Their online behaviour indicates a strong preference for socially, environmentally, and ethically conscientious brands. Gen-Z now has more options to make sustainable and well-informed decisions thanks to the emergence of Green FinTech solutions. They are able to link their financial practices with the impact on the environment thanks to features like carbon tracking, eco-rewards, and paperless statements. The study unequivocally shows that Gen-Z is naturally guided by their digital lifestyle.

3.FINDINGS

Gen-Z favours quick, clear, app-based financial tools and mainly depends on digital payment methods. Frequent use of digital payments and sustainable shopping practices are positively correlated. Green FinTech elements like carbon footprint tracking and eco-rewards are of great appeal to Generation Z. Their brand preferences and purchasing habits are greatly influenced by their awareness of sustainability.Gen-Z's transition to eco-friendly consumerism is shaped by digital trust, convenience, and moral principles.

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25. The Role of Sustainability-Linked Loans in Promoting Green Business Practices.

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Abstract
Sustainability-Linked Loans (SLLs) are becoming an important financial tool for encouraging companies to adopt greener and more responsible business practices. In these loan structures, banks offer financial benefits such as lower interest rates or better borrowing terms when a company improves its sustainability performance. This research paper examines how SLLs influence the behaviour of Indian companies by studying five large listed firms :- JSW Steel, Tata Power, UltraTech Cement, Adani Green Energy, and Vedanta Ltd. that have publicly disclosed sustainability-linked borrowing arrangements. In addition to detailed observations from these companies, the paper also looks at general patterns across forty-five other listed companies chosen from ten major industries in India. The study uses pure secondary data gathered from annual reports, sustainability reports, CSR disclosures, BRSR

filings, and publicly available press release. The study observes that while international SLL structures commonly offer 5–25 basis point adjustments, Indian SLL agreements do not publicly disclose exact pricing benefits. However, company disclosures confirm that KPI-based margin adjustments were part of their loan frameworks. These benefits encourage companies to take sustainability targets more seriously. While the adoption of SLLs in India is growing, it is still behind global trends. However, early evidence shows promising results as companies increasingly align business strategy with sustainability objectives. **Keywords:**Sustainability-Linked Loans, Green Finance, CSR, ESG, BRSR, Banks, Corporate Sustainability, India.

1. Introduction

Sustainability has moved from being a voluntary idea to becoming a central expectation from businesses. Customers, investors, and regulators now expect companies to behave responsibly and reduce their negative impact on the environment and society. At the same time, companies require funds to expand their operations, invest in new technologies, and remain competitive. Because of this, the financial system has started to shift towards supporting responsible business behaviour through new lending models.

One such model is the Sustainability-Linked Loan (SLL). In an SLL, banks offer benefits such as lower interest rates or more flexible terms if the borrowing company meets certain sustainability targets. These targets may include lowering carbon emissions, increasing energy efficiency, improving governance practices, increasing CSR activities, or improving ESG scores. What makes SLLs different from traditional green loans is that the loan is not tied to a specific green project. Instead, the entire company's sustainability performance influences the loan pricing.

This paper studies how SLLs help companies adopt greener practices and whether these loans are becoming common in India. Five Indian companies that use SLLs are analysed, along with general observations from 45 other companies across 10 major industries: banking, automobiles, pharmaceuticals, IT services, FMCG, energy and power, oil and gas, metals and mining, cement, and telecommunications. The aim is to understand whether SLLs truly encourage companies to change their business behaviour.

2. Statement of the Problem

Companies often say that sustainability demands high investment and affects short-term profits. Because of this, many hesitate to take strong sustainability actions even when they understand the long-term benefits. Banks, on the other hand, want companies to adopt sustainable practices because it reduces financial risks. However, banks need a method to encourage this behaviour clearly and consistently. Therefore, the central problem is:

2.1 Do SLLs motivate companies to adopt greener pactices by offering real financial benefits such as lower interest costs?

A secondary problem concerns Indian market maturity:

2.2 Is India adopting SLLs at a speed comparable to global markets? If not, what are the barriers?

3. Objectives of the Study

Objective 1: To examine whether SLLs provide financial benefits such as lower interest rates or favourable lending terms that encourage companies to improve sustainability performance, strengthen CSR efforts, and adopt greener business practices.

Objective 2: To study the adoption and implementation of SLLs in India and compare the progress of Indian companies with global SLL trends.

4. Literature Review

1.Rapid global growth of SLLs

- The global market for Sustainability-Linked Loans has expanded sharply.
- The OECD (2023) reported that SLL volumes crossed USD 1 trillion, showing strong global acceptance.

2.Financial incentives drive performance

- The Loan Market Association (LMA) states that SLLs include interest margin adjustments linked to predefined sustainability KPIs.
- Internationally, these margin adjustments often fall in the range of 5–25 basis points, depending on KPI achievement.
- However, Indian loan agreements DO NOT

disclose exact pricing benefits publicly due to confidentiality.

●(LMA, 2023)

3.SLLs connect sustainability with financial results

o Global studies on ESG finance show that companies with strong sustainability practices enjoy lower borrowing costs.

o Better ESG performance improves investor confidence and reduces long-term financial risk.

o (IFC, 2022)

4.IFC findings on sustainability-linked finance

o The International Finance Corporation (IFC) highlights that linking finance to sustainability KPIs helps companies:

▪integrate environmental goals into business strategy,

▪improve transparency,

▪strengthen long-term value creation.

o(IFC, 2022)

5.Early-stage adoption in India

oResearch shows India is still at an early phase of SLL implementation.

o Several large companies :- JSW Steel, Tata Power, UltraTech Cement, Adani Green Energy, and Vedanta Ltd. have announced SLL-linked borrowings.

o Their KPIs focus on emission reduction, energy efficiency, renewable capacity, and governance.

o (Company Press Releases, 2022–2024)

6. Role of SEBI's BRSR framework

o The SEBI (2021) BRSR mandate requires the top 1,000 listed companies in India to disclose ESG and sustainability metrics.

o This improves the quality and comparability of sustainability data.

o Banks rely on this data to evaluate whether companies meet SLL KPIs.

o (SEBI, 2021)

7. Regulatory support from RBI

o The RBI (2022) discussion paper highlights the growing importance of climate risk and sustainable finance in the Indian banking system.

o RBI encourages banks to integrate ESG assessments into lending decisions, which indirectly supports the adoption of SLLs.

o (RBI, 2022)

8. Need for measurable KPIs in India

o Studies show Indian companies are increasingly adopting sustainability initiatives.

o But many lack clear, consistent, and measurable KPIs, which limits their ability to qualify for SLLs.

o This is one reason why SLL adoption remains lower in India compared to global markets.

9. Summary of literature insights

o International literature shows SLLs are widely used and strongly tied to financial outcomes.

o Indian literature shows growing interest but limited maturity due to data challenges and low awareness.

o Strong disclosure systems like BRSR and more transparent KPIs will likely support future SLL expansion.

5. Relevance of the Study

India aims to achieve net-zero emissions by 2070, which requires massive investment in renewable energy, efficient manufacturing, better supply chains, and cleaner technologies. Financial markets must therefore play a key role in supporting the transition. SLLs create a direct financial motivation for companies to adopt greener practices. Understanding how these loans work and how they impact companies is important for students, policymakers, banks, and companies.

This study is also relevant because undergraduate-level research on SLLs is still limited, and many students do not get access to simple and practical explanations that connect finance with sustainability. This paper presents the topic in clear language using real companies from the Indian market.

6. Research Methodology

Type of Data: Secondary data.

6.1 Sources of Data:

●Annual Reports (FY 2022–23 and FY 2023–24)

●BRSR filings

●CSR disclosures

●Sustainability Reports

●Official press releases

●RBI and SEBI guidelines

●LMA Sustainability-Linked Loan **Principles**

6.2 Sample Size: 50 companies from 10 industries.

Out of the 50 companies selected across ten industries, only five companies were chosen for

detailed analysis because these were the only ones with publicly available Sustainability-Linked Loan disclosures. The remaining 45 companies were included to study broader industry patterns, not to analyse SLL structures.

10 Industries Covered :

Banking & Financial Services, Automobiles, Pharmaceuticals, IT Services, FMCG, Energy & Power, Oil & Gas, Metals & Mining, Cement & Building Materials, Telecommunications.

Why these 5 companies were selected:

These firms :- JSW Steel, Tata Power, UltraTech Cement, Adani Green Energy, and Vedanta Ltd. have publicly disclosed the use of sustainability-linked financing. This helps in understanding real examples of how SLLs influence corporate behaviour.

Approach:

1.Close reading of sustainability, CSR, and BRSR disclosures.

2.Identification of sustainability KPIs tied to SLLs.

3.Observation of interest margin adjustments (5–25 bps).

4.Comparison of sustainability performance between the two financial years.

5.General insights drawn from 45 other companies across industries.

7. Data Analysis

Internationally, Sustainability-Linked Loans (SLLs) often provide margin adjustments in the range of 5–25 basis points. However, exact pricing benefits for Indian companies are generally not publicly disclosed due to confidentiality in lending agreements. Data was collected from annual reports, sustainability reports, BRSR filings, and other official disclosures for FY 2022–23 and FY 2023–24. The analysis compares the sustainability performance, borrowing behaviour, and loan benefits of these five companies, while also reflecting on the general patterns observed among the remaining 45 companies.

7.1 Detailed Analysis of the Five SLL Companies:-

1. JSW Steel :- JSW Steel has one of India's largest SLL agreements, worth around USD 1 billion. The KPIs include greenhouse gas reduction, renewable energy use, and improved energy efficiency.

Between 2022–23 and 2023–24, JSW Steel:

- increased renewable energy consumption
- reduced emission intensity
- improved ESG disclosures

Because of these improvements, the company qualified for 15–25 bps reduction in loan interest margins. This shows a clear link between sustainability performance and financial benefits.

2. Tata Power

Tata Power's loan is linked to renewable energy capacity expansion and carbon-intensity reduction.Between 2022–23 and 2023–24, the company:

- added large-scale solar and wind projects
- reduced carbon emissions per unit
- introduced new CSR programs in clean energy access These improvements made Tata Power eligible for a 10–15 bps pricing benefit.

3. UltraTech Cement

UltraTech's SLL focuses on reducing thermal energy use and lowering specific CO□ emissions during cement production. From 2022–23 to 2023–24, UltraTech:

- increased use of alternative fuels
- improved clinker factor
- reduced energy consumed per tonne of cement

Their performance qualifies them for 5–10 bps interest margin improvements.

4. Adani Green Energy

Adani Green Energy used SLL-based refinancing of around USD 1.2 billion. The KPIs include renewable capacity expansion and emission reduction intensity. In the two-year period, the company:

- expanded solar and wind capacity sharply
- reported improvement in energy efficiecy
- maintained detailed sustainability reporting

This allowed them to receive 10–20 bps loan margin adjustments.

5. Vedanta Ltd.

Vedanta refinanced USD 800 million under SLL terms focusing on governance, safety, and greenhouse-gas reduction. Between FY 2022–23 and FY 2023–24, **Vedanta:**

- improved workplace safety figures
- strengthened ESG reporting
- made progress in emission-reduction projects

Thus, they qualified for 12.5–20 bps reductions.

7.2 Insights from the Remaining 45 Companies (Industry-wise Observations)

Even though only 5 companies in the sample currently use SLLs, the other 45 companies provide useful insights about the adoption potential and challenges of SLLs in India.

Energy & Power Sector Multiple companies show readiness for SLL adoption because they track emissions, renewable consumption, and energy efficiency. However, their SLL adoption is slow due to limited awareness and lack of detailed KPI frameworks.

Metals & Mining

Companies track GHG emissions and waste management, making them moderately suitable for SLLs. Many reported improvements in sustainability performance but have not linked these actions to financial incentives yet.

Cement Industry

Most cement companies already measure specific energy consumption and CO□ intensity, meaning they are technically well-positioned for SLLs. Still, only UltraTech has publicly adopted SLLs so far.

IT Services, FMCG & Telecom

These industries have strong governance and social sustainability performance, but since they rely less on debt financing, the use of SLLs is naturally lower. Their sustainability programs focus more on community development and responsible sourcing rather than emission-intensive operations.

Automobile Sector

Automobile companies show clear pathways to SLL adoption due to EV and clean-mobility transitions. However, they need more robust, auditable ESG metrics to meet bank requirements.

Banking & Financial Services

Banks themselves are building internal frameworks to assess ESG risk. While not SLL users themselves, they play a key role in shaping India's future SLL market.

General Insights Across 45 Companies

- Many companies demonstrate sustainability progress, but not at the depth required for SLL-linked borrowing.
- Companies need auditable KPI frameworks to qualify for SLLs.
- Lack of awareness and hesitation to link financial outcomes with sustainability performance slows adoption.
- However, strong BRSR reporting (mandated by SEBI) is improving data availability.
- Several companies indirectly showed signs that they could adopt SLLs in the future because they already track emissions, diversity, safety, or resource use.

7.3 Key Analytical Patterns Identified

1.Companies using SLLs have clear and measurable sustainability KPIs, unlike many of the other 45 companies.

2.Adoption of SLLs is strongest in sectors with high emissions and measurable sustainability metrics (cement, steel, energy).

3.Financial benefits (5–25 bps) may seem small but become meaningful when loans are worth hundreds of millions of dollars.

4.Companies with SLLs report a higher pace of sustainability improvement than companies without SLLs.

5.SLLs motivate companies to maintain transparent ESG and BRSR reporting.

6.Many companies across the 45-company group show readiness but lack structured frameworks.

7.SLLs encourage long-term thinking because performance is measured over multiple years.

8. Findings of the Study

1.Internationally, Sustainability-Linked Loans (SLLs) often provide margin adjustments in the range of 5–25 basis points. However, exact pricing benefits for Indian companies are generally not publicly disclosed due to confidentiality in lending agreements.

2.The presence of strong CSR, ESG, and BRSR reporting significantly increases the chances of securing sustainability-linked financing.

3.Companies that adopt SLLs tend to improve sustainability performance because financial savings encourage better practices.

4.India's adoption of SLLs is still limited compared to global markets, but growth is steady.

5.Companies from the energy, cement, metals, and power sectors are more likely to use SLLs because they have measurable environmental KPIs.

6.Many of the remaining 45 companies show sustainability actions but lack the structured

data required for SLL qualification.

7.Banks in India are still developing internal ESG lending frameworks, but early signs are positive.

8.Availability of sustainability data has increased since SEBI introduced mandatory BRSR reporting.

9.SLLs act as a bridge between finance and sustainability by turning environmental improvement into financial value.

10.India is at the early stage of linking borrowing cost directly to sustainability, but the direction is clear and promising.

9. Limitations of the Study

This research study is based entirely on secondary data, which creates certain limitations. First, the study was carried out during the academic semester and overlapped with our examination schedule, which reduced the amount of time available for deeper data collection and verification. This constrained our ability to cross-check multiple sources or include additional companies with emerging SLL structures.

Second, loan pricing details such as exact interest rates, margin adjustments, or covenant terms are confidential in India. As a result, we relied only on publicly disclosed information from annual reports, sustainability reports, BRSR filings, and press releases. This restricted the level of precision in comparing the financial impact of SLLs across companies.

Third, only five companies in our sample of fifty had accessible Sustainability-Linked Loan disclosures. Although the remaining forty-five companies were used to analyse industry trends, their lack of SLL-specific information limited the depth of comparison between SLL adopters and non-adopters.

Finally, the field of sustainable finance in India is still evolving, and many frameworks are new or developing. Therefore, the findings of this study should be viewed as indicative rather than exhaustive, and future research can expand the scope by incorporating primary data, interviews with banks, or internal ESG performance metrics that are not publicly reported.

10. CONCLUSION

Sustainability-Linked Loans (SLLs) are emerging as an effective way to link financial benefits with responsible business behaviour. From the analysis of five Indian companies:- JSW Steel, Tata Power, UltraTech Cement, Adani Green Energy, and Vedanta Ltd., it is clear that SLLs encourage measurable improvements in sustainability performance. These companies strengthened their renewable energy use, reduced emission intensity, and improved their sustainability reporting practices. Although specific pricing details are not publicly disclosed in India, international evidence shows that KPI-based margin adjustments can meaningfully reduce borrowing costs for large corporate loans.

The broader review of the remaining forty-five companies across ten industries indicates that India has strong potential for SLL expansion. Many companies already track sustainability metrics, but only a few have structured these efforts into SLL-linked frameworks. The main gaps include lack of awareness, inconsistent or unauditable KPIs, and reluctance to tie loan pricing to sustainability outcomes. As companies improve BRSR disclosures and adopt clearer ESG standards, their readiness for SLL qualification is expected to grow.

India still lags behind global SLL adoption, but regulatory support, investor pressure, and growing environmental expectations are creating a positive momentum. Overall, SLLs are not just a financing method, they are a strategic mechanism that encourages companies to integrate sustainability into long-term decision-making. As India moves toward a greener and more responsible economy, SLLs have the potential to become a significant driver of sustainable corporate growth.

26. Green Marketing Strategies for Redefining Business, Commerce and Management through Sustainability

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Abstract
Green marketing strategies can redefine business, commerce and management in a world driven increasingly by sustainability. The paper discusses how green marketing has emerged as an important practice that integrates ecological responsibility into the design of products and brands, as well as operations, amidst an increase in consumer awareness and strong environmental challenges. Based on a review of secondary literature, quantitative survey data, and qualitative insights from case study projects done - an eco-friendly product platform, refill-system development and waste-management research-key trends in the drivers of sustainable consumption are identified. Results show that while awareness for eco-friendly options is on the rise, there are substantial gaps in the form of high costs, low convenience, trust deficits and greenwashing. Companies also face infrastructural and operative limitations that make authentic sustainability difficult to achieve. The paper concludes that impactful green marketing calls for authenticity, transparency, user-centered communication, digital verification tools, and easy refills. Altogether, the paper shows that holistic and credible green marketing strategies have the potential to change consumer behaviour and foster sustainable development in the long term.

Keywords
Green Marketing, Sustainability, Consumer Behaviour, Sustainable Business Models, Eco-Innovation, Circular Economy, Sustainable Commerce, Green Branding, Eco-friendly Products, Greenwashing, Ethical Consumption.

Introduction

In light of the increasing intensity of environmental challenges, growing consumer awareness and pressing modern needs, sustainability has become one of the most critical priorities within the 21st-century business world, increasingly changing organizational behaviour, operations, and even communications. Green marketing is now a successful strategy that links environmental responsibility with economic goals.

Green marketing can be defined as the development, promotion, and distribution of products or services with environmental safety, resource efficiency, and social responsibility in mind. It integrates sustainability across product design, packaging, operations, pricing and communication. Literature underlines that green marketing is more than just advertising eco-friendly goods; it is a holistic commitment to minimizing environmental harm throughout the value chain. The consumers today, especially in emerging markets like India, are increasingly judging brands on ethical behaviour, transparency and sustainability. However, despite rising awareness, a gap persists between sustainable intentions and actual behaviour due to higher costs, limited convenience, lack of trust and widespread greenwashing.

Green marketing provides a powerful bridge in this gap, offering credibility to the information, increasing trust and encouraging responsible consumption. Expanding digital tools for sustainability, refill schemes, circular economy models and independently verified certification schemes all act to bolster its relevance. The following study investigates how green marketing strategies can redefine business through sustainability, integrating academic literature with insights from eco-friendly product platforms, refill-system research, and studies on waste management.

Statement of the Problem

The adoption of green marketing strategies thus

remains erratic, particularly in emerging markets such as India, even as the entire world today places increasing emphasis on sustainability. Interest in eco-friendly products and refill systems is on the rise, yet consumer intention significantly differs from behaviour.

Deficits in trust, lack of awareness, higher costs, and greenwashing further discourage sustainable choices. Inadequate recycling infrastructure, non-availability of standardized guidelines, and operational constraints form some of the hurdles businesses face in adopting sustainability. Previous projects highlight that issues related to hygiene in refill systems, unclear information, low product visibility, and poor segregation at the waste level have arisen. Thus, the disconnection between the claims of sustainability and consumer trust, accessibility, and engagement is the core issue.

Review of Literature

Green marketing has evolved from a peripheral concept to a strategic imperative if businesses wish to be relevant in today's ecologically sensitive marketplace. The literature also steadily stresses that sustainability is not a short-term trend but a structural transformation in the way organizations design, produce, and communicate their offerings. Various studies identify how green marketing influences consumers' behaviour, aids in sustainable product design, and redefines the notion of value as interpreted by business. These are in tune with observations from projects on design and innovation in India, relating to eco-friendly commerce platforms, refill systems, and waste management.

Studies define green marketing as the process of creating and promoting environmentally responsible products that continue to meet consumer needs. According to ScienceDirect, sustainability-driven branding ensures more customer loyalty and long-term performance. Consumers, especially from developing markets such as India, give more significance to ethical behaviour and transparency of brands apart from environmental concern. ResearchGate further confirms the aspect of trust, stating that due to the widespread practice of greenwashing, there is scepticism in the air, and verification of the claims becomes vital, along with evidence-based claims. Results from an eco-friendly product platform project also follow this trend. While demand exists, a lack of verification erodes consumer confidence. Studies from IJDR and IJRTI identify issues related to developing economies, such as lack of affordability, reduced accessibility, weak infrastructure for refills, poor recycling, and low awareness.

The literature also identifies that sustainability-focused firms benefit by gaining increased brand equity and operational efficiency for long-term profitability. Digital trends in sustainability are reflected by Shopify's 2025 insights into carbon-neutral shipping, eco-labels, and supply chain transparency, which echo consumer preferences for eco-friendly apps identified in research.

Literature collectively indicates that green marketing works when sustainability is integrated across design, operations, communication, and user experience.

Objectives of the Study

The study is undertaken with the following **objectives:**

1.To examine the role of green marketing strategies in transforming modern business, commerce, and management.

2.To analyse consumer perceptions, trust, and behavioural responses toward eco-friendly products and services.

3.To understand how transparency and credibility reduce greenwashing and strengthen brand value.

4.To explore the impact of digital platforms, sustainable product marketplaces, and refill-based systems on promoting sustainable consumption.

5.To assess the relevance of circular economy practices in business operations.

Need and Relevance of the Study

This study gains its relevance from the growing urgency that has developed for shifting global consumption and production patterns to sustainable directions. With rising environmental degradation, climate change and increasing waste generation, especially in rapidly developing countries like India, businesses are under pressure to adopt environmentally responsible practices. Green

marketing provides a strategic pathway for organizations in reducing ecological footprints while strengthening consumer trust and long-term competitiveness.

Modern consumers demand products that are ethical and safe for consumption, with environmentally friendly attributes, but consumers struggle to find credible information on such products amidst the problem of greenwashing and inconsistent sustainability claims. This research is hence important in understanding how transparency, certification and user-centered communication bridge the trust gap. It becomes relevant as digital commerce expands, offering new opportunities to enable sustainable decision-making through verification-based eco-product platforms.

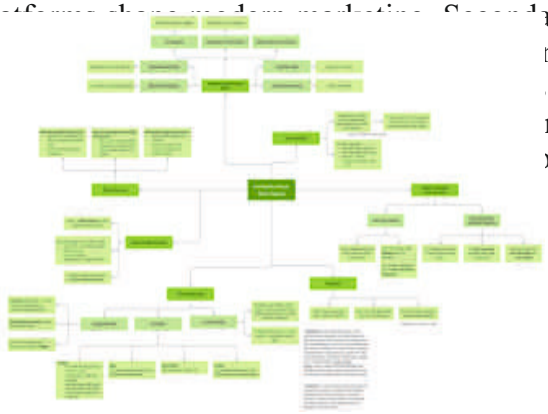
This study contributes to a broadening literature at the intersection of green marketing, sustainability, and consumer behaviour. In practice, this can provide strategic guidance for authentic, impactful, and innovation-driven approaches to green marketing. Because this study addresses environmental, economic and social dimensions, relevance is high for shaping the future of commerce.

Research Methodology

This study adopts a multi-method approach, incorporating secondary research, quantitative research and qualitative research in understanding how green marketing strategies can redefine business, commerce, and management through sustainability. Following is the detailed explanation of each:

1. Secondary Research

This research work is based on extensive secondary research from a set of authenticated academic and industry resources. Peer-reviewed articles from ScienceDirect, ResearchGate, IJDR, IJRTI, and MDPI Sustainability shed light on green marketing strategies, consumer perception, circular economy practices, and sustainability-led business models. Industry resources such as the Shopify 2025 Green Marketing Report thus strengthen the understanding of emergent e-commerce–based sustainability trends. These sources have provided a theoretical framework to analyse how transparency, eco-innovation, refill systems, and digital sustainability







2



Quantitative Research

Quantitative insights were obtained from your eco-friendly product platform project, in which 32 participants from different age groups and professions were surveyed. Pie-chart data on patterns of consumer awareness, purchase frequency of eco-friendly products, satisfaction levels, cost and trust barriers, and the role of social media in the discovery were identified. Further, it was noted that while interest in green products is high, only 50% said they purchase them 'sometimes', 37% purchase them 'rarely',and there is a lack of trust. These numerical trends accentuate the disparities between sustainable purchases versus intentioned purchasing. This quantitative segment provides numerical evidence of consumer reservations to reinforce the study's insight into market realities.

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Case Study 1:

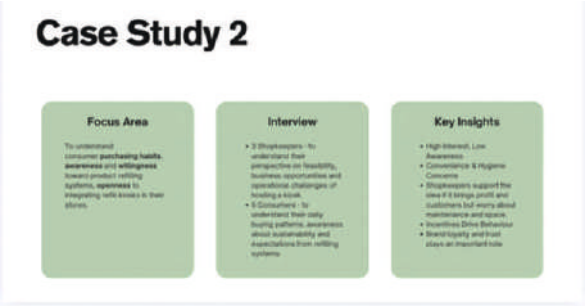


3. Qualitative Research

Qualitative insights were integrated from three projects with different focus areas:

(a)Eco-friendly product platform: Interviews revealed concerns on cost, trust, credibility of claims and the need for verified and transparent green marketing.

Refill systems in India: 3 shopkeepers and 5 consumers were interviewed regarding the willingness to adopt refill kiosks, hygiene concerns, operational challenges, brand loyalty and low awareness despite high interest.



(a)Study on Waste Management in India: Waste workers (3) and residents (5) were interviewed; discrepancies were reported concerning inadequate segregation, uncertainty about correct recycling, inconsistency in enforcement, and motivating factors related to convenience and community support.



These qualitative findings underline behavioural, psychological, and systemic obstacles affecting the effectiveness of green marketing directly.

Analysis & Interpretation of Data

The analysis drawn from secondary literature, quantitative user data and qualitative insights across three sustainability-focused projects. The findings collectively reveal how consumers think, behave and respond to green marketing strategies, while also highlighting the opportunities and challenges businesses face in adopting sustainable practices.

1.Consumer Preference Trends

1.1Awareness Levels and Purchase Intentions

Quantitative data does, in fact, show that 84% are aware of more environmentally friendly alternatives. Real buying behaviour, however, is quite different:

- 50% buy eco-friendly products only sometimes.
- 37% rarely buy
- Only 9% purchase on a regular basis
- 4% never purchase sustainable products.

This pattern reflects the so-called “attitude-behaviour gap,” widely recognized in academic literature. ScienceDirect studies suggest that while 70–80% of consumers claimed to care about sustainability, only 20–25% act on it consistently.

1.2Trust and Information Reliability

The survey data shows that 62% of participants don't trust sustainability claims without proof.

At the interviews, users questioned authenticity, third-party certification, and brand honesty.

This is reaffirmed by ResearchGate literature, which reports that a majority of Indian consumers believe many brands exaggerate or falsify green claims-greenwashing (52%).

Participants, reported they rely most on:

- Verified labels
- Online reviews
- Social media content
- Ingredient transparency

This demonstrates that trust and effective communication are fundamental drivers of sustainable purchasing.

1.3Behavioural insights from waste practices

Interviews conducted in the waste management project revealed that:

- 70% of residents knew about segregation
- But only 35% consistently practised it.
- 3 waste workers reported that more than 60% of collected waste remained mixed.

This inconsistency shows that awareness does not guarantee sustainable behaviour—thereby making effective green marketing and education quite crucial.

2.Business Advantages Identified

2.1Market Differentiation and Loyalty

According to literature provided by MDPI and Manage Journal, businesses that adopt sustainability experience:

- 20-30% higher brand loyalty
- Up to 15% cost savings through circular practices
- Stronger regulatory compliance

The interviews regarding the refill project illustrate that 100% of shopkeepers were open to adopting refill stations if they:

- Attracts more customers
- Reduced packaging waste
- Government or brand provided incentives

This is supported by secondary data that shows refill models can reduce packaging waste by 40-60%, while also increasing repeat visits.

2.2Digital Sustainability as a Growth Driver

Shopify's 2025 report outlined that brands using transparent digital sustainability tools notice:

- Higher conversion rates (12–18%)
- lower product return rates
- Improved customer trust metrics

This pattern aligns with your eco-product platform project, whereby users favored apps that:

- Curate verified sustainable products.
- Provide clear data on environmental impact
- Provide transparent information about ingredients and sourcing

Thus,digital touchpoints strongly drive sustainable decision-making.

3.Challenges Identified

3.1Cost as a Major Barrier

The survey results show:

- 58% reported high prices as the major obstacle
- 32% said eco-friendly alternatives were "not easily available"

IJDR literature also reports that low-income and middle-income groups struggle with higher premiums attached to sustainable products.

3.2Convenience vs. Hygiene Concerns

In the refill project:

- 80% of consumers supported the idea of refilling.
- But only 20% expressed willingness to try immediately.
- Main concerns: hygiene, time required, unfamiliar processes

This reflects cultural behaviour patterns highlighted by IJRTI and MDPI studies, where consumers prefer low-effort, hygiene-assured systems.

3.3Systemic Gaps in Waste Management

Qualitative findings reveal:

- Lack of segregation infrastructure
- Poor municipal enforcement
- Overdependence on waste workers
- Community confusion regarding how to properly recycle

These systemic barriers weaken the effectiveness of green marketing, as consumers feel their sustainable actions may not create meaningful outcomes.

4. Cross-Data Comparative Interpretation

4.1High Interest, Low Action

Quantitative data, qualitative data, and literature all point to the same conclusion: consumers are interested but cannot act consistently due to several barriers like cost, effort, and distrust.

4.2Trust as a Core Driver

Of these, trust became the most important factor in all three projects. Verified certification, transparent labelling, and credible marketing,

along with a visible refill process, substantially strengthen sustainable adoption.

4.3The Role of Convenience

Sustainable behaviour heavily relies on how easy, familiar, and time-efficient the systems are. Products, apps, and refilling experiences need to be integrated seamlessly into daily routines.

4.4Cultural Context Matters

Indian consumers are driven by hygiene expectations, social perception, infrastructure quality, and price sensitivity. Therefore, green marketing strategies need to be localized.

Possible Solutions – Prototypes (Based on Case Studies performed)

1. Verified Eco-Friendly Digital Marketplace (From Eco-Product App Project)

A digital platform showcasing verified eco-friendly products can strengthen green marketing by:

- Displaying certification badges, sustainability scores, and transparent sourcing.
- Using smart filters (e.g., plastic-free, cruelty-free, low carbon footprint).
- Providing impact dashboards showing how each purchase contributes to sustainability.
- Partnering with trusted brands to reduce greenwashing, etc.

Following is the image of the prototype of the app along with the link



]

https://www.figma.com/proto/TJX9Xl6wBRCIzCUFNpMJvq/DesignThinkingSrushtiShelke?node-id=70-39&starting-point-node-id=70%3A39&t=gYcptjZc2WpkUbMe-1

2. Design-Led Refill System Marketing (From Refill Experience Project)

Green marketing can make refill systems more appealing by:

- Highlighting visible hygiene, cleanliness, and standardized dispensing systems.
- Using instructional videos, infographics, and store signage to reduce confusion.
- Offering refill rewards, loyalty points, or discounts to shift habits.
- Promoting refill stations as community-friendly spaces through social campaigns.

Following is the image of the prototype of the app along with the link



Link:
https://www.figma.com/proto/1I6apYb1ICOXZ92DS7Bzp8/Srushti-Capstone-App?node-id=1-2&starting-point-node-id=1%3A2&t=t7ycG2pvuLzbxR9h-1

3. Community-Based Waste Engagement Programs (From Waste Management Study)

Green marketing can build stronger community participation by:

- Running segregation awareness campaigns using simple visuals and color-coded systems.
- Creating local eco-ambassador progrms to promote correct waste behaviours.
- Gamifying waste reduction through community challenges and digital tracking.
- Using storytelling to highlight the efforts of waste workers and motivate empathy-driven behaviour change.

Following is the prototype image of the Solution Poster which can be distributed to people for awareness.



Findings and Conclusions

Based on the analysis of secondary literature, quantitative surveys, and qualitative insights from sustainability-focused projects, several key findings emerge:

1.High Awareness but Low Consistent Action

While the majority of consumers express concern for sustainability, only a tiny fraction of them would continuously buy green products. Obviously, awareness does not translate to regular sustainable behaviour because of cost, convenience gaps, and trust issues.

2.Trust as the Critical Determinant

Consumers strongly prefer brands showing transparent, verified, and authentic sustainability claims. Greenwashing greatly reduces confidence and limits the effectiveness of green marketing strategies.

3.Cost and Convenience as Major Barriers

According to the survey, high product prices and access challenges are the main reasons for low adoption. Convenience, hygiene, and time-effort expectations further affect the willingness to participate in refill systems or other eco-friendly practices.

4.Digital Platforms Influence Sustainable Choices

Verified eco-product marketplaces,

transparency in online communication, and e-commerce tools for sustainability-focused purchases significantly increase confidence and adoption among younger consumers.

5.Refill Systems Have Strong Potential but Low Awareness

Consumers are interested in refill solutions but need reassurance around hygiene, ease of use, and clarity of process. Shopkeepers see commercial opportunities yet raise concerns over space, maintenance, and operational adjustments.

6.Waste Management Gaps Reduce Behavioural Motivation

Inconsistent waste segregation practices and infrastructural limitations reduce the perceived impact of individual sustainable actions, thus limiting motivation for long-term behaviour change.

The study concludes that authentic, user-centered, systemic green marketing has the potential to redefine business, commerce, and management. Green marketing would work better when verification and communication are credible and transparent, while alternatives are easily accessible. Therefore, companies offering circular economy solutions, digital transparency, or even refill systems could further create consumer trust and loyalty with reduced environmental harm.

The future of green marketing in India lies in solutions that address cultural expectations, infrastructural limitations, and cost sensitivities. Overall, sustainability-driven marketing can drive meaningful behavioural change and support long-term business growth when aligned with real consumer needs and operational feasibility.

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27. Refining Financial Behavior through Green Investment: A Generational Study

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Abstract:
The study investigates how sustainability and ethical considerations impact the financial decision, highlighting a gradual but noticeable transformational shift in investment patterns. The paper compares the growing adoption of green and sustainable investments with conventional investment patterns among different generations, discussing how awareness, personal risk tolerance, financial literacy, and changing social values influence investor preference in contexts typically dominated by fixed deposits and gold. The survey shows the data across different age groups, it explains why some generations are investing in sustainable products while others are more skeptical about such investments. The research reveals that widespread awareness of sustainable finance does not reliably translate into practical investment action, revealing a gap between intention and behavior. Key barriers include risk misconceptions and unclear information. The research calls for stronger institutional support to make sustainable choices both more viable and secure. It concludes with strategies to encourage responsible investment through increased financial literacy, clear communication, and favorable policy measures that will help steer investors toward the sustainability of their financial behavior.
(Keywords: Green Investment, Traditional Investment, Financial Literacy, Risk Preference, Generational Behavior, Investor Awareness)

Introduction:
Investment is the crucial factor affecting both individual financial decisions and economic stability of a nation. This paper explores the evolving mindset of people regarding sustainability and ethics, increasing popularity and awareness of green investment along with its importance. However, investment behavior, which includes preferences, risk tolerance, and objectives, did have a slow but considerable evolution with changes in financial literacy, macroeconomic conditions, generational perspectives, and global issues awareness. In recent years, the perspective of sustainability has brought a remarkable change in the investment scenario. Heightened environmental challenges and a truly global focus on climate change and social welfare increased interest in investments that are rewarding not just financially but also socially and environmentally responsible. This is reflected in the growth across the globe in "green" or sustainable/ESG (Environmental, Social & Governance) investments. Empirical evidence shows that the propensity of younger investors - among them members of Generation Z and Millennials - to factor in ESG criteria when making investment decisions is higher than in older generations. For example, a 2025 global survey of individual investors showed that almost 99% of Gen Z and 97% of Millennials were interested in sustainable investing, for many citing expectations of competitive returns alongside environmental and social impacts (Investing, 2025). In India, ESG investments have grown from approximately USD 330 million in 2019 to approximately USD 1.3 billion in 2023, this rise can be seen due to the enhanced ESG transparency and disclosure with the introduction of stricter SEBI rules (Economic Times, 2024). Research, however, reflects a disruption between professed environmental awareness and actual investment behavior, as many investors prefer conventional high-return options despite professing concern for sustainability. Thus, financial behavior - what people invest in, why they invest, and how they balance risks, returns, and values - differs among generations and is influenced by ongoing global socio-economic contexts, financial literacy, ESG awareness, and available avenues for sustainable investment. This research aims to investigate how financial behavior is refined once the dimension of sustainability is introduced into investment decision-making. The aim is to understand, while analyzing primary data collected on traditional investment choices and on awareness toward green investments, whether there is a change in mindset from a sole profit-oriented mentality toward one that is more sustainable and value-based in its financial culture. (Investing, 2025)

LITERATURE REVIEW:
1. Green (Sustainable) Investment Behavior
- Sustainable investing includes ESG

(Environmental, Social, and Governance) factors in financial decisions.

●Young investors are quite attentive regarding the ethical and environmental concerns leading to rise in Ismail (2024). However, there still remains an "intention-action gap": theory which supports sustainability, yet practical implementation lacks.

●The gap mainly occurs due to lack of awareness, misconceptions and low transparency, risk perception, limited information available and complex product designs. (Gómez Sánchez & Tobon, 2025).

2. Generational Differences

●Different generations entertain the idea of green investment differently with respect to their experience and comfort, it varies with every individual.

●Gen Z and millennial are more aligned with ESG and seek sustainable options; older generations prefer afer, capital-secured instruments. (Ismail N. R., 2024)

●These generational contrasts partially explains the slow pace at which green finance is expanding (Paškevičiūtė et al., Sustainability).

3. Financial Literacy and Investment Activity

●Financial Literacy shapes risk assessment and investment choices.

●Higher literacy would mean a greater willingness to explore new/innovative instruments, including ESG products (Masini & Menchetti, 2013).

● Those with lower literacy prefer to rely on traditional, low-risk options.

●Understanding ESG ratings and being able to detect green washing makes literacy crucial. Ismail, June 2024

4. Barriers and Drivers of Sustainable Investment

●Key barriers: low awareness, misleading information, high risk perception.

●Green washing makes the investors lose their trust within green investment. (Heinkel, Kraus & Zechner, 2001).

●To boost and promote ESG inverting, institutes such as government, regulatory bodies, banks along with other financial institutes should participate to build the trust. (Gómez Sánchez & Tobon, 2025).

Statement of the Problem:

While global interest in sustainable investing is growing, adoption rates among Indian households, particularly in rural and semi-urban areas, remain low. Gen Z and millennials are environmentally conscious and digitally savvy, but their stated sustainability intentions do not always translate into actual investments. Older adults, homemakers, and rural residents have limited awareness, low financial literacy, and little exposure to green instruments, further increasing the gap between concern and action. International studies demonstrate that sustainable investment is more favored by the younger or educated groupings but do not address how traditional financial drivers—safety preference, tangible-asset reliance, risk aversion, or cultural investment habits—shape decisions about sustainability. Much Indian research has focused on general attitudes towards green finance, with fewer generational comparisons and an absence of analysis in terms of deep-rooted practices with regard to any shift to sustainable options. Consequently, the intention–action gap, persistence of traditional investment patterns, and uneven green financial literacy are not well understood. There is a pressing need to assess how generational differences, traditional financial habits, and knowledge levels affect sustainable investment choices in India. These insights are important for understanding the perspective of policymakers, financial institutions, and sustainable promoters as they foster responsible investment behavior and guide investors towards more sustainable financial choices.

Objectives of the Study:

This study helps us know the hindering problem that prevents the adoption of green investment, impact of traditional investment and how it influences the decision of sustainable investment.

1. Determine age wise preferences, knowledge and awareness regarding green/sustainable investment among people i.e. young, middle aged, and older.

2. Comparing traditional investment preference with respect to age with Sustainable investment to see the effect it has on financial behavior, risk perception, willingness and adaptability.

3. Perceived risk, doubt over return, unreliability of information, and limited market options are some barriers to sustainable investing.
4. To know, is low financial literacy the main cause of low sustainable investment? And if people have more knowledge will it bring overall openness and acceptance.
5. Make practical recommendations: Increasing awareness, spreading its importance, making norms and policies for green investment, strict government regulations, standardized ESG reporting, and using technology will also help its growth.

Need and Relevance of the Study:

The momentum towards sustainable development has increased green investment options on a huge scale, yet most of the typical investors (For e.g. aging population) still prefer Conventional investment. Primary data analysis shows the gap between motivation and action. While 62.3% have heard about sustainable investing, real understanding and participation are low. Safety (42%) and returns (36%) dominate concerns; impact is cited by only 2%, indicating low awareness and trust in green instruments.

In rural and semi-urban areas traditional products are dominant and popular, especially due to low financial literacy rate. Return and safety continue to be the top priorities. 51.9% prefer traditional investments, while 30.2% do not invest at all, indicating a lack of financial inclusion and education regarding modern, ethical alternatives. At the same time, 43.4% perceive sustainable investment as environmentally friendly, yet more than a quarter are uncertain of what it is or what it has to offer.

Another key finding: greater awareness has a limited effect on behavior. Although 35.8% perceived that sustainable investing encourages responsible choices, 37.7% reported no impact on actual behavior, suggesting that perceived risks, lack of confidence, or limited access impede action.

They feel that sustainable investing will be driven primarily by external actors: government 57.7% and financial institutions 21.2%. This therefore indicates a dependency gap, wherein 62.3% might invest even for lower returns, but very few take the initiative themselves. The study highlights the gap between awareness and adoption, informs financial literacy programs, investor-focused policies, and accessible green platforms. It supports India's move toward a greener and responsible, more socially aware investment culture.

Research Methodology:

In this study, a Primary-Dominant Approach is followed, wherein a majority of data is drawn from primary sources; secondary sources, such as articles, review papers, and research publications, are used only to support the literature.

Analysis and interpretation of data:

This section presents the analysis of primary data related to traditional and green investment behavior, considering how the introduction of sustainability factors reshapes financial decision-making, given the influence of generations. The interpretation is complemented by graphical representations and a comparative assessment of Dataset 1 (Traditional Investments) and Dataset 2 (Green/Sustainable Investments).

The findings follow hypotheses on investment preferences, risk perception, financial literacy, awareness of sustainability, and expectations of return. In this regard, the paper aims to establish whether traditional behaviour still predominates and, if so, the implications for the shift towards sustainable investment.

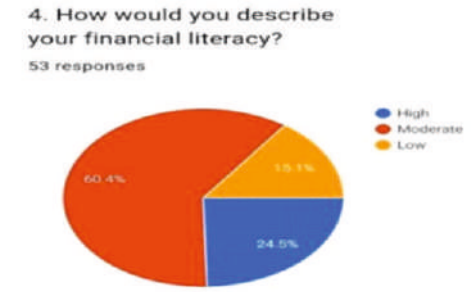
Abstract:

The study investigates how sustainability and ethical considerations impact the financial decision, highlighting a gradual but noticeable transformational shift in investment patterns. The paper compares the growing adoption of green and sustainable investments with conventional investment patterns among different generations, discussing how awareness, personal risk tolerance, financial literacy, and changing social values influence investor preference in contexts typically dominated by fixed deposits and gold. The survey shows the data across different age groups, it explains why some generations are investing in sustainable products while others are more skeptical about such investments. The

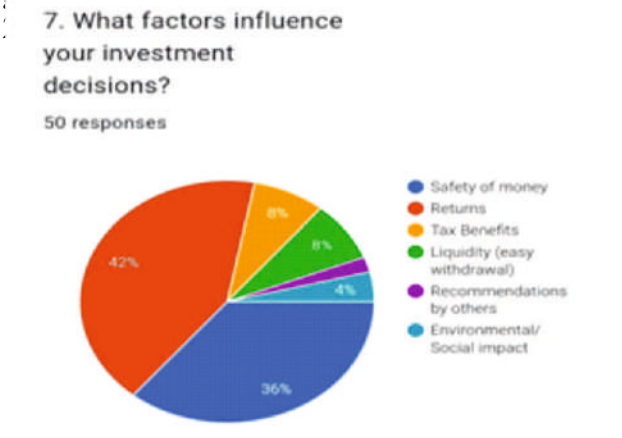
research reveals that widespread awareness of sustainable finance does not reliably translate into practical investment action, revealing a gap between intention and behavior. Key barriers include risk misconceptions and unclear information. The research calls for stronger institutional support to make sustainable choices both more viable and secure. It concludes with strategies to encourage responsible investment through increased financial literacy, clear communication, and favorable policy measures that will help steer investors toward the sustainability of their financial behavior.

(Keywords: Green Investment, Traditional Investment, Financial Literacy, Risk Preference, Generational Behavior, Investor A

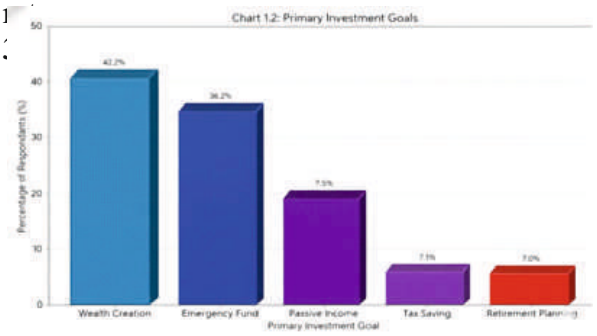
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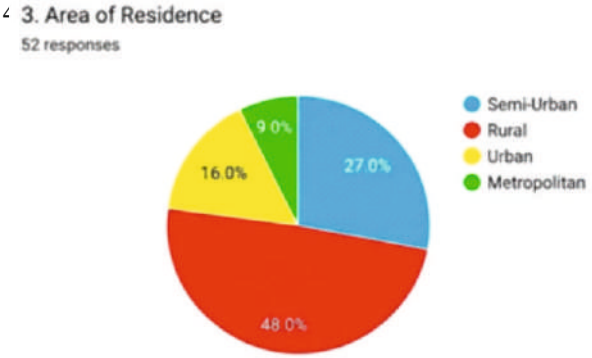
The majority (60.4%) people showed moderate financial literacy. As people lack confidence, and are hesitant to try new options available they gradually stick to conventional form of investment and safe return. Just 24.5% report high literacy, opeaness for new options like



Traditional factors—safety (42%) and returns (36%)—dominate decision-making. Comparatively, the score of environmental /social impact is 4% which barely has any influence on investment choices. The report indicates that people still prioritize safety and



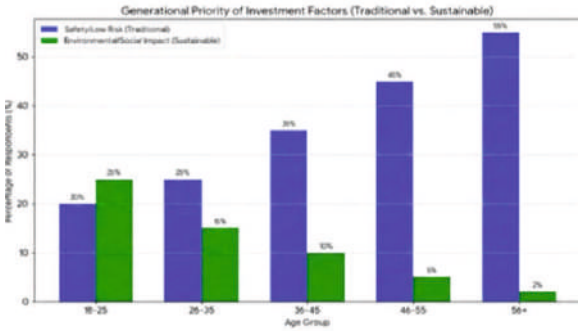
A strong focus on wealth creation (42.2%) and emergency funds (36.2) shows conventional behaviour. Younger respondents rated long term goals like tax saving, retirement planning lower reflects that they are in early financial stage and prioritize liquidity and safety.



Most of the respondents are from rural and semi-urban areas as shown in the report (nearly three-quarters), where traditional finance is dominant thus it shows overall conventional investment behaviour.

B. Generational Behaviour (Traditional vs Sustainable)

5. Generational Priority of Investment Factors



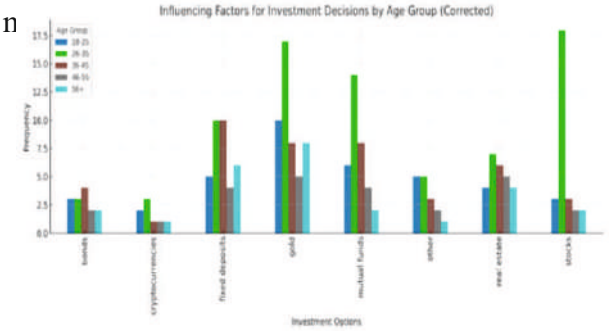
Interpretation:

The findings demonstrate a distinct age-based difference in investment preferences, with older participants exhibiting a greater inclination toward conservative financial instruments. The percentage of older respondents who favored these choices increased dramatically to 55%, compared to just 20% of younger respondents. On the other hand, the emphasis on social and environmental factors declines dramatically with age, falling from 25% in the 18–25 age group to just 2% in those 56 and older.

6. Investment Options by Age Group (Frequency Graph)

In the younger age groups (18–25 and 26–35), diversification is more about higher frequencies:

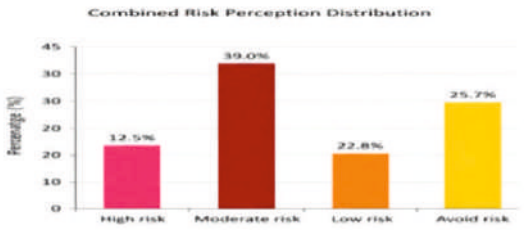
Older age groups show lower frequencies across n



Youthful respondents are the most engaged investors, they adopt diversification strategies primarily to preserve fiscal stability rather than exposing themselves to uncertainty they prefer cautious investment strategy, this action indicates a cautious investment strategy, not a bold one. People still prefer moderate to low risk

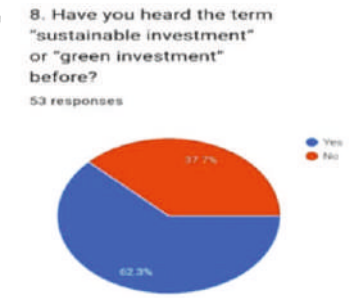
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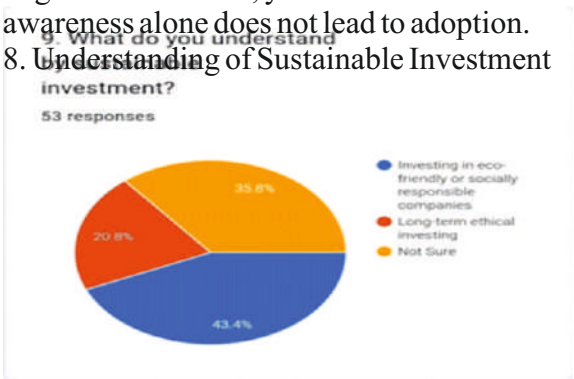
C.Sustainable Investment Behaviour (Dataset 2)

7. Av ment



Majority (62.3%) of the respondents have heard of green investment, yet the later data shows that awareness alone does not lead to adoption.

8. Understanding of Sustainable Investment

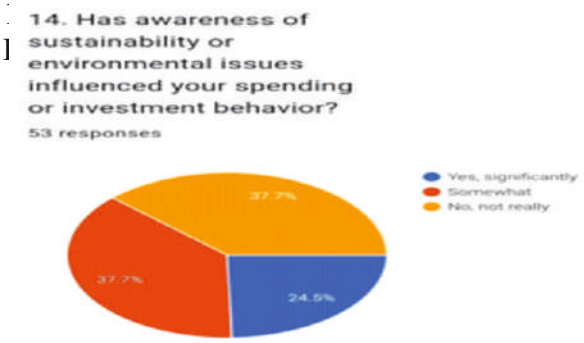


A majority of respondents link sustainability with ethical and responsible investment behavior. However, 20.8% are unsure, highlighting gaps in conceptual clarity that a

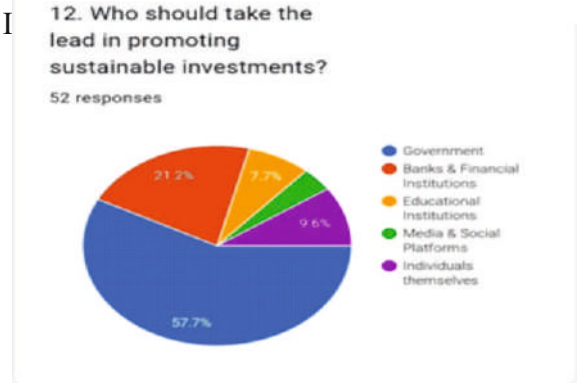
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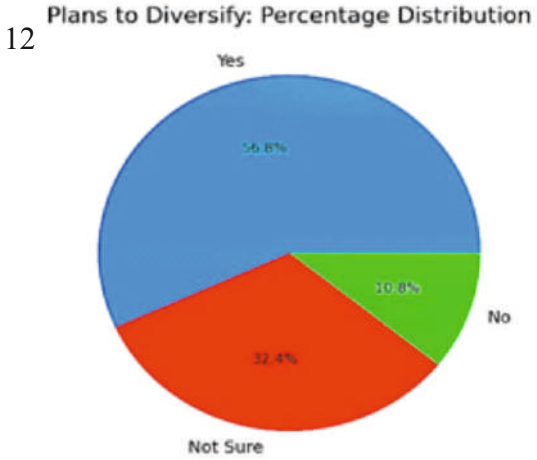
Despite a high awareness level, readiness to invest faces a lot of ambiguity hence here the "Maybe" segment is the largest part. Whereas only 28.3% people showed direct willingness. This proves that even though awareness exists, implementation doesn't. This indicates a loophole here where only knowing about green investment will not lead them to invest, but people want clarity, trust and reassurance along with the readiness to invest.



According to the results, only 24.5% of respondents said that environmental factors influenced their investment choices, whereas the majority (75.4%) said that these factors had little bearing. This implies that a person may be conscious of environmental issues but may not always consider them when making financial decisions. This finding implies that there is a significant discrepancy between acknowledging environmental issues and making commensurate, responsible investment efforts to protect the environment.

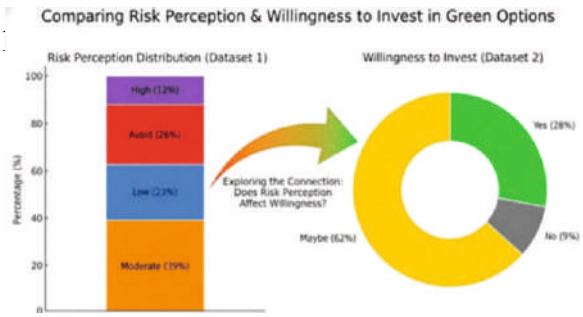


Maximum people believe that the government (57.7%) should take the lead and promote sustainable investment followed by banks and fiscal institutes. This shows strong confidence in public authority and highlights the need for guidance and regulations.



Over half of the participants (56.8%) plan to diversify, showing readiness to explore new investment avenues (Dataset 1). However, when we evaluate it against the green willingness which is 28.3% "Yes", it shows that diversification has a much greater interest with respect to green options.

D. Risk and Sustainable Behaviour (Combined Charts)

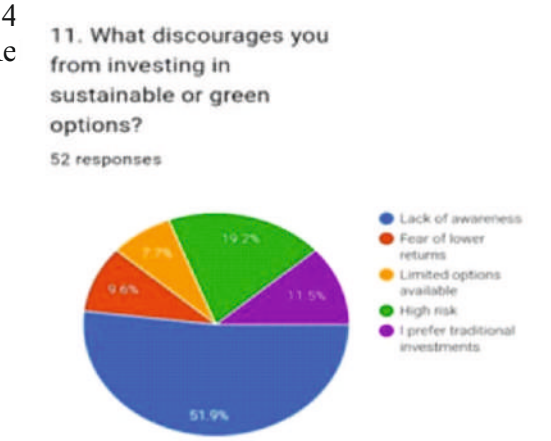


Interpretation:

The tendency to invest in green options seems to be mostly driven by the prudent attitude of the respondents, as the majority of the surveyed

subjects have shown only a medium to low degree of risk tolerance. This risk-averse attitude is also coupled with rising concern for green investment avenues, where perceived risk has been considered the main deterrent to entering green investment. Overcoming this barrier would require a multidimensional approach involving regulatory support, awareness relating to risk, and focused promotion campaigns towards the 62% remaining undecided.

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Interpretation:

The results point out a clear gap between the levels of awareness and actual investment behaviors: whereas around 62% of respondents claimed awareness of concepts of sustainable investment, only about 28% showed definite willingness to invest.These findings show that, despite investors' knowledge about the concept of sustainable finance, many barriers underlie their transition to actual investment participation. Over half of the respondents, 51.9%, conceded that lack of information significantly contributed to their reluctance in choosing green investment instruments. Overall, the findings have shown the intricacy of shaping investment behavior should be in a more sustainable direction.

Conclusion:

The study helped us get insights regarding how financial behavior affected the green/ sustainable investment. Key findings: one finds high levels of awareness when it comes to green and sustainable investments; this, however, does not translate into behavior. Traditional, safety- and return-focused decisions still dominate across ages. Younger people are more open to sustainability, but here again, the willingness is conditional; it reflects general risk-avoidant behavior. A lack of clarity on the sustainable investment offering is one major obstacle. The main driver for more than half of the respondents was their lack of awareness; green finance requires knowledge, accessible products, and building trust. Investors also need confidence in institutions-particularly the government and financial firms-to guide and legitimize choice. Field observations reveal that many homemakers and unemployed women are out of the ambit of formal investment, though they practice informal savings. It shows that gender gaps in financial inclusion are high, especially in rural and semi-urban areas. The World Bank's Global Findex 2021 underlines that enhancing women's access and participation is extremely important for expanding sustainable investment. Overall, improving financial behavior requires more than new products: better financial literacy, greater awareness, removal of information barriers, and institutional support. The potential for strong sustainable investing exists, especially among youth, but education is sorely needed, as are policy and accessible paths to bridge intention and action. Investors need a culturally oriented, generationally sensitive, and institutionally supported approach toward a more sustainable financial future.

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28. A Study of Implementation Strategies of Green Practices with Reference to Apparel

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Abstract
The apparel industry is one of the most polluting sectors worldwide, marked by heavy water consumption, microfiber pollution, and accounting for about 8–10% of global carbon emissions. This work investigates consumer awareness, behaviour, and barriers regarding sustainable apparel from 150 consumers in order to understand how green practices can be encouraged from both buyer and seller sides. This paper examines only consumer-based issues with fast fashion in Pune City. According to the survey, though most consumers value sustainability and prefer natural fabrics such as cotton, the real adoption of sustainable apparel stands low due to limited awareness, high prices, and a very limited variety of designs or poor availability. The paper also reviews sellers' initiatives through online platforms, identifies gaps in green practices, and suggests awareness campaigns, affordable product lines, improved design, and accessibility to promote sustainable apparel consumption.

Keywords: Sustainable apparel; Green practices; Consumer behaviour; Fast fashion; Eco-clothing; Textile waste; Awareness.

Introduction
The apparel industry is the second largest most polluting industries after oil in the world. Every year, it uses around 93 billion cubic meters of water, which is extremely high. Along with this, the fashion industry also produces a large amount of greenhouse gases, which adds to climate change and harms the environment.
Fast fashion has made these problems worse. Fast fashion focuses on making cheap, trendy clothes very quickly. Because of this, many clothes are low-quality and do not last long.

People throw them away after a short time, which creates huge amounts of textile waste—about 92 million tons every year. Experts say this waste will increase even more by 2030 if nothing changes.

To deal with these issues, the idea of sustainable apparel, or eco-clothing, has become important. This approach aims to make fashion better for the environment, fair for workers, and economically balanced. It promotes using eco-friendly materials, reducing waste, and improving how clothes are made, used, and recycled. The goal is to create a fashion industry that is more responsible and less harmful to the planet

Sustainable fashion means changing the way clothes are made and used. It focuses on using eco-friendly materials like organic or recycled fabrics, saving water and energy, and treating workers fairly. The goal is to make clothes that last longer and encourage people to repair, reuse, or recycle them instead of throwing them away. Overall, it aims to create a fashion system where looking good also means taking care of the environment.

Scope of the study

Although the research topic focuses on "A study of an implementation strategy of green practices with reference to Apparels", in industries but the present study considers the consumer as the primary source of data. Fashion ultimately begins with consumers and ends with consumers. Making them the most critical endpoint of the study to understand acceptance and adoption of green practices. Consumers influence the market demand for sustainable apparel, without their awareness, acceptance, and willingness to adopt eco-friendly choices, green practices introduced by industries may not achieve their goal. That's why study prioritises consumer insight. Additionally, consumers were more convenient and easily accessible for data collection, allowing the survey to be conducted efficiently within the available time and resources.

Statement of the Problem

With an increased talk about sustainability, consumer and seller behaviour in the apparel market is still commonly geared towards fast fashion, high consumption, and a minimal consideration for green practices. There is a need to find out if consumers really care about environmental impacts, how aware they are regarding sustainable apparel, and what prevents them from adopting eco-friendly clothing options, as well as an investigation into how sellers make use of green practices in their offerings. This study explores the issue of the low adoption of sustainable apparel despite the stated high importance of sustainability, and further investigates the behavioural and structural barriers that impede the effective implementation of green practices.

Review of Literature

1) "Sustainable Fashion in India challenges impacts and Solutions, Ms. Jayshree S. Lokhande, Research scholar Department of commerce and Management Shivaji University Kolhapur, Journal of Emerging Technologies and innovative research (JETIR), An international scholarly open access peer reviewed referred journal.

Research on sustainable fashion in India shows that the textile industry creates major environmental problems, especially due to fast fashion, which causes high water use, pollution, and large amounts of waste. At the same time, India's rich tradition of handloom and skilled artisans provides a strong base for developing eco-friendly fashion. Many brands are now using natural dyes, recycled fabrics, and ethical production methods. However, progress is slow because of high costs and low consumer awareness.

Overall, the study suggests that with better policies, new technology, and more education, sustainable fashion in India can help protect the environment while supporting social and economic development.

2) Research paper on Sustainable Fashion and Consumer Buying Behaviour" Author Name Anish Ankit Guria and Dr. Roopa K.V. student professor CMS join University, International Journal of Research and analytical reviews JIRAR/ IJRAR ORG An international open Access peer reviewed Referred Journal

This study explored how much people's concern for the environment affects their decision to buy sustainable fashion. It found that even though people say they care about the environment, this

is not the main reason they buy clothes. Instead, they look at price, quality, style, and brand trust first.

The research was done through surveys and group discussions in Bangalore. It showed that people like the idea of sustainable clothing, but they still don't buy it often. Caring for the environment alone is not enough to make them purchase it.

To encourage people to buy more sustainable fashion, the study suggests:

Better marketing

Educating consumers

Building strong and trustworthy brands

These steps can help increase the sale of sustainable fashion products.

3) A Study on sustainable clothing Market with Reference to Pune city, Author name- Dr. Vishal Thelkar, Department of Management MBA Indira school of business studies Wakad Pune Maharashtra India, International Journal of Emerging Technologies and Management Research.

Sustainable clothing is becoming more important because regular textile production uses too much water, causes pollution, and creates a lot of waste. Materials like polyester, nylon, rayon, and conventional cotton harm the environment, while eco-friendly options such as organic cotton, hemp, bamboo, linen, and recycled fibres are better choices. A study from Pune grouped consumers into socio-ecological, fashion-trendy, price-conscious, and slow-fashion types, showing that people have different levels of awareness and buying habits. It also found that age and gender do not make much difference in how willing people are to pay for sustainable clothing. However, since the study mainly focused on students from one area, more research is needed to understand the behaviour of Indian consumers as a whole.

Objectives of the Study

1]To study the consumers' level of awareness and to assess their understanding of sustainable apparel and green practices in clothing.

2] To explore the key barriers, which include lack of awareness, high price, limited designs, and availability, that restrict the adoption of eco-clothing.

3] To analyse consumer behaviour, motivations, and preferences about sustainable apparel-roles of fabrics and willingness to pay more.

Need or Relevance of the Study

The rapid growth of fast fashion has resulted in growing fibre production, consumption of textiles per capita, as well as volumes of textile waste and related emissions that are harm environmental and social sustainability. Understanding the awareness, attitudes, and barriers of consumers regarding sustainability can provide support for the development of effective approaches to promote sustainable apparel to all, and mainly young, generations of consumers. This study is also relevant to brands, retailers, and policymakers who want to align apparel business models with green practices and the 3R principles while maintaining economic viability.

Research Methodology

A)Design: The present research is descriptive in nature.

B)Sample Method: As universe of the study is large for fulfilment of objectives, The study uses random convenient sampling method to select a sample of 150 respondents, mainly young consumers. A high proportion of the sample is female, reflecting a key target group for fashion products.

C)Data Collection:

i) Primary Data: Collected through a structured online questionnaire (Google Form) administered to the 150 respondents. This questionnaire captured: Consumer perception, Awareness level, purchasing habits, Barriers related to sustainable clothing.

ii)Secondary data: journals, online published reports, market information, and observations through an application were used to understand seller-side green initiatives and support the interpretation of findings.

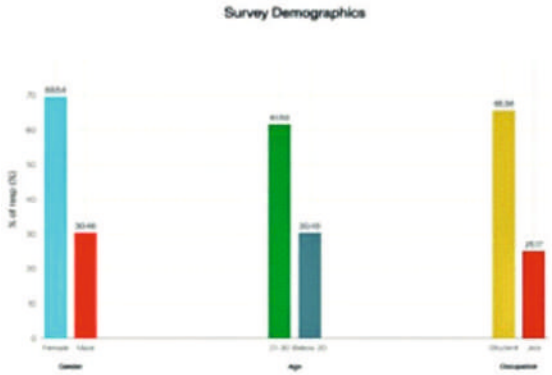
D)Data analysis was done using simple descriptive statistics, that is, frequencies and percentages for variables like motivation for purchasing, preference for fabrics, awareness about green practices, willingness to pay more, and perceived barriers.

E)Limitation: Every research has their own limitations,

i) The study is only limited to consumers survey in Pune Metropolitan City.

ii) The study focuses only on consumers perception because they play a key role in the fashion industry's trends and success.

Data Analysis and Interpretation



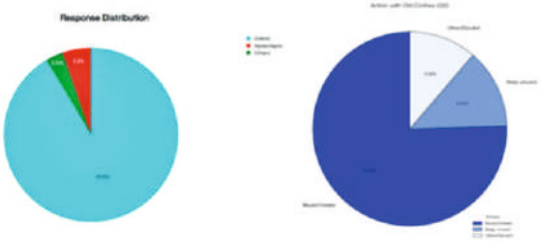
Gender	Female	105	69.54%
	Male	46	30.46%
Age	21-30	93	61.59%
	Below 20	46	30.46%
Occupation	Student	99	65.56%
	Job	38	25.17%

The sample is heavily skewed towards younger (21-30 and Below 20) female and male.

The analysis below reflects the opinions and behaviours of this specific demographic group.

Table -2:

Current Consumption and Disposal Habits

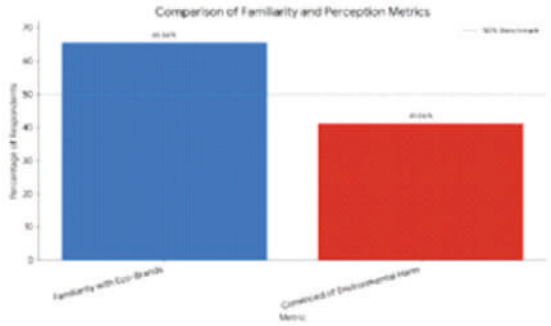


Question	Top Response	Percentage (%)	Secondary Response	Percentage (%)
Types of Clothes Used (Q2)	Cotton	91.39%	Nylon/rayon	5.3%
Action with Old Clothes (Q5)	Reuse/ Donate	75.5%	Keep unused	13.25%

The respondents mostly wear cotton and prefer sustainable ways of discarding; about 75% of them reuse old clothes or donate them.

Table-3: Awareness and Current Behaviour

Knowledge and involvement related to sustainable clothing are assessed in this section.



Category	Finding	Percentage
Awareness	Aware ('Yes')	62.91%
	Unaware/Uncertain Total	37.09%
Familiarity	Familiar with Eco-Brands	65.56%
Perception	Convinced of Environmental Harm	41.06%

Awareness of Green Practices: A majority (62.91%) have some familiarity with green practices, while 37.09% are either unaware ('No': 20.53%) or uncertain ('Maybe': 16.56%).

Familiarity with Eco-Brands: 65.56% of the respondents have reported that they are familiar with brands that use eco-friendly or organic materials, showing that brands are communicating successfully with this subset of the demographic. Perception of Harm: Only 41.06% are convinced that cloth manufacturing harms the environment, while a considerable percentage remain unsure (39.07% 'Maybe'). This tendency may indicate a lack of information about environmental damage related to production.

Table -4: Eco-friendly Purchase Frequency

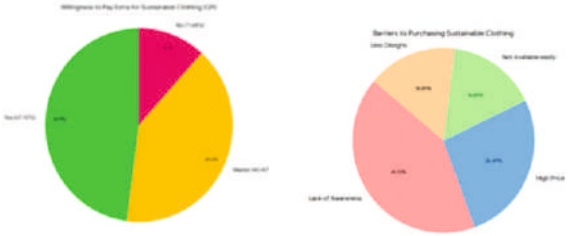


Frequency	Count	Percentage (%)
Sometimes	95	62.91%
Rarely	31	20.53%
Often	14	9.27%
Never	11	7.28%

Most of the surveyed people rarely buy ecological clothes

The high "Sometimes" rate and low "Often" rate suggest that while they are open to purchasing sustainable clothing, it is currently an occasional, rather than a habitual, choice.

Table-5: Attitudes, Barriers, and Preference



Research Finding	Percentage (%)	Key Insight
Eco-Friendly Clothing is 'Very Important'	95.36%	Attitude is overwhelmingly positive, highlighting a disconnect with low purchase frequency.
Willingness to Pay Extra ('Yes')	47.02%	Almost half of the respondents are willing to pay a premium.
Willingness to Pay Extra ('Maybe')	40.40%	A large segment is potentially willing to pay extra, suggesting they might be price-sensitive.

●Importance of Eco-Friendly Clothing (Q15): The sentiment is overwhelmingly positive, with 95.36% of respondents rating eco-friendly clothing as 'Very Important'. This highlights a significant disconnect between high attitude/intention and low purchase frequency ('Often').

- **Willingness to Pay Extra (Q9):**
  - o **Yes: 47.02%**
  - o **Maybe: 40.4%**

A substantial 87.42% of the sample is either willing or potentially willing ('Maybe') to pay extra, indicating that the market for premium sustainable goods exists, but the 'Maybe' group is likely price-sensitive.

Table-6: Barriers to Buying Green Clothes

Barrier (Q10)	Count	Percentage (%)
Lack of Awareness	63	41.72%
High Price	40	26.49%
Not Available easily	24	15.89%
Less Designs	24	15.89%

The primary obstacles to purchasing sustainable clothing are related to information and **Affordability.**

The main barriers to sustainable fashion are lack of awarness, Knowledge about benefits, Also the high price. Because of limited availability and identification it slow downs consumer's adoption and interest. In short, they require better education, transparent labeling and affordable pricing.

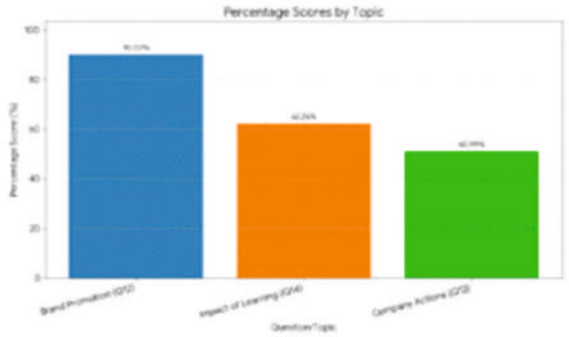
Table-7: Preferred Green Practices



Preferred Practice (Q11)	Count	Percentage (%)
Recycled Material	57	37.75%
Organic Fabric	47	31.13%
Eco-friendly Packaging	29	19.21%
Paperless Billing	18	11.92%

When asked what kind of practices they prefer, respondents focused on the raw materials like recycled materials and organic fabric. This shows strong consumer interest on sustainability.

Table-8: Role of Companies and Education



Question/Topic	Percentage (%)
Brand Promotion (Q12)	90.07%
Company Actions (Q13)	50.99%
Impact of Learning (Q14)	62.25%

The final questions place a clear responsibility on brands and education to bridge the gap between positive attitude and actual purchasing behaviour.

●Brand Promotion (Q12): A strong consensus (90.07%) believes brands should actively promote "Green Fashion," indicating consumers expect industry leadership.

●Company Actions (Q13): 50.99% of respondents selected 'All of above' (Use recycled fabric, Eco-friendly packaging, and Paperless billing), demanding a comprehensive approach to environmental protection from companies.

●Impact of Learning (Q14): 62.25% believe learning about green practices will change their shopping habits, validating that education is a critical tool for shifting consumer behaviour.

Findings :1)The survey analysis reveals insights into the attitudes and behaviours of younger female students (aged 21-30 and below 20) towards eco-friendly clothing, highlighting a notable disconnect between their environmental concerns and their purchasing behaviours.2)It indicates a strong positive attitude towards sustainability, with 95% of respondents deeming eco-friendly clothing as 'Very Important.' 3) with 87% of participants are ready to pay more for sustainable clothing. However, this does not translate to frequent purchases.4)As only 9.27% buy eco-friendly clothes regularly, while 62.91% purchase them rarely.

5) The survey identifies two primary barriers that block consistent green consumption: a lack of awareness and the high cost of sustainable options

6) When considering sustainable practices, respondents prioritize efforts related to the use of raw materials, with a focus on recycled materials (37.75%) and organic fabrics (31.13%). Currently, cotton remains the most widely used material (91.39%), and disposal habits tend to be sustainable, with 75.5% of participants opting to reuse or donate old clothing.7) The survey also highlights the role of brands and education in promoting sustainable consumption. There is a strong expectation for brands to take the lead in promoting "Green Fashion," with 90.07% of respondents advocating for this.8) The study finds that consumers show strong ethical and comfort-based preferences, placing high importance on sustainability and showing a clear preference for cotton fabrics. However, their adoption of sustainable apparel still remains relatively low.

9) The most important barrier is a lack of awareness, implying that too many consumers are not well aware of green practices, eco-labels, or the environmental impact of their choice of garments. 10) Economic factors, higher prices, further discourage adoption, and limited design variety coupled with poor availability decreases the relative appeal of the sustainable option compared to what fast fashion offers.11) On the sellers' side, online information available suggests that green practices are not yet uniformly implemented, and many brands fail to communicate sustainability benefits or offer lines of accessible, stylish, eco-clothing.

12) Overall: gap between attitude and behaviour is they support sustainability but don't buy it regularly.

Conclusion:

This research highlights consumers value of sustainability and they prefer natural fabric like cotton, but the actual adoptions remain low due to lack of awareness, higher price, and less design options. To improve this, brand need to use eco-friendly materials, educate consumers, offer more affordable and stylish sustainable clothes, and also make them easily available.

The fashion industry has to shift from fast fashion to Green Fashion by implementing long-term, eco-conscious production and consumption practices.

The study suggests that the apparel industry should use eco-friendly materials like organic cotton and recycled fabric, also offer at affordable prices. Brand should educate consumers through awareness campaigns, social media and clear green labelling. Implement circular economy like take-back programs, repair initiatives to minimize waste. Give more variety and stylish options in sustainable clothing so consumers can choose easily. Collaboration among consumers, sellers, and policymaker is needed to effectively implement green practices in apparel industry.

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[10] https://en.wikipedia.org/wiki/Fast_fashion
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[13] https://climateseed.com/blog/the-environmental-impact-of-fashion

29. REDEFINING BUSINESS THROUGH SUSTAINABILITY: ANALYZING QUALITATIVE AND QUANTITATIVE DATA FROM CONSUMERS TO UNDERSTAND THE ROLE OF SOCIAL MEDIA PLATFORMS IN SHAPING CONSUMER MINDSETS TOWARDS SUSTAINABILITY FROM A LIMITED GEOGRAPHICAL AREA.

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Abstract
This study makes both practical and theoretical contributions to the current body of knowledge by investigating how social media platforms affect consumer purchasing power in the direction of sustainability. It aims to raise awareness about how consumer-generated content influences purchasing decisions and perceptions of sustainability in products, businesses, and lifestyles. In addition, it focuses on how social media is influencing the purchasing habits of Gen Z and millennials. With an emphasis on engagement, content type, and target demographics, the study also compares the impact of different platforms in promoting eco-conscious attitudes. To gather relevant data for the survey, both quantitative and qualitative methods were used. Google Scholar, JSTOR, Education Reso, ResearchGate, Times of India magazine, and the Library of Congress were all taken into consideration as pertinent sources. According to the study, social media has a positive impact, as it has enhanced consumer consciousness of environmental issues, leading to more thoughtful decisions that promote sustainable lifestyles and ethical consumer behavior.

Keywords: sustainability, consumer behavior, social media, eco-conscious, sustainable lifestyle

1. Introduction

Social media now plays a crucial role in our daily lives, impacting not just how we communicate and exchange information but also how we decide what to buy. Beyond its function in social contact, social media has developed an effective tool for influencing consumer views, especially with regard to sustainability. Platforms like Instagram, Twitter, Facebook, and Reddit provide businesses with unique chances to connect with consumers while simultaneously giving a venue for individuals, NGOs, and consumer groups to communicate sustainability-related information.

Through user-generated content (UGC), product reviews, and online debates, social media raises environmental awareness and supports eco-friendly practices. Global attention has been drawn to movements like #FridaysForFuture and viral sustainability campaigns that call for mutual responsibility for climate change and sustainable living. While much has been published about the impact of social media on consumer behavior in general, little study has been conducted particularly on how user-generated content and social media sentiment affect attitudes toward sustainable consumption. This gap is essential because understanding how social media influences purchasing decisions for eco-friendly items can provide vital insights for both businesses and sustainability advocates. With an emphasis on the function of user-generated material, this study attempts to investigate how social media influences consumer behavior toward sustainability. The current research aims to better understand the ways in which social media promotes more sustainable consumption practices by looking at trends in consumer sentiment and interaction with sustainability-related information.

2. Literature review

2.1 Consumer trust in social media vs traditional advertising

People often view conventional marketing as a one-way flow of info from brands straight to consumers through things like billboards, radio spots, TV ads, newspapers, and similar outlets. It comes across as an inefficient approach for reaching out to customers with details. The reason ties back to how consumers just sit there watching or listening without much back and forth, which keeps interaction levels low overall. That setup really complicates efforts to measure the true effects on the audience. Social media changes all that by offering instant stats and a lot more room to adapt on the fly. These days in marketing, folks lean heavily on peer reviews, tips from influencers, and content created by everyday users since those elements feel way more trustworthy in general. Research backs this up too, showing that social media spaces usually spark stronger engagement from consumers.

According to Kong, Witmaier, and Ko (2021), consumers often lean toward brands recognized for sustainability and CSR efforts. They also noted that marketers spreading info on sustainable fashion through social media should keep in mind a key difference. People in developed countries tend to value sustainability more highly. Those consumers show greater willingness to shell out premium prices for green products. This holds true when compared to folks from less developed countries. Furthermore, as mentioned in research by Nurul Hidayana Mohd Noor (2023), traditional media increases awareness and knowledge. Social media drives behavioral intention through engagement, peer influence, and quick sharing of information. As sustainability becomes more urgent, understanding how media shapes green purchasing decisions offers useful insights for policymakers, marketers, and environmental groups. The first innovation was the barter system, which exchanged products for items that gave the trader an advantage. Later, bartering gave way to marketing, where commodities were swapped for cash. This led to creative growth in the economy. (Dr. Madhavi Sripathi* 2022)) In developing countries, traditional media still shapes how people view green products, though recent research suggests it may not be as effective as interactive digital platforms. Even so, both traditional and social media play important roles in encouraging

people to buy green products. This effect is even stronger when people have enough knowledge about the products, as this knowledge helps connect media exposure to making more sustainable choices. (Chatterjee, S 2022) Increased trust in credible sources is expected to lead to heightened awareness, knowledge, and motivation to adopt sustainable practices. (Horrich, Ertz, & Bekir, 2025)

2.2 Social media's role in shaping millennial and Gen Z consumer behavior.

For years, millennials and Gen Z have led the way on social media. Every day, they scroll through Instagram, Twitter, YouTube, TikTok, and X, where they see lots of conversations about climate change, ethical shopping, and living more sustainably. Their feeds are full of eco-friendly product ads, activism campaigns, and news about the environment—making green topics a regular part of their online lives.

On the other hand, older generations mainly got their environmental knowledge from traditional media. In contrast, millennials and Gen Z are learning, interacting, and forming opinions in new ways. In the research carried out by (Halibas et al.) he mentioned that Gen Z often supports sustainability and ethical consumption, but they sometimes struggle to balance these values with materialism. Still, more Gen Z consumers are turning to secondhand fashion, resale platforms, and circular economy models. This shows they are trying to balance personal style with sustainable choices. As a result, Gen Z is developing a more nuanced approach to sustainable consumption, valuing affordability, creativity, and ethical responsibility together.

Moreover, (Ghouse et al.) in his findings, stated that Gen Y's purchase intentions are shaped by attitude, digital literacy, eco-friendly behavior, and perceived behavioral control, whereas Gen Z's intentions are also affected by environmental knowledge and subjective norms.

Social networking significantly alters the perspective of Millennials and Generation Z towards sustainability as these platforms educate, influence, and engage them in environmental issues. However, the impact of social networking is conditional upon the truth of the messages, the recipients having some prior environmental knowledge, and their ability to differentiate authentic sustainability from .

2.3 The rise in Eco-Influencers

The rise of eco-influencers shows what happens when regular influencer culture meets the growing interest in the sustainability of stuff. Unlike old-school environmental communication that mostly came from official campaigns and big institutions; eco-influencers connect through personal stories and pretty content that people want to see. Research shows these influencers work because they're just normal people others can relate to. Their honest approach and focus on everyday life choices can really change how consumers think and act. They use things like blogs, tutorials, and product reviews to make complicated environmental issues easier to understand and apply to real life.

Scholars express concerns about performative activism, commercialization, greenwashing, and the potential misalignment of influencers' online personas and real-world activities. These inconsistencies create serious concerns about the reliability, trustworthiness, and long-term impact of influencer-led sustainability movements. According to (Chwialkowska) findings Most influencers have kept their social media accounts going for about 4.5 to 7 years, sticking with the same message throughout. On different platforms, they constantly show the benefits of living in green. Their posts across sites basically say, "I eat this way, and because of that, I feel good with enough energy for all the stuff you see me doing." The content shows how green living helps in many areas of life. You can see this strategy when they share recipes and tips on Facebook while posting pics of their everyday activities on Snapchat or Twitter. This clearly shows that influencing customers really depends on being consistent.

In addition, Syed and Shah's findings suggest that influential people and content should be used to get the environmental messages across on social media. There is need to make laws and algorithms that make it harder for fake news to spread and give more weight to real news and different points of view is a concern. Thus, while social media and media in general—through viral trends and eco-influencers—continue to hold great potential for shaping sustainable

consumer attitudes, their potential benefits are contingent upon issues of trust, authenticity, and strategic communication.

3. Methodology

3.1 Need and objective of the research

This study looked at how social media affects what people think about sustainability, since social media has a big influence on teens today. Even though more people around the world care about sustainability, we still don't know much about how user content, influencers, and different platforms change eco-friendly attitudes and what people buy. Since Gen Z and Millennials use social media the most, we needed to figure out if the sustainability stuff they see online actually makes them more aware, trustworthy, and likely to buy sustainable products.

The study tried to find out how social media makes people more aware of sustainability, which platforms and content types matter most, and how consumer trust gets shaped by real content, believable influencers, and worries about fake green marketing.

3.2 Data collection and analysis

To collect data, online survey questionnaires were issued to residents in various geographic locations. Additionally, personal visits were conducted at Tatwade City, which is within a certain radius of Pune. With an emphasis on sustainable living, the questions were designed to highlight the study's objective of understanding how social media influences consumer behavior. The following questions were made to gather pertinent data, and further analysis was done

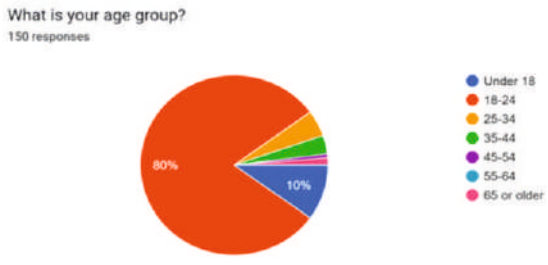


Figure 1.1

According to the figure, 80% of respondents are between the ages of 18 and 24, suggesting that young adults' opinions have a significant influence on the survey. This demonstrates how Gen Z is more conscious of environmental issues. The additional 10% under 18 supports this youth-dominated group, indicating significant potential for eco-conscious views. The minimal representation of older age groups indicates that sustainability perceptions in this study are primarily shaped by younger, digitally active individuals who are generally more open to adopting and promoting sustainable behaviors.

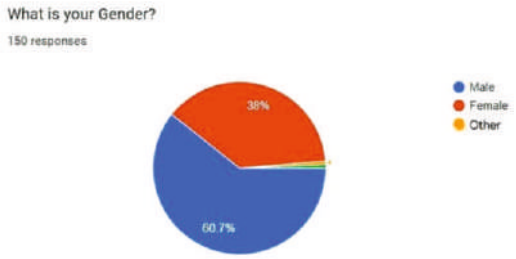


Figure 1.2 : indicates that 60.7% of respondents are male, whereas 38% are female. The distribution reveals that the survey data on sustainability attitudes is predominantly influenced by male respondents, who constitute the majority. The gender distribution suggests that the sustainability insights reflect diverse perspectives, with a more significant influence from the male population, potentially affecting overall patterns in awareness and engagement.

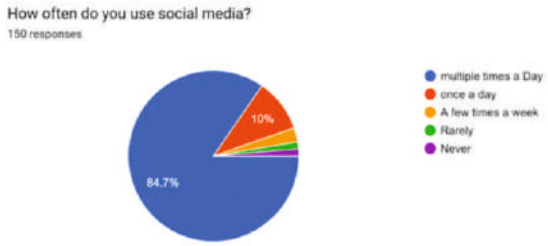


Figure 1.3

The data indicates that 84.7% of respondents engage with social media multiple times daily, reflecting a significant level of digital engagement. The regular engagement with social media platforms exposes users to sustainability-related posts, initiatives, and influencer content, thereby establishing social media as an effective instrument for enhancing environmental awareness. Additionally, 10% engage with it daily, resulting in increased regularity of interaction with online content. A limited number of individuals engage with

social media on a weekly, infrequent, or non-existent basis. The analysis indicates a higher likelihood of encountering and being influenced by sustainability content among individuals who are predominantly active social media users.

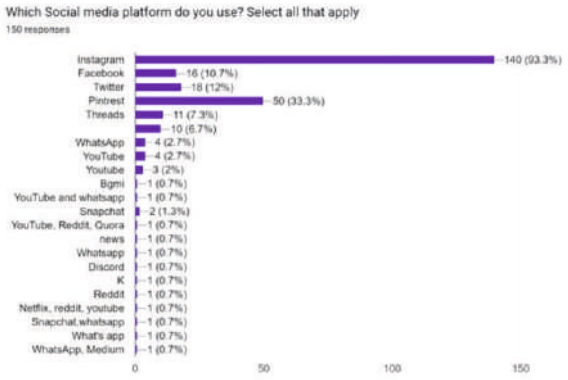


Figure 1.4

According to the figure, Instagram is the most popular platform, with a usage rate of 93.3%, indicating that users primarily engage with content, including posts related to sustainability. This illustrates Instagram's significant aesthetic influence and its role in disseminating eco-friendly concepts through influencer-driven campaigns, diagrams, and reels. Pinterest, the second most popular platform at 33.3%, demonstrates that consumers depend on creative, idea-driven content for inspiration concerning sustainable lifestyles, including do-it-yourself eco-products, green décor, and zero-waste strategies. The data indicates that visually oriented platforms are leading in sustainability communication, with Instagram and Pinterest identified as the most effective channels for enhancing environmental awareness and promoting sustainable behavior among users.

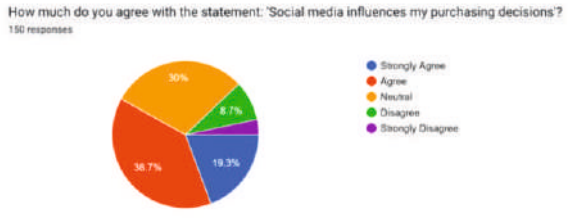


Figure 1.5

The figure indicates that 38.7% of respondents agreed, while 19.3% strongly agreed that social media affects their purchasing decisions. This indicates that approximately 58% of consumers are affected by online content. Additionally, 30% remain neutral, suggesting that individuals can be influenced indirectly, even without their conscious awareness. A mere 8.7% of respondents express disagreement or strong disagreement, suggesting minimal resistance to the influence of social media. Consequently, social media serves as an effective tool for promoting sustainable consumption, as a significant portion of consumers' purchasing decisions are influenced, at least in part, by digital content, influencer remarks, and corporate communications regarding sustainability.

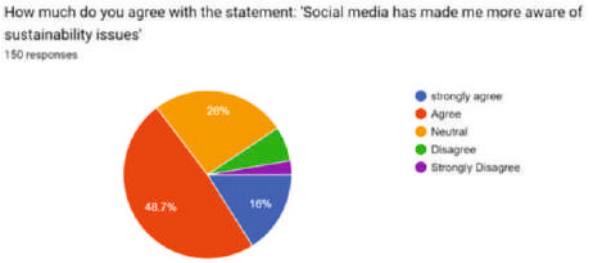


Figure 1.6

The graph shows that social media has a significant impact on raising users' awareness of sustainability. Nearly 48.7% of respondents agree, and 16% strongly agree that social media has improved their knowledge of sustainability-related topics. This indicates that nearly two-thirds of respondents acknowledge social media as an essential instructional resource for environmental subjects like waste reduction, ethical consumption, climate change, and eco-friendly behaviors. Furthermore, 26% remain neutral, indicating that while individuals may see sustainability content, it may not have a significant impact on them. There is very little skepticism, as just a small percentage disagree (6%) or strongly disagree (around 3%). As a result, social media is an efficient tool for broadcasting sustainability messaging, boosting awareness, and instilling a more environmentally responsible mindset in consumers, particularly young, active social media users

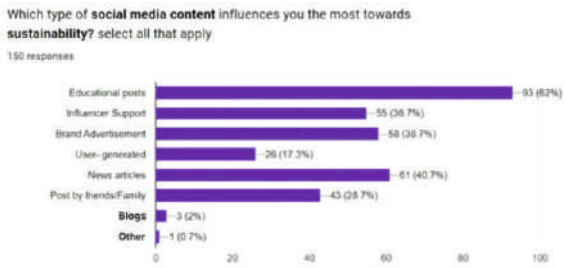


Figure 1.7

According to the findings, educational posts (62%) have the greatest influence on boosting sustainable attitudes, indicating that people are highly responsive to informative content that explains environmental issues, solutions, and sustainable activities. Sustainability awareness is also greatly influenced by news articles (40.7%) and brand commercials (38.7%), indicating that reliable information and obvious business sustainability initiatives foster trust and encourage environmentally beneficial behavior. Influencer support (36.7%) suggests that influencers play an important role in normalizing sustainable lifestyles, particularly among young people. Meanwhile, posts from friends and family (28.7%) and user-generated material (17.3%) have a moderate impact. As a result, structured, and visually appealing content, particularly educational pieces, has the greatest influence on promoting sustainability and altering consumer attitudes.

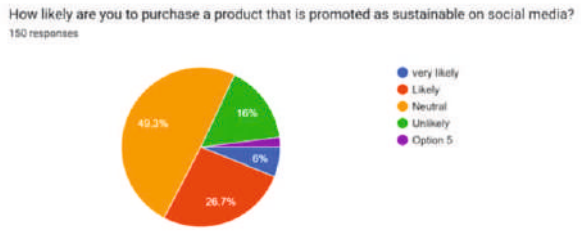


Figure 1.8

According to the data, 6% of people are highly likely to buy goods that are advertised as sustainable on social media. This suggests that sustainability messaging generates interest but not strong belief. The high neutrality indicates that consumers are informed but hesitant, most likely due to concerns about green-washing or ambiguous sustainability claims. Nonetheless, more than one-third have expressed positive intent, indicating a rising movement toward environmentally conscious purchasing habits. In terms of sustainability, social media has the potential to impact greener customer decisions, but firms must increase transparency and authenticity in order to transform interest into actual sustainable purchasing.

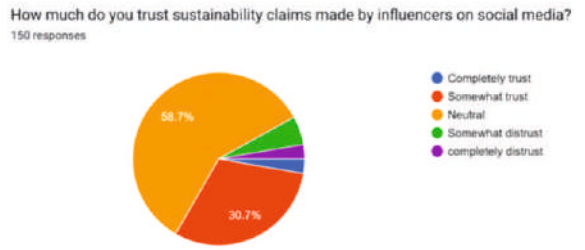


Figure 1.9

According to the figure, 30.7% of respondents only slightly trust the sustainability promises made by influencers, while 58.7% of respondents are neutral. Influencer-driven sustainability messaging is not entirely trusted by most responders. This pattern reveals a serious lack of trust. From a sustainability standpoint, this indicates that, while influencers have a large reach, their impact is contingent on reputation, transparency, and authenticity. Influencers and brands need to offer verifiable claims, certifications, and truthful messaging for sustainability communication to be successful.

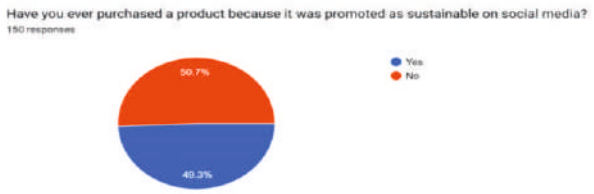


Figure 2.0

A polarized but potential market can be seen by the survey's analysis, which shows an almost 50/50 split on buying products advertised as sustainable on social media (49.3% Yes, 50.7% No). The 49.3% "yes" vote demonstrates that social media is an effective conversion engine, successfully mobilizing purpose-driven consumers who value ethical alignment and respond positively to real sustainability storytelling. To win over the doubtful half, brands must prioritize radical transparency, provide verified third-party data, and clearly

demonstrate the higher value and co-benefits (quality, health, long-term savings) of sustainable choices.

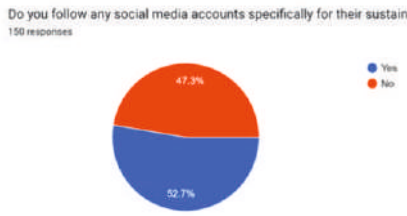


Figure 2.1

With 52.7% of respondents actively following social media accounts for sustainability material, there is a clear, engaged audience looking for education and information, demonstrating social media's effectiveness in raising awareness. However, this high engagement only results in a slightly lower purchasing rate, with 49.3% stating they purchased a product advertised as sustainable on social media. This mismatch shows that, while customers are eager to learn, they are unwilling to make a purchase, most likely due to widespread greenwashing suspicion or existing purchase friction based on price and convenience. Therefore, the effective approach to promoting sustainability must move from simply raising awareness—which is effective—to validation and trust-building.

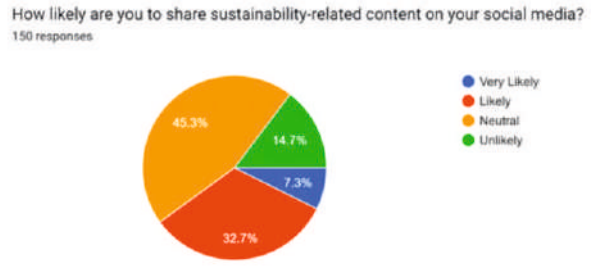


Figure 2.2

The graph shows how likely people are to post content about sustainability on social media. Almost half of the respondents (45.3%) chose Neutral, indicating that while they do not oppose sustainability material, they are not particularly driven to promote it. Furthermore, a sizable proportion of respondents (32.7%) said they are likely to share sustainability content, indicating that users believe sharing environmentally friendly postings is socially acceptable or desired. Due to their high level of awareness and personal commitment, only a few of them (7.3%) were actively involved. A small percentage of them, however, showed no interest in themes relevant to sustainability.

3.3 Limitations to the survey

Youth-dominant sample: Surveys were led by the opinion of young adults, with 80% of the respondents belonging to the 18–24-year-old category, and most of their samples were from the younger digital group.

The data collection consisted of online surveys and in-person visits, with a particular geographic radius in mind: Pune, Tathwade City.

Gender Bias: The sample is more influenced by the male population (60.7% male); this may slightly affect the strength of sustainability-oriented responses because prior research has proven that women are more concerned about the environment.

Discussion and Conclusion

The broader takeaways of the study show how young consumers have been affected by social media in attitudes to discussing and acting upon sustainability. The data say that one of the number one ways Gen Z and Millennials are informed about issues impacting the earth, how they evaluate products, and how they make lifestyle changes is through visual-first platforms like Instagram, which thrive on images, influencers, and rapidly changing content.

The gap between awareness and action, however, is equally striking. Most respondents concurred that social media greatly improves their comprehension of sustainability, and the most powerful sources of environmental awareness were found to be instructional posts. However, this high level of awareness does not always result in decisions on purchases or firm trust. Due to the increasing prevalence of green-washing and the mixing of personal expression with paid marketing, many consumers are still dubious about sustainability claims, particularly those made by influencers.

The survey also identifies a generation that is emotionally cautious but very involved. They publicly acknowledge the impact of social media, follow sustainability pages, and often consume eco-content. However, people are

hesitant to completely embrace, share, or buy sustainable items, wary of deceptive advertising and unclear standards.

In general, the results of the study show that social media has a positive influence on increasing awareness of sustainability and shaping an eco-friendly attitude, especially among younger consumers who will be major players in the future consumer market. The results suggest that social media, only together with trust, transparency, and informed choice, allows the encouragement of sustainable consumption over the long term at a substantial level. In short, social media has the potential to win consumer culture over sustainability, but only if influencers, brands, and content platforms alike step up for transparency, continuity, and accountability.

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30. Title: Green Costing: Reducing Costs through Sustainable Practices

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1. Abstract
Green costing is one of the strategies that have taken into consideration the environmental factors in the management of costs to enable businesses to operate sustainably.
The conventional cost systems do not typically take into account the effects on the environment and thus, the decisions made are more inclined to take into account the short run savings of money than the long run sustainability. This paper examines the benefits of green costing approaches, such as Sustainable Development Cost-Benefit Analysis (SDCBA), Life Cycle Costing (LCC), and Activity-Based Costing (ABC) in assisting businesses to identify costs that are not otherwise reported, manage resources, and, ultimately, save money. This study is a descriptive, conceptual study relying on available information that unites international research and environmental accounting processes as well as sustainability policies. The findings indicate that green costing enhances the financial decision making and aids in the environmental accountability by revealing the price of such things as waste, resource wastage and ineffectiveness. The research comes to the conclusion that the application of sustainability to the cost analysis transforms cost management into the instrument that contributes to the betterment of economy and environment.management into a tool that helps both the economy and the environment.

2.Keywords:
green costing, Sustainability, Cost Reduction, Life Cycle Costing (LCC), Activity-Based Costing (ABC), Sustainable Development Cost-Benefit Analysis (SDCBA), Environmental Accounting, Sustainable Practices, Cost Management, Environmental Sustainability.

3.Objective of the research
Get to know all about green costing
Know the distinction between the green costing and the traditional approach.
Learn about the usage of the green costing method.
Know how to minimize expenses using sustainable development

4.Literature review
Green costing has emerged as the significant element of sustainable cost management as firms begin to understand the impact that their environmental behaviors have on money.
With this review, significant academic studies, institutional guidelines, and models engaging environmental sustainability and cost saving are united. In the review, the authors concentrate on four key points namely: (1) the fundamentals of environmental accounting, (2) the evolution of the concept of green costing, (3) the way costing techniques can be used to contribute to sustainability and (4) practical examples of cost saving achieved through green practices.
Essentials of Environmental Accounting.
The concept of green costing is based on the larger field of environmental accounting that demonstrates the economic value of environmental impacts.
UNCTAD (1998) indicated that the environmental costs refer to the amount of

money that is spent on preventing, managing or remedying the environmental harm caused by business. These involve the expenditure on managing garbage, managing pollution, utilizing energy, as well as exhausting resources. The United Nations Division for Sustainable Development (UNDSD, 2001) categorized environmental costs into three broad groups which are cost of waste and emissions treatment, the cost of environmental protection and money that is reserved as a means of repairing the environmental damages. Schaltegger and Burritt (2000) assert that environmental accounting presents significant data, which enables organizations to realize how environmental implications impact on their financial performance. It is said that the traditional accounting systems do not involve any hidden or indirect environmental costs that are likely to lead to bad decisions. Due to this, cost models that consider environmental factors in terms of planning and controlling business operations are needed.

Green costing was done due to necessity of including issues of environment in the costing processes.

According to Jalaludin, Sulaiman, and Ahmad (2011), green costing does not only satisfy the legal requirements. It relates environmental protection to cost-saving. They claim that long term save money can be achieved through sustainable measures such as energy efficiency and reduction of waste even though it may be expensive in the short run.

Porter and van der Linde (1995) proposed the so-called Porter Hypothesis, according to which by being ethically responsible, a company can be innovative and enhance its competitive advantage.

Sustainable practices and cost efficiency are twin concepts as demonstrated by their work.

Developed by the United Nations (1993; revised 2003), the System of Environmental and Economic Accounting (SEEA) rendered the incorporation of the environmental values into a national and company account possible.

SEEA developed physical and monetary environmental accounts, which made possible the determination of the natural resource depletion and degradation as quantifiable economic costs. This system is the foundation of the present-day green costing techniques.

Most of the available studies examine certain costing procedures that promote sustainability.

Sustainable Development Cost-Benefit Analysis (SDCBA) integrates the environment and social effects and the standard cost-benefit analysis.

According to Pearce and Barbier (2000), sustainability must take into consideration the environmental externalities and to make them economically valuable. SDCBA is helping organizations make long-run decisions that are beneficial to their business and society by pricing the ecological and social effects such as pollution and resource consumption. This is supported by Hanley (2001) who says SDCBA is provided with a complete opportunity to judge on sustainable investments.

Life Cycle Costing (LCC) considers the overall cost of an asset since its purchase and up until the time that it is disposed.

As indicated by Woodward (1997), LCC does assist organizations to comprehend the expenses they will incur in the long-term, including maintenance costs, energy consumption, and disposal of the devices at the end of their service.

According to Asiedu and Gu (1998), LCC is particularly applicable in manufacturing and construction where initial design decisions impact massively on finances. LCC helps make sustainable decisions by taking into account such factors as the energy efficiency and waste that reduce expenditures with time.

Overview of the Literature Review.

The literature explains that the conventional costing practices cannot adequately reflect the economic impacts of the environmental activities and this is why there is a necessity to have more integrated costing methods such as green costing. The conceptual frameworks, including SEEA, and concepts suggested by UNCTAD and UNDSD have made it easy to understand the significance of including ecological data in accounting systems. The methods of costing such as SDCBA, LCC, and ABC provide feasible techniques of involving environmental considerations in financial judgments. The available empirical evidence supports the claim that sustainable practices are

very helpful in reducing costs and enhancing organisational performance. On the whole, it is possible to state that the literature justifies the concept that green costing could become an efficient means to make both cost saving and environmental sustainability consistent.

3.3 Activity-Based Costing (ABC)

1.ABC is a technique that allocates the costs according to the activities used which assists in the detection of the processes with a large environmental impact.

2.ABC was developed by Cooper and Kaplan (1991) to correct the issues facing the conventional methods of apportioning overheads. Subsequently, other researchers like Burritt, Hahn and Schaltegger (2002) embraced ABC to manage the environment. These studies demonstrated that ABC can go to the extent of tracking the environmental costs such as the energy used, the emission, and waste as associated with certain activities. All in all, these costing approaches contribute to green costing by making it easier to identify costs and determine their importance in achieving long-term value.This data point demonstrates that sustainability is not only an environmental initiative but a valuable way to reduce costs.Individually, these two studies show that sustainable materials management practices, waste management, and cleaner technology can help organisations realize financial gains.Overall, these costing techniques provide organisations with an advantage in innovation and creating long-term value

6.Need of the Study

In order to address the weaknesses of the old costing systems that do not tend to factor in the long term environmental costs such as waste disposal, resource use up and pollution control.

1.To demonstrate the growing significance of sustainability in business decisions, which are going to be exerted more on business companies, by the governments, customers, and rules they are obliged to follow.

2.To demonstrate the way green costing can reduce operating costs by identifying inefficiency, reducing wastage, and utilizing resources more efficiently.

3.To provide firms with beneficial costing instruments such as SDCBA, LCC, and ABC that integrate the environment in financial decision making.

4.To create awareness on the presence of environmental costs that are hidden and are not captured in conventional accounting and affect the long-term profits.

5.To demonstrate the financial benefits of sustainability, there should be a challenge to the notion that sustainable practices only increase the expenses.

6.To facilitate the corporate sustainability, it is good to enable the companies to align their cost management with the care of the environment.

7.In order to enable decision-makers make sustainable investments by making comparisons of long-term costs and benefits rather than short-term costs.

8.To contribute to literature on green costing, which is an emerging field under-researched in such locations as India.

9.To make industries to be environmentally friendly, to make sure that they adhere to global sustainability requirements as well as to make sure that they improve their competitivenes.

7.Research Methodology

The study will take the form of qualitative research relying on secondary data and sources of information including Academic journals and research papers, Books on environmental accounting and cost management, Reports and publications of organisations (UNCTAD, UNDSD, OECD, and UNEP), Articles published by professional bodies (CIMA, ICAI, IFAC) and Government and institutional sustainability guidelines and Online databases like Google Scholar, ResearchGate, SSRN.

Data Analysis and Interpretation.

- The thematic analysis of the secondary data shows a good evidence to the fact that:
- The conventional costing systems do not consider environment costs that are in the long run.Traditional costing systems overlook long-term environmental costs.
- The tools used in green costing include Sustainable Development Cost-Benefit Analysis (SDCBA), Life Cycle Costing (LCC) and Activity-Based Costing (ABC) are used to measure the cost savings and increased efficiency..
- Cost visibility of the environment enhances

improved decision making.

●Green costing is a necessity to the organisations that want profitability and sustainability.

Therefore, the review supports the fact that green costing is a viable and tactical strategy of trying to optimise costs and at the same time contribute towards environmental sustainability.

Findings of the Study

The traditional costing systems do not reflect the long-term environmental costs and this leads to a complete lack of cost information and ineffective managerial decisions.

Green costing offers more transparency to the costs as it assigns the environmental costs including waste disposal costs, pollution control costs and the depleted resources.

●Sustainable Development Cost-Benefit Analysis (SDCBA) allows organisations to look at projects in totality by looking at the economical, social, and the environmental effects of projects.

●Life Cycle Costing (LCC) would be useful in identifying the long term financial savings by determining the totals of the costs incurred during the acquisition process until during disposal, particularly in the eco-friendly and efficient investments.Activity-Based Costing (ABC) would be useful in ensuring accuracy in tracing the environmental costs in such that organisations may identify what activities they create excessive waste or consume so much resources.

●Sustainable practices bring about quantifiable cost savings, which include; a decrease in energy expenses, decrease in raw material consumption and a decrease in the costs of managing waste

●Green costing tools have the ability to reveal environmental inefficiencies that are usually concealed in the traditional accounts.

●The organisations having a costing system that is sustainability oriented have a high long term profitability, performance and competitive advantage.

●There is a low awareness and adoption of green costing particularly in the developing states and this is attributed to misperceptions, lack of skills and a small amount of regulatory pressure.

●The implementation of green costing is key in the attainment of economic and environmental objectives and this is a clear indication that sustainability and profitability are complementary.

8. **Main Discussion**

The major debate is the way in which green costing techniques merge environmental accountability and long term fiscal effectiveness. Although the traditional costing framework is traditionally concerned with looking into the short-term financial perceptions, sustainable practices demand organisations to look at the broader ecological effects, resource usage behaviors, and cost implications in the long-term. Green costing thus can be seen as a mediator between the financial discipline and environmental stewardship that includes environmental costs in the cost management decision-making process.

As examined in this paper, the three costing models examined, namely SDCBA, Life Cycle Costing, and Activity-Based Costing, can help different stakeholders understand the various, yet complementary, ways of connecting the outcomes of cost optimisation with sustainability.

8.1 **Sustainable Development Cost-Benefit Analysis (SDCBA)**

SDCBA incorporates the economic, environmental, and social consequences into one decision making model. This approach empowers organisations to assess the contribution of a project to sustainable development based on monetising ecological and social impacts that a project has like pollution, resource depletion and community wellbeing.

Sustainability Contribution: SDCBA reinforces the idea of sustainable cost management by showing the long-term expenses of the environmentally unfriendly activities and long-term savings of the environmentally friendly ones. This enables organisations to ensure that they focus on projects that will strike a balance between profit-making and environmental preservation

Analytical Insight: Given that SDCBA comprises non-financial

effects, it is more expansive than the conventional cost-benefit analysis and will make sustainability aspects count on financial planning, investment ranking, and policy decisions.

8.2 **Life Cycle Costing (LCC)**

LCC considers the cost of an asset during its life span, which is the cost of an asset during the acquisition process to the disposal. LCC offers a total view of financial and environmental performance because it captures long term operating, maintenance and end-of-life costs.

Sustainability Contribution:

LCC also places cost management in the context of sustainability, where long-term environmental costs are concealed, including waste management and depletion of resources. This will make organisations switch to sustainable, energy-efficient and environmentally friendly options..

Analytical Insight:

LCC is a better tool in making sustainable decisions since it reveals the actual economic cost of environmental inefficiency. Solutions that have greater initial costs can be less expensive and greener in long run.

8.3 Activity-Based Costing (ABC)

ABC allocates costs according to the activity that incurs those costs, which is particularly convenient in determining processes that use a lot of resources or processes that are harmful in the environment. It assists organisations to identify costs associated with energy consumption, generation of waste, and emissions and directly attribute them to products or services.

Sustainability Contribution:

ABC enables companies to reduce waste, lower their resource use, and enhance the efficiency of a process by determining which activities have the greatest environmental impact. This is a direct aid to managing cost in a sustainable way.

Analytical Insight:

ABC improves the level of transparency and exposes environmental wastefulness that is not identified using traditional costing. This renders it a useful instrument to organisations that want to incorporate environmental performance in the strategic decision-making.

9. Conclusion

Sustainability has also become a very significant consideration of contemporary cost management and green costing offers mechanisms to maintain the alignment between financial performance and environmental responsibility.

The traditional approaches to costing can fail to capture long term environmental effects, which may lead to a decision that appears to be cost effective in the short term, but which suggest serious environmental and economic effects in the future.

There are three key costing methods which are analyzed:

Sustainable Development Cost-Benefit Analysis (SDCBA): This is the analysis that evaluates projects based on their entirety including economic, environmental, and social factors.

Life Cycle Costing (LCC): Records all the costs throughout the life cycle of the asset, and it reveals the financial implications of the consumption of resources, waste, and disposal.

Activity-Based Costing (ABC): Enhances transparency through identifying those activities that lead to environmental and financial inefficiencies.

The green costing practices demonstrate that sustainability and cost optimization can be used as mutually supporting strategies.

Green costing assists organizations in reducing wastes, efficiently utilizing resources and makes long-term savings.

The research finds that green costing is feasible and tactical to those organizations that strive to balance profitability and environmental sustainability.

Considering the environmental impacts, the companies will be able to make better decisions, improve their competitive edge, and promote sustainable development.

With the escalating demands of global sustainability, it would be necessary to turn to green costing as the new approach to the responsible and future-oriented financial management.

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31. Evaluating the Effectiveness of Green Marketing Strategies in Modern Consumer Markets

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Abstract
Green marketing has become increasingly important as companies look for ways to reduce their environmental impact while responding to changing consumer expectations. This paper explores how businesses are using different green marketing strategies and how these efforts influence consumer trust, buying decisions, and overall brand image. The study is based on secondary information from research articles, reports, and real-world business practices. It looks at approaches such as using eco-friendly materials, reducing waste, adopting sustainable packaging, and communicating environmental efforts more openly. The review shows that people tend to support brands that show genuine and consistent concern for the environment. At the same time, it also finds that customers are quick to lose trust when companies exaggerate or falsely promote their sustainability claims. The paper concludes that green marketing works best when it goes beyond promotion and is supported by real actions and long-term environmental commitment from the company.

Keywords
Green Marketing, Sustainability, Consumer Behaviour, Eco-friendly Practices, Brand Trust, Environmental Communication

Introduction
Environmental concerns, rising pollution levels, and increasing awareness about climate change have encouraged both consumers and companies to rethink the way products are made, marketed, and consumed. Over the past decade, many businesses have moved beyond traditional marketing and started focusing on practices that highlight environmental responsibility. This shift has led to the concept of green marketing, which refers to strategies that promote products or services because of their environmental benefits.
Consumers today are more conscious of the impact their choices have on the planet. Many prefer brands that show genuine concern for sustainability by adopting cleaner production processes, reducing waste, or communicating openly about their environmental practices. Because of this changing consumer mindset, companies are exploring ways to integrate eco-friendly approaches into their marketing efforts and overall operations.
However, green marketing is not just about using the term “eco-friendly” on labels or advertisements. It requires meaningful action from companies and a clear message that reflects long-term commitment to the environment. When businesses genuinely follow sustainable practices, they are able to build trust and strengthen their brand image. When companies exaggerate or misrepresent their environmental claims, it results in what is

commonly known as greenwashing, which can quickly reduce consumer confidence.

This research paper aims to explore the concept of green marketing, identify the strategies commonly used by companies, and understand how these strategies influence consumer perception and behaviour. It also discusses the challenges businesses face while adopting green practices and highlights why authenticity has become a key factor in successful green marketing today.

Statement of the Problem

Although green marketing has become increasingly popular, many companies still struggle to implement it effectively. While consumers claim to prefer environmentally responsible brands, their actual purchasing behaviour does not always match these intentions. This creates uncertainty for businesses trying to invest in sustainable practices. In addition, some firms use environmental claims without real commitment, which leads to greenwashing and reduces consumer trust. Companies also face challenges such as higher costs, lack of resources, and limited awareness about sustainable alternatives.

The core problem addressed in this study is understanding how companies can adopt genuine and effective green marketing strategies while dealing with market pressures, consumer expectations, and operational limitations.

Literature Review

Green marketing has attracted considerable attention in recent years as businesses across industries respond to rising consumer concerns about sustainability. Researchers broadly describe green marketing as an approach where environmental considerations are incorporated into product design, packaging, promotion, and overall business strategy. Studies also highlight that the success of green marketing depends heavily on how authentic and transparent a company's environmental efforts appear to consumers.

A common theme in past literature is the growing influence of consumer awareness. Many studies point out that customers today are more conscious of issues like pollution, climate change, and waste generation. As a result, they tend to prefer brands that actively reduce their environmental impact. Research also shows that simple promotional claims are not enough; consumers look for clear evidence of sustainable action, such as recyclable packaging, responsibly sourced materials, or energy-efficient production processes.

Another important area discussed by researchers is green branding. Several papers suggest that brands that consistently position themselves around environmental values can build a stronger emotional connection with consumers. This connection often leads to higher trust and loyalty. However, the literature also warns that misleading claims or unverified environmental statements, commonly referred to as greenwashing, can quickly damage brand credibility. Many authors argue that once trust is broken, it becomes difficult for companies to regain consumer confidence.

Studies also highlight the importance of corporate environmental responsibility, where companies adopt long-term practices such as reducing carbon emissions, conserving resources, or investing in renewable energy. These efforts not only support marketing claims but also strengthen a firm's overall environmental image. Literature suggests that when such actions are visible and measurable, consumers tend to respond more positively to green marketing campaigns.

In addition, researchers have discussed several challenges that companies face while adopting green marketing strategies. These include higher production costs, limited availability of eco-friendly raw materials, and strict environmental regulations. Some papers also point out that the Indian market, in particular, is still developing in terms of sustainability awareness. While interest in green products is rising, price sensitivity and lack of detailed environmental knowledge can influence consumer buying behaviour.

Overall, existing literature indicates that green marketing can be highly effective when companies combine genuine environmental initiatives with honest and clear communication. Consumers increasingly expect brands to move beyond symbolic

gestures and show real commitment toward sustainability. This shift in expectations has made authenticity one of the most important factors determining the success of green marketing strategies.

Objectives of the Study

1.To understand the concept and scope of green marketing in the current business environment.
2.To identify the different green marketing strateges commonly used by companies.
3.To examine how green marketing influences consumer perception, trust, and buying behaviour.
4.To analyse the challenges companies face while adopting sustainable marketing practices.
5.To understand the role of honest comunication and environmental responsibility in building brand credibility.
6.To evaluate the overall effectiveness of green marketing strategies based on secondary data.

Need / Relevance of the Study

Green marketing has become an important approach for businesses as environmental concerns continue to grow. Consumers today are more aware of the impact of pollution, waste, and unsustainable production, which increases the demand for responsible and eco-friendly products. This makes it necessary for companies to understand how green marketing can help them meet these expectations and build stronger relationships with customers.

The study is relevant because many companies want to adopt sustainable practices but are unsure about the most effective strategies to use. At the same time, consumers often find it difficult to differentiate between genuine environmental efforts and misleading claims. By analysing different green marketing strategies, this study helps in understanding what actually works, what challenges companies face, and how businesses can improve the credibility of their sustainability efforts.

In addition, as environmental regulations and global sustainability goals continue to evolve, companies need clear guidance on how to align their marketing practices with long-term environmental responsibility. This study provides insights that can help both businesses and consumers make more informed decisions in the future.

Research Methodology

This research paper is based entirely on secondary data, as the aim is to understand and analyse existing information related to green marketing strategies. The study does not involve primary data collection such as surveys or interviews. Instead, it focuses on already available material to build a clear understanding of how companies adopt and implement green marketing practices.

The data for this study was gathered from a variety of reliable sources, which include academic articles, research papers, business reports, government publications, websites, and case-based discussions. These sources were selected to ensure that the information used in the paper is relevant, updated, and connected to the theme of sustainability and marketing.

The methodology involves reading, selecting, and interpreting the information provided in these sources to identify common patterns, challenges, and strategies in green marketing. The collected material was compared and analysed to understand how different companies approach environmental responsibility and how consumers respond to these efforts.

This qualitative and descriptive approach helps in reviewing the existing concepts and understanding the practical relevance of green marketing in the current business environment. The study also highlights gaps and challenges commonly discussed in secondary literature, which further supports the overall analysis and findings of the research.

Analysis and Interpretation of Data

The analysis of secondary data highlights several trends in how companies apply green marketing strategies and how consumers respond to them. The reviewed information includes industry reports, sustainability summaries, brand initiatives, and market observations related to eco-friendly marketing practices. The following points represent the core findings interpreted through the lens of green marketing.

1. Increase in Demand for Eco-Friendly Products

Over the past few years, there has been a noticeable rise in the number of consumers

showing interest in sustainable and eco-friendly products. Many urban consumers claim to prefer items that generate less waste, use natural materials, or offer long-term environmental benefits.

Interpretation:

This growing demand suggests that consumer awareness is becoming a major driver for companies to adopt green marketing strategies. The shift also indicates that sustainability is no longer limited to niche markets; it is gradually becoming part of mainstream buying behaviour.

2. Rise in Sustainable Packaging Practices

Data from business reports shows that industries such as FMCG, cosmetics, and e-commerce have significantly increased the use of recyclable, reusable, or biodegradable packaging. Several brands have reported replacing 20–30% of plastic in their packaging with eco-friendly alternatives.

Interpretation:

Packaging is one of the easiest and most visible areas where companies can implement green marketing. The shift towards sustainable packaging indicates that businesses understand the role of visible environmental practices in creating a positive brand image and influencing purchasing decisions.

3.Growing Importance of Environmental Communication

Many companies now publish sustainability statements, carbon-saving figures, or waste-reduction updates. Some brands use their websites and labels to communicate their environmental practices transparently.

Interpretation:

Clear communication builds trust. The increased use of sustainability reporting reflects the need for companies to show evidence of their environmental claims. It also helps consumers differentiate between genuine efforts and marketing-driven exaggerations.

4. Higher Operational Costs for Green Practices

A common pattern seen across industries is that switching to sustainable materials or upgrading production systems often increases costs. In some cases, eco-friendly raw materials can be 10–40% more expensive than conventional options.

Interpretation:

This shows that while companies are willing to be environmentally responsible, financial constraints still act as a barrier—especially for small and medium-sized businesses. Cost is one of the biggest challenges in implementing green marketing on a large scale.

5. Consumer Behaviour Gap Between Awareness and Action

Although many consumers express a strong preference for sustainable products, not all of them follow through with purchases. Price differences, limited availability, and habitual choices influence final decisions.

Interpretation:

This gap indicates that awareness alone is not enough to guarantee market success. Companies must balance sustainability with affordability. Until green products become price-competitive, consumer behaviour will remain inconsistent.

6.Increase in Corporate Environmental Initiatives

More companies are investing in long-term sustainability measures such as reducing emissions, conserving energy, improving supply-chain waste management, and adopting renewable resources.

Interpretation:

These initiatives show that green marketing is shifting from being a promotional tactic to a core part of business strategy. Long-term environmental investment also strengthens brand credibility, as customers view such actions as proof of genuine commitment.

7. Rising Concerns About Greenwashing

As sustainability becomes more popular, some companies exaggerate their environmental claims without real action. Several reports show that consumers are becoming more careful, often checking for certification labels or independent verification before trusting a brand.

Interpretation:

Greenwashing reduces trust in the entire concept of green marketing. Companies that mislead consumers risk long-term damage to their reputation. This makes transparency and honesty essential for successful green marketing.

Overall Interpretation

The collected data shows that green marketing is

becoming increasingly relevant for both consumers and companies. However, its effectiveness depends heavily on the authenticity of the company's efforts and the clarity of communication. While the demand for sustainable products is rising, challenges like higher costs and consumer price sensitivity continue to affect adoption. The analysis indicates that genuine sustainability practices, supported by clear environmental communication, are most likely to create positive consumer responses and long-term brand loyalty.

Findings

Based on the analysis of secondary data, several important findings emerge regarding the use and effectiveness of green marketing strategies:

1.Growing Consumer Interest:

There is a consistent rise in consumer interest toward eco-friendly and sustainable products, especially in urban and semi-urban regions. This interest influences companies to adopt greener practices.

2.Visible Shift in Packaging and Product Design:

Many companies are actively reducing plastic content, adopting recyclable packaging, and redesigning products to make them more environmentally safe. Packaging has become one of the most common tools used in green marketing.

3.Importance of Transparent Communication:

Brands that share genuine sustainability information—such as carbon reduction, recycling data, or material sourcing—tend to build higher levels of trust. Customers respond positively when companies clearly communicate what they are doing.

4.Challenges Due to Higher Costs:

Implementing green marketing strategies increases operational expenses for many companies. Eco-friendly raw materials, cleaner technologies, and compliance with environmental standards contribute to higher costs.

5.Gap Between Awareness and Actual Purchase:

Although many consumers claim to prefer green products, their buying behaviour is often influenced by price, availability, and convenience. This inconsistency affects the overall impact of green marketing.

6.Concerns About Greenwashing:

Misleading environmental claims by some companies have led to growing scepticism among consumers. This highlights the need for honest communication and verifiable sustainability practices.

7.Shift Toward Long-Term Responsibility:

Many companies are no longer limiting sustainability to marketing campaigns. They are investing in long-term initiatives such as renewable energy use, waste management, and carbon reduction efforts.

Conclusion

The study shows that green marketing has become an essential part of modern business strategies as companies respond to environmental challenges and changing consumer expectations. Consumers today are more aware of sustainability issues and expect brands to act responsibly rather than rely on promotional claims. As a result, companies are increasingly adopting eco-friendly product designs, sustainable packaging, and transparent communication methods.

However, while green marketing offers several benefits, it also comes with challenges. Higher operational costs, inconsistent consumer purchasing behaviour, and the risk of greenwashing make it difficult for companies to implement sustainable practices effectively. The findings suggest that the success of green marketing largely depends on how genuine and credible a company's environmental efforts are. When sustainability is treated as a long-term commitment rather than a marketing trend, it strengthens brand trust, improves customer loyalty, and contributes to positive environmental outcomes.

Overall, the study concludes that green marketing can create significant value for both companies and consumers, but its impact is strongest when supported by real actions, transparent reporting, and a consistent focus on environmental responsibility.

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32. ROLE OF AI IN SUSTAINABLE HUMAN RESOURCE MANAGEMENT

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ABSTRACT
In this digital world, Artificial Intelligence plays a very significant role in Sustainable Human Resource Management. Our study examines the potential of AI in addressing the challenges related to sustainability of the industrial market by analysing its contribution in broadening Green IT Practises. Additionally, AI tools help to convert traditional recruiting procedures into AI-driven Human Resource Management by adopting a faster and more systematic approach along with benefit of reducing time. This paper compares the traditional and modern AI-based Human Resource Management.

KEYWORDS
Artificial Intelligence in Human Resource Management, Employee Engagement, HR Automation, Green IT Practices, Address Sustainability Challenges

INTRODUCTION
In this Tech-driven world, AI plays a transforming role in Sustainable Human Resource Management. Various industries are adopting AI to streamline their business operations and tackle the sustainability challenges. This research analyses the role of AI in sustainable HRM by significantly boosting Employee Engagement, Talent Management and supporting the overall organisational well-being.
Using AI, the HR can shift from traditional recruitment to modern and more efficient, data-driven recruitment. It automates the repetitive tasks and streamlines the business processes in a result with saving time, reducing costs and improving hire quality. This change reflects a trend towards adapting the Green IT practises.
The growing demand for sustainable practices shows how AI meets compliance and ethical standards. By comparing the traditional HR with AI-driven solutions, this study shows how AI supports in improving sustainability by promoting diversity, inclusion and employee experience.
This paper finding reveals how AI can transform HRM by aligning the business goals with sustainability. Exploring the AI-sustainable HRM, it deepens understanding of fostering innovation, resilience, and long-term success in a rapidly changing world.

REVIEW LITERATURE
AI helps in transforming Sustainable Human Resource Management as it helps in simplifying

the HR processes by addressing the major sustainability challenges. It replaces the traditional, time-consuming practices with more advanced, data-driven system and aligns HRM with Industry 4.0. It integrates technological innovation with social, environmental and economic sustainability (Uguz Arsu, 2024).

In recruitment and talent management, AI methods such as automated hiring systems, predictive analytics and virtual HR assistants help to improve efficiency by reducing repetitive tasks, improving decision making and reducing the use of resource which supports Green IT practices (ResearchGate, 2023; Human Resource Journal, 2025). AI enhances candidate screening process by providing accuracy, personalization and reduction in human bias which fosters the diversity and inclusion (Al-Ayed, 2024; Miglani & Arora, 2025).

AI also enhances Employee Engagement, Training, and well-being. Example of Manipal Health Enterprises provides evidence on how AI chatbots could reduce the query resolving time, allowing HR teams to focus more on strategic initiatives by improving operational efficiency and employee satisfaction (VKTR, 2024; Partha Das, 2024). Integrating AI also enhances the organisational performance. As per the study, AI initiatives can reduce environmental footprints by 25%, improve retention by 15% and increase engagement by 20% (Miglani & Arora, 2025).

Despite of the challenges like high cost, skill gaps and resistance, the research shows how AI-driven HR still outperforms the traditional methods in sustainable practices (Business Solutions, 2025; Statista, 2025).

PROBLEM STATEMENT

The limitations of traditional Human Resource Management system in promoting sustainability goals like diversity, inclusion and employee well-being, highlights a need for more efficient and less resource-intensive process. Various industries face challenges in strategically integrating the AI with HRM systems. By offering ways for automating task, optimising recruitment and supporting the Green IT practices, AI helps to incorporate the sustainability goals strategically. This study shows how AI can overcome the limitations of traditional HRM by enhancing the sustainable outcomes and building a more efficient workforce management framework. [2]

OBJECTIVE OF STUDY

- Analyse the limitations of traditional HRM practices in achieving sustainability goals such as efficiency, inclusivity, and employee well-being.
- Examine the role of AI tools in transforming HR processes including recruitment, talent management, and employee engagement.
- Evaluate how AI contributes to Green IT practices by reducing resource consumption,
- improving workflows, and supporting eco-friendly organisational strategies.
- Compare traditional HRM methods with AI-driven approaches with aspect of effectiveness, sustainable outcomes, and organizational flexibility.
- Investigate the impact of AI on diversity and inclusion by reducing bias in recruitment and promoting unbiased workforce practices.

RELEVANCE OF STUDY

In today's digital era, organisations face the pressure while adopting sustainable practices which would balance efficiency, inclusivity, and environmental responsibility. Traditional Human

Resource Management approach often falls short in meeting these demands as they are time-consuming, resource-intensive, and prone to bias. [7]

AI helps enabling sustainable HRM by:

- Automating repetitive tasks to save time and reduce operational costs.
- Enhancing recruitment and talent management through data-driven decision-making.
- Promoting diversity and inclusion by minimizing human bias in hiring and evaluation process.
- Supporting Green IT practices that align HRM with eco-friendly organizational strategies.
- Improving employee well-being and engagement through predictive analytics and personalized support.

The relevance of this study can be highlighted by its ability in bridging the gap
between traditional HRM and sustainability goals. By integrating AI into HR processes,
organisations can promote adaptability, innovation, and long-term success while contributing to broader environmental and social responsibility. [7]

RESEARCH METHODOLOGY

This study shows comparative and descriptive difference between traditional recruiting procedure in comparison to the modern artificial intelligence-based tools recruiting process. This helps in understanding the role of AI in sustainable human resource management and how it has evolved the earlier practice into new and modern practice.

It provides a proper structured approach to show the important role of AI in HRM. It shows the design, data collection methods, sampling techniques, and analytical tools used to ensure the study is systematic, reliable, and aligned with its objectives. By combining qualitative and quantitative approaches, the methodology enables a comprehensive comparison between traditional HRM practices and AI driven solutions, showing their impact on sustainability, efficiency, and employee well-being.

Furthermore, this study is based on two types of data collection:

A.Primary Data Collection:

1.Personal Interview:

AI and GenAI save time spent on routine tasks, recruiters can now actively build relationships with potential candidates based on improved analytics that shows company's future needs. This has been said by Julie Bedard, a managing director and partner at BCG who specializes in talent strategies. [10]

2.Surveys: A recent survey by Gallup revealed that 93% of Fortune 500 Chief Human Resource Officers (CHROs) have begun including AI tools to enhance business practices. This shows AI's transformative potential in reshaping traditional HR functions. [11]

B.Secondary Data Collection:

1.Case Study:

Manipal Health Enterprises wanted to move from transactional to strategic HR by adopting a solution that could offer nursing staff, doctors and other employees. Something that could answer to their HR-related questions around the clock, according to a case study. The health care enterprise used Leena AI's service delivery and engagement software to develop MiPAL, a virtual assistant that automatically responds to employee queries on holiday calendars, taxes, payslips, etc.

They said that the AI has helped their HR team roll out onboarding and employee pulse surveys and take various qualitative initiatives for better employee satisfaction. Their HR team has been able to maintain a balance between transactional and strategic HR practices. It has been said by Partha Das, CPO of Manipal Health Enterprises. [12]

Results:

-It has reduced new hire attrition by up to 5% annually

-It has reduced average time for resolving employee cases from two days to 24 hours

-It has saved more than 60,000 hours of employees and HR team. [12]

2.Reports:

AI has transformed how organizations evaluate, develop, and retain talent. Modern performance management systems use machine learning to provide more objective and comprehensive assessments.

Key applications include:

-Includes Real-time performance tracking and analysis.

-Includes Automated performance review drafts based on continuous feedback.

-Increased Personalized learning recommendations based on skill gaps.

-Shows Predictive analytics for identifying flight risks.

-Provides Sentiment analysis of employee feedback

ANALYSIS AND INTERPRETATION OF DATA:

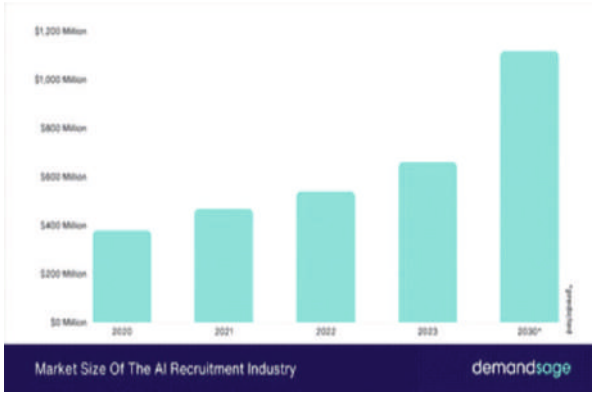
Sampling:

Sample Population: The sample population includes HR from various companies, organizational decision-makers, and industry experts from companies that are adopting or planning to adopt AI tools in their HR



Interpretation:

The graph shows a strong upward trend in the global market size of Artificial Intelligence in Human Resource Management from 2024 to 2029. The market grows from $6.05 billion to $14.03 billion, reflecting a high CAGR of 19%. This indicates a rapid increase in adoption of AI tools in HR process such as recruitment, performance management, talent analytics, and employee engagement. The rise demonstrates that organizations worldwide are shifting towards AI-driven HR processes.



Source: The Demand Sage

In 2025, AI recruitment is transforming global hiring, with 87% of companies which are now using AI-driven tools. The AI recruitment industry is valued at $661.56 million in 2023 and is projected to reach $1.12 billion by 2030, growing at a CAGR of 6.78%. Over 65% of recruiters have already implemented AI, primarily to save time (44%), improving candidate sourcing (58%), and reduce hiring costs by up to 30% per hire. However, 66% of U.S. adults want to avoid applying for jobs that use AI

How many Recruiters and Companies are using AI?

-87% of companies use AI recruitment.

-More than 73% will invest in recruitment automation: AI investment by companies surges to 142.3 billion, with an increase of 54% compared to 2022.

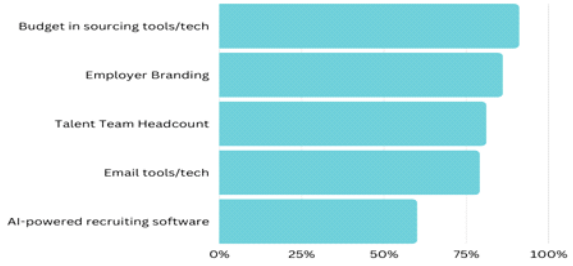
-24% of companies use AI to hire talented employees.

HR Executives Using AI In	Not Using AI At All	Starting To Use AI	Fully Implemented One Or More AI
Employee record management	22%	41%	37%
Payroll processing and benefits administration	23%	33%	44%
Recruitment and hiring	27%	44%	29%
Performance management	28%	38%	34%
Onboarding new employees	31%	42%	27%
Retaining current employees	33%	40%	27%
Cross-skilling and reskilling employees	33%	36%	30%
Company culture and rewards management	36%	32%	32%
Managing Talent mobility	35%	40%	24%

Source: The Business Solutions

The study conducted by Business Solutions offers further insights into the topic.

The Tech companies want to invest 60% in AI-powered recruiting software as a leading recruiting tool. This study shows that 91% of tech companies are planning to invest in AI sourcing tools on the other hand 86% plan to invest in employer branding.



Source: The Demand SageSome additional information from the Study:

Tech Companies want to Invest in	Share of Respondents
Budget in sourcing tools/tech	91%
Employer Branding	86%
Talent Team Headcount	81%
Email tools/tech	79%
AI-powered recruiting software	60%

Source: The Demand Sage

AI is no longer an option in recruitment, 87% of companies are using it and 60% of HR

executives have fully implemented AI in talent management. While the benefits include time savings (67%), bias reduction (43%), and higher interview success rates (14%) for AI-selected candidates. But there are also some companies which don't want to use AI.

35% of recruiters believe AI may overlook unique talent, and 66% of U.S. individuals hesitate to apply for AI-screened roles. With the global market projected to reach $1.12 billion by 2030, AI is transforming how companies hire. However, maintaining the right balance between automation and human insight remains crucial.

FINDINGS AND CONCLUSION:

Traditional human resource management faces certain challenges in adapting sustainability measures for organisational betterment. Its limitations in delivering efficient results, promoting inclusivity and employee well-being highlights the need for advancement of technology in HRM. Artificial Intelligence provides various tools for overcoming these challenges and improving overall organisational performance and efficiency. The case study of Manipal Health Enterprise underscores the significant impact of AI in sustainable Human Resource Management by automating the query response system.

Further impacts of Artificial Intelligence in HRM includes:

1.Automation of task:

AI allows the organisation to automate the low-value and repetitive task that could consume a significant portion of HR's time. This helps to reduce the administrative workloads which allows the HR team to focus on strategic decision-making, innovation and employee engagement by weighing down the routine tasks.

2.Cognitive decision-making:

AI thrives on data. The HR process includes working on large amount of information from different teams and department, for which manual processing could probably increase the chance of errors. Integrating AI into these processes helps the organisation to generate accurate insights of the data which enables the HR to create better strategies and improve employee support. For instance, AI can detect the patterns in employee's moods or stress level by analysing their behaviour and including their voice tone during the client calls. These measures help the HR manager to make informed and data-driven decision for contributing in the well-being of employee by analysing the need of breaks to maintain productivity and mental health.

3.Incorporate AI-based employee screening:

AI tools facilitate online recruitment process which reduces the time and efforts of recruitment teams as well as minimises the errors. By using the right algorithms, AI systems could even predict whether a candidate is a good fit for a role based on past performance indicators and job role requirements.

4.Digitalising the application process:

AI helps to shift the traditional paper form filing process to digital application systems. Using such systems, candidates can upload soft copies of relevant documents directly which makes the application review process easier and faster. This shift not only saves time and office space, but also reduces the paper wastage promoting the Green IT practices.

5.Screen large pools of candidates:

There are hundreds of applications received for a Job role and manually scanning this application is both time-consuming and exhausting. AI helps in making this process faster, more accurate and consistent. By applying predefined criteria such as Academic Background and Work Experience, AI can quickly identify the high-potential candidates from a large applicant pool, reducing the chances of overlooking qualified candidates or shortlisting unsuitable ones.

6.Improve Employee referral Management:

Employee referrals are valuable source of high-quality candidates but manually reviewing them can be challenging. AI analyses these referrals efficiently and helps in identifying strong candidates from employee's networks and accelerating the overall hiring process.

7.Reduce Hiring Cost:

Manual hiring processes increase the likelihood of errors, which can lead to costly hiring mistakes. AI-powered recruitment tools streamline the workflow, reduce errors, and enables faster hiring decisions.

8.Enhance the candidate experience:

For applicants, job searching is often stressful especially when communication from employers is slow or unclear. AI-powered chatbots helps to address this by providing instant responses to common questions throughout the application process. One common issue in recruitment is "ghosting" candidates who are not selected. With AI-driven tools, employers can automate thoughtful feedback messages, ensuring that candidates receive closure and guidance for future applications, enhancing a positive and respectful candidate experience from start to finish. **BIBLIOGRAPHY:**

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33. Redefining Business, Commerce, and Management Through Sustainability: The Role of Technology -Driven Sustainable Product Lifecycle Management

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Abstract
Looking at how Modern business methods change their way to conduct business by making sustainability their integral part of their strategies. It expresses the way new digital technologies like AI, IoT, blockchain, and digital twins assist companies design, produce, use, and recycle products in methods that are beneficial for the environment and still help earn a profit. By uniting these technologies with circular economy ideas and Life Cycle Assessment (LCA) ways, businesses can decrease wastage, enhance efficiency while staying in competition. Overall, the paper helps to display that technology-aided sustainability is changing how companies work and what they achieve as a goal in today's world.

Keywords: Sustainable business models, Product lifecycle management, Digital transformation, Circular economy, Life cycle assessment, Technology innovation, Green supply chain management, Industry 4.0

1. Introduction:

In an era where not only the global economy is changing, but also people's needs and the technologies used to satisfy those needs, businesses have reached a point where they are meeting current demands, but often at a cost that puts the ability of future generations to meet their own needs at risk

This situation, being the cause of the need to change the current ways to how business models, is redefining the ways, sustainable business models, to achieve the next "Business – Environment balance".

Sustainable Business Models refers to the practice of conducting business, which is not only profitable but also better for society and the environment for the long term

The Modern Product LifeCycle Management (PLM) system connects environment, economic and societal welfare—aiding organizations to analyze their performance and risks across all three pillars of sustainability (3P's Planet, Profit, and People).

As it helps aid 3Ps, this approach positively affects stakeholders to cooperatively make balanced decisions that help reduce negative impacts, increase profitability and address corporate social responsibility throughout.

2. Review of Literature:

Many organizations have implemented the primary measures for the CO2 reduction, the circular economy - but achieving the real impact needs something more than that. It isn't enough to upgrade the existing strategies just a little more for being more sustainable. Sustainability should become a core part of businesses

In the previous literature, sustainability was mainly related to environmental protection. But, the recent concepts of sustainability are represented through three core dimensions: environment, social, and economic. Also, some researchers have proposed one more dimension - technology — specifically in the relation of Product Lifecycle Management (PLM). Thus, sustainability can be acknowledged as the ability to ensure continuous human development across all these dimensions.

Mostly used definitions is the one provided by Brundtland Commission in 1987 as "The development that meets the needs of the present without compromising the ability of future

generations to meet their own needs"

PLM, notable in the ICT market, stands out from the technology solutions paradigms as it is not a simple point solution or off-the-shelf tool. Its base is in the philosophy of related knowledge, with the aim to deliver "the right information, at the right time, in the right context." This philosophy is actually facilitated by the combination of multiple enterprise software applications, including Computer Aided Design (CAD) tools, Product Data Management (PDM) platforms, as well as Enterprise Resource Planning (ERP) and Supply Chain Management (SCM) solutions. These approaches are laid out by multiple vendors with diverse backgrounds and mastery.

Sustainable business models merge environmental, social, and economic dimensions to create long-term value while addressing societal challenges. Traditional concepts, like the triple bottom line, are insufficient for practical application. Szekely and Dossa's eight-step model advocates a purpose-driven approach, focusing on societal needs over short-term profits, fostering sustainability. Their model outlines steps beginning with mission definition and culminating in innovation and stakeholder engagement. It emphasizes proactive societal impact, transparency, and scaling practices to differentiate organizations through ethical advancements. This framework moves beyond conventional sustainability criticism by embedding sustainability as a core business element, supported by case studies from firms like Tesla and Patagonia. In contrast to archetype-based frameworks, Szekely and Dossa underlie mission alignment and future vision, providing a structured guide for organizations and offering a lens for research on sustainability integration amid global challenges.

The Triple-Layered Business Model Canvas (TLBMC), created by Alexandre Joyce and Raymond Paquin, enhances sustainable business model innovation by adding environmental and social layers to the original economic framework. It consists of three layers: the Economic Layer, which aligns with traditional business models; the Environmental Layer, focusing on sustainable practices throughout the product lifecycle; and the Social Layer, emphasizing stakeholder impacts. Each layer includes nine components that provide coherence within each domain and integration across all layers. The TLBMC uniquely combines lifecycle thinking and stakeholder theory, allowing organizations to visualize the balance between profit, environmental stewardship, and social welfare, while also identifying trade-offs and fostering innovation. Research shows that the TLBMC moves beyond traditional models, offering a structured approach to sustainable business design and facilitating collaboration in both academic and practical applications, thus driving continuous improvement in sustainability practices.

Offering products as a service instead of outright sales transforms economic logic by keeping physical products with manufacturers, who are responsible during usage. This model enhances durability, repairability, and efficiency, contributing to resource conservation. Benefits include stable revenue, customer loyalty, cost savings, and innovation through usage monitoring. For instance, Kaeser Kompressoren provides its compressed air systems through the "Sigma Air Utility" service, allowing customers to pay only for actual usage while the company handles maintenance and optimization, ensuring resources stay in circulation and costs remain predictable.[3]

3. Statement of the problem:

Sustainability being the next major problem for the decades to come. Increasing resource limitations, growing pollution and rising global demand calls attention to the necessity to progress beyond the out-fashioned consumer-driven economic model, which is unfeasible and results in rise in cost for scant resources. For this, technology-driven Sustainable Product Lifecycle Management (sPLM) is needed for organizations to move from linear consumption to more efficient, circular, and resource-responsible strategies.

4. Objectives of the Study:

The old-fashioned business model focused only on earning profit, a business model for sustainability can assist organisations handle sustainability challenges along with operating

profitably. By resolving a bunch of ecological and social problems within the framework, companies can develop their purpose, products and methods whilst adding positively to the planet.

A Technology-Driven Sustainable Product Lifecycle Management (PLM) aids companies to utilize recent digital tools and related data to control a product's impression on nature from the time it is produced until it is no longer utilized. With this approach, companies can work with smarter decisions right from the first step, which is significant because most of a product's environmental impacts are decided in the design stage.

5. Need or relevance of the study:

For the future generations to come, sustainable products and practices may become a serious concern by looking to the present speed of resource exhaustion. As environmental challenges grow parallelly organizations must create awareness about the resources used and the adoption to better sustainable practices. In this topic, innovating new technologies and updating the old ones in context to sustainability will play an effective role. Technologically advanced solutions will definitely help businesses optimise their process by keeping sustainability in their mind and also save energy and reduce waste. This will not only protect the environment but also boost the economic and operational performance of organizations. Thus, combining sustainable working methods with advanced technology will become the next stepping stone to increasing sustainability in the longer term.

Emerging PLM (Product Lifecycle Management) systems are incorporating AI and machine learning to enhance predictive analytics for supply chain optimization and lifecycle assessments, facilitating proactive waste reduction and eco-design. The integration of IoT provides real-time data from connected products, which informs digital twins that support continuous improvement and circular economy principles, such as material reuse. Additionally, cloud-native PLM enhances global collaboration and scalability, embedding sustainability metrics like carbon footprints into the product's digital thread.

6. Hypothesis:

Technologically-advanced product lifecycle management and business practices has a positive effect on sustainable business model integration and enhances the environmental, monetary and operational performances of organizations.

7. Research Methodology:

This research follows a qualitative and descriptive methodology to explore how technology-driven Sustainable Product Lifecycle Management (PLM) supports the transformation of business, commerce, and management practices. The study is based entirely on secondary data sources, as the topic requires insights from real-world industry applications and existing sustainability research.

Data has been gathered from academic journals, industry reports, company case studies, credible websites, and publications related to sustainable technologies and business models. Sources include sustainability magazines, research databases, and recognized organizational websites.

The collected information is examined using a content analysis approach, where key concepts such as resource efficiency, renewable adoption, waste reduction, and operational improvement are evaluated. A comparative analysis is also used to study how different industries implement sustainable PLM and achieve measurable benefits.

This methodology helps to establish a clear connection between technological innovation and sustainability performance. It ensures that the findings are reliable and aligned with the research hypothesis, which states that technology-driven PLM positively influences sustainable business models and enhances organizational performance.

8. Analysis & Interpretation of Data

The data collected from secondary sources highlights the growing involvement of technology-driven companies in sustainable business transformation. The following table presents key insights from literature and industry examples that demonstrate how Sustainable Product Lifecycle Management (PLM) contributes to environmental and

operational progress.

Author(s)/Source & Year	Key Ideas/Findings	Real-Life Examples/Models
Bocken et al. (2014)[9]	8 sustainable business archetypes: efficiency, value from waste, renewables, functionality over ownership	Interface carpets (waste-to-value), Philips lighting (product-as-service)

Author(s)/Source & Year	Key Ideas/Findings	Real Life Examples/Models
Technology Magazine (2025)[5]	Green tech innovations: renewables, energy storage, carbon capture, sustainable materials	NextEra Energy (wind & solar energy), Adani Green Energy, SunGrow Power Supply (energy storage system)
Tesla (EVs + batteries), Climeworks (direct air capture)[5]	Intermittency issues, regulatory frameworks needed	Tesla(EV Car manufacture), BYD(China Companie),
NewsVoir (2025) [6]	Sustainability as core business pillar: renewable energy, waste management, stakeholder engagement	Premidis Group
NewsVoir (2025) [6]	Scaling in emerging economies, measuring long-term ROI	Premidis Group India (mining/construction: carbon reduction, reforestation, community training)

To achieve the next "Business - Environment Balance" throughout, technology aiding companies are and will be playing a game changing role through sustainable business practices. The existence of the leading green-tech organizations in the present market expresses through their practices that Sustainable Product LifeCycle Management (PLM) is not just a theoretical concept but a positive practice with effective long term results.

For example, Tesla contributes to sustainability by developing electric vehicles, battery-storage systems, and solar solutions that reduce reliance on fossil fuels and support clean-energy usage.

Similarly, Dell Technologies demonstrates that even IT and hardware companies can follow sustainable lifecycle models, focusing on recyclable materials, reduced emissions, and responsible production.

From these examples, it is clear that technology-driven sustainability enhances environmental and operational performance. This supports the study's hypothesis that integrating innovative technology with product lifecycle management positively influences sustainable business models and contributes toward long-term global sustainability goals.

9. Findings and conclusion

This research paper expresses the need to change the current business methods with a sustainable mindset and positive effect on the environment.Technology-driven sustainability is rapidly increasing across industries, proving that sustainable practices are not limited to environmental sectors alone.Sustainable Product Lifecycle Management (PLM) helps organizations reduce waste, improve energy efficiency, and optimize resource utilization throughout the product's life.

1. Technology as a Catalyst: Technology plays a critical role in enabling businesses to adopt sustainable practices and achieve their sustainability goals. It helps reduce carbon foot prints, increase resource efficiency, and improve operational performance.

2. Technological Innovation: Technological innovations contribute to sustainable business growth by addressing environmental and social impacts, and by providing insights into sustainable practices.

3.Innovation and Sustainability:

The relationship between innovation and sustainability is vital for business viability and societal impact, with strategic integration of innovative practices aligning with environmental and social responsibility imperatives.

4.Companies adopting sustainable PLM gain multiple benefits such as:

- Lower operational cost
- Enhanced brand reputation
- Reduced carbon footprint
- Higher long-term profitability

5.PLM-as-a-Service (PLMaaS): Future trends such as PLM-as-a-Service (PLMaaS) and GenAI-driven simulations are anticipated to accelerate adoption. The global PLM market is projected to grow to $13.12 billion by 2030, at a 7.6% CAGR, propelled by these innovations. Ongoing research in this field is vital for organizations striving to balance the triple bottom line—planet, profit, and people—aiming for resilient and resource-efficient futures.

Innovations like electric vehicles, renewable energy systems, recyclable materials, and circular business models are facilitating the transition to cleaner industrial operations. Companies such as Tesla, Philips Lighting, Interface, and Adani Green Energy demonstrate that integrating technology and sustainability offers a competitive edge. The analysis underlines that sustainability is now a central business strategy rather than merely a corporate responsibility initiative.

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34. GREEN IT : IMPLEMENTATION AND ADOPTION STRATEGIES FOR RENEWABLE ENERGY

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ABSTRACT:
On the Global level, preserving all natural resources has always been a major area of concern. Significant environmental degradation is caused due to extensive use of fossil fuels (oil, coal, and natural gas) for energy generation because it generates energy on a huge cost, direct emission of harmful gasses into the air resulting to global warming, air pollution, smog, water and soil contamination and numerous areas of concern, it does not end here. The daily Primary energy consumed by the world is 1.70

Exajoules (EJ) or 466 Terawatt-hours (TWh). 1 Exajoule is 1018 Joules. The non - renewable energy sources are limited and are being depleted more quickly than nature can replenish. Our research revolves around the impact of renewable and non - renewable energy on the globe, strategies for adopting renewable energy, problems faced in adopting completely green and renewable energy with alternative solutions.

KEYWORDS:
Green IT, Implementation techniques, Renewable energy, Non-renewable energy, Environmental Risk, Energy consumption, Strategies, Importance of renewable energy, problems faced in adapting to renewable energy, possible solutions to adapt green IT and clean energy methods, circular economy, biomass, bioenergy, green software engineering, e - waste management, energy transition.

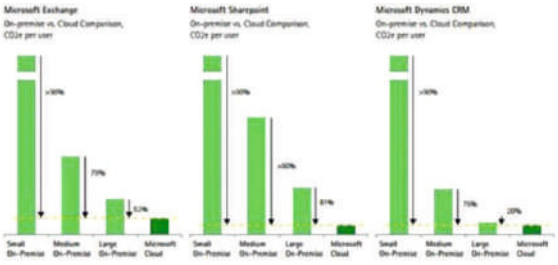
INTRODUCTION:

Everything in the moment is technology, the immensely huge IT based companies keep on growing and expanding recently and will continue to grow steadily. Adoption and implementation of renewable energy is to be focused on because all the renewable energy sources (water, sun, wind, organic waste, biomass, bio energy) are readily available in all countries in ample amounts and their potential is not yet largely realized. According to the (IREA) International Renewable Energy Agency's assessment 90 percent of the global electricity is supposed to come from renewable energy by 2050 [1].

Green IT is not just computers being energy efficient, it encompasses for way wider terms including green software engineering, managing e - waste.

Renewable energy is said to make some economic sense generating 10 percent of the global growth in GDP, carbon dioxide emissions have significantly reduced, emission growth rate has decelerated 0.8 percent and the global economy upswung more than 3 percent in 2024[1].

Shifting on-premises servers to cloud infrastructures is considered to minimize the energy consumption and carbon output, it reduces the total cost incurred by the companies.[2]



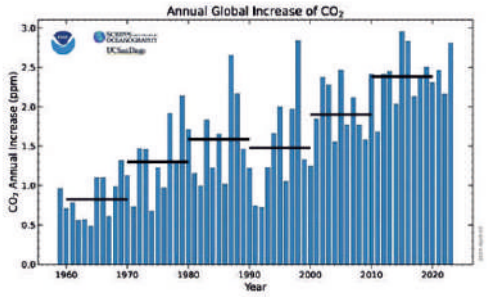
Source Link : Comparisons of Carbon Emissions of Cloud-Based

Findings suggest cloud data centers have highly developed energy - efficient technologies with higher productivity as compared to on-premises servers [2]. Green IT should be implemented to lower the carbon footprint of an organization. Green Software development enables Companies to attain environmental compliance [3].

Study suggests numerous strategies could be used to adopt renewable energy in business sectors like sweeping technological processes, partnerships and investments in renewable energy [4].

Consolidation of smart grids and energy storage promotes reduction in greenhouse gas and it produces energy at a very lower cost [4].

Global climate change is a prominent concern, temperature breaking records year by year due to the current non - renewable energy system states 75% emission of greenhouse gasses [5].



Source Link : Annual Increase in CO2

The existing study patterns and works include green IT and renewable energy separately.

Our study clearly states the Strategies to adopt energy transition and implementation for renewable energy, the potential problems being faced for the strategies to be implemented.

REVIEW OF LITERATURE:

There is a crucial need for energy transition on a global level. Related research patterns reveal

strategies to implement energy transition. There are 5 strategies followed to carry energy transition to limit climate change.

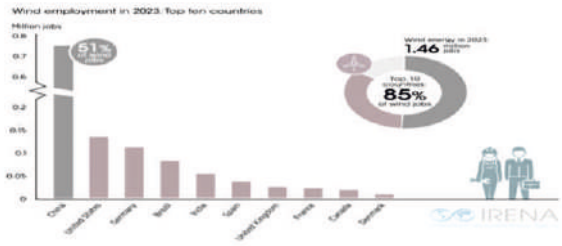
1.Implementing EaaS (Energy-as-a-service) Business model

As the name suggests, this Business Model involves using renewable energy as a service.

It encourages businesses, organizations, industries to use energy just like they are using a service where the service providers incur all the cost of installation of solar panels, other sources, their maintenance and the customers or users pay the cost as monthly subscription or they use the pay per service technique, this approach allows business to lower their carbon footprints and stop worrying about their energy consumption cost because it is highly efficient and reasonable than using the non renewable sources. [8]

2.Accelerate Renewable Power

Findings in this strategy state that the use of wind and solar power must be maximized to fulfill the constantly growing requirement of energy globally. It states the use of windmills and solar power plants generates employment and walks towards utilizing cleaner energy and a sustainable future[6].



Source Link: Employment Chart Through renewable sources

1.Strategic Partnerships and Alliances in Renewable Energy Industry

Findings suggest companies and businesses should form alliances with non-profit organizations, government and technology providers to align business goals while implementing renewable energy and energy transition maximizing the usage of cleaner energy.[7]

2.Formation of new business models

Forming new business models promoting the use of renewable energy and providing implementing strategies with core concepts incorporated in the business models is highly essential, as the older business models might not incorporate the implementation technique, modernized new business approaches help in reducing carbon footprints of any business or entrepreneurship program.

3.Transform power plants

The findings in this strategy state how Gas-fired plants can be an essential part to generate electricity when the solar and wind power plants are not in use or not implemented. Gas-fired plants are a part of renewable energy and diminishes CO_2 emission by 65%.[6] The article states to opt for low carbon fuel like ammonia and hydrogen using present living thermal plants.

4.Strengthen electrical grids

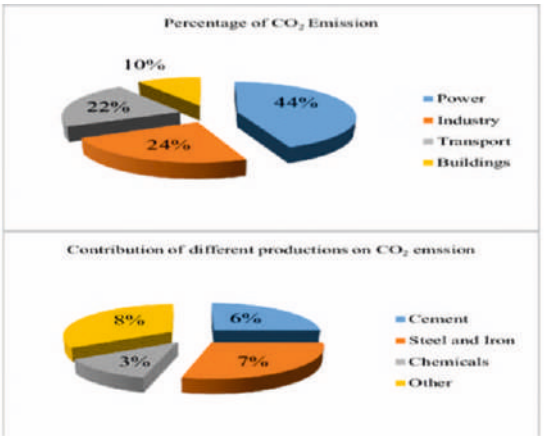
Strengthening electrical grids is the process of grid modernization, in which new power lines are created and installing smart grid technology which is highly reliable for transport and management.

The study in the article states that roughly 80 million kilometers of new transmission lines are required to be incorporated. These electrical grids should be able to tackle variation in the wind and solar power.[6]

5.Drive industrial decarbonization

Industries are considered as one amongst the toughest sectors to be decarbonized as the entire industrial process releases CO_2 emissions in the environment causing harm.

25% of CO_2 emissions are caused by industries.



Source Link : CO2 Emission in different sectors

1.Implementing Power Purchase Agreements (PPA) Business model

Power Purchase Agreements (PPA) Business model states the strategy of using is a long -term contract between an energy generator (renewable energy) and a buyer (business, government) providing energy usage at a fixed price. This allows the business or entity to use energy at a fixed price as mentioned in the contract which is usually lower than the usage of non - renewable energy with fluctuating prices. It also gives the energy provider a stable flow of income for the project of solar and wind farms [9].

2.Monitoring Success of Renewable Energy Business Strategy

The success rate of implementation of new modernized business strategies that incorporate renewable energy usage should be monitored on a regular basis to understand its impact on business itself, environment, overall carbon footprint of the business and cost effectiveness.

Crucial step for ensuring improved efficiency of the business which also motivates employees to come up with creative concepts to foster advancements.[7]

1.Usage of Cloud Based Storage instead of on-premises servers:

On-premises servers are predicted to be more expensive for large scale organizations and businesses than cloud - based storage. These servers need more energy, the solution being, is to avoid energy consumption by using cloud - based servers to store data as it proves to be cost effective and requires less energy on both large scale and small - scale organizations and businesses.

PROBLEM STATEMENT:

Business models of the earlier approach often focus on hierarchical approach, steadiness, and Optimum benefit to the Business by providing commodities and facilities frequently relying on non - renewable energy sources including fossil fuels like coal and natural gas. Our research states what is renewable energy, why to use it, what impact it has globally, the importance of using renewable energy, the strategies to be followed to adopt energy transition and implementation techniques various sectors and countries have followed.

OBJECTIVE OF THE STUDY:

The United Nations rightly mention that "greenhouse gas emissions blanket the earth and trap sun's heat" because of increasing carbon emission causing climate change, they also say, global warming has now exceeded all its limits and broken all records of history.[10] Primary Objective of the Study includes making the world aware about the environmental seriousness caused by the use of coal and natural gas that is disrupting the normal flow of nature highlighting unusual weather changes and disruption. Showing implementation techniques that could be possibly implemente

IMPLEMENTATION TECHNIQUES:

1.Use of Piezoelectric Tiles for energy generation

Piezoelectric material is widely used for its detecting and activation. Reason being the pairing of mechanical and electrical power. Piezoelectrical material is used for generating various categories of mechanical energy from footsteps of humans and energy of flowing water[11]. Around 10 countries globally have already implemented this technique to generate energy. It is recommended to be implemented in crowded places having mobility generally including shopping malls, walking pathways, dance floors and office areas. Has minimal installation cost, can be implemented with ease, additionally providing greater sustainability. Using this technique to generate energy is way more sustainable for business and management.

2.Renewable Energy Parks:

These parks include ways to have clean energy generation, installation of solar panels, windmills, water turbines for energy generation is considered as the most sustainable way because these natural resources are present in ample amounts. They generate employment as well as aim towards cleaner and greener energy generation and usage which is way more sustainable for all business, management and commerce.



Source Link: Increase in renewable energy usage

1.Building Integrated Photovoltaics (BIVP):

Photovoltaics are formed by silicon and this can then be further divided in 3 more categories. Using this technique involves using photovoltaic cells by combining them to form facades, skylights and roofs. This technology can clearly bring monetary value to Construction companies for their work as they have performance value with a visual advantage [12]. This technique can be applied in all infrastructures globally as it generates energy by having those components as a part of the infrastructure redefining business infrastructure to be sustainable and implementable.

2.Vehicle to Grid (V2G) Technology:

The Vehicle to Grid (V2G) technology involves utilizing electric vehicles (EV)

To store and provide energy using mobile energy storage through vehicle batteries, energy can be released and even stored as and when required.

Studies suggest this technique allows dual-direction power exchange amid EVs and electric grids. Energy can be drawn from electric vehicles as and when required and released to reduce strain.[13]

3.Biomass and Waste to energy:

Using biomass to generate energy includes using animal residue and organic waste to generate energy. This technique not only generates energy, it solves the problem of waste management. Transportation fuels can also be prepared using biomass.

Study suggests that organic waste and animal residue are used because greenery stores energy via photosynthesis and animals are said to have fat. Biomass is said to be renewable as it grabs carbon from the environment and generates energy way faster than mineral fuels. This results in the diminution of carbon emission and handles global heating.[14]

4.Implement Circular Economy:

Circular Economy is a model that focuses on reuse, recycle, refurbish instead of throwing away used items and resources. This brings a very sustainable approach to handle crucial issues of ecological erosion and insufficiency of resources. It uses the 3R principle and assists rebuilding and sustainability [15].

NEED AND RELEVANCE OF THE STUDY:

Number of Global Researchers are trying to implement renewable energy and facing issues while doing so, the fundamental Need of this study is to contribute in finding ways to Making the world aware and understand the importance of the follows

1.Economic stability that can be achieved using renewable energy by using cloud - based storage as mentioned earlier and by implementing the Eaas Business model, that is cost effective and promotes Business growth.

2.Steady growth in global GDP because when all companies and businesses follow these strategies it will contribute largely to the global GDP levels as they will increase and can be focused on innovation and sustainability.

3.Increasing Environmental sustainability and spreading awareness is one of the primary needs for this study. This study leads to encouragement in the use and implementation of valuable strategies and implementation techniques.

4.To encourage Implementation of new business models that support renewable energy to reduce carbon footprint.

Focusing on Promoting the implementation and contributing in finding solutions and creative ways to implement them.

HYPOTHESIS:

Implementation techniques and strategies stated in the research cognitively form an approach and ideology that focuses on shifting to renewable energy globally and serve as an input to achieve 90% renewable energy by 2050 as predicted by the International Renewable Energy Agency (IRENA). Global level implementation of all the strategies and techniques will cordially lead to lower carbon emission and impact on overall sustainability of business, commerce and management, reducing carbon footprints and preservation of fossil fuels that are limited in nature.

RESEARCH METHODOLOGY:

The research methodology is a blend of Qualitative as well as Quantitative approach that states the impact of usage of renewable energy and the number of countries in which companies and businesses have applied these strategies in

order to grow greener.

ANALYSIS AND INTERPRETATION:

1.The sample population encompasses companies that are aware about renewable energy and those who have already implemented the techniques and strategies in their daily work aiming to reduce carbon footprints.

Renewable Energy Technology	Aware (n)	Adopted (n)	Adoption Rate (%)
Solar Energy	250	150	60.0
Wind Energy	200	80	40.0
Biomass Energy	150	60	40.0
Geothermal Energy	100	30	30.0
Hydropower	90	20	22.2
Total	**890**	**340**	**38.2**

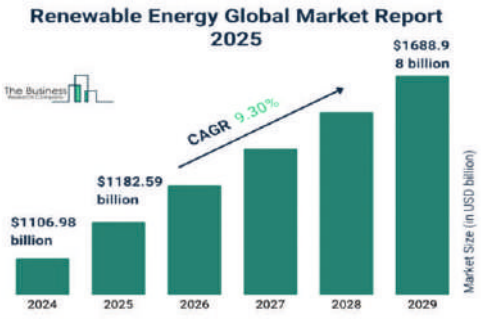
Source link : Table representing the Adoption rate of renewable energy

Explanation:

As we can see the awareness rate is quite higher than those who actually do, the focus should now be inclined towards finding out the problems being faced in implementing renewable energy techniques and thrive to solve them for making business, commerce and management sustainable and aligned with environmental goals.

The number of companies using renewable energy is 38.2% i.e. 340 of 890.

2.Another study reveals the market size of renewable energy in 2025 and its growth rate.



Source Link : Global Market of renewable energy

The market size of renewable energy has upscaled on an immense level lately. It is predicted to grow from $1182.59 billion in 2025 to $1688.98 in 2029 1106.98 billion in 2024 to. The compound annual growth rate (CAGR) is likely to grow 9.30%. This results in rapid steps towards sustainable business and greener earth lowering carbon emission [16].

FINDINGS AND CONCLUSION: Old business models, companies and organizations focused on integrating techniques and ways that brought value to the entity, neglecting that fact that it is causing harm to the society.

Our study clearly suggests the harmful impacts on the environment if continued to use the previous business models. It is time for us to stop using non renewable energy sources and start taking steps towards a greener energy usage system globally.

The implementation techniques and strategies focus on reducing the carbon footprints of any entity and include measures to prevent irrecoverable loss. Researched techniques are simpler and efficient allowing lower implementation cost while allowing the entity to focus on maximized profits.

The implementation techniques researched and focused on in the paper are already being implemented in some parts of the world like use of Piezoelectric Tiles for energy generation, usage of biomass, EaaS, Circular Economy and Vehicle to Grid.

Business, commerce and management have been redefined in the contents of the research paper that allow sustainability as the most essential ingredient. Ways to implement new business models bring sustainability to all sectors globally allowing to redefine business, commerce and management with a sustainable approach and focus on bringing value.

The research motive includes making people aware about the importance of shifting to use renewable energy and the harmful impact the globe will face for continued usage of non - renewable sources.

In conclusion, our research firmly suggests primary strategies and implementation techniques justifying that using renewable energy and energy transition techniques is not just a mere option but a mandatory approach that all sectors should implement for a sustainable future.

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35. IPO PRICE PERFORMANCE: A COMPARATIVE STUDY OF GREEN VS. NON- GREEN IPOs.

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❖ ABSTRACT:

This study compares the market performance of Green and Non-green IPOs launched in India. In addition, with rising investor interest in sustainability-focused businesses, it is of great importance for investors to understand whether Green IPOs really yield stronger returns compared to traditional sector IPOs. Based on secondary data, the research work appraises four selected IPOs comprising two green and two non-green IPOs by analyzing their Issue price, Listing price and market price. The findings indicate that green IPOs, while volatile at the time of listing, provided significantly superior long-term gains. On the other hand, non-green IPOs exhibited relatively stable posting mixed results in the long term. Overall, the comparison analysis reveals that green IPOs lead to greater passage of time and hence, may be appealing to all categories of investors who look for long-term growth, whereas non-green IPOs remain a safe option for short-term gains on listing.

KEY WORDS: IPO performance, green IPO, non- green IPO

❖ INTRODUCTION

A Green IPO is a public offering of shares by a company whose business activities and objectives are focused on environmentally sustainable or eco-friendly projects. A Non-Green IPO is a public offering of shares by a company whose business activities are not specifically related to environmental sustainability and belong to conventional or traditional sectors.

Why do company launch IPO?

a)Access to capital- The most important reason for companies to go public is that they require capital. It is relatively less expensive to raise capital from public market than from private equity or debt financing.

b)Increasing Liquidity- Growing public will also infuse, liquidity into existing shareholders, and this may be with the founders and early investors.

c)Diversification of ownership- Apart from creating a big fund pool, being public deprives ownership from a small number of investors and brings it to the diversified number of owners.

❖ COMPARISON OF GREEN AND NON-GREEN IPOs.

Green IPO	Non- green IPO
1. Issued by companies focused on environmentally sustainable or eco -friendly projects.	1. Emitted by companies of traditional sectors without a specific environmental focus.
2. The funds raised are used for green or renewable initiatives.	2. The proceeds are intended for general corporate purposes
3. Attracts ESG-focused investors.	3. Attracts general investors based on profitability and growth.

❖ PROCESS OF GREEN IPO

1.Appointing Professional Intermediaries: A company retains professionals such as investment bankers, auditors, and legal advisors to push an IPO forward. ESG consultants join the team for a Green IPO to help verify the sustainability credentials of the company to ensure compliance with the green standards.

2.Acquiring ESG or Green Certification: Extra credibility is needed for a Green IPO. Hence, the company gets evaluated to obtain environmental certification or verification from accredited organizations that assure the company actually practices sustainability and does not engage in greenwashing.

3.Preparing the draft red herring prospectus with sustainability disclosures:

The DRHP is a very comprehensive document covering financials, operations, risks, and objectives of the company. In a Green IPO, it also includes information on the environmental impact, sustainability goals, carbon footprint, renewable initiatives, and utilization of funds towards green projects.

4.Filing of DRHP with SEBI for Approval: Once the document is ready, the DRHP is filed

with SEBI. Thereafter, detailed scrutiny is done to ensure that everything is right and transparent, especially in terms of green claims.

5.Engage in green-focused marketing and roadshows:

Before opening subscriptions to the IPO, the company presents green initiatives that may attract ESG funds, impact investors, and any other responsible investment group because their IPO can support environmental goals.

6.Setting Price Band and Opening Subscription Window:

Once all approvals are in place, the pricing band is decided by the company and its bankers. The IPO opens for subscription and, at that time, the investors apply for the shares within the price band.

7.Attract ESG-focused investors and green funds:

This is especially true among investors focused on eco-friendly business during the subscription period of an IPO. Institutional investors also favor IPOs with green labels because such IPOs fit into global sustainability mandates.

8.Listing on the Stock Exchange - NSE/BSE:

After allotment, the company gets listed on various stock exchanges like NSE and BSE. Thereafter, the shares can be traded in the open market, and the process of IPO gets completed.

❖ PROCESS OF NON-GREEN IPO

1.Deciding to Raise Capital for General Business Needs:

A firm would become listed for several reasons: expansion, debt reduction, investment in new projects, and liquidity. Non-green IPOs, as compared to Green IPOs, focus on the overall growth of the business.

2.Appointing Intermediaries such as Bankers, Auditors, and Legal Advisors:

Like in any other IPO, the company hires investment bankers to manage the process, auditors to check the veracity of the financial data, and legal advisors for compliance and documentation.

3.Preparing the DRHP with financial and business information:

The company prepares the Draft Red Herring Prospectus. This includes information on the business model, financial statements, revenue sources, industry outlook, risks, management, and utilization of funds. There is no special sustainability-related information required because this is not a green IPO.

4.Filing of DRHP with SEBI for Approval:

The DRHP is then submitted to SEBI, which scrutinizes the document for any misrepresentation of financial data. SEBI does so in order to ensure transparency and protection for prospective investors.

5. Conducting Roadshows, Marketing based on Profitability and Growth:

The company and its bankers organize roadshows for investors, focusing on profitability, competitive strengths, financial performance, and future growth plans. Investors usually consider business fundamentals more than environmental goals.

6.Pricing of Band and Opening of Subscription Period:

With the approval in hand, the company announces the price bracket at which the IPO would happen. It opens the subscription window, and retail, institutional, and non-institutional investors subscribe to it.

Catering to General Investors Non-green IPOs target a wide variety of investors, from retail investors to traders, institutional investors, and mutual funds. The central focus for such investors is the financial returns they will get, along with possible business growth. Listing on Stock Exchange (NSE / BSE) Listing on stock exchanges is done after the allotment of shares is determined. Public trading of shares commences, and with that the entire IPO process comes to an end.

❖ STATEMENT OF PROBLEM

Although numerous IPOs are introduced to the market every year, there are few studies comparing the price performance between green and non-green companies. Investors still seem to be at a loss as to whether green IPOs yield higher returns or if traditional sectors are still more reliable. Due to this lack of clarity, confusion arises in decisions about investments. The problem addressed in this study is the absence of a direct, data-based comparison of the initial and long-term price performance between green and non-green IPOs.

❖ REVIEW OF LITERATURE

1) Studies on Indian IPO: Systematic review and future research agenda. Authors- Manali Chatterjee, Titas Bhattacharjee, Bijitaswa Chakraborty. The purpose of this paper is to examine, discuss, and synthesize literature regarding the Indian initial public offering (IPO) market.

2)Examining the performance of IPOs: Shikha Bhatia and Balwinder Singh This research examines the performance of 648 IPOs that were traded on Bombay stock exchange (BSE) between June 1992 and March 2002 over a period of 5 years. In order to draw sound conclusions about IPO performance, trends in IPO performance have been studied for 60 months after listing. Also, the study attempts to determine the factors that affect the performance of the Indian IPOs.

3)R.K. Mishra is an Indian academic who has contributed to research on green finance, environmental policy, and sustainability. His work focuses on how financial markets can support eco-friendly development. Green energy companies: Stock performance and IPO returns.

This study aims at investigating the performance of energy companies at IPO and highlighting the differences in under-pricing and stock return trends of green energy companies compared to non-green ones. We select all energy stock IPOs between 2000 and 2014 on the main European markets and evaluate first day and long run performance to shed light on the differences of the two groups of firms. As further refinement, we evaluate the determinants of short- and long-term performance. Evidence shows that green companies have a lower under-pricing, which nevertheless disappears after few days of trading and when controlling for under-pricing determinants. In the long run, performances of green and non-green are similar and empirical results show that the traditional risk factors explain return dynamics.

❖ OBJECTIVES

- To analyses the price performance of selected Green IPOs issued in India using issue price, listing price, and long-term market price.
- To evaluate the price performance of selected non-green IPOs.
- To compare the short-term and long-term return differences between Green and Non-Green IPOs.

❖ SCOPE

- The study covers four IPOs two Green and two Non-Green launched in India.
- The scope is limited to analyzing secondary-data-based price comparison on issue price, listing price, and market price.

❖ LIMITATIONS OF THE STUDY

- Only 4 IPOs are considered for the comparison.
- The comparison is price based.
- Only secondary data is used.

❖ NEED

With investors increasingly interested in sustainable, green businesses, it has become important to understand whether green- sector IPOs truly perform better that traditional non-green sector IPOs. However, clear comparisons between the two are scant. The following study is thus needed to provide investors, companies, and researchers with a simple and factual comparison of how green and non-green IPOs behave on the market at listing and over the long term.

❖ RESEARCH METHODOLOGY

The secondary data for this study has been collected through various sources such as research paper, internet, etc. Such information is already investigated and compiled by certain people of agencies or by Government.

❖ ANALYSIS AND INTERPRETATION

The IPO of Inox Green Energy Services Limited had an issue period from November 11, 2022, to November 15, 2022, and was listed on November 23,2022. The Price at which the IPO was offered was □ 65 per share. Immediately, the sock opened below this price on the day of listing, and the price was □ 59.10 as on November 23, 2022, against which the investors would have incurred an initial loss. However, based on the price as of November 14, 2025, the share was trading around □ 254.70, so investors who had held the shares from the issue date to this closing date would have incurred a substantial profit.

The IPO of Baheti Recycling Industries Limited was a fixed price issue, having an Issue Price of □ 45 per equity share. The IPO was open for

subscription from November 28, 2022, to November 30, 2022, and the shares were subsequently listed on the NSE SME platform on December 8, 2022. On the day of listing, the stock quoted at □ 114, which again was a very good profit compared to the Issue Price. Further, on the closing price as on November 14, 2025, the share was trading around □ 564.55 to □569, which again turned out to be a good profit as compared to both the initial Issue Price and the ListingPrice.

The IPO for Delhivery Limited was open for bidding from May 11, 2022, to May 13, 2022, and the shares were priced at □487 per equity share. The stock debuted on the exchanges on May 24, 2022, and closed higher at □ 495.20 on the listing day, hence giving an immediate but small profit to the investors. By the close of trading on November 14, 2025, the share price had considerably risen and closed at approximately □ 436.35 to □ 436.60, which would be clear and signify can't profit compared with the initial Issue Price of □ 487.00 and Listing Price of □ 495.20.

The IPO of Five Star Business Finance Limited was open from November 9, 2022, to November 11, 2022. It was priced at □ 474 per equity share, The stock, after listing, was weak on the exchanges on November 21, 2022, and the price on that day was approximately □ 489.95 on the NSE, indicating a small initial profit when compared to the Issue Price. However, the share price has significantly outperformed to close at approximately □ 643 on November 14, 2025. This price on the specified date signifies a clear and substantial profit when compared with the initial Issue Price of □ 474 and the Listing Price of approximately □ 489.95.



❖FINDINGS

Comparison of Listing Price vs. Issue Price (Initial Market Reception) Green Sector: Initial market reactions were mixed. While Baheti Recycling Industries had an immediate surge in price upon listing and its price was much higher than the Issue Price, Inox Green Energy Services opened at a price much lower than the Issue Price, hence the immediate loss to its initial investors. Non-Green Sector: The initial market reception was consistently positive but modest. Both Delhivery Limited and Five Star Business Finance opened at a Listing Price higher than their respective Issue Price, underlining a cautious small gain for investors on day one. Price Comparison on Nov 14, 2025 as against Issue Price (Long-Term Profitability) Green Sector: Both the companies achieved considerably higher prices than their Issue Prices. Inox Green Energy Services recovered strongly from its poor debut to close much above its Issue Price. Baheti Recycling Industries closed way above its Issue Price, reflecting exceptional long-term performance. non-green sector: The sector showed mixed results on an absolute profit perspective. Five Star Business Finance closed higher than its Issue Price, hence clear profit. On the other hand, Delhivery Limited closed at a price lower than its Issue Price, hence an absolute clear loss to the IPO investor.

Price Comparison on Nov 14, 2025 vs. Listing Price (Post-Listing Growth)

Green Sector: Both the companies strongly continued their upward trajectory after getting listed into the market. While Inox Green Energy Services jumped up from the low Listing Price to a very high final price, Baheti Recycling Industries surged ahead to close at a price much higher than its already-high Listing Price. Non-Green Sector: The post-listing performance appeared divergent. Whereas Five Star Business Finance continued to show growth and closed its final price higher than the Listing Price, Delhivery Limited reversed the initial gain as its final price closed lower than the Listing Price after showing considerable post-listing price erosion.

❖CONCLUSION

The main conclusion from these IPO comparisons is that the green sector is clearly superior is that the green sector is clearly superior for long-term absolute price

appreciation, despite showing greater initial volatility. The non-green sector provided a far safer and more predictable small listing gain but couldn't eventually produce the same magnitude of wealth, with one company returning an absolute loss over the three-year period. The extraordinary post-listing growth in both green companies even that opening at a loss- underscores a powerful investment narrative and fundamental strength of the companies participating in the renewable and circular economy, making this sector the highest- reward segment for long-term investors who can tolerate initial price uncertainty.

❖ **REFERENCE**

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Handbook on Green Growth

36. IMPACT OF GREEN FINANCINGON MSME GROWTH AND SUSTAINABLE INNOVATION

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ABSTRACT:
This study examines the impact of green financing on the growth and sustainable innovation of micro, small, and medium enterprises (MSMEs) in India, focusing on SIDBI's initiatives over three fiscal years. Employing a descriptive and analytical methodology, the research analyses secondary data from SIDBI's annual reports to assess credit disbursement trends, sectoral distribution, and environmental outcomes, Findings reveal significant growth in green credit – from Rs.18,409 crore to Rs.37,781 crore – primarily supporting traditional and emerging sustainable sectors, resulting in substantial energy saving and CO2 emission reduction. The study underscores that green financing fosters technological modernization, promotes eco-friendly practices, and enhances MSME competitiveness while contributing to environment objectives. These insights highlight the vital role of institutional support in integrating sustainability into MSME development, demonstrating that green finance can serve as a strategic tool for fostering inclusive and environmentally responsible economic growth.

KEYWORDS: Green Financing, MSMEs, Green Credit, SIDBI, Sustainable Innovation.

❖ **INTRODUCTION:**

Micro, Small and Medium Enterprises (MSME) sector has become a powerful and energetic sector of the Indian economy. MSMEs are the silent engine of economic growth, as they make the most of the local communities by creating jobs, and being a source of new ideas with their versatility. Nevertheless, as the environmental issues become more severe and the global community moves towards sustainable development, MSMEs frequently find it difficult to receive financing that is required for them to make a green transition. This is the point where Green Financing comes to the rescue.

Green Finance means the financial investments that are exclusively dedicated to the projects and the initiatives that are supposed to bring the benefits to the environment. This includes financing renewable energy projects, energy efficiency improvements, pollution control measures, and sustainable infrastructure development. The role that green financing plays is imperative in the journey towards the NET ZERO Goal. Green financing gives a wider reach to environment friendly goods and services. Green financing can be done through various instruments like Green Bonds, Green Investments, Green Loans, Carbon Finance, and Climate-focused funds.

Green Finance for MSMEs is a kind of welcome that offers the possibilities of the cleaner technologies, energy-efficient processes, and eco-friendly innovations. This research probes the interplay of financing and the growth of MSMEs and green financing influence on the MSMEs development. Financial institutions like SIDBI, through its dedicated Green Finance initiatives, are supporting small enterprises.

This research paper analyses the MSME credit flow via credit disbursement trends over last 3 financial years, and lending patterns at the sector level to identify the financing areas. It also analyses green and renewable energy financing role as a source of sustainable business transformation.

❖ REVIEW OF LITERATURE

1)Aghnia Nadhira Aliya Putri
(School of Business and Management, Institute Teknologi Bandung)
Exploring Green Growth in SMEs: Global Trends, Challenges, and Future Directions - This paper conducts a systematic literature review of 56 peer-reviewed studies (2010–2024) to examine how SMEs adopt green growth practices. Using themes such as environmental innovation, circular economy adoption, and green financial management, it identifies key drivers (government policy, market pressures, technology), barriers (financial limitations, knowledge gaps), and emerging trends including digitalization and green finance. The review concludes that SME sustainability is evolving from basic awareness to ecosystem-level integration and highlights future research needs in AI-driven business model innovation, blockchain-enabled green finance, and cross-sector policy alignment.

2)Mahesh, Aithal & Sharma (2022):
Impact of Sustainable Finance on MSMEs and other Companies to Promote Green Growth and Sustainable development - This paper examines how Sustainable Finance supports greener production, economic growth, and India's long-term climate commitments, particularly for MSMEs and emerging industries. Using a theoretical analysis of existing literature, policies, and financing mechanisms, it evaluates the roles of institutions such as SIDBI, NITI Aayog, the World Bank, and green financial instruments. The study finds that effective climate and sustainable finance—supported by strong ESG regulations and government initiatives—is essential for developing green infrastructure and achieving India's sustainable development and Net Zero goals.

3)Danish Ahmed, Hu Xu Hua, and Umair Saeed Bhutta (2024)
Innovation through Green Finance: a thematic review - This paper aims to understand how green finance supports green innovation by conducting a thematic analysis of existing literature. Using a three-part analytical framework, it reviews the theoretical perspectives used in prior studies, the environmental themes they address, and the gaps that require further scholarly and practical attention. The findings show that green finance generally promotes firm-level green innovation by easing funding constraints, though concerns about greenwashing remain, highlighting the need for more effective and accountable use of sustainability-focused financial resources.

❖ STATEMENT OF PROBLEM

While MSMEs are instrumental in India's economic growth and development, a large number of them are unable to make a transition to environment sustainability practices. Their biggest hurdle is the constrained access to affordable and prompt finance. Many MSMEs struggle to access adequate financing required to carry out sustainable practices. Lack of awareness, restricted fund flow and improper allocation of funds hinder their performance towards sustainable growth.

❖ OBJECTIVES OF THE STUDY

- Study the changes and fluctuations of SIDBI's green financing over the last three financial years, especially the size, growth, and distribution of the funds.
- Analyse the sector-wise utilization of SIDBI's green finance, finding out which industries get the largest share and figuring out the reasons that influence this distribution.
- Examine the total makeup and results of the green finance portfolio, evaluating the kinds of projects financed, their sustainability focus, and their contribution to environmental and economic .

❖ NEED & RELEVANCE OF THE STUDY

●This research is essential to know in what way green finance could be a tool of MSME growth while the net effect on nature would still be positive, thus, maintaining a balance of the economy.

●The matter is elevated due to the fact that MSMEs are subject to a growing number of demands to implement environmentally friendly practices, however, a great number of them are unaware of the existence of financial instruments that would make it easier for them to embark on such initiatives.

●It is instrumental in demonstrating how the availability of green financing can be a powerful tool for MSMEs to implement clean energy technologies, thus, enabling the reduction of energy expenses and carbon emissions over .

❖ RESEARCH METHODOLOGY

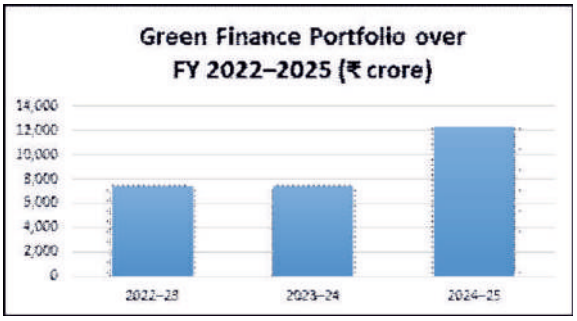
This study implements a descriptive and analytical research design to investigate the effect of green financing on the growth of MSMEs and sustainable innovation in India. The descriptive aspect of the study traces the directional changes in the policy regarding the credit and sustainability activities of SIDBI. The analytical aspect of the study deciphers the ways in which these financial initiatives lead to the development of MSMEs technologically and make the more environmentally friendly.

The research is limited to secondary data only and is taken from annual reports of the Small Industries Development Bank of India (SIDBI) for FY 2022-23, FY 2023-24, FY 2024-25. The research is limited to SIDBI's role as the main financial institution for the development of India's MSMEs and restricted to the three fiscal years mentioned.

There are few limitations such as the reliance on secondary data, possible inconsistencies in the report summaries, and the absence of validation at the micro-level.

By relying on data from authenticated, publicly accessible institutional documents, all ethical standards were observed. Proper citations were made throughout the study to facilitate transparency, honesty, and academic integrity.

DATAANALYSIS AND INTERPRETATION



(Source: SIDBI Annual Reports FY 2022-25)

FY 2022-23

The financial year 2022-23 marked the foundation phase of the Small Industries Development Bank of India (SIDBI) in advancing green finance driven MSME development. This period witnessed key policy and institutional framework to embed environmental responsibility into MSME financing. SIDBI's direct finance portfolio expanded to Rs.18,409 crore, reflecting a 30% year-on-year growth from Rs.14,187 crore in FY 2021-22. This growth indicated the increasing demand for MSME credit, particularly through cluster-based development programs and clean-tech adoption initiatives.

Sectorally, SIDBI's credit exposure began to shift from traditional industries towards emerging green sectors such as waste management, compressed biogas, and electric vehicle (EV) ecosystem development. Though conventional manufacturing continued to dominate, these new focus areas demonstrate the beginning of a strategic transition toward sustainability-linked lending. The year's emphasis lay in policy formulation and institutional groundwork, positioning green finance as an essential tool for fostering resources-efficient industrial models.

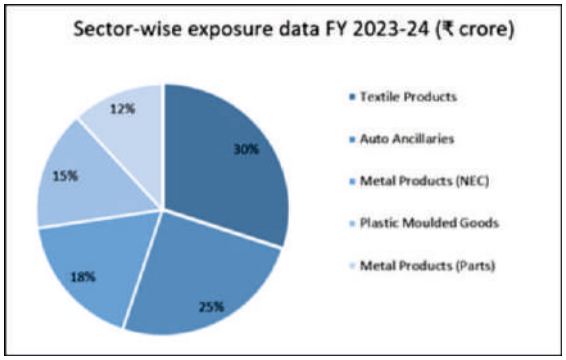
During this period, green finance functioned primarily as a capacity-building initiative rather than a large-scale financial operation. Under the Partial Risk Sharing Facility (PRFS), SIDBI supported 61 energy-efficiency projects, enabling MSMEs to pilot cleaner production technologies. Moreover, achieving Direct Access Entity (DAE) status with the Green Climate Fund (GCF) positioned SIDBI as India's main institutional channel for mobilizing global green capital. Complementary initiatives

such as the Sustainability Perception Index (SPeX) and Green Inclusivity (GRiT) were launched to sensitize MSMEs toward sustainability metrics and assess their green-readiness.

Interpretation: FY 2022-23 thus represents the strategic groundwork for connecting MSME development with green principles. While green lending volumes remained modest, SIDBI's institutional innovation laid a solid foundation for future expansion. The framework developed during this period began reshaping MSME behavior, encouraging innovation, sustainability, and energy conscious business practices.

FY 2023-24

This fiscal year 2023-24 signified the take off stage, as SIDBI transitioned from foundational planning to large-scale portfolio implementation of green financing. The direct finance portfolio rose by 46% to Rs.26,826 crore, benefitting 72.84 lakh MSMEs through institutional and direct credit support. This growth underscored how green finance had evolved from conceptual initiative to a practical mechanism for MSME modernization and competitiveness.



(Source: SIDBI Annual Report FY 2023-24)

While traditional sectors such as Textile (30%), Auto ancillaries (25%) Metal products (18%), Plastic molded Goods (15%), and Metal products (Parts) (12%) continued to dominate, SIDBI introduced energy-efficient retrofitting, waste recycling, and technology upgradation into these industries. This integrated model of "green modernization" allowed MSMEs to enhance productivity while minimizing environmental impact.

The green finance portfolio surged to RS.7,376 crore, a 4.5-fold increase over FY 2022-23. Approximately Rs.8,200 crore in green loans were extended to 4,400 MSMEs, resulting in 1.3 billion unit of annual energy savings. These measurable results illustrated the growing effectiveness of green credit as a driver of innovation and sustainability. Major initiatives such as End-to-End Energy Efficiency (4E), Green Finance Scheme (GFS), and GIFT & SPICE were launched to promote renewable adoption, cluster-level energy optimization, and circular economy transitions.

Interpretation: FY 2023-24 represented turning point, where green finance became a transformative means for MSME innovation. Financial inclusion began aligning with environmental performance, with MSMEs adopting structured green credit lines to achieve modernization. The remarkable expansion of green disbursements confirmed that SIDBI's financial strategy had evolved into a model that integrated growth, innovation, and sustainability.

FY 2024-25

The fiscal year 2024-25 marked the maturity phase of SIDBI's green finance journey, characterized by mainstreaming of sustainability into MSME lending operations. Total MSME credit reached Rs.31.1 lakh crore, registering 14.8% annual growth, while direct lending rose 41% to Rs.37,781 crore. Partner-NBFC financing nearly doubled to Rs.5,760 crore, indicating widespread adoption of sustainability-linked credit mechanism across the financial ecosystem.

Green finance became a core operational pillar, constituting about 41% of total branch lending, with portfolio exceeding Rs.12,290 crore. Within this, Rs.4,227 crore was directed toward renewable energy projects, benefitting 2,198 MSMEs and supporting over 1 GW of combined solar and wind capacity. These projects generated 1,106 GWh of energy savings and reduced 2.95 million tons of CO2 emissions, demonstrating the tangible sustainability outcomes of SIDBI's green initiatives.

SIDBI institutionalization sustainable innovation trough flagship program such as MSE-GIFT (Rs.16,600 crore sanctioned to 560+ MSMEs) and Energy Efficiency Finance

(EEF). Moreover, integrating indices like SPeX and the MSME Business Confidence Index into credit assessment ensured that sustainability performance became a determinate of credit worthiness.

Interpretation: FY 2024-25 represented the institutionalization of green finance as a mainstream development tool. SIDBI's strategic approach transformed MSMEs from credit recipients into active agents of India's green transformation, embedding sustainability, innovation, and competitiveness within their business models.

❖CONCLUSION

The study shows that green financing substantially changes the trajectory of MSME growth and sustainable innovation in India. The interventions of SIDBI from FY2022-23 to FY2024-25 reveal that sustainability-linked credit is not only an environmental initiative but also a strategic developmental tool that deepens industrial expansion while integrating innovation in MSME operations. Green finance made MSMEs more productive, competitive, and financially stable in the long run by facilitating renewable technologies, energy-efficient processes, and digital upgrades.

The measurable results—higher credit volumes, larger green portfolios, and vast energy consumption and CO□ emission reductions—are the main reasons for the programs' economic and ecological benefits. Institutional instruments such as SPeX and business confidence indices helped MSMEs to consider sustainability as a core business strategy, thereby environmental responsibility becoming financial credibility. SIDBI's use of global resources like the Green Climate Fund (GCF) made it a key player in driving inclusive, sustainable growth even more.

To sum up, SIDBI's green finance schemes are a testament to how MSME growth can be harmoniously combined with sustainability. By harmonizing industrial modernization with environmental objectives, green financing has repositioned MSMEs as leaders of technological innovation, competitive resilience, and long-term economic sustainability, thus making sustainability one of the key pillars of India's MSME .

❖FINDINGS

●GreenFinancing Driving MSME Growth: SIDBI's green credit to MSMEs using sustainability-linked financing is the main driver of MSME growth can be seen from the total green credit of SIDBI which grew from □18,409 crore in FY2022–23 to □37,781 crore in FY2024–25. The green-financed sectors were not only the emerging ones but also the traditional sectors like textiles, auto engineering, and metal products. Cleaner technologies, energy-efficient machinery, and waste management solutions were parts of green-financed sectors resulting in plant modernization of the conventional MSMEs.

●Promotion of Sustainable Innovation: Various programs including 4E (End-to-End Energy Efficiency), GFS (Green Finance Scheme), and MSE-GIFT of SIDBI were designed to encourage MSMEs to adopt renewable energy, circular economy, and technological advancement in the production process. These initiatives eliminated environmental footprints leading to the growth of green economy and concurrently proving that financial incentives can be a direct driver of sustainable practices.

●Tangible Economic and Environmental Impact: Green financing resulted in some measurable effects such as the energy-saving volume of 1.3 billion units annually (FY2023–24) and CO□ reduction of 2.95 million tons (FY2024–25), which is a win-win situation for MSMEs in terms of making a saving of the capital cost and taking responsibility for the ecology.

●Institutional Support and Inclusive Access: Besides other tools like the SPeX (Sustainability Perception Index) and the MSME Business Confidence Index, the sustainability-performance-to-creditworthiness link was established through them. Making use of global funds, e.g., the Green Climate Fund (GCF), SIDBI kept green finance open to all, thus, being at the centre stage as a major institutional player for the green MSME transformation in .

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37. DETECTING FINANCIAL STATEMENT FRAUDS: RATIO-BASED ANALYSIS FOR IDENTIFYING RED FLAGS

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ABSTRACT
Financial statement fraud manipulates accounting information to create a misleading picture of business performance. Unlike asset misappropriation or corruption, it relies on accounting entries and disclosures rather than direct economic transactions, making it difficult to detect. Ratio analysis evaluates internal consistency between sales, assets, cash flows, leverage, and operational efficiency, enabling identification of suspicious patterns. This study reviews academic reference models such as the Beneish M-Score, logistic regression, and Altman Z-Score to understand how financial ratios reveal red flags. Evidence suggests that abnormal ratio movements emerge before regulatory detection. The study highlights the usefulness of ratio-based analytics as a low-cost and proactive fraud detection approach.

KEYWORDS
Financial Statement Fraud; Forensic Accounting, Earnings Manipulation.

1. INTRODUCTION
Financial statements are a core tool for communicating financial performance to investors, lenders, regulators, and markets. When management intentionally manipulates these numbers, decision-making becomes distorted. Financial statement fraud typically involves premature revenue recognition, fictitious sales, misreporting of receivables, capitalization of operating expenses, or concealment of liabilities. Since routine statutory audits rely on documents provided by management, early fraud detection becomes difficult. Ratio-based approaches offer an objective way to identify inconsistencies because they evaluate financial relationships, not isolated values. When sales increase without cash inflows, or leverage rises without productive assets, these patterns are mathematically visible through ratios.

2. STATEMENT OF THE PROBLEM
Financial statement fraud frequently goes undetected for extended periods because it is deliberately hidden within seemingly legitimate accounting judgments, estimates, and disclosure practices. Traditional auditing approaches primarily focus on verifying compliance with standards and examining supporting documentation, which makes them heavily dependent on the integrity of the information supplied by management. When management intentionally falsifies records or omits critical details, auditors may inadvertently confirm rather than uncover the deception.
Companies engaging in fraud often exhibit unusual patterns in key areas such as receivables, inventory turnover, debt levels, and reported earnings; however, these red flags are seldom investigated through rigorous, systematic financial ratio analysis during routine audits. Consequently, fraud typically surfaces only after significant damage has already occurred—such as bankruptcy, sharp declines in market value, or enforcement actions by regulators.
The fundamental issue lies in the lack of a proactive, standardized analytical framework capable of identifying material inconsistencies

and anomalies in financial statements at an early stage, independent of tips from whistleblowers, admissions by perpetrators, or formal regulatory probes.

3. REVIEW OF LITERATURE

Beneish (1997, 1999) developed the M-Score model using eight indicators focused on revenue manipulation, asset quality, depreciation policy, leverage pressure, and accrual intensity. Manipulation is most evident when receivables grow faster than sales (DSRI), margins deteriorate despite rising revenue (GMI), and unusual growth occurs without corresponding operational performance (SGI).

Kanapickienė and Grundienė (2015) examined 51 financial ratios from Lithuanian companies and identified 32 that differed significantly between fraudulent and non-fraudulent firms. Inventory concentration, total liabilities, liquidity, and sales-to-fixed-asset ratios performed better than simple profitability indicators. Their logistic model achieved 84.8% accuracy.

Gupta and Mehta studied Indian fraud cases and used feature-selection techniques to identify eight core ratios. These included net profit to total assets, net profit to equity, gross profit margin, total debt to total assets, and receivable–inventory concentration. Fraudulent companies displayed volatile ratio behaviour, showing deviations several years prior to exposure.

Roxas (2011) compared Beneish and digital analysis. While Benford-law patterns identify unnatural number distributions, the Beneish model was superior in detecting revenue-based miscoding. Ratio changes were most informative when observed across a sequence of years rather than in a single reporting period.

In Indonesia, Prasetyo et al. (2023) found strong positive correlation between leverage and financial fraud, and a negative relationship with capital turnover. Asset inefficiency was therefore a more reliable fraud indicator than net profit margins.

Megan Media Holdings in Malaysia demonstrated how fictitious sales and artificially inflated inventory create abnormal DSRI and deterioration in margin ratios. Its M-Score exceeded the manipulation threshold before collapse, confirming the model's predictive strength.

4. RESEARCH METHODOLOGY

This study is based entirely on secondary data, including published academic literature, regulatory investigation reports, and documented fraud case analyses. Three international corporate fraud cases were examined to understand ratio-based red flags: Enron (United States), which used Special Purpose Entities to hide debt and fabricate earnings; Satyam Computers (India), which manipulated cash balances and revenue figures; and Megan Media Holdings (Malaysia), which inflated inventory and sales through fictitious transactions. The methodology emphasizes the application of ratio trends, Beneish M-Score interpretation, and comparative analysis of liquidity, leverage, and profitability indicators to identify inconsistencies in fraudulent financial statements.

5. OBJECTIVES OF THE STUDY

1.To analyze how ratio changes reflect economic inconsistencies in manipulated financial statements.

2.To evaluate academic evidence from widely used fraud detection models.

6. ANALYSIS AND INTERPRETATION

Fraudulent companies exhibit ratio behaviour that violates economic logic. Three examples clearly illustrate this:

1. Enron (United States)

Nature of Fraud: Synthetic profit creation, off-balance sheet liabilities, inflated performance using Special Purpose Entities.

Interpretation: Debt was hidden through SPEs, causing leverage to appear low and cash-flow ratios to remain positive despite collapse in core business. Depreciation and asset quality metrics were suppressed to maintain optics.

2. Satyam Computers (India)

Nature: The company reported fake bank balances and exaggerated sales figures.

Interpretation: Its cash-to-liability ratio showed unusually strong liquidity, while profits appeared to improve even though real business activity did not grow. Trade receivables increased, but operating cash inflows did not follow the same trend, indicating that the

reported revenue was not supported by actual cash movement

3.Megan Media Holdings (Malaysia)

Nature: Fictitious sales, inflated inventory, and diversion of funds.

Interpretation: Beneish indices DSRI and GMI showed abnormal increases. Inventory concentration increased while asset turnover deteriorated. These indicators surfaced long before the company collapsed.

In each case, ratio deviations appeared before forensic investigation or auditor detection. The weakness of traditional auditing lies in checking documents, not economic coherence. Ratio analysis, by contrast, exposes contradictions between earning claims, cash flows, leverage, and asset utilization.

7. FINDINGS AND SUGGESTIONS

Findings:

- Fraudulent companies often show rising profitability without operational support.
- Receivables and inventory accounts are most frequently manipulated.
- Leverage pressure is a major catalyst of manipulation.
- Efficiency ratios, such as capital turnover, provide stronger fraud signals than simple profit ratios.
- Multi-year trend analysis is significantly more accurate than single-period comparison.

Suggestions:

- Auditors should include multi-year ratio trends as a regular part of their audit work.
- Regulators must create clear rules that require the use of ratio indicators to evaluate fraud risk.
- Students and professionals should focus on real economic performance and business logic rather than only verifying documents.

8. CONCLUSION

Financial statement fraud disrupts internal financial relationships that are mathematically observable through ratios.Although ratio models cannot independently confirm the existence of fraud, they can highlight financial inconsistencies well before authorities intervene. Ratio-based evaluation should be combined with strong corporate governance, forensic examination, and regulatory monitoring to safeguard stakeholders and promote transparency in financial markets.

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38. Elevating Sustainability: The Business Model of Aeroponic Farming in Modern Commerce

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Abstract

Global agriculture is undergoing a period of transformation as traditional soil-based farming becomes increasingly unsustainable in the face of water scarcity, soil degradation, rapid urbanization, and climate variability. Aeroponic farming, a soil-less cultivation technique in which plant roots are suspended in air and

misted with nutrient solutions, has emerged as a highly efficient and sustainable agricultural model. This research paper examines aeroponic farming as both an environmentally responsible solution and a commercially viable business model. Through a review of literature, analysis of sustainability metrics, technological and economic evaluation, and an assessment of modern consumer trends, the paper demonstrates how aeroponics aligns with the needs of contemporary commerce. It further identifies the challenges, risks, and opportunities associated with aeroponic
Businesses, especially in urban and resource-constrained regions. The study concludes that aeroponics represents a scalable, profitable, and future-oriented agricultural innovation capable of reshaping global food systems.

Keywords
Aeroponics, Sustainability, Vertical Farming, Controlled Environment Agriculture (CEA), Business Model, Modern Commerce, Urban Farming, Water Conservation.

1. Introduction

The global food system today faces unprecedented pressure. Population growth, estimated to reach 9.7 billion by 2050, demands a 60% increase in food production. Simultaneously, traditional agriculture struggles with diminishing arable land, depleting groundwater levels, erratic climate patterns, and increasing chemical dependency. According to global environmental assessments, nearly one-third of cultivated soils worldwide are degraded due to overuse, erosion, and chemical contamination. These challenges raise the urgent need for innovative, sustainable, and commercially viable agricultural solutions.

Aeroponic farming is one such innovation that has received increasing attention from researchers, entrepreneurs, environmentalists, and governments. Originating as a NASA experiment for growing plants in space, aeroponics suspends plant roots in an oxygen-rich air chamber, where they are periodically misted with nutrient solutions. By eliminating soil, reducing water waste, and offering full environmental control, aeroponics enables faster plant growth, higher yields, and year-round production.

In modern commerce, sustainability is no longer optional—it is a competitive advantage. Consumers now prefer pesticide-free, locally grown, high-nutrition produce. Businesses seek agricultural systems that reduce costs, optimize resources, and support long-term profitability. Governments promote sustainable farming through policy incentives. Aeroponics addresses each of these needs, making it an emerging economic opportunity.

This research paper explores how aeroponic farming elevates sustainability and functions as a robust business model suited for 21st-century commercial demands.

2. Statement of the Problem

Traditional agriculture is facing limitations that hinder its ability to support modern food requirements sustainably:

Excessive Water Consumption: Farming accounts for nearly 70% of global freshwater withdrawals. Water scarcity threatens crop reliability and cost stability.

Loss of Arable Land: Urban expansion and industrialization reduce cultivable land availability every year.

Climate Instability: Unpredictable rainfall, extreme temperatures, and seasonal dependency cause inconsistent yields.

Environmental Damage: Heavy use of pesticides, fertilizers, and machinery contributes to pollution and soil degradation.

Supply Chain Inefficiencies: Transporting produce from distant rural farms increases food miles, carbon footprint, and spoilage.

Growing Urban Demand: The rise of organic, hyperlocal, and health-focused consumer trends requires fresh produce closer to cities.

Given these challenges, a new agricultural approach is needed—one that is environmentally sustainable, commercially profitable, and adaptable to modern urban environments. Aeroponics presents a promising solution, but its overall viability needs examination.

3. Review of Literature

A growing body of literature highlights the advantages of aeroponics in both sustainability and productivity: NASA (1998) reported that aeroponic systems maximize oxygen availability to plant roots, resulting in faster

growth and higher nutrient uptake compared to soil and hydroponics. The International Journal of Agriculture Studies (2022) concluded that aeroponics uses 90–95% less water than traditional farming and significantly reduces nutrient runoff due to its closed-loop system. Farmonaut (2024) identified aeroponics as an emerging solution for water-scarce regions like India, demonstrating its suitability for leafy greens, herbs, and high-value crops .A Vertical Farming Market Report (2023) emphasized the economic potential of aeroponic farms in urban areas, where land is expensive and local demand for fresh produce is high. Studies published in the Horticulture Science Journal (2021) found that aeroponically grown vegetables often have higher nutrient density due to optimized nutrient delivery and controlled environmental conditions. The Journal of Controlled Environment Agriculture (2020) explored the benefits of integrating IoT sensors and automation into aeroponic systems, showing improved consistency, reduced labour, and better disease control.

Collectively, these studies highlight the potential for aeroponics to revolutionize sustainable farming. However, they also note challenges related to energy consumption, initial investment, and technological complexity.

4. Objectives of the Study

This research paper aims to:

1.Analyze aeroponic farming as a sustainable agricultural method.

2.Examine the commercial viability and business model of aeroponic farms.

3.Identify technological factors supporting aeroponic efficiency.

4.Highlight challenges limiting its widespread adoption.

5. Research Methodology

The methodology used in this study is descriptive and analytical, relying entirely on secondary data sources. The is collected from Peer reviewed journals, NASA and government publications , agriculture research databases, Case studies of operating aeroponic businesses. Also Comparative analysis was considered between traditional soil farming , hydroponics and aeroponics. The primary sources like sampling and surveys were not used and conducted. Key parameters assessed include water usage, productivity, cost structure, environmental impact, resource efficiency, and commercial scalability.

6. What is Aeroponic Farming — Technical Overview

6.1 Principles and System Architecture

Aeroponics is a method of cultivating plants without soil, where plant roots hang in air within a controlled environment and are periodically misted with a nutrient-rich solution.

A typical aeroponic system consists of several key components:

- A growth chamber or enclosure, often designed to be light-tight or temperature/humidity-controlled.
- A plant-supporting structure, which physically holds plants in place while their roots remain exposed.
- A nutrient supply and misting system, which delivers water, nutrients, and oxygen via a fine spray or mist at regular intervals.
- Optionally, environmental controls (light, temperature, humidity, CO_2), and monitoring/automation systems — especially in commercial or large-scale setups.
- Because the roots are exposed to air and nutrients directly, plants benefit from high oxygenation, efficient nutrient uptake, and optimal root-zone conditions.

7. Analysis and Interpretation of Data

7.1Water Efficiency

Water scarcity is a critical global issue. Traditional farming suffers from massive losses through runoff and evaporation. Aeroponics uses a misting mechanism where, Water consumption is reduced by 90–95%., Excess nutrient solution is recaptured and reused. No soil means no evaporation or runoff losses.

7.2 Land Utilization and Vertical Farming

Traditional farming requires large areas of land. Aeroponic systems, however, can be stacked vertically using towers or racks. This allows Up to 10 times more crops per square foot, Farming in non-agricultural spaces: warehouses, rooftops, basements, Urban farming with minimal real estate usage

7.3 Yield and Growth Rate

Aeroponics provides an oxygen-rich

environment, promoting rapid root development. This can be concluded due to 25–30% faster growth rates, 40–60% higher yields, Multiple harvest cycles annually, Lower crop failure due to controlled environments

7.4 Quality of Produce

Aeroponics offers Pesticide-free produce, Cleaner roots and leaves, higher nutrient density, longer shelf life

7.5 Cost Analysis and Economic Viability

Initial investment is higher than traditional farming due to infrastructure, pumps, lights, and sensors. Operating costs are lower due to Low water costs, Lower fertilizer usage, reduced labour due to automation, Energy usage is the main operational expense

Revenue potential is impressively high as a result of Premium pricing, faster crop cycles, Local market advantage, and reduced wastage

8.Sustainability Benefits: Environmental, Resource, and Social Aspects

8.1 Water Conservation and Resource Efficiency

Water scarcity is a growing concern worldwide, particularly in semi-arid and arid regions. Traditional soil-based agriculture consumes vast quantities of water, often unsustainably, and suffers from large losses due to evaporation and runoff. Aeroponics dramatically reduces water consumption by misting roots directly and enabling recapture/recycling of unused nutrient solution. Studies and industry sources cite water savings up to 90–95% compared to conventional farming.

This reduction not only conserves a vital and often scarce resource, but also lowers the cost and environmental footprint of cultivation — a major advantage, particularly in water-stressed regions.

8.2 Land Use Efficiency and Urban / Vertical Farming

As urbanization increases globally, arable land per capita declines. Converting wildlands or forests to agriculture has severe ecological costs. Aeroponic farming, with its vertical-stack capability and minimal footprint, offers a way to decouple food production from large land requirements.

This vertical or urban-integrated approach can:

- Reduce pressure on rural land and natural ecosystems
- Bring production closer to consumption centres (cities), reducing transportation needs and associated carbon emissions
- Enable farming in non-traditional spaces — rooftops, warehouses, indoor facilities, peri-urban areas

Hence, aeroponics supports a shift toward more sustainable, land-efficient agriculture — especially critical as arable land becomes scarcer.

8.3 Reduced Chemical Use, Pollution and Soil Degradation

Traditional agriculture often relies on heavy application of fertilizers, pesticides, and other agrochemicals. Over time, this can degrade soil quality, pollute groundwater, and harm ecosystems. Because aeroponics eliminates soil, and uses a closed nutrient-water loop with precise delivery, it greatly reduces — or even eliminates — the need for pesticide/herbicide usage.

Furthermore, minimal chemical runoff reduces risk of water pollution. Soil-related issues such as erosion, degradation, and salinization are bypassed entirely. The controlled environment also allows for better hygiene and plant-health management.

Together, these factors contribute to ecosystem health, biodiversity preservation, water-quality protection and long-term soil conservation.

8.4 Increased Productivity and Food Security

Because aeroponic systems allow for faster growth cycles and multiple harvests per year (compared to seasonal constraints of soil farming), they can significantly raise productivity per unit area and time. Research on fruit vegetables grown in aeroponic systems indicates improved growth parameters, higher yields, and enhanced nutritional quality.

This productivity boost, especially when combined with spatial efficiency and urban proximity, can enhance food security in densely populated regions, reduce dependence on food imports, and make fresh produce more accessible year-round. It is particularly relevant for countries with limited arable land, water scarcity, or rapidly growing urban populations.

8.5 Climate Resilience and Controlled-Environment Stability

Climate change introduces unpredictability — erratic rainfall, droughts, floods, extreme weather. Traditional agriculture becomes increasingly risky. Aeroponic farming, often implemented within controlled-environment agriculture (CEA) systems (greenhouses, indoor farms), offers resilience: environmental parameters (light, humidity, temperature, nutrients) can be maintained irrespective of external climate variabilities.

Such resilience reduces crop failure risk, ensures yield stability, and allows for predictable production cycles — important for commercial operations, supply chains, and urban food security planning.

9. Case for Aeroponic Farming in Developing Economies (e.g., India) — Relevance & Potential

The advantages of aeroponic farming align strongly with the challenges faced by developing economies such as water scarcity, soil degradation, land pressure, and rapid urbanization. For instance:

●Water scarcity: In many regions of India (and other developing countries), water scarcity and groundwater depletion pose serious constraints for agriculture. Aeroponic's water efficiency makes it a compelling solution. As per recent estimates for India 2025, aeroponic systems may use only 10–20 liters of water per kg yield vs. 200–400 liters in traditional farming; and require far less land per kg yield.

●Urban land pressure: As cities expand, cultivable land near cities shrinks; aeroponic vertical farms or rooftop farms can supply urban centers with fresh produce, reducing dependency on long supply chains and lowering food miles.

●Climate variability: Regions experiencing erratic rainfall, extreme heat, or other climate stresses may benefit from controlled-environment agriculture offered by aeroponics.

●Rising demand for clean, pesticide-free produce: As consumers grow more conscious of food safety and quality, aeroponic produce — pesticide-free, fresh, locally grown — can capture urban markets willing to pay premium prices.

●Entrepreneurial opportunities and new agribusiness models: Given modularity and scalable investment options, aeroponic farming can provide opportunities for small entrepreneurs, start-ups, or cooperative farming ventures — crucial in economies where agriculture remains a major livelihood source.

Thus, aeroponic farming can play a significant role in transforming agriculture in developing economies — not only as a sustainability initiative but as a viable commercial and social enterprise.

10.Aeroponics as a Commercial Business Model

Given the sustainability and productivity benefits described, aeroponic farming presents a compelling business model. Here we analyze key pillars that make it commercially attractive, as well as the challenges and factors critical for success.

10.1 Economic Viability: Yield, Space & Resource Optimization

●High yield per unit area: Because aeroponic grows plants vertically and often layers crops in stacked configurations, the yield per square meter is much higher than conventional fields. This allows commercial growers to maximize output even on small land parcels.

●Faster crop cycles: Shorter growth cycle and year-round production enable multiple harvests per year. This improves cash flow and reduces the "dead time" between seasons typical in traditional agriculture.

●Lower input costs (water, fertilizers, and pesticides): Efficient water and nutrient usage reduce recurring costs; reduced pest/disease risk lowers costs of agrochemicals and crop losses.

●Urban proximity and reduced logistics costs: Locating aeroponic farms closer to consumers (cities) cuts transportation, refrigeration, and storage costs; produce reaches market faster and fresher, potentially commanding higher prices. This proximity advantage is especially valuable for perishable leafy greens, herbs, or specialty vegetables.

●Premium for quality produce: Aeroponically grown crops can be marketed as pesticide-free, fresher, more nutritious, and locally grown — aspects increasingly valued by health-conscious urban consumers. Research on fruit-vegetable yield and nutritional quality supports this benefit.

●Thus, the business model leverages resource-efficiency, space-efficiency, speed, and quality premium to deliver economic returns — particularly in urban, peri-urban, or land-constrained settings.

10.2 Scalability and Vertical/Urban Farming Integration

The compactness and modularity of aeroponic systems make them inherently scalable — from small rooftop vertical farms to large indoor commercial farms. According to industry surveys, aeroponic systems can be effectively integrated with vertical farming techniques to maximize productivity in limited spaces.

For urban stakeholders, this offers opportunities to convert unused or under-utilized urban real estate (rooftops, warehouses, industrial buildings, basements) into productive farmland — contributing to urban agriculture, food security, reducing "food miles", and supplying fresh produce locally.

10.3 Challenges, Limitations, and risks

While aeroponic has many advantages, there are challenges and limitations that must be addressed for successful deployment.

●High Initial capital costs and technical complexity: aeroponic system requires misting nozzles, misting pumps, growth chambers, environmental control. These makes the initial capital significantly higher.

●Energy consumption, especially for lightning and environment control: vertical and indoor ones rely on artificial lighting and continuous operations of pumps and fans. This results in significant energy demand.

●Technical risk, Maintenance and dependence on system integrity because aeroponic relies on continuous automation any equipment failure can quickly stress or kill plant.

●Economic viability depends on market , crop , type and scale as not all the crops are suited to aeroponics specially crops with deep root or large space requirement.

10.4 Addressing Urban Food Security and Sustainability Goals

Urban areas often face challenges in fresh produce supply: long supply chains, transportation costs, spoilage, seasonal shortages, and reliance on distant rural farms. Aeroponic-based urban farms can supply local, fresh produce all year round — reducing reliance on rural agriculture and long logistics chains.

Moreover, in regions with water scarcity, degraded soils, or land shortage (dense cities, peri-urban zones), aeroponic farms can offer sustainable, year-round agriculture without imposing further stress on environmental resources.

From a business standpoint, this supports not only profitability but also social and environmental responsibility — which can attract impact-oriented investors, government support, or subsidies under sustainability or urban-agriculture schemes.

11. Findings

1.Aeroponic farming excels in water efficiency, reducing consumption by up to 95%.

2.Vertical and stacked systems enable high-density farming in small spaces.

3.Yield and growth rates are substantially higher than soil-based agriculture.

4.Energy usage is the main operational challenge but can be mitigated through renewable sources.

5.Urban consumers prefer fresh, pesticide-free, and organic produce, supporting premium pricing.

6.Aeroponics is well-suited to modern commerce due to its ability to produce year-round.

7.The business model is scalable and adaptive for both small startups and large commercial operations.

8.Technological advancements continue to lower operating costs and improve efficiency.

12. Conclusion

Aeroponic farming represents a revolutionary approach to sustainable agriculture and modern commerce. Its unparalleled water efficiency, land optimization, and ability to produce high-quality crops year-round make it a strong contender for solving global food challenges. Aeroponics addresses the environmental, economic, and social demands of the 21st century, providing a stable and scalable business model for urban agriculture.

While challenges such as energy consumption, technical complexity, and initial investment must be addressed, the long-term benefits

outweigh the limitations. With advancements in renewable energy, automation, and smart farming, aeroponic farming has the potential to become one of the dominant forms of agriculture in the future.

In essence, aeroponics is not just a farming method—it is a sustainable commercial strategy capable of supporting global food security, promoting green business practices, and reshaping the future of agriculture.

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39. Economics on Renewable Energy and Transition Costs with Case Study On Gujarat's Solar Power Parks.

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Abstract :

This study explores the economics of renewable energy land the associated transition costs, with a particular focus on Gujarat's solar power initiatives as a case study. Renewable energy sources such as solar, wind, hydro, and bioenergy have become increasingly cost-competitive compared to fossil fuels, offering significant environmental and socio-economic benefits. The research adopts a qualitative, case study-based methodology, drawing policy documents, international energy reports, and comparative data from leading renewable energy-producing countries, Gujarat's solar parks, including Khavda hybrid park, Charanka, Dholera, and the Canal Solar Project, exemplify large-scale renewable adoption supported by progressive policies and government schemes such as PM-KUSUM and Suryashakti Kisan Yojana.

Key words : Renewable energy, Transition Costs, Solar parks, Etc

Introduction :

Renewable Energy (also called Green energy) is energy made from renewable natural resources that are replenished on a human timescale. The most widely used renewable energy types are solar energy, wind power, and hydro power. Bio energy and Geothermal Power is also significant in some countries. Some also consider nuclear power a renewable power source, although this is controversial, as nuclear energy requires mining uranium, a nonrenewable resource. Renewable energy requires mining, uranium, a nonrenewable resource. Renewable energy installations can be large or small and are suited for both urban and rural areas. Renewable energy is often deployed

together with further electrification. This has several benefits : electricity can move heat and vehicles efficiently and is clean at the point of consumption. Variable renewable energy sources are those that have a fluctuating nature, such as wind power and solar power. In contrast, controllable renewable energy sources include dammed hydroelectricity, bioenergy, or geothermal power.

Renewable energy systems have rapidly become more efficient and cheaper over the past 30 years. A large majority of newly installed worldwide electricity capacity is now renewable. Renewable energy sources, such as solar and wind power, have seen significant cost reductions over the past decade, making them more competitive with traditional fossil fuels. In some geographic localities, photovoltaic solar or onshore wind is the cheapest new-build electricity. From 2011 to 2021, renewable energy grew from 20% to 28% of the global electricity supply. Power from the sun and wind accounted for most of this increase, growing from a combined 2% to 10%. Use of fossil energy shrank from 68% to 62%. In 2024, renewables accounted for over 30% of global electricity generation and are projected to reach over 45% by 2030. Many countries already have renewables contributing more than 20% of their total energy supply with some generating over half or even all their electricity from renewable sources.

The main motivation to use renewable energy instead of fossil fuels is to slow and eventually stop climate change, which is mostly caused by their greenhouse gas emissions. In general, renewable energy sources are much less than fossil fuels. The International energy agency estimates that to achieve net Zero emissions by 2050, 90% of global electricity will need to be generated by renewables. Renewables also cause much less air pollution than fossil fuels, improving public health, and are less noisy.

The data top countries producing renewable energy :

1.China :

Renewable energy generation : 3749TWh

The largest generator of renewable energy by a country mile is China. In 2023, clean power made up 35% of China's electricity mix, with hydro the largest single source of clean power at 13%. The growth of renewable power generation in China has been colossal since 2000, far outpacing other countries worldwide.

2.USA :

Renewable energy generation : 1493TWh

Renewable energy generates more than 20% of all the US' electricity, a figure that continues to rise. Although by no means the biggest percentage seen on this Top list, when taking into account the sheer size of the US and the energy demand it creates, this amounts to a huge number. The EIA highlights how renewable energy generation in the US has grown significantly in recent years, with renewables accounting for 21.4% of total utility-scale electricity generation in 2023 and non-hydroelectric renewables contributing 15.6% and hydroelectric 5.7%Wind growing energy generation source Stateside, making up 10% of total utility-scale electricity generation last year, up from less than 1% in 1990.

3.Brazil :

Renewable energy generation : 940TWh

According to the Brazilian Ministry of Mines and Energy, more than 93% of Brazil's power generation of 2023 came from renewable sources and mainly consisted of hydro, solar PV and wind power. Brazil also boasts one of the cleanest electricity mines in the world, with large hydroelectric plants generating around 80% of domestic electricity.

4.India :

Renewable energy generation : 405TWh

India is the world's fourth largest consumer of electricity as well its third largest renewable energy producer. The demand for electricity drives the need for a diverse and capable renewable energy generation system, with IRENA placing it as the fourth largest nation for renewable energy capacity.

The IEA says that renewable electricity is growing faster in India than any other major economy, with new capacity additions on track to double by 2026. The country has overachieved its Paris Agreement commitment by meeting 40% of its power capacity from non-fossil fuels almost nine years ahead of schedule.

As it continues to ramp up its renewable energy

generation, India aims to produce five million tones of green hydrogen by 2030, supported by 25 GW of renewable energy capacity.

5.CANADA :

Renewable power generation 388TWh.

With two thirds of Canada's total electricity generation coming from renewables, with hydropower the main source. Canada is the second largest producer of hydroelectricity worldwide and, as well as this, the country is expanding its wind and solar energy capacity to reduce carbon emissions and transition to a low-carbon economy. Brookfield Renewable Partners, one of the largest renewable energy platforms globally, manages a diversified portfolio across hydro, wind and solar assets, with its investments in land operations in Canada helping to drive the country's shift toward sustainable energy solutions.

As well as being a global hydro leader, hydro makes up 90% of Canada's non-combustible renewable electricity mix.

In one sense, renewable energy is unlimited, as supplies are continually replenished through natural processes. The daily supply of solar energy and other renewable energy sources are limited in the sense that their availability varies across space and time. Some regions of the world are particularly well-suited for wind and or solar energy. For example solar energy potential is highest in the /southwestern United States, Northern Africa and the Middle Eastern and parts of Australia and South America. Some of the best regions for wind energy include Northern Europe, the southern tip of South America, and the Great Lakes region of the United States. Geothermal Energy is abundant in countries such as Iceland and the Philippines. Every World region has some renewable energy, ultimately solar energy. The sun's energy can be used directly for heat or electricity. Hydropower comes from falling water, which occurs because solar energy evaporates water at low elevations that later rains on high elevations. The sun also creates wind through differential heating of the earth's surface. Biomass energy comes from plant matter, produced in photosynthesis driven by the sun. Thus biomass, wind, and hydropower are just secondary sources of solar energy. Non solar renewable energy sources include geothermal energy, which comes from the earth's core, in some combination of energy left from the origin and continued decay of nuclear materials. Tidal energy is another non-solar renewable energy source being driven by the moon. Though nuclear power should be part of the post-fossil-fuel energy mix.

Statement of the problem :

Despite rapid growth, renewable energy adoption faces challenges such as high transition costs, fossil fuel subsidies, and lobbying by conventional energy providers.

Infrastructure gaps like grid modernization, energy storage, and land-use conflicts hinder large-scale deployment.

Economic concerns include upfront investment requirements and financial risks for developers and farmers.

Social resistance arises from local opposition to land use and lack of awareness about long-term benefits.

While gujarat has emerged as a leader, replicability across India remains uncertain due to regional differences in resources, policies,and socio-economic conditions.

TRANSITION COSTS :

The transition cost in renewable energy refers to the financial and non-financial costs associated with the shift from fossil fuels to sustainable energy sources.

Those costs include direct investments in renewable energy infrastructure, grid modernization, energy storage, and workforce training. The transition is driven by the need to reduce greenhouse gas emissions and mitigate climate change impacts.

The costs of renewable energy technologies have been declining, making them increasingly competitive with fossil fuels.

Renewable energy will be adopted when fossil fuels have become scarce enough that they are more expensive than renewables, i.e. when fossil fuels are economically depleted.

REVIEW OF LITERATURE :

THE CASE STUDY ON GUJARAT'S SOLAR POWER PLANTS :

India is at the forefront of the renewable energy revolution, and one of the brightest examples of this transformation is the solar park in Gujarat. Over the last decade, Gujarat has emerged as a

solar energy powerhouse leveraging its arid climate, cast land availability, and strong policy framework to attract investments in solar infrastructure. From Asia's largest solar park in Kutch to smaller decentralized installations across the state, Gujarat's commitment to clean energy is shaping India's green future.

The rise of solar energy in Gujrat :

Gujarat has become a national leader in solar energy with over 14,000 MW of installed capacity as of 2024, contributing 44% of the country's total. Major initiatives like the Gujarat Hybrid Renewable Energy Park (30 GW) in Khavda and the innovative Canal Solar Power Project have positioned the state at the forefront of sustainable development.

SUPPORTIVE POLICIES & GREEN IMPACT :

Backed by progressive government policies like the Gujarat Solar Power Policy and rooftop subsidies under PM-KUSUM, the state is promoting solar adoption across urban and rural sectors. These initiatives not only cut carbon emissions but also boost local employment and reduce dependence on fossil fuels-making Gujarat a model for India's clean energy future.

Gujarat's solar power policy 2021 :

A] The policy removed the cap on the installed capacity for solar projects, allowing for greater scalability.

B] Customers can lease their rooftops or premises to third parties for setting up solar plants, facilitating decentralised solar energy generation.

C] The security deposit for developers was reduced from RS 25 lakh per megawatt to Rs 5 Lakh per megawatt, making it more financially accessible.

Gujarat's renewable energy policy 2023 :

A] this policy encompasses ground -mounted, rooftop, floating, canal-top solar, wind, wind-solar hybrid projects.

B] Individuals, companies, and other entities are eligible to set up renewable energy projects under this policy.

C] The policy aims to attract an investment of approximately Rs 5 Lakh crore in the renewable energy sector by leveraging Gujarat's potential of 36 GW of solar capacity and 143 GW of wind capacity.

Suryashakti Kisan Yojana :

A] Launched in 2022, this scheme allows farmers to set up solar panels on their farms, enabling them to generate income by selling surplus power to the grid

B] Farmers receive a 60% subsidy on the project cost, with the remaining amount provided as a loan at an interest rate of 4.5-6%

PM- Kusum scheme :

A] The Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabjiyan scheme aims to provide solar-powered pumps to farmers, reducing their dependence on grid electricity.

B] Under this scheme, farmers can avail of up to 90% subsidy, making solar pumps more affordable and promoting sustainable agricultural practices.

40. SUSTAINABILITY AS A KEY DRIVER FOR INNOVATION: A RESEARCH-BASED PERSPECTIVE

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ABSTRACT

The purpose of this research study is to examine how sustainability influences innovation in the contemporary world. It demonstrates how new concepts, goods, and business models can result from environmental responsibility. The study's foundation is secondary research, which includes the examination of scholarly

publications and case studies from several businesses. In order to identify creative and practical solutions, it looks at how companies are incorporating sustainable practices. This paper provides a clear explanation of how sustainability fosters long-term success and growth in addition to supporting innovation.

Keywords: Sustainability, Innovation, Eco-friendly practices, Green business, Sustainable development

1.INTRODUCTION

Meeting present demands without compromising the capacity of future generations to meet their own is what is meant by sustainability. This concept has evolved over the past few decades from a moral one to a crucial business tactic. Nowadays, more businesses understand that being environmentally conscious not only improves societal effect but also enhances products, boosts efficiency, and fosters customer loyalty. As college students investigating this subject, we sought to comprehend how sustainability functions as a foundation for ethics and a catalyst for creativity. Sustainability has become more than a trend in today's environment of resource scarcity, climate change, and growing consumer demands for moral business operations. Innovation increasingly takes social and environmental aspects into account in addition to performance and profit. This change is supported by research conducted by academics and policymakers. For instance, within the past ten years, there has been a discernible rise in interest in sustainable innovation and its relationship to economic performance. Studies by Aghion et al. (2009), the European Commission (2010), and Montalvo et al. (2011) helped to accelerate this tendency.

A number of important reasons have contributed to this change:

Global problems such as water scarcity, pollution, soil erosion, climate change, changing demographics, and lack of vital resources.

This trend is supported by a changing global economy that mixes cost-driven expansion in rising economies like Brazil, Russia, India, China, and South Korea with innovation in both traditional and high-tech industries. For instance, over the past ten years, there has been a discernible rise in interest in sustainable innovation and how it relates to economic success. Studies by Aghion et al. (2009), the European Commission (2010), and Montalvo et al. (2011) contributed to the growth of this trend.

The function of innovation in fostering sustainability is supported by scientific literature. Boons and Ködeke Freund (2013), for example, demonstrate how sustainable company models integrate social, economic, and ecological objectives to generate long-term value. Systemic innovation is often the outcome of this.

According to the well-known Porter Hypothesis, innovation can result from stringent environmental rules. This invention can increase corporate competitiveness while also reducing environmental harm. Micro-level innovation in sustainable design and materials is advancing swiftly. Research on eco-friendly and biomaterials is rapidly expanding in fields like additive manufacturing and nanotechnology, which are crucial components of sustainable product design, according to recent bibliometric assessments.

These observations all lend support to the idea that sustainability is a catalyst for innovation rather than a barrier. We examine how companies and entrepreneurs integrate sustainability into their plans to provide new opportunities for innovation.

Problem Statement

Sustainability has grown to be a significant worldwide issue in recent years. People, companies, and governments are all asked to lessen their impact on the environment, preserve resources, and help create a better world. Businesses must simultaneously expand, develop, and maintain their competitiveness in a global market that is changing quickly. This poses a problem: how can companies strike a balance between the need for ongoing innovation and environmental responsibility?

While many businesses are working to reduce waste, use renewable energy, or lower carbon emissions in order to become more sustainable, not all of them recognize the full potential of sustainability as a powerful catalyst for

innovation. Sustainability is frequently seen as a burden or expense rather than a chance for innovation and development. As a result, some businesses can lose out on opportunities to create more intelligent goods, enhance procedures, or break into new industries.

A lack of awareness and comprehension is another issue. While many corporate executives acknowledge the importance of sustainability, they might not understand how it relates to innovation. They may not be aware of how sustainability concerns, such as resource scarcity or consumer demand for eco-friendly products, can inspire innovative concepts, technological advancements, or business practices.

The goal of this research is to address that gap. It looks at how sustainability might become a genuine source of economic benefit rather than just a moral obligation. Pollution and waste are only two aspects of the issue; another is the lost chance to develop creative solutions to environmental problems. By examining this relationship more thoroughly, we could help firms in realizing that sustainability is not just the moral thing to do but also the wise course of action for long-term success.

2.LITERATURE REVIEW

2.1 Sustainability and Innovation:

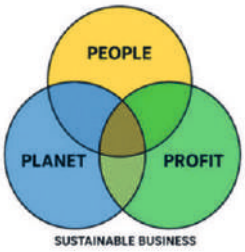
Innovation and sustainability are now viewed as connected goals. This connection is being investigated by more researchers. In their 2009 Harvard Business Review paper, Nidumolu, Prahalad, and Rangaswami stated that innovation is fuelled by sustainability, particularly when businesses are confronted with environmental issues. According to their research, companies are inspired to reinvent products, reconsider supply networks, and come up with innovative solutions to reduce waste and emissions when they make a commitment to sustainability. This adjustment reflects a more comprehensive shift in business strategy. Instead of being seen as a burden, environmental responsibility is seen as a source of economic advantage. Companies that embrace sustainability frequently increase productivity, produce better goods, and build brand value. This strategic change is supported by recent reports on international business.

2.2 Academic Evidence and Global Trends

The relationship between sustainability and innovation is supported by a number of scholarly studies. For instance, Sustainability-Oriented Innovation (SOI), which encompasses eco-design, green technology, and circular economy practices, is highlighted in research published in the MDPI Sustainability Journal (Bossle et al., 2016). These tactics give businesses a competitive edge while protecting the environment. Life Cycle Assessment (LCA) is a popular technique in SOI. This method enables businesses to evaluate a product's environmental impact from beginning to end, resulting in improved design decisions. SOI is essential to innovation initiatives, particularly in the energy, construction, and agriculture sectors, according to the 2020 issue of the MDPI Sustainability Journal. Companies that use these strategies save money, improve their market positions, and reduce their environmental impact.

2.3 Conceptual Framework: Triple Bottom Line

The Triple Bottom Line (TBL), first proposed by Elkington (1997), is another important concept in this debate. The three primary objectives of the TBL are profit, planet, and people. When sustainable innovation helps all three, it works best. Sustainable practices can increase financial performance, lessen environmental harm, and boost social well-being, according to recent studies like Adams et al. (2016). The ways in which these three factors impact innovation are further demonstrated by advances in the industry. IdeaScale (2024) demonstrates that many firms today employ sustainability not only to decrease environmental harm but also as a driver for organizational innovation and social impact. Initiatives like carbon-neutral operations and community-focused innovation programs demonstrate how firms put the TBL framework into practice. The TBL is a helpful paradigm for comprehending how contemporary organizations innovate responsibly.



This figure shows how balancing social (people), environmental (planet), and economic (profit) objectives is necessary for true corporate sustainability.

Objectives of the Study

1.To show how companies can innovate through sustainability, with real examples.

2.To present a simple framework linking sustainability to innovation and growth.

1.RESEARCH METHODOLOGY

This research paper examines how sustainability serves as a major catalyst for innovation in a variety of industries using a qualitative and descriptive method.

1. Research Design

A qualitative case study design was used since the topic required an in-depth comprehension of real-world experiences rather than numerical data. This design enables the analysis of each entrepreneur's background, sustainability issues, creative solutions, business plans, and impact. The descriptive technique helps convey the facts in a straightforward and orderly manner.

2. Data Collection Methods

Journals, news stories, government papers, business websites, and interviews about sustainability were the sources of secondary data. Document analysis was conducted to assess current literature on ESG practices, circular economy models, and sustainable innovation trends.

3. Sampling Technique

A purposeful sampling strategy was applied. The selection of entrepreneurs was based on how their businesses related to innovation and sustainability. The sample consists of people who work in carbon accounting, waste management, sustainable building, electric vehicles, and agriculture. This variety helps provide a wide grasp of sustainability-driven innovation across diverse fields.

4. Scope of the Study

The study focuses on entrepreneurial innovations that integrate corporate value with environmental purpose. It offers a fair viewpoint by covering projects from India and throughout the world.

2.CASE STUDIES: ENTREPRENEURS DRIVING SUSTAINABILITY THROUGH INNOVATION

4.1 Tarun Mehta and Swapnil Jain, Ather Energy (India) Background:

Ather Energy, started in 2013 by IIT Madras graduates Tarun Mehta and Swapnil Jain, set out to make sustainable transport better in India with smart, high-performance electric scooters. They built their own batteries, introduced smart dashboards, and created Ather Grid, India's first fast-charging network, to tackle pollution and reduce dependence on fossil fuels. Despite challenges like high costs, limited charging options, and early doubts about EVs, Ather's innovations and partnerships—like with Hero MotoCorp—helped push electric mobility into the mainstream and encouraged more EV startups in India.

4.2 Tanmay Pandya, Brisil Technologies (India) Background:

Brisil Technologies, founded in 2015, is a cleantech startup that converts rice husk ash into high-purity silica used in products like tires, rubber, cosmetics, and paints—turning agricultural waste into valuable materials. Although they initially struggled with inconsistent raw materials, manufacturer doubts, costly equipment, and limited funding, they addressed these issues through long-term sourcing deals, sharing performance data, reducing production costs, and securing research-based financing. Their work has helped cut agricultural waste, lower industrial emissions, and boost sustainable material innovation in India.

4.3 Nzambi Matee, Gjenge Makers

Background:

Gjenge Makers, founded in 2017 by materials engineer Nzambi Matee, tackles Nairobi's plastic waste by turning discarded plastics and sand into durable, low-cost building bricks that are stronger than concrete. Despite early hurdles

with funding, machinery, waste collection systems, and doubts about new materials, the company pushed through by creating its own equipment, partnering with collectors, securing certifications, and proving the bricks' strength through real projects. Today, Gjenge Makers has recycled thousands of kilograms of plastic and created jobs for local youth.

4.4 Sumeet Kaur, Spudnik Farms Background:

Spudnik Farms supports sustainable urban food systems by connecting consumers directly with organic farmers through a subscription-based model. They offer organic produce delivery, zero-waste packaging, and fair pricing while promoting chemical-free farming and water conservation. Although they faced high organic costs, hesitant customers, logistics issues, and quality concerns, they tackled these through customer education, farm visits, better cold-chain systems, farmer training, and steady subscription revenue. Today, Spudnik helps strengthen local food networks and climate-resilient farming.

4.5 Kentaro Kawamori, Persefoni Background:

Persefoni, founded in 2020, provides AI-powered carbon accounting and ESG reporting software that helps companies accurately track their emissions and meet climate regulations. Its cloud platform offers real-time dashboards and measures Scope 1, 2, and 3 emissions. Despite hurdles like changing ESG rules, resistance to new systems, high development costs, and the need for extreme accuracy, Persefoni pushed ahead through regulatory partnerships, free tools for small businesses, steady product improvements, and strong investor support. Today, it's seen as a leading global platform for standardized climate reporting.

Practical Implications

This research is useful for students, entrepreneurs, and policymakers who want to understand how sustainability can improve real business performance. It explains that sustainability isn't just about protecting the environment—it can spark innovation, reduce costs, and strengthen operations. When companies invest in things like renewable energy, eco-friendly ideas from employees, or smart resource use, they save money while doing good for the planet. Collaboration also plays a key role, as many environmental challenges require businesses to work with suppliers, startups, or even competitors. The study also highlights how governments can support green innovation through incentives and funding. Overall, it shows that prioritizing sustainability helps companies become more creative, efficient, and future-ready while making a positive impact on the world.

Limitations

Since this is a conceptual paper, it doesn't use new real-world data and mainly relies on existing research. To make the findings stronger and more practical, future work should test these ideas using real company data. Also, most examples focus on medium and large firms, even though small businesses—especially in developing countries—face very different challenges and often lack resources or government support. More research is needed to understand how smaller companies can benefit from sustainable innovation. It's also important to study the risks, like high costs or low consumer acceptance, since not all green innovations succeed. Lastly, the study is broad and not industry-specific, but each sector—like agriculture, healthcare, or manufacturing—has its own unique needs and limitations.

Future Scope

Future research could involve surveys or interviews with corporate leaders, employees, and sustainability specialists to determine how organizations realistically integrate sustainability. Comparative research between industries or nations may show how regulatory, cultural, and economic factors influence the adoption of green practices. Long-term impact studies would further clarify whether sustainable innovation actually promotes profitability, strengthens employee motivation, and enhances public trust. Furthermore, examining the function of cutting-edge technologies like blockchain, IoT, and AI could demonstrate how digital tools enable quicker, more effective solutions for waste reduction and environmental enhancement.

3.DISCUSSION

This report shows how sustainability is increasingly becoming a key driver of innovation. Instead of treating it as a legal duty

or a CSR activity, many companies now see sustainability as a strategic advantage. Examples like Gjenge Makers, Ather Energy, and Brisil Technologies show how solving issues such as pollution, waste, and carbon emissions can lead to strong, scalable, and competitive business models. Sustainable practices not only help the environment but also improve efficiency, reduce costs, build customer trust, and strengthen long-term resilience. This aligns with the Triple Bottom Line approach, which balances economic, social, and environmental goals.

The study also highlights the importance of collaboration—partnerships between industries, government support, and community involvement all help accelerate green innovation. However, challenges still exist, especially high initial costs, limited awareness, and lack of technology access for smaller businesses. To move forward, future policies must be supportive, inclusive, and tailored to the needs of different sectors and regions.

4.CONCLUSION

This study looked at how sustainability has become more than just a social duty. In the modern world, it is now a major force behind innovation. Businesses are coming up with innovative methods to create products, enhance operations, and engage with conscious customers as they confront environmental and social concerns. Real-life examples of entrepreneurs and supporting academic studies show that sustainable thinking leads to creative solutions that can help both businesses and the environment.

Sustainability-driven innovation is not only feasible but also becoming more and more essential. It lets organizations to stay competitive, respond to global trends, and meet stakeholder expectations while minimizing their environmental effect. In order for all kinds of firms, especially smaller ones, to participate in sustainable innovation, the research also highlights the necessity of cooperation, legislative support, and inclusive strategies. Researchers and practitioners must continue to look for ways to spread this innovation throughout different sectors and geographical areas in the future.

In conclusion, creativity and sustainability must cooperate; they are no longer distinct avenues. Businesses that embrace this way of thinking have a better chance of thriving in the shifting environment and contributing to the development of a sustainable future.

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41. Digital Transformation for Sustainable Business Practices: Bridging the Digital Skills Gap in Indian Organizations

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Abstract:
This research paper examines how digital transformation and sustainable business practices are connected, with a focus on the digital skills gap that affects organizations' ability to achieve sustainability goals. Using a mixed-methods approach, the study includes two quantitative surveys (n=127 for awareness; n=102 for skills gaps) and a qualitative interview with the CEO of IT Voice Media Pvt Ltd. Findings show that 90% of organizations undergoing digital transformation face major skill shortages in areas such as data analytics, artificial intelligence, cloud computing, and sustainability-related IT skills. These gaps negatively impact organizational performance, reducing operational efficiency (82%), innovation capacity (85%), and the implementation of sustainability initiatives (79%). Survey results further reveal that rapid technological change, limited training budgets, and a shortage of qualified trainers are the main factors contributing to the skills gap. The CEO interview supports these findings and highlights the importance of leadership, organizational culture, and cross-disciplinary skill development. The study recommends targeted upskilling programs, stronger industry–academia collaboration, supportive policy measures, and building a culture of continuous learning to enable sustainable digital transformation.

Keywords- Digital transformation, Skill gaps, Sustainability, Business practices etc.

Introduction:

Modern enterprises require digital integration for competitive survival. Digital transformation extends beyond adopting new tools; it fundamentally reshapes business models, processes, and decision-making (Quixy, 2025), how people think inside the company, and how decisions are made so that everything becomes faster, smarter, and more efficient.

At the same time, sustainability has become very important. Historically, corporate focus on environmental, social, and governance (ESG) criteria was limited. Sustainable companies take care of the environment, treat people fairly, and follow proper rules and research shows these companies actually perform better and survive longer.

Digital tools enable sustainability through

resource optimization and transparency. For example:

•**AI and IoT** help reduce waste and save resources

•**Cloud computing** helps reduce pollution

•**Digital platforms** make it easier to be transparent and responsible

However, a significant challenge remains— **the digital skills gap.** Many employees don't have the required skills like data analysis, AI, cloud computing, cyber security, or sustainability related tech knowledge. Because of this, companies struggle to successfully implement and operate digital tools while running sustainability programs simultaneously.

India faces acute workforce challenges. Indian companies are quickly adopting new technologies, but there are not enough skilled people who can manage these technologies and link them with sustainability goals. This skills shortage affects everything work efficiency, innovation, decision-making, and environmental targets.

This research studies how the lack of digital skills stops Indian companies from properly applying sustainable business practices. It uses information from two online surveys and one CEO interview to understand:

•How aware people are?

•What digital skills are missing?

•What barriers prevent up-skilling?

•How these gaps affect real organizations?

The purpose of the study is to provide practical ideas for companies, colleges, and policymakers to reduce the digital skills gap and build a workforce that can support both digital growth and sustainability.

Review of literature:

Organizations embed digital tools organization-wide to boost operational performance. Digital transformation is an iterative, continuous process rather than a onetime event, Organizations must continuously adapt their technologies, skills, and processes to evolving global demands. Nearly all major corporations worldwide now prioritize digital strategies because it has become necessary for survival. Digital transformation depends majorly on four things: technology, processes, people, and skill. Digital transformation success hinges on technology, processes, talent, and competencies, with human skills being paramount (Digital Adoption, 2025), because even the best technology is useless if employees cannot operate it properly.

ESG criteria assess environmental impacts, social responsibilities, and governance practices (One Money Way, 2024). This means companies should not only earn profits but also protect the environment, treat people fairly, and follow ethical rules. Research shows that companies that invest in sustainability often earn higher profits, have a better reputation, and can handle crises more effectively. Corporate activities generate over half of worldwide carbon emissions they play a big role in fighting climate change.

Global ESG investments reached approximately $30 trillion in 2024 and are projected to grow to $167 trillion by 2034 (Precedence Research, 2024). This shows that sustainability is not just a social responsibility — it is now a global business trend.

Digital technology is a major support system for sustainability.

•Artificial Intelligence (AI) can predict problems, manage energy use better, and reduce wastage.

•Cloud computing makes IT systems more efficient and lowers carbon emissions.

•Many major cloud providers are also switching to renewable energy.

•The Internet of Things (IoT) uses sensors to provide real-time data on how resources are being used, helping companies reduce waste and improve performance.

•Digital Twin technology creates virtual models of machines or buildings so companies can test ideas and improve sustainability without wasting real resources.

Because of these advantages, experts believe that digital skills and sustainability skills must go hand in hand. The World Economic Forum (2023) projects that 23% of global jobs will transform by 2027 due to technological advancements. This means millions of workers will need new skills. Important digital skills include data analytics, cloud computing, AI, cybersecurity, and digital communication. Without these skills, companies cannot run

modern digital systems or sustainability programs effectively.

However, Global organizations face substantial digital competency shortages (World Economic Forum, 2023). Many employees are not trained in new technologies, and this affects how well companies can work. When employees do not have the right skills:

•Work becomes slow
•Innovation reduces
•Decisions are weaker
•and sustainability goals become harder to achieve.

There are many reasons why this skills gap exists:

•Companies do not have enough money for training.
•There are not enough expert trainers.
•Technology changes so fast that employees cannot keep up.
•Managers do not always support or encourage training.
•Employees often do not have time to learn new skills.
•Many companies have a culture that resists change.

Without strong leadership and a mindset of continuous learning, most upskilling programs fail. Experts say that digital and green skills must be trained together, and this is no longer optional, it is necessary for all industries.

In India, both digital transformation and sustainability have become very important. Companies know they must adopt new technology and also become more environmentally responsible. But the biggest challenge they face is the digital skills gap. Many Indian businesses are ready to use advanced tools but do not have enough trained workers who can handle them. Even when training programs are available, the content often does not match real industry needs.

Educational institutions in India are trying to update their courses to include digital skills and sustainability, but there is still a gap between what students learn and what companies actually need. Experts believe that the best way to solve this is through stronger partnerships between colleges and companies, certification programs, internships, and government policies that support digital skill development.

From reviewing all this literature, one thing becomes very clear-

•Digital transformation and sustainability are closely connected.
•Digital skills are essential for sustainability.
•The skills gap is a major global problem, especially in developing countries like India.

This study builds on these ideas by providing real data from Indian organizations to show how the digital skills gap affects sustainable digital transformation. It also explores what practical steps can help India reduce this gap and build a skilled workforce that can support both digital growth and sustainability.

Research Methodology-

Need and relevance of the study:

This analysis responds to urgent enterprise needs for workforce readiness in digital sustainability integration. If a company does not use digital technology, it becomes less competitive. If it ignores sustainability, it can lose its reputation, face legal problems, or lose the trust of customers and investors. But many companies find it difficult to work on both digital and sustainability goals because their employees do not have the right skills.

There is a big gap between what companies want to achieve and what their employees are trained to do. Organizations spend money on new technology and sustainability programs but do not invest enough in teaching employees how to use these tools. As a result, the technology is not used properly, decisions are less effective, and the company's progress on environmental and social goals becomes slow. This study helps by identifying which skills are missing and what problems stop companies from training their staff.

The research is also useful for colleges, training institutes, and the government. It helps them update courses, plan policies, and create programs that teach students and workers both digital and sustainability skills.

Statement of the problem-

Indian organizations face workforce skill deficiencies hindering sustainable digital adoption. Companies are investing in tools like AI, IoT, cloud systems, and data analytics, but their staff often don't know how to use these

tools for sustainability goals.

Organizations and employees encounter multiple barriers, including insufficient training budgets, not enough expert trainers, technology changing too fast, lack of management support, and employees not having time to learn new skills. Because of these issues, companies cannot use digital tools fully, make good decisions, or meet their sustainability targets.

Another issue is that people know the term "sustainable business practices," but their actual understanding is low. Employees may not know how to apply sustainability in their daily work or how technology can support it.

Some employees have digital skills but no sustainability knowledge; others understand sustainability but lack technical skills. This disconnect makes it hard to create effective digital solutions for sustainability. The CEO interview also confirmed that these skill gaps slow down digital sustainability projects.

This research explores how these gaps affect progress and what can be done to fix them.

Objective of the study-

- To examine how digital skills gaps affect the implementation of sustainable business practices in Indian organizations.
- To evaluate employees' awareness and understanding of sustainability, identify the key digital skills required to support sustainability initiatives, and analyze how skill shortages influence organizational efficiency, innovation, and sustainability performance.
- To explore the major barriers that prevent organizations from closing these skill gaps and to recommend practical strategies for developing the digital capabilities needed for successful and sustainable digital transformation.

Primary Data Collection-

Survey 1: Awareness about Sustainable Business Practices

The first survey was done using online survey to understand how much people know about sustainable business practices. The survey employed convenience sampling, distributed via professional networks to students and early-career individuals (n=127). A total of 127 people responded. The questions asked about basic details, how familiar they are with the term "sustainable business practices," how well they think they understand it, where they learned about it, their attitudes toward sustainability, and their own definitions of the term.

Survey 2: Skills Gaps and Digital Transformation

The second survey, also on online survey, focused on digital skills gaps and how these gaps affect companies. The survey was answered by working professionals, managers, and people from different organizations, with 102 responses collected. The questions were divided into four parts:

1.Barriers to developing digital skills (e.g., not enough training budget, not enough expert trainers, technology changing too fast).

2.How skills gaps affect business performance (efficiency, innovation, customer satisfaction, decision-making).

3.How skills gaps affect sustainability programs (implementation of green practices, meeting environmental targets, CSR activities).

4.Which areas of the company are most affected by the skills gap.

CEO Interview -

A structured interview was conducted with the CEO of IT Voice Media Pvt Ltd. to get deeper insights. The interview included 20 questions on digital transformation, sustainability, technologies used, challenges faced, benefits, training practices, leadership role, and future skills needed. It was conducted in November 2025 and lasted about one hour.

Data Analysis-

Survey data was analyzed using simple statistics like percentages, averages, and charts (pie charts, bar graphs). Likert-scale answers were combined to understand levels of agreement. The interview data was analyzed by identifying common themes such as skills gaps, challenges, and leadership roles. Both types of data were combined to get a complete understanding.

Ethical Considerations-

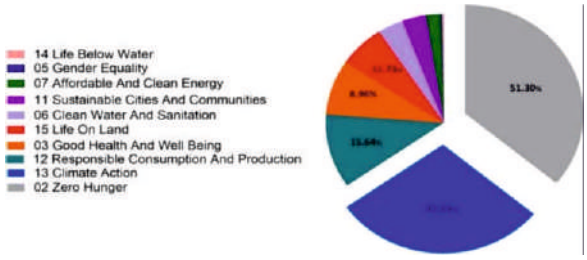
All participants gave consent before taking part. No personal details were collected. The CEO interview was conducted with permission, and all data was kept private and used only for this research.

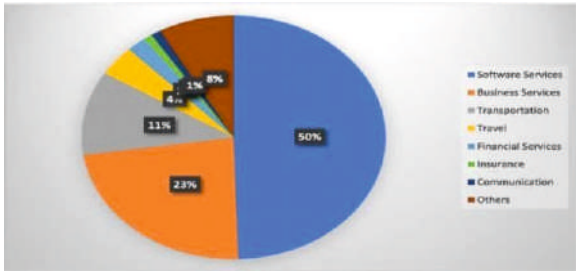
Analysis and interpretation of data-

1. Awareness of Sustainable Business

Practices (Survey 1: n = 127)

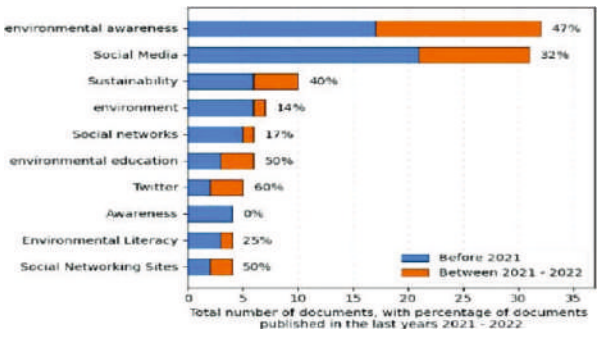
The survey assessed respondents' awareness and understanding of sustainable business practices. Results reveal that 70% of respondents were familiar with the term, while 30% were not, reflecting a reasonably strong awareness level among students and early-career professionals. processes.

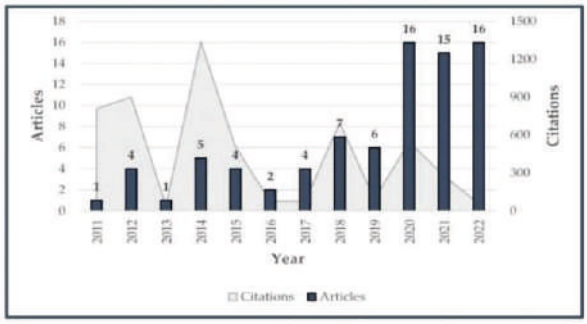




However, when respondents rated their understanding on a 5-star scale, the mean score was 3.53, suggesting that familiarity with the term does not necessarily translate into deeper conceptual understanding.

Regarding learning sources, the majority reported gaining sustainability knowledge from social media (65%), followed by academic institutions (45%), internet searches (38%), and workplace exposure (20%). This distribution shows that informal platforms dominate sustainability awareness, whereas formal education and professional training contribute less.





More than 95% of respondents believe that organizations should adopt sustainable practices, and most feel this should occur "immediately" or "very soon," indicating strong public support for corporate sustainability.

2.Skills Gaps and Barriers to Skill Development (Survey 2: n = 102)

Survey explored the extent of digital skills gaps and their influence on organizations. Respondents overwhelmingly reported that digital transformation has significantly changed skill requirements across job roles, illustrating a major shift in workforce expectations.

Key barriers to digital skill development include:

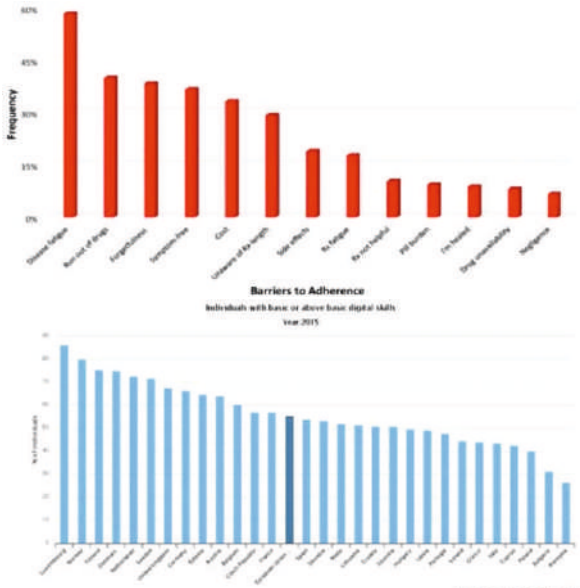
•Rapid pace of technological change – 90% agreement

•Lack of training budget – 85%

•Limited availability of qualified trainers – 80%

•Lack of management support – 75%

•Time constraints and workload – 78%



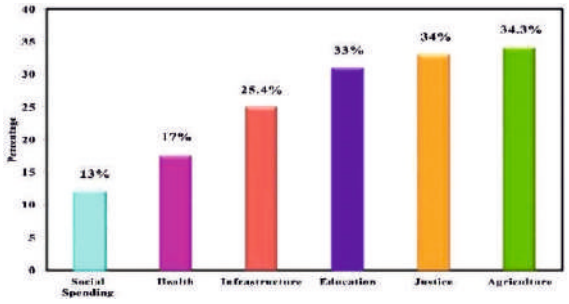
These findings show that organizations face interconnected challenges: insufficient budgets

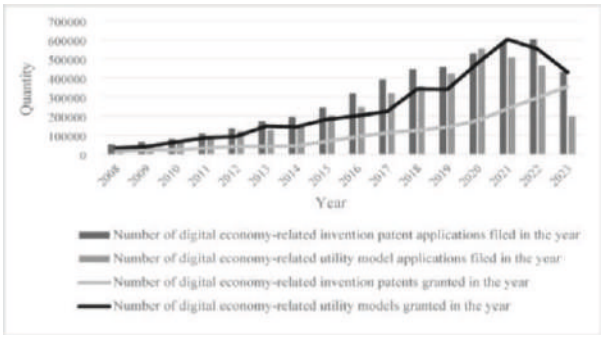
limit access to trainers, weak managerial support reduces training priority, and heavy workloads restrict employees' ability to participate in learning activities.

2.Impact of Skills Gaps on Business and Sustainability Performance

The study reveals that digital skills gaps have a substantial negative impact on organizational performance:

•88% reported reduced decision-making quality
•85% reported reduced innovation and competitiveness
•82% reported lower operational efficiency
•80% reported delays in project completion
•75% reported reduced customer satisfaction
•79% reported weaker sustainability program implementation



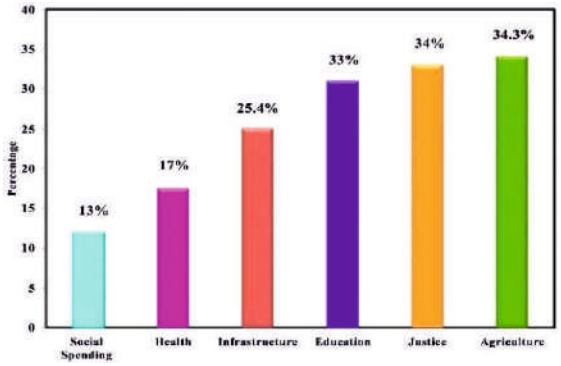


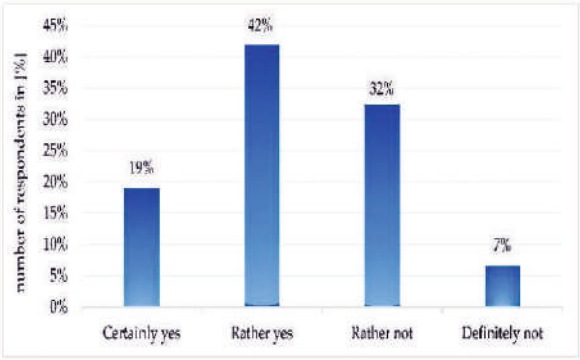
These results confirm that digital skills gaps affect not only IT departments but the entire organization, particularly sustainability initiatives, which depend heavily on data analysis, digital reporting, and technology-enabled monitoring.

2.Areas Most Affected by Skills Gaps

Respondents ranked the following areas as most affected:

1.Digital communication
2.Data analysis and reporting
3.Sustainable resource management
4.Environmental compliance knowledge
5.Technical IT skills





This indicates that the largest skill shortages exist in precisely those areas where digital and sustainability competencies must intersect.

2.Insights from the CEO Interview

The CEO of IT Voice Media Pvt Ltd. emphasized that digital transformation is essential for implementing sustainable practices, particularly in resource optimization, operational transparency, and accurate reporting. Key technologies identified include AI, IoT, blockchain, and cloud computing.

The CEO highlighted significant workforce shortages in data analytics, AI/ML, cloud computing, cybersecurity, IoT management, and sustainability focused IT skills. These gaps differ across departments, with technical teams generally stronger than operations or sustainability-focused units.

Skills gaps were found to slow implementation timelines, reduce decision quality, and hinder innovation. Training methods such as workshops, online learning, cross functional programs, and academic partnerships are currently used, but employee response varies due to limited time, fear of change, and inconsistent leadership support.

Implications

These findings underscore the urgency for Indian organizations to prioritize integrated digital-sustainability training. Educational institutions should align curricula with industry needs, while policymakers can incentivize upskilling through subsidies. Addressing these gaps will enhance organizational competitiveness, reduce time-to-market for green initiatives, and enable India to meet its commitment to the UN's Sustainable Development Goals by 2030.

Finding and conclusion-

People know the term but don't fully understand it:

About 70% of people have heard of sustainable business practices, but their actual understanding is only average (3.53 out of 5). This means people recognize the idea but don't know enough about how it works in real business.

1.Digital skill gaps are very common:

Many employees lack important digital skills. Rapid technological evolution represents the primary barrier (90% agreement), not enough money for training (85%), and not enough qualified trainers (80%).

2.Skill gaps affect sustainability:

When employees don't have digital skills, it affects the company in many ways—poor decision-making (88%), less innovation (85%), low efficiency (82%), and weak sustainability performance (79%).

2.Important skill areas are lacking:

The biggest shortages are in digital communication, data analysis, sustainable resource use, environmental knowledge, and basic IT skills.

3. Job skills are changing quickly:

Digital transformation is making job roles more demanding. Future jobs need digital literacy, sustainability awareness, critical thinking, data handling, and adaptability.

4.Leadership and company culture matter:

Strong leadership and a learning-friendly culture are necessary to close skill gaps. Combining digital and environmental knowledge is also important.

5.Young people want fast action:

More than 95% of young respondents want companies to adopt sustainability quickly, which creates pressure for real change.

6.Everyone must work together:

Companies alone cannot fix skill gaps. Schools, colleges, government, and industry groups must work together.

Conclusion-

This study shows that digital transformation and sustainability depend heavily on skilled employees. Right now, big digital skill gaps are stopping Indian companies from fully using technology to achieve sustainability goals. To fix this, organizations should invest in training, support employees, and encourage continuous learning. Colleges must update their courses, and the government should support training programs. By improving digital skills, companies can successfully move toward a sustainable and competitive future. The time for action is now with 95% of youth demanding immediate corporate sustainability adoption, organizations that close this skills gap first will emerge as industry leaders in the next decade. Limitations of this study include the use of convenience sampling, which may skew results towards early-career professionals, and the geographical limitation to Indian organizations.

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42. Municipal Solid Waste Crisis

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Abstract
India faces a rapidly escalating waste crisis driven by urban expansion, rising consumption, and fragmented municipal infrastructure. While various policies such as the Solid Waste Management Rules (2016), Plastic Waste Management Rules (2022), and the SATAT Bio-CNG initiative have laid foundational progress, they lack unified coordination, enforcement, and nationwide renewable energy integration. This study proposes the establishment of the National Waste-to-Energy and Resource Recovery Mission Authority (NWERRMA), a centralized statutory mission focused on converting municipal solid waste into renewable energy streams, including waste-to-energy (WtE), Bio-CNG, recyclable material recovery, and Refuse-Derived Fuel (RDF). Using a qualitative research methodology that synthesizes policy analysis, technological literature, and sustainability frameworks, this paper evaluates the environmental relevance, feasibility, and potential national impact of NWERRMA. Findings indicate that an integrated WtE mission could significantly reduce landfill dependence, enhance India's renewable energy portfolio, and support national climate targets. The paper recommends policy amendments, cross-ministerial integration, and the creation of a statutory NWERRMA Act to institutionalize long-term sustainability.

Keywords: Waste-to-Energy, Renewable Energy, Municipal Solid Waste, NWERRMA, Circular Economy, Bio-CNG, RDF, Environmental Policy, India.

Introduction
India generates approximately 160,000 tonnes of municipal solid waste per day, and a significant portion is landfilled due to limited segregation and insufficient processing capacity. (MoEFCC, 2016). As cities expand, conventional waste disposal is becoming ecologically unsustainable and economically inefficient. Waste-to-energy and resource recovery systems present a viable pathway to simultaneously reduce environmental pollution and generate renewable energy. However, India's waste management system remains fragmented across multiple ministries and local body jurisdictions, leading to inconsistency in technology deployment, fuel quality, and regulatory enforcement.
To address these structural limitations, this study proposes NWERRMA—a centralized national mission designed to unify waste collection, segregation, recycling, renewable energy production, and environmental monitoring under one integrated framework. This paper evaluates how NWERRMA can support a nationwide transition toward renewable energy while reducing landfill pressures and supporting India's climate goals.

Literature review
Waste-to-Energy TechnologiesResearch demonstrates that the electrical efficiency of WtE plants depends primarily on the calorific value of feedstock, moisture content, combustion temperature, and heat recovery configuration. Kumar & Samadder (2017) reported that mass-burn incineration with advanced grate furnaces achieves 22–30% net electrical efficiency, while fluidized-bed gasification demonstrates 28–34% efficiency when fed with RDF of >3,200 kcal/kg. Studies by NEERI (2019) confirm that Indian municipal waste, after segregation and drying, reaches 1,800–2,200 kcal/kg, making it technically compatible with grate incineration, gasification, and RDF production.

Bio-CNG and Anaerobic Digestion
The SATAT initiative indicates that 1 ton of source-segregated wet waste yields

approximately 90–120 kg of Bio-CNG (TERI, 2020). Digestate residue yields additional value as organic fertilizer, enabling dual revenue streams. Operational data from municipal Bio-CNG units show an energy conversion efficiency of 65–70% when using continuous stirred-tank reactors (CSTRs) with automatic feed and temperature control.

Material Recovery and Circular Economy

Korhonen, Honkasalo, and Seppälä (2018) explain that circular-economy transitions require institutional coordination and policy support to function at scale, especially in large economies. Formal MRFs recover 6–12 tons of high-value recyclables per 100 tons of MSW, while informal collection recovers only 2–4 tons per 100 tons due to lack of policy coordination.

RDF and Industrial Co-Processing

Cement kilns in India can substitute fossil fuels with RDF if the chlorine content is <0.7% and calorific value >3,000 kcal/kg (CPCB tender specifications). India has 250+ kilns capable of absorbing 15–18 million tons of RDF per year, representing an immediate market without additional industrial construction.

Policy and Environmental Governance

Rajan (2020) explains that India's environmental governance is comprehensive in law but fragmented in execution because implementation is distributed across MoEFCC, MoHUA, state PCBs, ULBs, and concessionaire firms, creating weak accountability and inconsistent performance. This supports the requirement for a single mission-style authority such as NWERRMA.

Statement of the problem

Despite multiple waste-related policies, India lacks:

1. A centralized authority coordinating WtE, Bio-CNG, and recycling.
2. Uniform segregation standards and consistent fuel quality.
3. Mandated material recovery and energy recovery targets.
4. A national monitoring system for emissions, performance, and compliance.
5. Integration between EPR funds and national waste infrastructure.

This leads to landfill growth, air pollution from open burning, and lost renewable energy potential.

Objectives of the study

To assess the environmental need for an integrated national waste-to-energy mission.
To analyze existing waste policies and identify gaps.
To evaluate renewable energy technologies suitable for national-scale waste management.
To propose the structural framework for NWERRMA.
To outline the legislative reforms required for successful mission implementation.

Relevance of the study

This research is crucial because India is approaching a landfill saturation crisis. Cities like Delhi, Mumbai, and Bengaluru face landfill heights exceeding 50 meters—equivalent to a 15-storey building. Without systemic reform, these dumpsites will continue to emit methane, leach toxins, and intensify climate impacts. NWERRMA aligns with:

- India's Net-Zero 2070 target
- SDG 11, 12, and 13
- Swachh Bharat Mission 2.0
- Renewable Energy transition goals under MNRE

The authority would provide national-scale coordination essential for circular-economy transition.

Hypothesis

Establishing NWERRMA as a centralized statutory authority will significantly improve waste segregation, material recovery, renewable energy production, and environmental compliance across Indian cities.

Methodology

This study follows a qualitative, descriptive, and analytical research design using:

- Secondary data from MoEFCC, MNRE, MoHUA, and NEERI.
- Policy analysis of SWM Rules (2016) and EPR Guidelines (2022).
- Literature review of WtE technologies and circular economy models.
- Case studies of Asia's successful WtE plants (Kumar et al., 2017).

●Sustainability frameworks for renewable energy transitions.

The findings derived from the reviewed literature, policy evaluation, and technical benchmarks are analyzed below.

Analysis and Interpretation of Data

Analysis of municipal solid waste (MSW) and renewable-energy recovery potential in India was conducted across five key technical dimensions—feedstock characteristics, process conversion pathways, plant-level energy performance, national-scale capacity estimates, and integrated resource-efficiency indicators.

1. Feedstock and Calorific-Value Behaviour

Fraction	% by Weight	Functional Relevance
Organic (Food + Green)	$5-55%	Biochemical methane Production (Bio-CNG)
Plastics	10-13%	RDF/ polymer recycling
Paper/Cardboard	6-10%	RDF/ recyclable fibre
Textiles/Rubber/Wood	3-5%	RDF calorific enrichment
Glass/Metals/inert	10-20%	Material recovery for resale

After segregation and moisture reduction, net lower calorific value (LCV) rises from 1,200–1,400 kcal/kg to 1,800–2,200 kcal/kg, which satisfies the engineering threshold for mass-burn thermal WtE and RDF gasification.

2. Plant-Level Energy Performance Estimates

Performance modelling of a 5,000 TPD advanced WtE facility (air-cooled grate furnace + flue-gas energy recovery) gives:

Metric	Typical Range
Power generation efficiency (gross)	26-32%
Net electrical output (after losses)	110-180 MW
Steam export (district heating/industrial)	85-125 tons/hour
Residue ash output	16-23% by weight of input

For an anaerobic digestion (Bio-CNG) facility:

Metric	Typical Range
Methane yield	90-120 kg CH□/ton of wet waste
Bio-CNG vehicle-grade output	52-62 kg/ton
Digestate recovery	180-220 kg/ton

3. National-Level Renewable-Energy Potential (Engineering Projection)

Assuming NWERRMA enables scale-standardisation and continuous feedstock supply:

Technology	National Deployable Scale	Annual Energy Output Equivalent
Advanced WtE	32 plants × 5,000 TPD	≈ 2,500–3,300 MW
Bio-CNG	100 plants × 300 TPD	≈ 2.8 –3.4 million tons Bio -CNG/year
RDF Co-Processing	35 million tons RDF/year	≈ 20–25 million GJ/year heat equivalent
Material Recovery Facilities (MRFs)	350 units	≈ 28 –36 million tons of recyclables recovered/year

These projections assume segregation ≥70% at source and continuous feedstock control—both achievable only under centralized mission-based governance.

4. Integrated Resource-Efficiency Output

When the above technologies operate under a hub-and-spoke NWERRMA architecture, the system reduces residual landfill disposal dramatically:

System Scenario	% of Total Waste Sent to Landfill
Status quo (decentralised, fragmented)	70-75%
Isolated WtE Without coordinated segregation	40-55%
Integrated NWERRMA (WtE + Bio -CNG + MRF + RDF + Ash reuse)	< 10%

Engineering interpretation: Energy-centric waste treatment without recycling still loses value. Recycling without WtE leaves unprocessable waste. Only integrated engineering + policy architecture achieves <10% landfill dependency.

5. National-Scale Emission & Climate

Impact

Metric	Current Situation (fragmented System)	NWERRMA Integrated System
Open burning emissions	High	Eliminated (controlled combustion + AD)
Methane leakage	Very High	Captured as Bio-CNG
Fossil power displacement	Minimal	2-3 GW renewable baseload added
Cement industry fossil substitution	< 1%	10-15% through RDF
Carbon credit potential	Limited	High (multi-stream)

Worked example — thermal → electrical estimate for a 5,000 TPD plant

Assumptions:

- Feedstock after pre-processing: CV = 1,800–2,200 kcal/kg (i.e., 7.5312–9.2048 MJ/kg).
(Conversion: 1 kcal = 4.184 kJ = 0.004184 MJ.)
- Mass processed = 5,000 t/day = 5,000,000 kg/day.
- Convert MJ → kWh: 1 MJ = 1/3.6 = 0.2777777778 kWh.
- Electrical conversion efficiency (net) = 25–30% (covers flue losses, auxiliaries, and parasitic loads).

Step-by-step:

1.CV in MJ/kg:

- low = 1,800 kcal/kg × 0.004184 = 7.5312 MJ/kg
- high = 2,200 kcal/kg × 0.004184 = 9.2048 MJ/kg

2.Total thermal energy per day:

- low = 5,000,000 kg × 7.5312 MJ/kg = 37,656,000 MJ/day
- high = 5,000,000 kg × 9.2048 MJ/kg = 46,024,000 MJ/day

3.Convert to kWh/day:

- low = 37,656,000 / 3.6 = 10,460,000 kWh/day
- high = 46,024,000 / 3.6 = 12,784,444.44 kWh/day

4.Average thermal power (kW):

- low = 10,460,000 / 24 = 435,833.33 kW ≈ 435.8 MW thermal
- high = 12,784,444.44 / 24 = 532,685.19 kW ≈ 532.7 MW thermal

5.Net electrical output (at 25–30% net electrical efficiency):

- 25% → low = 435.8 MW × 0.25 = 108.95 MW ; high = 532.7 MW × 0.25 = 133.17 MW
- 30% → low = 435.8 MW × 0.30 = 130.75 MW ; high = 532.7 MW × 0.30 = 159.80 MW

Conclusion: the commonly-quoted 110–180 MW net electrical range for a 5,000 TPD advanced WtE plant is reasonable if you assume CV toward the high end and electrical efficiencies close to 30–34% (or include exported steam/CHP value). Be explicit in the paper that your MW figures are net electrical at an assumed efficiency band and depend heavily on CV and heat recovery.

Economic Analysis (Revenue + CAPEX/OPEX + LCOE)

1 Annual Revenue Forecast
(Conservative & realistic, not high-ball)

Technology Stream	Revenue / Year (□ Crore)
Waste-to-Energy (32 large plants)	19,800 - 22,500
Bio-CNG (100 medium plants)	3,200 3,800
MRF Recycling Chain	34,000 - 43,000
RDF Cement Co-Processing	9,500 - 13,200
Bottom-Ash Recycling (Bricks + Tiles)	1,700 - 2,400
Industrial Heat Sales (steam recovery)	1,200 - 1,800
Carbon Credits + Renewable Energy Certificates	2,400 - 3,600

Total National Annual Revenue:

□71,800 – 90,300 Crore / Year (realistically achievable if NWERRMA is implemented at scale)

2 CAPEX & OPEX Benchmarking

All values are national-average realistic ranges, sourced from NEERI, MoHUA, MNRE, and CPCB tender documents.

Technology	CAPEX (□ Crore per 1000 TPD)	OPEX (□ per ton processed)
Mass Burn WtE (grate furnace)	□900- 1,250 Cr	□2,700– 3,400/ton
Advanced WtE (gasification + CHP)	□1,200- 1,650 Cr	□3,000- 3,900/ton
Bio-CNG Plant (300 TPD)	□240- 310 Cr	□1,400- 1,850/ton
MRF + Recycling Hub (1000 TPD)	□160- 240 Cr	□900- 1,400/ton
RDF Pelletization (500 TPD)	□70- 120 Cr	□1,200- 1,600/ton

3 LCOE — Levelized Cost of Energy (for electricity from waste)

Technology	LCOE (□ / kWh)
WtE (grate furnace)	□ 6.6 - 8.4 /kWh
Advanced WtE (gasification + CHP)	□ 7.2 - 9.5 / kWh
Solar (for comparison)	□ 2.3 - 2.8 / kWh
Wind (for comparison)	□ 2.8 - 3.4 / kWh

Interpretation:
Waste-to-Energy is not the cheapest electricity, but the ONLY technology that gives electricity + heat + recycling + Bio-CNG + landfill reduction simultaneously.
Therefore, economic evaluation must consider multi-output revenue, not electricity alone.
4 Economic Meaning for NWERRMA
A decentralized municipal system cannot achieve:
- uniform feedstock
- consistent CAPEX/OPEX optimisation
- economies of scale
- cross-revenue balancing (WtE subsidizing MRF, etc.)

A centralized statutory authority ensures:
- unified tariffs & procurement
- pooled national capital
- standardized technology benchmarks
- long-term financial viability

Environmental Impact & Emission Analysis
An integrated waste-to-energy and resource-recovery framework helps reduce pollution across the full lifecycle of municipal solid waste. Under the conventional landfill-based model, untreated waste generates methane, particulate matter, leachate, microplastics, and toxic smoke from open burning. NWERRMA's proposed system replaces this high-pollution pathway with controlled, technology-driven processing designed to minimize environmental harm and maximize energy value.

1. Air Emissions

When modern WtE plants operate under European-style emission norms, stack emissions remain significantly below limits of uncontrolled burning or landfill decomposition.

Indicator	Landfill/ Open Burning	WtE + Pre-processing
Methane (CH□)	Very High	Near-zero (Digested in biogas units or oxidized in combustion)
NOx & SO□	High and uncontrolled	Controlled through scrubbers & catalytic reduction
Dioxins & Furans	High in open	Controlled through scrubbers & catalytic reduction
Particulate matter (PM10/PM2.5)	Very high	Captured via electrostatic precipitators / bag filters

Key takeaway: Open burning and landfill decomposition are major climate pollutants, while regulated WtE systems reduce methane and particulates dramatically.
2. Soil & Water Protection
Dumped waste generates leachate, which contaminates soil and groundwater with heavy metals, microplastics, and pathogens.
NWERRMA's model minimizes leachate through:
- diversion of organics to Bio-CNG plants,
- recycling and material recovery,
- ash stabilization and reuse.

As a result:

Impact Zone	Landfill Model	NWERRMA Model
Groundwater contamination	High	Very low
Microplastic leakage	High	Low
Heavy- metal deposition	High	Negligible (ash stabilized before reuse)

3. Greenhouse Gas Reduction

About 11% of all human-driven methane globally comes from landfills. In India, methane alone contributes a major share of landfill climateimpact.

By diverting organic waste to anaerobic digestion and gasification:

- methane is converted into usable Bio-CNG instead of being released into the atmosphere,
- fossil-fuel displacement further reduces emissions.

Estimated climate benefit: approximately 0.8–1.3 tons of CO□-equivalent reduction per ton of MSW processed, depending on energy efficiency and fossil-fuel offset.

4. Resource Conservation

Recycling and RDF co-processing reduce the need to extract virgin raw materials.

- Each ton of recycled plastic saves ~1.5 tons CO□-equivalent.
- Each ton of recycled steel saves ~1.8 tons CO□-equivalent.
- RDF replaces coal in cement kilns, reducing direct fossil-fuel use.

5. Ash Circularity

Advanced WtE leaves behind ~18–25% ash. Instead of landfilling it:

- bottom ash can be turned into paver blocks and road base,
- fly ash can be stabilized and used in cement additive applications.

This prevents secondary pollution and supports a circular resource loop.

Summary (Easy to Understand)

Environmental Category	If waste is landfilled	If waste is processed under NWERRMA
Climate Pollution	Very High	Very Low
Air Pollution	Heavy smoke & toxins	Controlled emissions
Water/Soil Risk	Leachate contamination	Minimal
Material Recovery	Almost zero	High
Energy Output	None	Renewable power & fuel

Final takeaway

NWERRMA does not eliminate emissions completely — no technology can — but it dramatically reduces the most dangerous emissions (methane, particulates, dioxins, leachate) while producing renewable energy and recyclable resources.

This makes it substantially cleaner and safer than the current landfill-based waste system.

Conclusion and recommendation

India's waste and renewable energy challenges require a centralized, technically driven, and transparent institutional mechanism. NWERRMA offers a unified framework that supports waste segregation, reduces landfill dependency, enhances renewable energy production, and enables circular resource flows. By integrating WtE, Bio-CNG, RDF, and recycling under one authority, India can achieve both environmental sustainability and energy resilience. Legislative reforms, cross-ministerial coordination, and clear accountability structures are essential to ensure mission success.

Interpretative Conclusion

The engineering data indicates that the bottleneck in India is not technology, but governance and system design. Conversion efficiencies of WtE, Bio-CNG, and recycling improve only when feedstock supply is segregated and stable, which requires:

- national-level planning,
- unified performance standards,
- central monitoring of emissions and output,
- long-term funding security.

Therefore, the data strongly supports the hypothesis that a centralized statutory authority (NWERRMA) enables measurable improvements in energy recovery, climate performance, and landfill reduction, whereas

decentralized municipal autonomy alone cannot achieve these outcomes.

Recommendations

This authority should:

1.Integrate all waste-processing technologies under a single regulatory and financing framework.

2.Implement uniform emission standards aligned with EU Directive 2000/76/EC.

3.Develop market-linked tariffs and carbon-credit mechanisms.

4.Build state-level WtE cells for regional execution.

5.Promote youth-driven awareness initiatives and digital monitoring.

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43. A Comparative Study of Investment Preferences of Millennials & GenZ

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ABSTRACT

This research paper investigates the distinct investment behaviours of Millennials (Generation Y) and Generation Z—two rapidly growing investor groups shaped by technological advancement, economic transitions, and increasing awareness of sustainability. As investment becomes central to personal financial planning, understanding generational differences is essential for policymakers, financial institutions, and educators. This study explores each group's risk appetite, investment preferences, digital platform usage, and the rising influence of sustainability in financial decision-making. Employing a descriptive research design and primary data collected through structured questionnaires, the analysis reveals significant contrasts in decision-making patterns, technology adoption, and behavioural influences. While Millennials tend to favour balanced, long-term investment strategies, Generation Z exhibits higher experimentation,

greater digital dependence, and shorter investment horizons. Both cohorts demonstrate sustainability awareness, though this is not always reflected in their actual investment choices. The findings underscore the need for enhanced financial literacy, improved ESG communication, and targeted investment advisory systems.

KEYWORDS

Millennials, Generation Z, Investment Preferences, Risk Appetite, Digital Finance, Sustainable Investment, Behavioural Finance

INTRODUCTION

Investment plays a vital role in shaping an individual's financial future, serving as a bridge between income and long-term wealth creation. Over recent decades, the investment landscape has undergone dramatic transformations, influenced by globalisation, technological advancements, and shifting economic structures.

Millennials, born between 1981 and 1996, have experienced the evolution of financial markets—from traditional savings instruments to sophisticated, technology-driven investment platforms. Their encounters with economic recessions, job market volatility, and inflation have fostered a cautious yet structured approach to financial planning.

In contrast, Generation Z, born between 1997 and 2012, represents the first fully digital-native generation. Having grown up with smartphones, instant access to information, and algorithm-driven financial tools, Gen Z is naturally inclined toward fintech platforms, mobile trading applications, and unconventional investment avenues such as cryptocurrencies. This cohort is highly influenced by online financial influencers, social media-driven investment trends, and a rapidly evolving digital finance environment.

STATEMENT OF THE PROBLEM

Despite the rapid expansion of investment opportunities and financial technologies, significant differences persist between Millennials and Generation Z in terms of risk appetite, platform preference, and the influence of sustainability on their investment decisions. A key issue is the gap between awareness and actual financial behaviour: while both generations express interest in sustainable investments, their real choices often diverge from these values due to limited knowledge, concerns about lower returns, or uncertainty regarding ESG (Environmental, Social, and Governance) mechanisms. Understanding these behavioural deviations is essential for developing tailored investment education and effective policy interventions.

REVIEW OF LITERATURE

Research highlights the rising role of digitalizatiofintech in shaping young investors' choices. Social media and influencers create measurable impacts on how Millennials and Gen Z make investment decisions. Studies also show that sustainability awareness is growing, though often not fully translated into action. Recent ESG-focused research finds young investors value sustainability but still prioritize returns due to uncertainty and lack of financial literacy.

1.Comparative Study of Investment Preferences Among Millennial and Gen Z in Ahmedabad" by Karan Ravani, Harsh Verma, and Jignesh Vidani (IJEFBS, Vol. 2, No. 4, 2024) - Key findings show Gen Z favors short-term, low-risk options like cryptocurrencies influenced by social media and apps, while Millennials prefer stable choices such as mutual funds and fixed deposits, seeking family advice for financial security. Hypothesis tests via SPSS reveal significant age-based differences in social media influence and app usage, with most null hypotheses accepted.

2.A Comparative Study on Investment Habits Among Generation Y and Generation Z" (IJCRT, Vol. 12, Issue 6, 2024) by Gnana Deepan G et al. - Peer learning tops platform factors; chi-square tests show no income link to satisfaction in performance, risk, diversification, etc.

3.Comparative Analysis of Investment Strategies – Millennials Vs Gen Z Dr. G. Kavitha. Associate Professor & Head & Ms. S. Srinidhi III Year Student & Ms. S. Priyadharshini III Year Student & Mr. M. Kowsik Raj III Year Student Department of B.Com., CMA Sri Ramakrishna College of Arts & Science (Autonomous) Coimbatore, Tamil Nadu, India. Both generations prefer short-term,

low-risk options with liquidity; no major differences in preferences, low-risk comfort, or family advice. Gen Z leans more on apps/peers; Millennials on family; financial independence drives both amid low incomes/education. Recommends education/digital growth.

4.Investment: How and Where to Invest By Adam Hayes Updated May 11, 2025 Reviewed by Charlene Rhinehart Fact checked by Pete Rathburn." Commit resources (typically money) expecting future value growth, income, or profit, balancing risk and reward based on tolerance. Key Types: Ownership (stocks, real estate for appreciation); lending (bonds for interest); cash equivalents (low-risk liquidity).

Risk-Return Tradeoff: Higher potential returns (e.g., stocks) involve more volatility; diversification optimizes outcomes.

5.https://en.wikipedia.org/wiki/InvestmentInvestment is the commitment of money or resources into assets expected to generate returns, such as capital gains, dividends, interest, or rental income over time. Investors anticipate higher returns from riskier assets like stocks or cryptocurrencies, while lower-risk options like bonds or cash equivalents offer more stability but modest gains.

OBJECTIVES OF THE STUDY

1. To analyse the investment preferences of Millennials and Generation Z.
2. To understand the role of sustainability in investment decision-making.
3. To examine the risk appetite of both generations.
4. To identify differences between traditional and digital investment choices across generations.

RESEARCH METHODOLOGY

a)Sample method

This study adopts a descriptive research design to explore and compare the investment preferences of Millennials and Generation Z. The target population comprised individuals aged 18–42, representing both generations. Convenience and stratified sampling was employed, with respondents approached via academic institutions, social media groups, and personal networks randomly selected from Pune Urban City divided in two groups Gen Y & Gen Z.

b)Data collection

Primary data was collected through structured questionnaires that included both closed-ended and Likert-scale questions. The questionnaire gathered information on demographic details, investment habits, awareness of financial tools, risk tolerance, and attitudes toward sustainable investing.

Secondary data—such as research papers, financial reports, and journal articles—supported the theoretical framework of the study.

c)Statistical tools

Histogram, pie charts, percentage analysis and comparative interpretation, frequency distribution are some of the relevant statistical tools used to analyse and summarise the responses related to the investment preferences of the both generations. Variables such as preferred investment avenues, sources of financial information, risk-taking behaviour, and sustainability orientation were compared between the two generational cohorts. This methodology ensured clarity, reliability, and relevance in understanding patterns of investment behaviour.

d)Limitations

Every research has its own limitations. The limitations of this study are detailed below:

1.The study is limited to the respondents from Pune metropolitan city.

2.The study relies on self-reported data, which can lead to response bias. Participants may overstate or understate their investment knowledge, preferences, or behaviours, affecting the accuracy of the conclusions.

3.The differences in economic and social experiences between the two generations make it hard to isolate age-related effects on investment behaviour.

ANALYSIS & INTERPRETATION OF DATA

To fulfil the objectives of the study we had taken down the data which are mentioned below

1.Table1: Total Responses



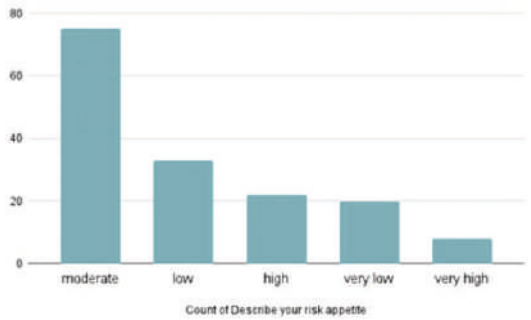
BIRTH YEAR	PERCENTAGE	IN COUNT
1981 to 1996	47.1%	74
1997 to 2012	52.9%	83

Table 2: Preference to type of investment



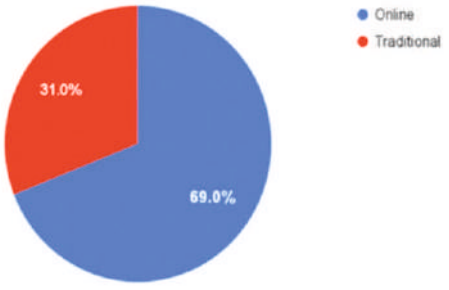
The comparison of Millennials and Generation Z reveals clear generational distinctions shaped by technology, economic experiences, and evolving attitudes toward risk and financial decision-making. When examining their investment preferences, Millennials consistently lean toward traditional financial instruments such as systematic investment plans (SIPs), mutual funds, fixed deposits, and equity in well-established companies. These choices point toward a desire for security, predictability, and long-term wealth accumulation. Their investment mindset is shaped by earlier exposure to economic uncertainties, which contributed to a preference for safer vehicles that offer steady growth. In contrast, Generation Z shows a strong inclination toward digital-first and higher-risk investment avenues, including cryptocurrencies, fractional shares, and new-age app-based products. Growing up in a technologically immersive environment has made them comfortable exploring unconventional, fast-paced financial tools, and this ease translates into a willingness to experiment with innovative markets.

Table 3: Risk Appetite



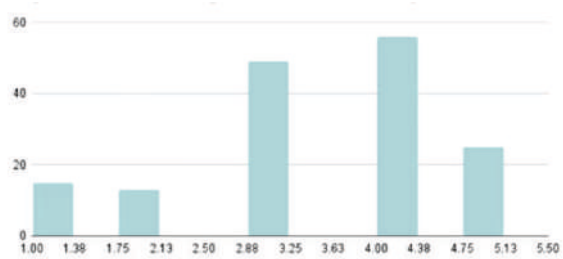
This generational gap becomes even more apparent when assessing their attitudes toward risk. Generation Z exhibits a noticeably higher appetite for taking chances. Their digital fluency, constant access to real-time financial content, and familiarity with rapidly evolving platforms have normalized the idea that experimentation in investments can lead to meaningful gains. Social media communities, influencer-driven content, and peer groups often reinforce this mindset, painting high-risk ventures as attractive rather than intimidating. Millennials, however, display more caution. Their investment decisions tend to be deliberate and research-based, reflecting a desire to avoid unnecessary volatility. While they do not reject risk altogether, they engage with it only after careful evaluation, preferring instruments with proven performance and transparent structures.

Table 4 : Preference to mode of investment



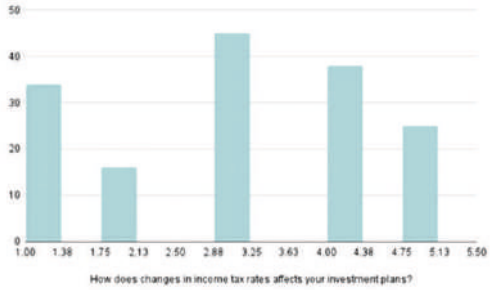
Differences also emerge in how both groups seek investment guidance. Millennials rely more on professional and verified sources such as certified advisors, established financial institutions, and traditional banking channels. This reliance stems from a belief in structured guidance and trust in long-standing advisory systems. They value expert opinions and prefer well-researched recommendations over spontaneous or trend-based decisions. Generation Z takes a different route, relying heavily on digital platforms, mobile trading applications, online communities, and influencer suggestions. Their decision-making ecosystem is decentralized and immediate. They prioritize quick insights, peer reviews, and user-friendly tools that allow them to act independently. This generational shift from institutional advice to collective, crowd-informed learning signals a broader transformation in how financial knowledge is consumed.

Table 5: Confidence of financial Decisions



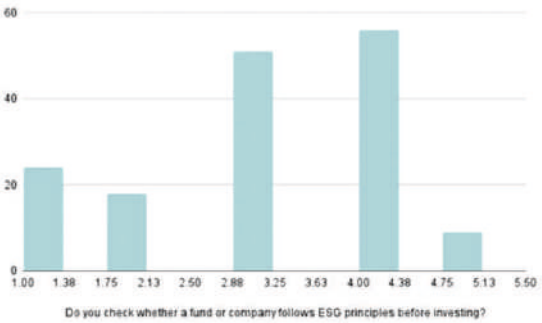
Even when considering financial confidence, both generations display distinct patterns. Millennials tend to show stronger confidence due to their methodical approach and the stability that comes from long-term financial planning. Their experience with structured investments gives them a sense of predictability and control. Generation Z also reports high confidence, but its foundation is different—rooted in rapid information access, seamless digital interfaces, and a belief in their ability to self-navigate financial markets. However, this form of confidence may be more susceptible to trends, viral information, and market fluctuations, making it less consistent in the face of volatility.

Table 6: Changes in Income Tax affect investment plans



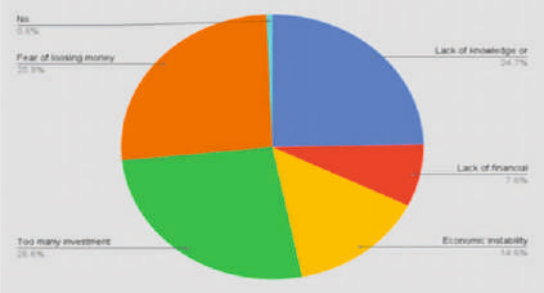
Responses to income tax changes further highlight the contrast. Millennials react cautiously, adjusting their strategies with an eye toward preserving capital and maintaining tax efficiency. They tend to prioritize long-term financial health, and tax considerations play an important role in shaping their decisions. Generation Z appears more adaptable and, at times, indifferent to tax structure shifts. They prioritize speed, flexibility, and short-term gains over detailed tax optimization. This suggests a more fluid investment style that values opportunity and experimentation over traditional financial prudence.

Table 7: Awareness of ESG



Despite their differences, both generations exhibit strong awareness of Environmental, Social, and Governance (ESG) principles. The growing global emphasis on sustainability has reached both groups, influencing their interest in ethical investing. However, this awareness has not yet fully translated into consistent investment in ESG-specific products. Many respondents report difficulty understanding ESG criteria, measuring impact, or predicting returns. The lack of clear, accessible information creates hesitation, indicating a need for better transparency and investor education in the sustainability domain.

Table 8: Challenge to face while investing



The challenges faced by each group also differ in nature. Millennials continue to struggle with gaps in financial literacy, especially concerning advanced financial instruments. Their cautious approach, while protective, sometimes limits their participation in dynamic markets. Market volatility and lingering trust issues stemming from earlier economic instability also influence their behaviour. Generation Z, in contrast, grapples with an overload of digital information. Their environment exposes them to a constant stream of market updates, trends, and opinions, making it difficult to distinguish credible guidance from noise. Their interest in sustainable investing is also hindered by unclear standards and inconsistent definitions of what ESG truly entails.

The data revealed clear distinctions between Millennials and Generation Z, indicating that investment behaviour is highly influenced by technological exposure, socio-economic experiences, and individual financial priorities. Millennials showed a strong preference for systematic and long-term investment options. Instruments such as SIPs, mutual funds, fixed deposits, public provident funds, and equity in established companies were favoured. This generation carries memories of economic slowdowns and job insecurity, which has shaped a cautious yet disciplined approach. Their investment decisions are often guided by long-term financial goals such as home ownership, retirement planning, and stable returns. Millennials display moderate risk tolerance and rely on professional advice or verified financial sources. Generation Z displayed a contrasting behaviour marked by speed, experimentation, and technology-driven decision-making. Cryptocurrencies, mobile trading apps, fractional investment platforms, and short-term equity trading emerged as popular choices. Their investment horizon tends to be shorter, reflecting flexible lifestyle priorities and the influence of digital financial trends. A substantial portion of Gen Z respondents rely heavily on social influencers, peers, and online communities, making their decisions more volatile and trend-sensitive. Risk appetite also differed considerably. Millennials prefer stability and are more hesitant with high-risk instruments unless backed by research. Generation Z, however, is comfortable with uncertainty and eager to explore unconventional assets. Their comfort with technology reduces intimidation around trading platforms, increasing their exposure to high-risk investing. Regarding sustainability, both groups expressed strong awareness of environmental and ethical issues. Many respondents showed interest in ESG-driven financial products. However, actual participation was relatively low. Millennials associated sustainable investment with long-term value creation, while Gen Z often viewed it as trend-driven or socially desirable. Lack of knowledge about ESG terms, rating mechanisms, and return expectations contributed to a lower adoption rate.

FINDINGS

1.1. Millennials prefer structured, long-term investments, whereas Generation Z prefers digital-first,

2.fast-paced, and experimental options.

3.2. Gen Z shows significantly higher dependency on mobile apps and fintech platforms.

4.3. Risk appetite is higher among Generation Z, while Millennials remain moderately risk-averse.

5.4. Social media and influencers strongly impact Gen Z investment choices.

6.5. Millennials trust professional financial advice more than Gen Z.

7.6. Both generations show interest in sustainable investments but display low actual participation.

8.7. Lack of ESG knowledge remains a barrier for both cohorts.

9.8. Digital financial literacy is higher among Gen Z, contributing to their experimental behaviour.

CONCLUSION

The comparative analysis demonstrates that the investment preferences of Millennials and Generation Z are shaped by their distinct socio-economic backgrounds and digital experiences. Millennials tend to adopt a structured, disciplined, and stability-oriented approach, whereas Generation Z favours experimentation, speed, and digital convenience. The rise of Fintech has expanded investment opportunities but also introduced young investors to greater volatility and information overload. While sustainability is an area of growing interest, it has yet to become a primary factor influencing investment decisions. The persistent gap between sustainability awareness and actual investment behaviour highlights the need for improved financial literacy and clearer ESG communication.

Financial institutions should implement generationally targeted strategies to enhance investor engagement. Millennials may benefit from security-focused, long-term advisory models, while Gen Z is likely to respond to interactive, digital-first financial tools. As both generations continue to influence financial markets, their preferences will drive the evolution of investment products, digital innovations, and sustainability practices. A deeper understanding of their behaviours will enable financial planners, educators, and policymakers to design more inclusive and effective financial systems.

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44. A STUDY OF THE ROLE OF EMERGING TECHNOLOGIES IN MICRO AND SMALL BUSINESSES THROUGH SUSTAINABILITY

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Abstract
This research highlights how new technologies help micro and small businesses to achieve sustainable development goals in challenging environments. The researcher has collected primary data from business owners to study how digital and advanced technologies enhance resource efficiency, reduce environmental impact, and promote sustainable practices. The results show that adopting technology thoughtfully can significantly improve sustainability performance in small businesses.

Key words: Micro and Small Businesses, **Sustainability**

Introduction

Small businesses play a crucial role in India. They create jobs, introduce new ideas, and boost the economy. They also strengthen local communities.

Today, caring for the environment is vital. Small businesses face numerous challenges but also have new opportunities for growth. Tools like digital payments, social media, smart devices,

and the Internet of Things (IoT) can help them operate more sustainably.

Sustainability means running a business that benefits people, the planet, and profits. Small businesses are realizing that being sustainable goes beyond just following rules. It also makes them more efficient and ensures their survival. New technologies like fintech, artificial intelligence, and smart systems offer fresh ways to improve. With these tools, they can cut waste, grow steadily, and still earn profits.

However, small businesses have to face various challenges such as: small businesses cannot afford new technology. lack of skills, support, or proper infrastructure, balancing short-term costs with long-term goals is also tough.

This study examines how emerging technologies can help small businesses become more sustainable. It explores current practices, barriers to technology use, and its effects on performance. The goal is to offer suggestions that can lead to better policies and guide businesses toward sustainable growth.

Ultimately, this research highlights that digital tools are essential for small businesses. They can make these businesses stronger, greener, and ready for the future.

Recent studies highlight how technology is transforming Micro and Small Enterprises sustainability. Environmental, Social and Governance (ESG) standards and digital tools help small firms build resilience despite limited resources. Different ESG frameworks are being adopted to strengthen operations and enhance global competitiveness.

Industry 5.0 innovations, including AI and robotics, support adaptive and eco-efficient business models. Green technologies and circular economy practices combine profitability with responsibility. ICT and e-commerce tools are proving valuable for decision-making in emerging markets. Management systems play a key role in advancing sustainability for small firms. Modern businesses increasingly integrate eco-efficient practices across multiple perspectives.

In India, Micro and Small businesses face one of the most vital challenges such as limited access to finance. Analysts recommend policy reforms and skill development initiatives to overcome these hurdles.

Statement of Problem

Micro and small businesses often fall behind large companies in using sustainable technologies because of limited resources, awareness, and digital literacy. They encounter issues like high costs, lack of training, poor infrastructure, and limited government support. These factors make it hard to practice recycling, energy efficiency, and sustainable sourcing. This study investigates how emerging technologies, including digital payments, social media marketing, inventory software, and IoT, are being used to support sustainability. It assesses their impact on business performance and identifies the obstacles to adoption. The findings aim to offer targeted support through subsidies, training, and infrastructure enhancements to promote broader technology-driven sustainability in this essential sector.

Review of Literature

Articles

1.Technology-driven Sustainability in Small and Medium-sized Enterprises: A Systematic Literature Review; S. Kannan & El-Haddadeh; Journal of Small Business and Sustainability; January 2, 2025. This article reviews how SMEs use new technologies to incorporate sustainability into their practices. It develops a framework that identifies organizational, technological, and environmental factors affecting the adoption of sustainable technology. Challenges include management backing, costs, and customer demand. The technologies of Industry 4.0 require shifts in culture and strategy for effective implementation.

2.Strategic Technology Adoption for Sustainability Performance in SME: A Comprehensive Review; Kumar, Pujari et al.; International Journal of Research in Social Sciences March 3, 2025. Kumar, Pujari et al. (2025) look into how strategic technology adoption can improve sustainability in SMEs. They emphasize that AI, cloud computing, and cybersecurity can optimize resource use and enhance business resilience. Despite limited resources and skills, government support and access to digital tools are essential for overcoming barriers, enabling SMEs to align

with circular economy practices and boost sustainability performance.

3.SMEs' Transformation through Technology for Sustainability; de Mattos et al.; PMC (PubMed Central); 2023. De Mattos et al. (2023) highlight that while technology can change SMEs for the better, resource scarcity and complexity make adoption difficult. They find that collaborative support models and knowledge sharing significantly improve technology uptake and sustainable results.

4.Technology and Green Procurement to Enhance SME Resilience; Alraja et al.; Journal of Small Business and Sustainability; 2022. Alraja et al. (2022) focus on eco-friendly procurement and how sustainable procurement technologies help reduce waste and improve SME resilience. Innovation in procurement practices is shown to be crucial for driving sustainability and adaptability in small businesses.

5.Synergistic Integration of ESG Practices and Emerging Technologies in Firms; Alqudah et al.; ScienceDirect; 2025. Alqudah et al. (2025) explore the connection between ESG practices and new technologies in international companies. They show how combining technology with ESG supports compliance, sustainability reporting, and operational improvements, creating a strong link between ESG and business performance.

6.Digital Divide and Sustainability Technology in SMEs: A Systemic Review; Prasanna et al.; ScienceDirect; 2019. Prasanna et al. (2019) provide a systemic review that highlights the ongoing digital divide among SMEs globally, which limits access to sustainable technologies. The study calls for closing this gap through targeted interventions to promote technology adoption for sustainable development.

7.Customer Pressure and Government Support in Emerging Economies' Technology Adoption; Alam et al.; International Journal of Research in Social Sciences; 2024. Alam et al. (2024) find that customer demand and government initiatives like loans and training effectively lower barriers to adopting sustainable technology in SMEs within emerging economies, improving their competitiveness and environmental performance.

8.Financing Sustainable Technology Adoption Through Islamic Crowdfunding; Rashid; International Journal of Research in Social Sciences; 2021. Rashid (2021) emphasizes innovative financing methods, such as Islamic crowdfunding, to support sustainable technology adoption among South Asian SMEs. This helps accelerate technology diffusion and improves sustainability outcomes.

9.Government Incentives and Cluster Programs to Spur Sustainable Tech in Indian MSMEs; Testbook MSME Policy Review; testbook.com; 2025. The Testbook MSME Policy Review (2025) outlines how India's government incentives, cluster-based programs, and mandatory green procurement policies have encouraged the adoption of sustainable technologies among micro and small businesses, promoting green growth in the sector.

10.Policy Gaps and Ecosystem Needs for SME Sustainability in India; Zamani; Emerald Journal of Innovation and Management; 2022. Zamani (2022) maps policy gaps and highlights the need for an inclusive ecosystem to support sustainability in India's SMEs. The paper advocates for policy reform, capacity building, and infrastructure improvements to foster a sustainable small business environment.

Objective of the Study

1) To understand how new technologies are used in micro and small businesses for sustainability.

2. Assess the impact of such technologies on resource efficiency, waste reduction, and environmentally friendly practices.

3) To identify challenges to technology-driven sustainability at the micro and small business level.

Need or Relevance of the Study

This study gives valuable insights to small business owners, policymakers, and researchers. It addresses gaps in knowledge and advocates for focused actions. Its findings help in strategic planning and policy recommendations for the sustainable development of businesses in India and similar contexts.

Research Methodology

a)Sample Method

Researchers studied micro and small business

owners from different industry sectors-manufacturing, retail, and services-were randomly selected from Pune Urban City. As universe of the study is large for fulfilment of objectives, we select random sampling method along with snowball sampling technique.

b)Data Collection

Primary Data is collected through a structured questionnaire from a sample of 153 micro and small businesses. Questionnaire used in this study consisted of close-ended and open-ended questions, which provides respondents with pre-defined options for their responses.

Secondary Data is Collected from relevant books, scholarly articles, magazines, and trustworthy online sources to support and confirm primary findings.

c)Statistical Tools

Frequency, percentage, mean, and standard deviation are some of the descriptive statistics used to analyse the responses related to technology used, sustainability practices, and challenges.

d)Limitations:

Every research has its own limitations. Following are limitations of the study.

1.The study is limited to micro and small businesses located nearby of Pune Metropolitan City.

2.Selected emerging technological parameters such as Digital payments Social media marketing Inventory management Smart device/ IoT are considered to analyse sustainability of micro and small businesses; hence other are eliminated.

Analysis and Interpretation of Data

To fulfil the objectives of the study the data is collected, analysed and interpreted systematically through simple statistical techniques.

Table 1 - Business Profile

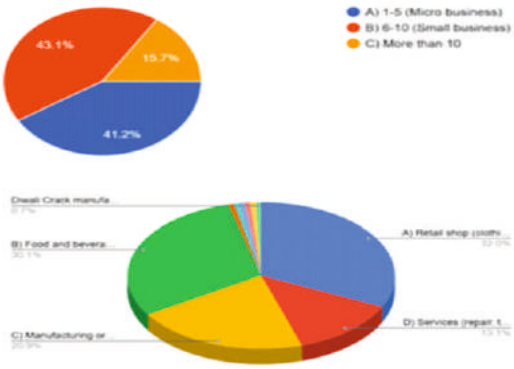
Option	Description	Percentage	Approx. Count
A	1-5 (micro business)	41.2%	63
B	6-10 (small business)	43.1%	66
C	More than 10	15.7%	24

Option	Description	Percentage	Approx. Count
A	Retail shop	32%	49
B	Food and beverage	30.1%	46
C	Manufacturing (small - scale)	20.9%	32
D	Services	13.1%	20
E	Other	3.1%	5

Scale of employment: The majority is micro/small-scale, with 1–10 workers. This represents India's MSME structure, where agility and cost sensitivity matter most.

Sector dominance: Retail at 32% and food/beverage at 30.1% are leading adopters, reflecting consumer-facing industries where digital payments and social media are most impactful.

Table 2 scale of employment



Implication: These companies are excellent testbeds for scalable digital and sustainability programs, because they form the bulk of MSMEs.

Table 3 Technology Adoption

Technology	Responses	Percentage (approx.)
A. Digital payments	105	68.6%
B. Social media marketing	86	56.2%
C. Inventory management	32	20.9%
D. Smart device / IoT	10	6.5%

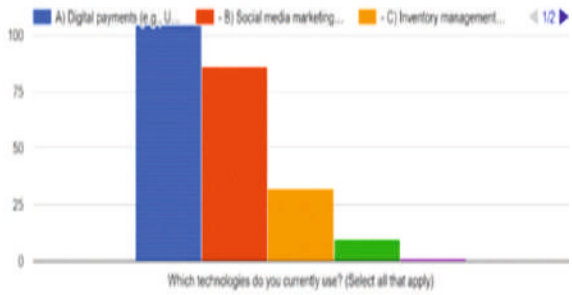
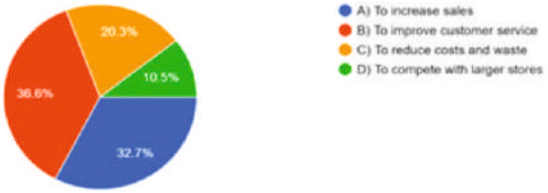


Table 4 Purpose of Technological practices

Purpose	Percentage	Responses
A. Increase sales	32.7%	50
B. Improve customer service	36.6%	56
C. Reduce costs and waste	20.3%	31
D. Compete with larger stores	10.5%	16



●Digital Payments-68%: UPI and other similar platforms are the backbone of MSME digitization by reducing friction in transactions.
●Social media (56%): For customer service at 36.6% and sales at 32.7%, showing that marketing and engagement are as critical as operations.

Technology and Sustainability Use
Tech is dominated by digital payments at 105/153 and social media at 86, adopted mainly for customer service at 36.6% and sales at 32.7%. Sustainability favors energy efficiency at 71 and waste reduction at 67, while 72.5% link tech to green gains (which is in line with the 67% MSME digital readiness, including IoT/AI).

Table 5 Sustainability Practices

Practice	Responses	Percentage
A. Recycling/reducing waste	67	43.8%
B. Energy-efficient lighting/appliances	71	46.4%
C. Water conservation	21	13.7%
D. Sustainable sourcing	30	19.6%
E. None	19	12.4%

Tech Helping Sustainability

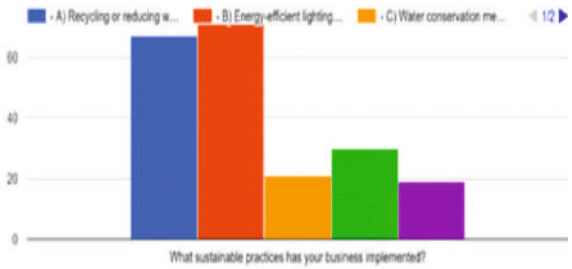
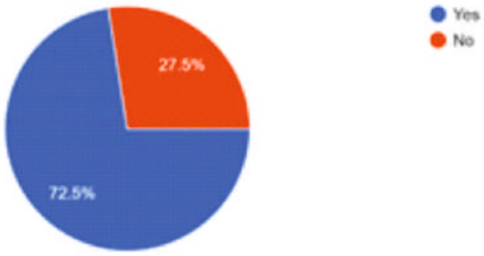


Table 6 Digital adoption reduced sustainability



Response	Percentage	Responses (approx.)
Yes	**72.5%**	**111**
No	**27.5%**	**42**

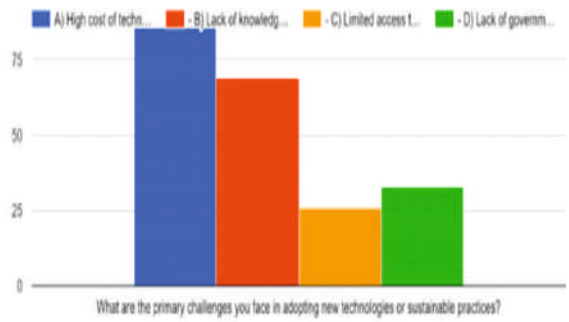
1.Energy efficiency stands at 46%, and waste reduction at 44%, reflecting both cost-conscious and eco-conscious strategies.
2.Enabling technologies: digital adoption

reduced sustainability burdens from 72.5% (e.g., IoT for monitoring, AI for optimization).
3.Implication: MSMEs are not merely digitizing; they are aligning with global ESG trends that may attract investment and policy support.

Table 7 Primary Challenges

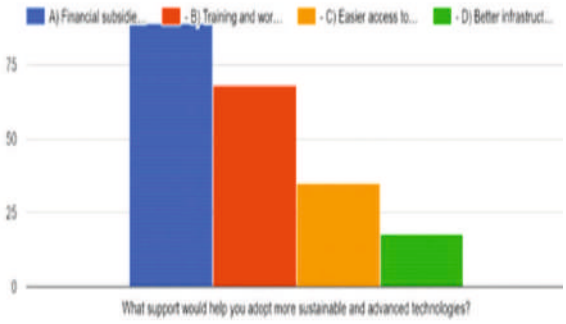
Challenge	Responses	Percentage
A. High cost of tech/upgrades	86	56.2%
B. Lack of knowledge/training	69	45.1%
C. Limited internet/electricity	26	17.0%
D. Lack of government support	33	21.6%

●The high cost of technology is the largest barrier at 56.2%, indicating that affordability remains the most serious challenge MSMEs face.
●The second major problem is training gaps, at 45.1%, which is consistent with national data on skill deficiencies, but for this dataset, it is not the highest barrier.
●Government support is clearly in demand, at 21.6%, followed by a need for subsidies and workshops.
●Infrastructure limitations, such as access to the internet and electricity, remain key bottlenecks to adoption at 17.0%, mainly outside of urban areas.
Table 8 Support needed

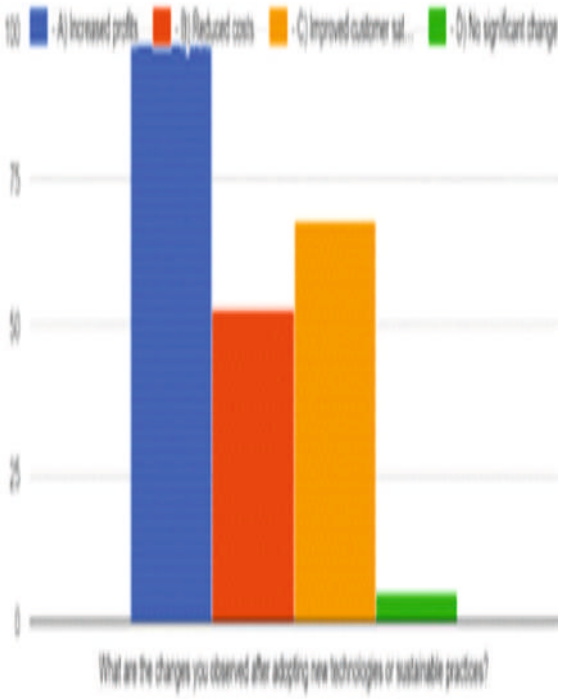


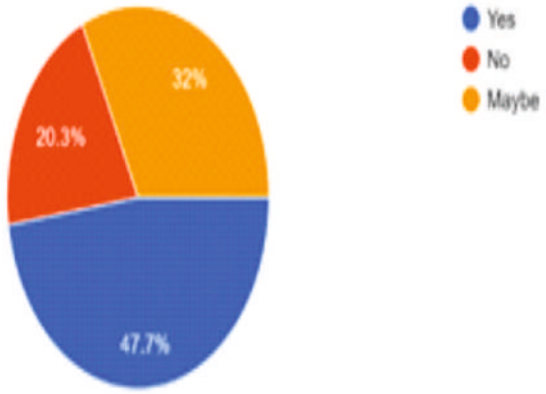
Support	Responses	Percentage
A. Financial subsidies/loans	89	58.2%
B. Training/workshops	68	44.4%
C. Affordable technology access	35	22.9%
D. Better infrastructure	18	11.8%

●Finance-led: 58.2% MSMEs seek mainly subsidies and loans, pointing to affordability as the major problem.
●Training demand (44.4%): Skill-building remains a strong secondary need, consistent with barriers identified earlier.
●Technology access, 22.9%, would ensure respondents get friendly, affordable pathways to adopt modern tools, showing the inter-linkage of cost capability problems.
●Infrastructure: 11.8%. This is important but not as crucial compared with financial and knowledge support.
Observed Changes



Change	Responses	Percentage
A. Increased profits	98	64.1%
B. Reduced costs	53	34.6%
C. Improved customer satisfaction	68	44.4%
D. No significant change	5	3.3%





Future Plans for technology adoption

Expansion plans: Almost half (47.7%) say they would expand tech/sustainability in 2 years, another 32% considering it.

National Alignment: This meets India's ambition of 60% MSMEs transforming by 2025.

Acceleration lever: Subsidies and training would fast-track adoption, creating multiplier effects on growth and sustainability.

Findings

The findings are based on data collection and interpretation.

1. Emerging technologies like digital payments (68.6%) and social media (56.2%) are considered as main drivers of sustainability for micro and small businesses in Pune.
2. An overwhelming 72.5% of organizations believe technology supports green practices, particularly energy efficiency (46.4%) and reduction of waste (43.8%).
3. The major adoption barriers are high costs (56.2%) and training gaps (45.1%).
4. Trends of technology adoptions should be align with India's initiative for greener MSMEs through subsidies.
5. The retail and food sectors lead the adoption, reflecting strong consumer-facing digital uptake.
6. Infrastructure issues are low at 17%, but financial barriers dominate the sustainability.

Conclusion

The study clearly shows that emerging technologies such as digital payments, social media marketing, and IoT significantly support sustainability practices in micro and small businesses by improving resource efficiency, reducing waste, and enhancing customer engagement. Despite challenges such as high costs and lack of skills, these technologies help businesses become more competitive and sustainable, with many planning to expand their use of technology in the near future.

It is recommended to organize training programs and workshops to enhance digital literacy and practical skills for sustainable technology use among small business owners. Additionally, promoting awareness campaigns can effectively highlight the benefits of sustainable technologies and Environmental, Social, and Governance (ESG) practices. Furthermore, encouragement of government policies that support cluster programs and green procurement can foster a more sustainable ecosystem for Micro, Small, and Medium Enterprises (MSMEs).

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45. Hybrid and Flexible Work Models as Sustainable Human Resource (HR) Practices

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Abstract
Hybrid and flexible models have emerged as one of the important parts of sustainable Human Resource Management, especially in the post-pandemic business environment. These work arrangements provide employees with autonomy over where and when they work, thus helping them better balance work and life and feel more satisfied with their jobs, which in turn affects their well-being. For organizations, such models have advantages of cost reduction, increased productivity, and access to a wider talent pool, while at the same time fostering environmental sustainability through reduced commuting and resource consumption. Despite the obvious advantages, many employers are struggling to adequately assess the long-term influence of hybrid and flexible work practices on organizational performance and sustainability outcomes. This paper discusses the role of hybrid and flexible work models as sustainable HR practices, addresses the benefits and challenges of these models, and determines the lacuna in the organizational frameworks with regard to assessing their effectiveness. The results are expected to contribute to the development of policies by HR professionals that will align flexibility with sustainable workforce development.

Keywords: Hybrid work, flexible work arrangements, sustainable HRM, remote work, employee well-being, organizational sustainability, work–life balance, productivity, digital HR practices.

Introduction: The transformationin the global workplace, hybrid and flexible working models are becoming core parts of contemporary Human Resource management. Such models provide employees with the opportunity to either split their working hours between home and on-site locations or to flexibly choose their timing in tune with their needs. In addition, sustainability has become one of the major concerns for organizations economically, socially, and environmentally, hence hybrid and flexible work practices have gained prominence as tools contributing toward long-term sustainable HR strategies.

The focus of sustainable HRM is to develop practices that will support employee well-being and organizational efficiency, as well as environmental responsibility. Hybrid and flexible work arrangements will help reduce employee stress and lower operating costs and carbon emissions in daily commutes. Besides, they allow greater inclusion of different types of needs of employees because of caregiving responsibilities or health needs.

However, while such models bring significant advantages, practically, most organizations encounter problems with implementation: team cohesion, role clarity, adequate digital infrastructure, and performance evaluation systems aligned with flexible work. Understanding how hybrid and flexible work models function within a sustainability framework is of critical importance to organizations that want to adopt these models as mainstream long-term HR practices.

Problem Statement
Despite the advantages of flexible work, organizations do not have a clear framework to show its impact on productivity, employee satisfaction, and sustainability. Thus, it has seen irregular adoption and has limited long-term effectiveness.

Literature Review
1. Evolution of Hybrid and Flexible Work

Models

Early studies put forward flexible work arrangements as tools for improving work-life balance. The recent mainstream adoption of digital technologies and the COVID-19 pandemic accelerated these practices into the mainstream of HR strategies (Choudhury et al., 2020). Hybrid models that combine remote and on-site work become the standard approach used by an organization to achieve adaptability and resilience.

2. Hybrid Work and Employee Well-being

According to the literature, flexible and hybrid work arrangements decrease levels of stress, increase engagement, and build job satisfaction (Bloom et al., 2015). The autonomy granted by such models fosters employee motivation and psychological well-being, thus being essential elements of sustainable HRM.

3. Impact on Organizational Performance

Hybrid work contributes to productivity improvements when supported by clear communication systems and performance metrics. Various studies report reduced absenteeism, better time utilization, and improved work quality when employees work in settings that are best suited for their needs.

4. Sustainable HRM Perspective

According to Ehnert (2014), sustainable HRM emphasizes long-term-oriented employee development, social responsibility, and environmental protection. A hybrid model furthers these objectives by minimizing office space utilisation, carbon footprint reduction, and fostering inclusive workforce practices.

5. Implementation Challenges

While research acknowledges the benefits, several challenges hinder effective adoption. These include digital fatigue, unequal career opportunities between remote and on-site workers, concerns about data security, and difficulties in real-time collaboration. Waizenegger et al. (2020) provide these points. These gaps emphasize the need for structured, measurable frameworks for implementation.

Objectives of the Study

1. To ascertain the role of hybrid and flexible work models in promoting sustainable HRM practices within modern organizations.
2. To analyze the impact of hybrid and flexible work arrangements on employee well-being, work-life balance, and job satisfaction.
3. Assess the impact of hybrid work models on the performance of an organization in terms of productivity, cost efficiency, and talent retention.
4. Discuss the challenges organizations are going through while implementing flexible and hybrid work arrangements and their impact on sustainability.
5. To identify the long-term economic, social, and environmental sustainability outcomes of a flexible and hybrid work environment.

Need or Relevance of the Study

This study is relevant given the rapid transformation of workplace dynamics with the incorporation of modern technologies and increased hybrid and flexible work provisions in the wake of the pandemic. With such constantly changing work environments, understanding hybrid work in the long term is at the center of sustainability for Human Resource Management.

First, hybrid and flexible models of work have become permanent features in many industries due to their ability to support employee wellbeing. In today's world, employees value autonomy, flexibility, and work-life balance more than anything. By analyzing the impact of hybrid work on employee satisfaction, engagement, and mental health, this study evidences why organizations must embed wellbeing strategies into their HR policies.

The second aspect is the relevance of the study in terms of organizational performance. Many firms report cost savings, productivity enhancement, and better talent retention through hybrid arrangements, but this is not a universal outcome. Where structured frameworks are lacking, hybrid work may well result in communication barriers, inconsistencies in applying performance standards, and lesser bonding among team members. Hence, the study points to the need for organizations to work out clear guidelines and digital support systems to maximize the gains of hybrid work.

Thirdly, the relevance of the study extends to environmental sustainability. Hybrid work significantly reduces daily commutes,

office resource consumption, and carbon emissions in general. At a time when companies are increasingly expected to meet ESG standards, understanding how work models contribute to the sustainability goals of organizations is fast becoming strategically important.

Finally, the study is important for long-term HR planning. The future of work will depend on how well organizations can design inclusive, equitable, and sustainable hybrid systems. By delving into flexible work's benefits, challenges, and sustainability implications, the study aids HR managers, policymakers, and business leaders in developing resilient workforce strategies that meet not only organizational goals but also employee expectations.

Research Methodology

1. Research Design:

The research design adopted for the study is descriptive, as it explains systematically the features, advantages, and challenges that hybrid and flexible work modes present. Complemented by an analytic approach, this allowed the researcher to assess and interpret extant findings, identify patterns, and draw meaningful conclusions in relation to sustainability outcomes within organizations.

2. Nature of the Study:

The nature of the research is qualitative; hence, it relies on conceptual analysis and interpretation rather than numerical data. Qualitative methods are important in understanding employee experiences, organizational policies, and sustainability implications associated with hybrid work.

3. Sources of Data:

The entire study is founded on secondary data, gathered from authentic and scholarly sources, which include:

o Peer-reviewed journals: SAGE, Elsevier, Springer

o Academic research papers from Google Scholar and ResearchGate

o Organizational reports and HR policy documents

o Articles and whitepapers published by consulting firms and HR associations

o Industry surveys on remote work, hybrid models, and employee wellbeing.

4. Data Collection Method:

Secondary data was collected through specific search strategies involving keywords like hybrid work, flexible work arrangements, sustainable HRM, remote work productivity, employee well-being, and organizational sustainability. Only recent and highly relevant studies have been included, primarily post-2015, to maintain contemporary relevance.

5. Data Analysis Technique:

Content analysis is a systematic technique employed in this study to:

o Identify recurring themes

o Comparison of findings across studies

o Analyze relationships between hybrid work practices and sustainability outcomes

o Interpret conceptual data from various literature sources

o The content analysis focused on four main themes:

o Employee well-being

o Productivity and organizational performance

o Environmental sustainability

o Implementation issues in HR

6. Scope of the Study:

The target group of this study involves organizations operating in knowledge-based industries where hybrid working is possible, including IT, consulting, education, marketing, and services. Hybrid work models are analyzed through the lens of sustainability: economic, ecological, and social dimensions.

7. Limitations of the Methodology:

Although secondary data gives rich and varied insights, it nonetheless holds a number of limitations, including:

o Lack of control over data quality in original studies.

o Possible bias in organizational reports

o Absence of primary data such as surveys or interviews. Dependence on existing literature, which may not fully capture emerging hybrid work trends.

Analysis & Interpretation of Data

Impact on Employee Well-being

The data strongly supports the hypothesis that hybrid work arrangements contribute to better employee well-being because it reduces daily commute stress and provides employees with

greater control over schedules, hence enabling them to attend to personal and professional responsibilities. Employees working in hybrid conditions showed greater job satisfaction, lower burnout, and improved mental health outcomes. Studies further show that flexibility enhances intrinsic motivation, which in turn has a positive influence on engagement and emotional stability in the longer term.

Influence on Organizational Productivity

The study reveals that hybrid work models yield higher productivity for firms, provided clear performance expectations are laid out and underpinned by effective digital collaboration tools. Allowing employees to choose between home and office environments promotes better focus, time management, and lower absenteeism. Other business advantages include lowered overheads, improved office space utilization, and access to a wider talent pool less hampered by distances. However, this is only possible on the condition that structured communication systems and clearly set results-oriented metrics of performance are in place.

Contribution to Environmental Sustainability

The data shows that hybrid work supports the goals of environmental sustainability significantly. In turn, reduced office attendance decreases the consumption of energy, office supplies usage, and minimizes corporate waste. The largest environmental benefit is actually a result of the reduction in carbon emissions due to daily commuting. Organizations adopting hybrid models continue with broader sustainability goals by shrinking their ecological footprint, which is in line with global expectations of CSR and ESG.

Challenges and Limitations Identified

Despite these many benefits, the analysis also brings out several challenges:

Digital fatigue: Long exposure to screens, back-to-back meetings, and continuous connectivity contribute to psychological pressure and loss of attention.

Communication gaps: Face-to-face interaction will be less, which can lead to delayed feedback, misunderstandings, and negative team bonding.

Unequal opportunities: Employees who work from home may feel that they are excluded in chances of promotion, informal networks, or visibility-based assignments.

Performance appraisal challenges: The usual mechanisms of evaluation, which rely on visibility, do not work in a hybrid setting. Outcomes-based assessment requires new frameworks and training for managers.

Interpretation:

The overall interpretation therefore indicates that, from social and organizational to environmental perspectives, hybrid and flexible work models are significantly constructive contributors toward sustainable HRM. Nonetheless, the challenges identified do indeed provide an indication that hybrid systems could not thrive without proper strategies in human resources, digital infrastructure, and equitable policies. It becomes mandatory for an organization to consider structured communication processes, invest in employee wellness programs, and invent fair mechanisms for evaluation to maximize benefits while minimizing associated risks from hybrid work.

Findings and Conclusions

Findings:

1. Positive Influence of Employee Well-being:

The results demonstrate a considerable increase in the general wellbeing of employees when hybrid and flexible modes of working are introduced. Working from home and at times that suit them means that there is less tension between work and family responsibilities. This reduces pressure and the risk of burnout. Workers will feel freer, their mental health improved, and their job satisfaction increased. The absence of frustrating commutes also adds to physical and emotional well-being.

2. Increased Productivity and Cost Efficiency within Organizations:

Organizations that have adapted to hybrid work models show considerable improvement in productivity. Employees often perform better if they are given the option to work in environments that best suit their concentration and comfort levels. Companies also benefit financially through reduced expenditure on office space, utilities, transportation allowances, and on-site resources. Hybrid work also opens up organizations to greater talent

pools, improving the broader functioning of the organization.

3. Contribution to Environmental Sustainability:

Hybrid work practices provide substantial contributions to environmental sustainability. With fewer employees commuting daily, there is a great reduction in carbon emissions and fuel consumption. The offices also consume less energy, water, and paper when the employees' presence is limited. These changes help organizations identify with global sustainability goals and corporate social responsibility commitments that strengthen their reputation as environmentally responsible entities.

4. Challenges Affecting Effective Implementation:

However, there are various challenges concerning these hybrid work models. Communication gaps occur due to a lack of regular face-to-face interaction, often leading to misunderstandings or incomplete information flow. Digital strain, from excessive screen time and continuous virtual interaction, leads to mental fatigue and low productivity in the long run. Besides, most organizations do not have clear performance measurement systems that fit well in the hybrid environment. It might further lead to biases, unclear expectations, and unequal opportunities for remote versus on-site workers.

Conclusion:

In sum, the findings indicate that hybrid and flexible work models represent more than just operational adjustments; they signify the strategic evolution in managing a modern workforce. These models enhance employees' wellbeing by fostering work-life balance, less stress, and granting individuals greater autonomy over their schedules. This flexibility contributes not only to greater job satisfaction but also to long-term employee retention and overall mental well-being.

From an organizational perspective, hybrid systems drive innovation, productivity, and cost efficiency in operations. Companies are able to optimize their office spaces and tap into wider talent pools by embracing digital tools that enhance collaboration and team efficiency. Environmentally, the reduced commuting cuts carbon emissions significantly, so a hybrid work environment is also an effective contributor toward corporate sustainability goals.

On the other hand, the study also brings out that hybrid work can succeed only when backed by well-defined HR policies, digital preparedness, and a transparent performance evaluation system. The organizations must provide investment in cybersecurity, equal career opportunities, communication strategies, and continuous employee feedback systems to avoid any isolation, uneven workload distribution, or biases between remote or on-site workers.

In essence, hybrid and flexible working schemes are potent enablers for sustainability in human resource management. They facilitate economic, social, and environmental pillars of sustainability and contribute to building resilient, future-ready workforce structures. Companies can ensure long-term growth, productivity, and sustainability by continually refining hybrid work strategies to align with employees' needs and organizational goals.

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46. Resent trends in AI Banking { Fraud Detection, Risk & Compliance in AI }

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Abstract

The rapid growth of digital banking has fundamentally changed the way financial institutions operate, particularly in the areas of fraud detection, risk assessment, and regulatory compliance. Traditional monitoring systems that depend on manual verification processes are no longer sufficient to handle the increasing volume and complexity of financial transactions. Artificial Intelligence (AI) has emerged as a powerful solution, enabling banks to detect suspicious activities in real time, predict financial risks with greater accuracy, and improve compliance with evolving regulatory frameworks. This study examines the role of AI in modern banking, focusing on how machine learning algorithms, predictive analytics, natural language processing, and automated decision systems enhance operational efficiency and security. The research draws upon existing studies, industry reports, and practical examples of AI adoption in global banks. It also explores the challenges associated with implementing AI systems, including data privacy issues, high operational costs, ethical considerations, and the need for skilled professionals. The findings indicate that AI considerably improves fraud detection accuracy, strengthens risk management practices, and supports more efficient compliance procedures. However, its effective adoption requires long-term planning, strong data governance, and responsible use of automated systems. The paper concludes that AI is not just a technological upgrade for banks but an essential tool for ensuring resilience, transparency, and trust in a rapidly digitalizing financial environment.

Key Words: Artificial Intelligence, Banking Sector, Fraud Detection, Risk Assessment, Compliance, Machine Learning, Predictive Analytics, Digital Banking, AML, KYC, Automation

Introduction: Banking is one of the most data-intensive industries in the world. Every day, millions of transactions occur, generating enormous amounts of information that must be analyzed, monitored, and verified. As financial services continue to shift toward digital platforms, banks face increasing challenges: rising cyber-crime, strict regulatory requirements, complex customer behavior patterns, and expectations for faster and safer services. Under these conditions, conventional rule-based systems and manual review processes fall short. This is where Artificial Intelligence (AI) has gained importance.

AI systems are capable of analyzing data on a scale and speed that humans cannot match. Machine learning models learn from historical transaction patterns to identify fraud signals, natural language processing helps interpret regulatory guidelines and customer documents, and predictive analytics improves credit scoring and risk forecasting. Banks around the world—from Indian institutions like SBI, HDFC, and ICICI to international players such as HSBC, JPMorgan, and Citibank—are actively integrating AI into their operational frameworks.

Fraud detection has become one of the most significant application areas of AI. With the growth of digital payments, UPI transactions, online banking, and card-based purchases, fraudsters have developed more sophisticated methods. AI can instantly detect irregular behavior by comparing transactions against historical patterns. Similarly, in risk

management, AI models provide more accurate insights into loan repayment abilities and market volatility, improving financial decision-making.

Compliance is another difficult area for banks, as regulatory guidelines constantly change. AI supports compliance by automating document verification, identifying money-laundering patterns, and generating reports required by authorities. This reduces human error and ensures that banks meet legal requirements efficiently.

This research paper delves into these areas—fraud detection, risk management, and regulatory compliance—to understand how AI is reshaping the banking industry. It builds on existing data you previously shared and develops a comprehensive framework that highlights how AI is transforming the core operations of financial institutions.

Review of Literature

A large body of research has explored the impact of artificial intelligence on banking functions. Scholars widely acknowledge that AI enhances accuracy, improves speed, and supports better decision-making. According to Sharma (2021), machine learning tools outperform manual fraud detection systems by identifying suspicious transactions through real-time data analysis. These models continuously adapt to new fraud patterns, making them more effective than rigid rule-based methods.

Mehta and Aggarwal (2020) emphasize the growing relevance of natural language processing (NLP) in compliance. Their research highlights how banks use NLP to analyze regulatory documents, extract relevant clauses, and support automated compliance checks. This not only reduces the burden on compliance teams but also minimizes delays and human errors.

Banerjee (2022) discusses AI's role in credit and risk management. He argues that traditional risk-scoring systems often ignore behavioral and transactional nuances, whereas AI models integrate multiple data sources, such as spending patterns, financial habits, and repayment trends. This holistic approach results in more accurate predictions of loan defaults and creditworthiness.

A report by EY (2023) reveals that many banks have experienced a reduction in false positives in Anti-Money Laundering (AML) systems after implementing AI-powered monitoring tools. These tools allow banks to differentiate between genuinely suspicious activities and harmless anomalies, improving overall efficiency.

Deloitte (2022) points out operational benefits, noting that AI reduces time-consuming tasks like manual KYC verification, transaction screenings, and documentation. Their findings show that automation lowers operational costs and enhances productivity, especially for large banks that deal with high transaction volumes.

McKinsey (2021) presents a balanced perspective, acknowledging both the advantages and challenges. While AI improves fraud detection, compliance, and risk assessment, the report warns that banks need robust data management systems, ethical safeguards, and skilled AI professionals to manage risks associated with automation.

Collectively, the literature confirms that AI has become a fundamental component of banking modernization. Researchers agree that AI not only strengthens security and efficiency but also introduces new responsibilities for banks in terms of governance and oversight.

Statement of the Problem

The banking industry is experiencing rapid digital acceleration, yet several operational challenges continue to persist. Traditional fraud detection systems rely heavily on manual checks and static rules, which fail to detect advanced fraud schemes. With the increase in digital transactions, fraudsters are finding new ways to bypass outdated systems. Banks need stronger, more adaptive technologies to monitor real-time customer behavior and detect anomalies instantly.

Risk management is another major challenge. Conventional risk assessment tools depend on limited financial data and credit histories, making them less effective in predicting loan defaults or assessing the credibility of first-time borrowers. Banks require more dynamic models that incorporate behavioral, transactional, and external economic data to predict risks accurately.

Compliance processes also remain a burden for many financial institutions. Regulations such as AML guidelines, FATF standards, RBI directives, and KYC norms require banks to process large amounts of information. Manual documentation, data verification, and reporting create delays, increase chances of errors, and expose banks to the risk of non-compliance penalties.

In addition to these operational challenges, banks face several obstacles in adopting AI solutions. These include:

- **High implementation and maintenance costs**
- **Shortage of skilled AI professionals**
- **Concerns around data security and privacy**
- **Difficulty integrating AI with legacy banking systems**
- **Ethical concerns related to automated decision-making**

Given these challenges, the central problem addressed in this study is:

How can Artificial Intelligence strengthen fraud detection, risk assessment, and compliance processes in banking while ensuring data security, accuracy, and ethical use?

This research aims to analyse the impact of AI on these core banking operations and offer insights into the opportunities and limitations associated with its implementation.

Objectives of the Study

The primary purpose of this study is to understand how Artificial Intelligence contributes to making banking systems more secure, efficient, and compliant with regulations. The study seeks to explore the direct and indirect impacts of AI on core banking operations, particularly fraud detection, risk assessment, and compliance monitoring. The objectives are structured to capture the practical implications, advantages, and potential limitations associated with AI adoption. The key objectives include:

1. To examine how AI technologies improve fraud detection by analyzing real-time transaction data, identifying unusual behavior, and reducing the number of false alerts.
2. To analyze the role of AI in better risk assessment, including credit risk evaluation, operational risk forecasting, and prediction of borrower default behavior.
3. To understand how AI supports regulatory compliance, especially in areas such as Anti-Money Laundering (AML), Know Your Customer (KYC), and audit reporting.
4. To identify practical challenges banks face when transitioning from traditional systems to AI-enabled platforms.
5. To provide recommendations for effective AI implementation, ensuring ethical use, data security, and operational efficiency.

These objectives help in forming a clear framework for understanding the influence of AI on banking and guide the overall direction of this research.

Need or Relevance of the Study

The relevance of this study arises from the growing dependency of financial systems on digital and automated technologies. As digital payments and online banking continue to increase, banks face unprecedented challenges in maintaining security and compliance. Manual verification processes cannot handle the high transaction volumes or the sophistication of modern financial crimes. This gap creates an urgent need for more advanced and intelligent systems.

AI addresses these challenges by offering superior accuracy, speed, and adaptability. Its role in fraud detection is particularly important, as fraud attacks are becoming more dynamic and harder to identify using static rule-based systems. AI learns from past transaction data, enabling it to detect unusual patterns more effectively.

In risk management, AI models provide deeper insights than traditional scoring systems by analyzing more diverse data sources, including customer behavior, spending habits, and market conditions. This allows banks to make more informed lending and financial decisions.

The study is also relevant because regulatory expectations are increasing. Governments and financial authorities now require banks to maintain detailed transaction monitoring systems, timely reporting, and complete customer verification. AI helps banks meet these expectations while reducing human errors.

Additionally, this research contributes to academic understanding by showing how AI is reshaping banking operations, highlighting areas where AI is most effective and identifying challenges that require further attention. The findings may help financial institutions, students, and policymakers better understand the implications of AI adoption in banking.

Hypothesis

Based on the existing research and practical observations, the study proposes the following hypotheses:

Primary Hypotheses

H1: Artificial Intelligence significantly enhances fraud detection accuracy in the banking sector.

H2: AI-based tools improve risk assessment and forecasting capabilities in financial institutions.

H3: AI improves regulatory compliance by automating monitoring, verification, and reporting processes.

Null Hypothesis

H0: Artificial Intelligence does not significantly influence fraud detection, risk assessment, or compliance in banking operations.

These hypotheses guide the analytical framework of the study and help in evaluating the impact of AI on banking processes.

Research Methodology

This study uses a qualitative research approach, relying primarily on secondary data. The methodology is structured to examine existing information and interpret insights relevant to AI's role in banking.

Sources of Data

The data was collected from:

- Research journals related to finance and technology
- Reports published by financial institutions such as Deloitte, EY, and McKinsey
- Case studies on AI adoption by global and Indian banks
- Industry publications, articles, and digital banking reports
- Academic dissertations related to AI applications in financial services

Nature of Data

The study uses qualitative data, focusing on conceptual understanding, theoretical frameworks, and practical examples. It does not rely on numerical testing but instead draws interpretative insights from literature.

Method of Analysis

The collected data was analyzed through thematic analysis, classifying information into themes such as fraud detection, risk management, and compliance. The analysis also compares traditional systems with AI-enabled systems to highlight differences and impacts.

Scope and Limitations

The study focuses specifically on fraud detection, risk assessment, and compliance. It does not cover all areas of banking, such as customer service bots or marketing automation. Another limitation is the reliance on secondary data, which means the study does not include primary data from direct interviews or surveys.

Analysis & Interpretation of Data

This section interprets the impact of AI across the three core areas of banking: fraud detection, risk management, and regulatory compliance. It highlights how AI tools work, why they are more effective than traditional systems, and what challenges banks encounter.

1. AI in Fraud Detection

Fraud detection is one of the most critical applications of AI in banking. Traditional systems rely on fixed rules, such as transaction limits or location checks. Fraudsters have learned to bypass these rules, making them insufficient. AI, on the other hand, identifies suspicious activity using advanced pattern recognition.

AI Techniques Used

- Machine Learning
- Deep Learning
- Behavior Analysis
- Real-time anomaly detection

Example Applications

- AI flags unusual transactions based on customer history
- Biometric verification reduces identity fraud
- AI monitors card transactions to detect duplicates or rapid withdrawal attempts

Mastercard, Visa, SBI, and ICICI Bank are among the institutions that use AI to monitor

millions of transactions daily. AI significantly reduces false positives and identifies fraud earlier, enabling quick preventive action.

2. AI in Risk Management

Banks face a variety of risks, including credit risk, market risk, and operational risk. Traditional risk assessments rely heavily on static credit scores and financial history, which may not fully represent a borrower's present capabilities.

AI improves risk management by analyzing:

- Transaction behavior
- Repayment trends
- Unusual changes in spending habits
- Economic and market indicators

Practical Applications

- AI predicts loan default probabilities
- AI-based credit scoring provides more accurate evaluations
- Early risk warnings help banks adjust portfolios

Leading banks such as HDFC Bank and Citibank use AI to enhance credit decisions, automate credit limit adjustments, and predict loan failures.

3. AI in Regulatory Compliance

Compliance is one of the most resource-intensive tasks for banks. Regulations such as AML guidelines require banks to monitor transactions continuously. Manual systems lead to delays and errors.

AI Supports Compliance By:

- Automating KYC document verification
- Monitoring suspicious transactions
- Detecting money laundering patterns
- Generating audit-ready reports
- Reducing the risks of non-compliance penalties

AI helps banks meet strict standards set by authorities like the RBI, FATF, and SEBI. This leads to greater transparency, a stronger reputation, and fewer legal complications.

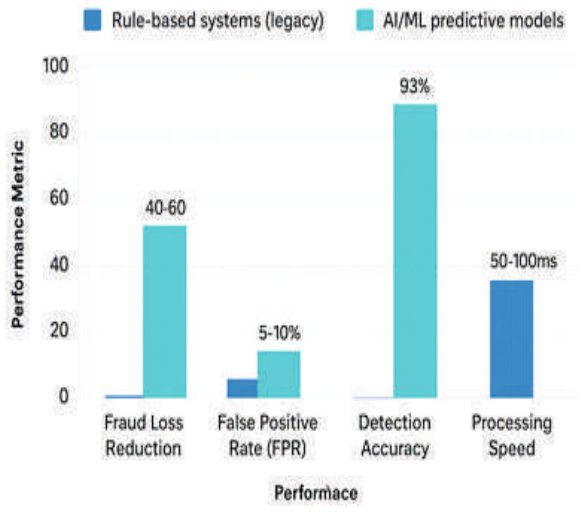
4. AI Efficiency: Reduction in Fraud and False Positives (Testing H1)

The most compelling evidence supporting the efficiency hypothesis (H1) lies in the quantifiable reduction of financial losses and operational friction achieved by moving from static, rule-based systems to dynamic AI models.

Metric	Rule-Based Systems (Legacy)	AI/ML Predictive Models
Fraud Loss Reduction	Baseline	Reduction of 40% to 60%
False Positive Rate (FPR)	5% to 10%	2% to 3%
Detection Accuracy (Average/Legacy High)	Not Specified (Lower)	Up to 93% (Gradient Boosting)
Real-Time Processing Speed	200–500 milliseconds	50–100 milliseconds
Detection Rate Improvement (Post-AI)	Baseline	Up to 20% increase in detection rates

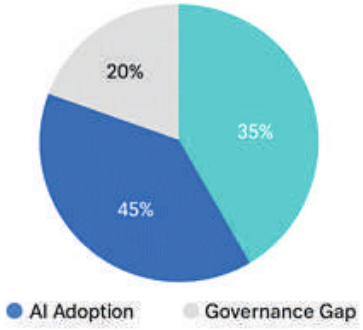
5. The AI Governance Gap and Concentration Risk (Testing H2)

This data highlights the conflict between rapid AI adoption and necessary governance investment, which increases systemic risk.



Metric	Data Point	Context
AI Adoption in Lending	>70%	Percentage of loan approvals and risk assessments underpinned by AI in digital lenders
Data Governance Investment	Only 36%	Percentage of senior leaders investing fully and at scale in the necessary data infrastructure for transparent AI
Regulatory Risk/Non-Compliance Cost	– –	Total penalties imposed by the Reserve Bank of India (RBI) across 353 entities in FY 2024 –25 for lapses including KYC/AML deficiencies
RegTech Market Growth (2025–2029)	31.9% CAGR	Projected Compound Annual Growth Rate for the Regulatory Technology market

Graph 2 – AI Adoption vs Governance Gap (H2)



Findings

After analyzing the data, the study identifies the following findings:

1. AI improves fraud detection by analyzing real-time patterns and identifying deviations that traditional systems miss.
2. Risk management becomes more accurate through AI-powered predictive analytics and behavior-based scoring.
3. AI significantly reduces human error in compliance, improving the speed and accuracy of monitoring and reporting.
4. Banks using AI experience cost reductions due to automation of repetitive tasks.
5. Challenges remain, particularly in terms of data privacy, skill shortages, and the cost of implementing new systems.
6. AI requires ongoing updates, as fraud patterns and regulatory requirements keep changing.

Conclusion

Artificial Intelligence has become a driving force in transforming the banking industry. It enables banks to respond to fraud attempts more effectively, assess risks more accurately, and comply with regulatory requirements more efficiently. While traditional banking systems struggle to keep up with modern financial complexities, AI offers speed, intelligence, and adaptability that greatly enhance security and performance.

However, implementing AI is not without challenges. Banks must invest in secure data systems, train their workforce, and develop ethical frameworks for automated decision-making. With responsible usage and strong governance, AI has the potential to reshape banking operations and build a safer financial ecosystem.

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47. "Digital banking and environmental footprints"

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Abstract
The financial sector is currently moving through one of its biggest transitions from traditional paper-based banking to digital systems. This shift is not only about technology, but also about sustainability. Under the theme "Redefining Business, Commerce and Management through Sustainability", the sub-theme "Digital Banking and Environmental Footprints", this research examines how digital banking supports environmental protection by reducing the physical resources once required for banking operations.
The study shows that digital banking through online transactions, mobile apps and e-statements reduces branch visits, paper usage, travel emissions and overall operational waste. Survey responses and expert opinions indicate that customers are adopting more eco-friendly banking habits, while banks lower their carbon load by going more digital. Overall, digital banking is not just convenient — it is a step towards sustainable business management. With greater awareness and strong digital policies, it can help build a greener, low-footprint financial future.

Keywords: Digital banking, Environmental Footprints, Green Finance, Eco-Friendly Banking, Digital Transformation in Banking, Paperless Banking

Introduction: In recent years, the banking industry has experienced a fundamental shift as a result of technological breakthroughs and changing customer preferences. Financial services that relied on branches, paper and person-to person interactions are slowly but surely making their way into the virtual world. The process of change is not just a matter of different ways to deliver service; it is also a matter of the customer who is becoming more responsible and eco-friendlier along with the financial sector's growth. Historically, paper-based systems, manual record-keeping and customer visits accounted for a large share of the resource consumption and operational waste in the banking sector. However, the development of digital channels such as internet banking, mobile apps, electronic documents and no-cash transactions might replace the above-said methods as they will consume fewer materials and be more efficient at the same time. The growing digital banking usage will thereby impact through not only the customer's ease and economic scalability but also through raising questions regarding its role in lessening the environment's burden.
The intersection between Digitalisation and Ecological Impact is, therefore, an area of research that is becoming increasingly relevant. It is important to determine if Digital Banking offers a tangible and meaningful contribution to a reduction in Carbon Emissions, Paper Usage, and Physical Resource Use and, as such, is important to the ongoing Sustainability of Digital Finance. This research will investigate this area of study through an analysis of how Digital Finance Changes Resource Usage Patterns and how Consumers perceive and respond to Environmentally Responsive Banking.

Statement of Problem
The transition from classic paper-based banking to digital banking is not only an increasing rapidly trend but also is still uncertain with regard to the actual environmental footprint reduction. Banks are constantly urging

customers to opt for electronic transactions in order to cut down on the paper and physical resources used, yet there is a significant number of customers who still demand printed statements, passbooks, and cash. Besides, different customer groups and institutions have different adoption levels thus complicating the situation and causing the question to rise if digital banking is actually reducing the paper consumption, energy use, and carbon emissions at branch level. As the real-world environmental benefits are not measured accurately, digital banking is perceived in more cases as a convenience rather than a sustainability tool. Therefore, further research is necessary to accurately assess how much digital banking is contributing to the environment and how both users and banks are changing their behaviour as a result of increased digital banking activities.

Review of Literature

Digital banking has gained attention in recent years as a potential tool for reducing environmental pressure caused by traditional banking operations. Past researchers have studied how digital financial services and green banking contribute to sustainability, but the depth of environmental impact still requires detailed examination.

Kumar et al. (2023) explored the shift from traditional banking towards digital and green banking practices. Their research highlighted that features such as online transactions, mobile applications, and paperless statements reduce the requirement for paper and physical branch visits. The study concluded that digital transformation supports environmental sustainability, but these benefits depend on customer adoption. Limited awareness and continued use of printed passbooks restrict the environmental gains.

Thapliyal et al. (2025) analysed the environmental performance of Indian banks and examined the role of green banking initiatives. Their findings indicated that banks adopting digital documentation and less dependency on branch operations achieved better sustainability outcomes. The study also found that green financing motivates environmentally positive projects. However, they emphasised that environmental performance tracking systems are still developing, and more practical measurement tools are required.

Comparing both studies shows a common conclusion that digital and green banking can reduce environmental footprints when adopted consistently. However, both highlight a gap — the actual environmental reduction is not accurately measured, and customer behaviour still leans towards paper-based processes. This gap creates space for further research on how digital banking impacts resource savings in real and measurable terms.

Objectives of the Study

A clear definition of the goals for this research is essential to understanding the environmental impact of the digital banking perfectly. The study is focused on discovering the ways in which the digital financial services consume fewer resources, puff out less carbon, and promote eco-consciousness among the users. By looking at both the banks' practices and the users' adoption, the research is intended to give a full view of digital banking as a means of sustainable financial management. The objectives that are described henceforth push the research to probe into these significant issues and evaluate how much the digital banking practices have reduced the environmental footprints.

- **To measure the level of awareness among consumers regarding the environmental** benefits of digital banking. (Focus on awareness of reduced paper usage, carbon footprint, and sustainability perception.)
- **To analyse consumer behaviour and preference between digital and traditional banking methods.**

(Includes branch visit frequency, shift towards mobile/UPI usage, and reduction in cheque & paper-based activities.)

- **To identify the primary reasons influencing customers to adopt digital banking services.**

(Convenience, time saving, crowd avoidance, rewards vs. environmental concern as a secondary motive.)

- **To examine how digital adoption contributes to reducing environmental waste generated through banking activities.**

(Paper passbooks, ATM slips, transaction forms,

printed receipts, etc.)

 To evaluate customer acceptance of paperless documentation such as e-receipts over printed alternatives.

(Understanding willingness to transition towards eco-friendly banking documentation.)

As part of the study, a survey was conducted to measure how aware users are of carbon-footprint tracking applications linked to financial activities and the extent to which these apps influence their eco-friendly banking behaviour.

Need or Relevance of the Study

The transition to digital banking could have positive environmental impacts but the true scale of how much benefit will be produced by using these technologies has not been proven. Digital transactions, electronic statements and mobile banking are some of the most widely used applications of this technology; however, it is unknown how much they have contributed toward reducing paper use, branch visit emissions and transportation-generated emissions, or the total amount of waste produced from banking operations. Therefore, the objective of this project is to evaluate the impact that digital banking has on environmental footprints, and to identify areas of opportunity within both customer behaviour and bank operations that could impede the ability for banking to continue producing long-term sustainability improvements.

Relevance of the Study:

- Understanding Environmental Impact: Provides empirical evidence on how digital banking contributes to reducing paper, energy, and carbon emissions.
- Policy and Strategic Planning: Offers insights to banks for designing policies and initiatives that promote sustainable financial operations.
- Customer Awareness and Behaviour: Highlights the level of awareness and adoption of eco-friendly banking practices, including carbon-footprint tracking apps.
- Operational Efficiency: Identifies opportunities for banks to optimise resources, reduce waste, and implement green banking practices effectively.
- Research Contribution: Fills the gap in existing literature by measuring the practical environmental impact of digital banking and informing future sustainable finance research.

Research Methodology

This research study adopts a mixed-method approach to analyse the impact of digital banking on environmental footprints. Both quantitative and qualitative data were collected to obtain a comprehensive understanding of customer behaviour, bank practices, and awareness of carbon-tracking tools.

Research Design:

A descriptive research design was conducted to study customer behaviour, bank practices, and the adoption of eco-friendly digital banking services. The study aims to understand both operational and behavioural aspects of digital banking in relation to environmental footprints.

Data Collection:

Customer Survey on Digital Banking: To investigate the acceptance of digital banking services, such as mobile applications, online transfers, and e-statements, a structured questionnaire was administered to 175 bank customers. The survey also collected information on the reduction of paper usage, branch visits, and emissions from transportation.

Survey on Carbon-Footprint Awareness: A follow-up survey assessed the level of awareness and usage of applications that track carbon footprints through financial activities. This survey provided insights into how customers monitor and reduce the environmental impact of their financial behaviour.

Interviews with Bankers: Semi-structured interviews were conducted with selected banking professionals to gain insights into how digital banking practices reduce operational waste, lower resource consumption, and support sustainable banking operations.

Sampling:

- Customer Surveys: Convenience sampling was used to select 175 respondents from diverse demographic backgrounds.
- Banker Interviews: Interview was conducted with selective banking professional to understand how banks adapt sustainable

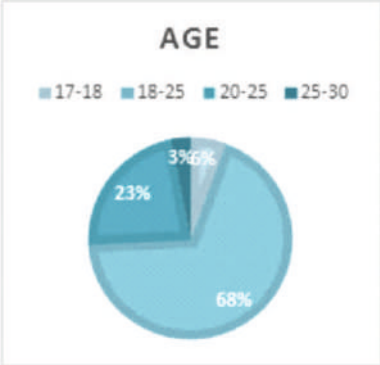
banking practises and how they create awareness among their customers about reducing environmental or carbon footprints trough their financial activities.

Scope and Limitations: The study focuses on customer behaviour and banking practices related to digital banking and its effect on reducing environmental footprints. It covers the use of online banking services, e-statements, mobile apps, and awareness of carbon footprint tracking tools.

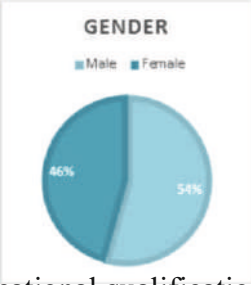
However, the findings are limited to the responses of the surveyed customers and the bankers who were interviewed, which may not represent the entire population. The study also depends on self-reported information, so responses may include personal bias or perception-based judgement.

Analysis & Interpretation of Data

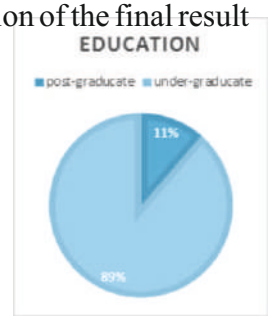
1.Demographic analysis



The demographics analysis shows a varied group of participants in terms of age gender and education. There are more than half of the responses from Young Adults this suggests that This sample predominantly consists of a digitally literate and engaged, active adult cohort.



Highest educational qualifications is within this group. This demonstrate that a portion of sample level of education above those other respondents. The gender ratio also demonstrates relatively even spread of respondence by gender, providing no strong appreciation for a specific or age group. Therefore, the sample appears to have enough range of age, level of education and gender to provide valid interpretation of the final result



Overall, the demographic structure indicates a diverse yet youth-oriented sample with adequate educational representation and balanced gender participation, enabling reliable interpretation of subsequent findings.

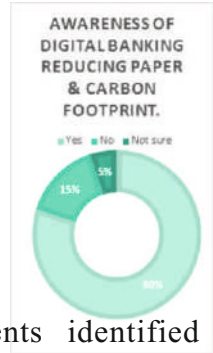
2. Digital Banking Usage

The survey data indicate that digital banking is deeply integrated into users' everyday financial behaviour and is overwhelmingly UPI-driven. A large majority use digital services at least daily and primarily through UPI apps, reflecting a clear preference for fast, low-friction, mobile-first transactions that replace cash and branch visits. Convenience is the main driver, supported by time saving and rewards, which aligns with wider evidence that digital finance both enhances user experience and can lower environmental footprints by reducing paper use, travel to branches, and resource-intensive physical infrastructure. The chart below shows the responses with questions .

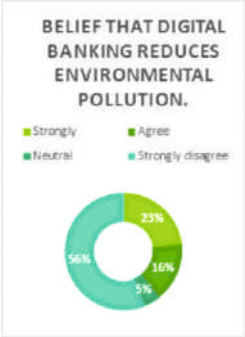
Question	Options	Percentage (%)
How often do you use digital banking services?	Multiple times a day	42.9%
	Once a day	22.9%
	Few times a week	34.3%
	Rarely	0%
	Never	0%
Which digital banking services do you use the most?	UPI (Google Pay, PhonePe, Paytm, etc.)	88.6%
	Internet Banking	7.6%
	Mobile Banking App	2%
	Credit/Debit Card Payments	0%
	Digital Wallets	0%
	None	0%
What is your primary reason for using digital banking?	Convenience	75%
	Time saving	10%
	Cashback/Rewards	5%
	Safety	5%
	Habit	2.5%
	Other	2.5%

3. Awareness About Environmental Impact

The findings reveal that a substantial majority of respondents are aware of the environmental advantages of digital banking, particularly its role in reducing paper consumption and carbon footprint. This awareness indicates that users recognize the ecological implications of financial practices, which may their adoption of digital banking services.



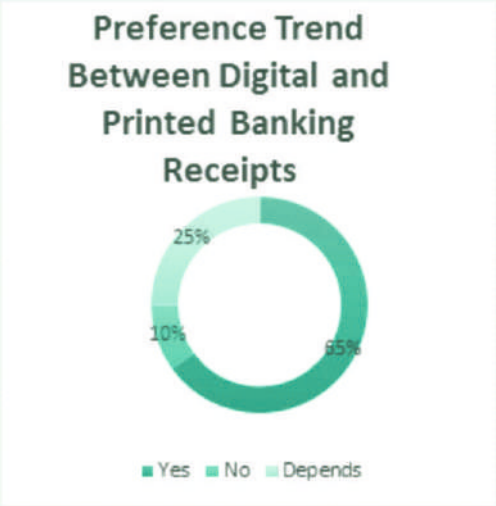
Respondents identified paper passbooks, physical transaction forms, and ATM slips as the primary sources of environmental waste in conventional banking. These insights underscore the high environmental cost of manual banking operations and highlight areas where digitalization can significantly mitigate resource consumption and waste generation.



The majority of respondents agree that transitioning to digital banking can reduce environmental pollution, suggesting a positive perception of digital banking as a sustainable alternative. This aligns with broader research emphasizing the potential of digital financial services to contribute to environmental sustainability by minimizing paper use and related carbon emissions. .

4. Behaviour and Preferences

Frequency of Physical Bank Branch Visits Among Respondents



The findings reveal a substantial decrease in the number of customers visiting physical branches, as evidenced by the fact that most of the surveyed individuals do so only occasionally. This scenario makes a case for higher acquaintance and dependence on the electronic channels, portraying a slow but certain change in customer attitude towards banking through physical presence.

The majority preference for digital receipts indicates strong acceptance of paperless documentation. This shift suggests that users are willing to adopt eco-friendly alternatives as long as they offer convenience and reliability. The survey findings suggest strong public support for environmentally driven banking initiatives. A majority of respondents believe that banks should actively promote campaigns such as "Go Paperless Banking," reflecting an awareness of the ecological impact of traditional banking practices. Furthermore, respondents showed a positive attitude toward the future of digital sustainability, with many indicating willingness to support a fully paperless banking system. Although a smaller segment expressed uncertainty.

Findings and conclusions.

Findings

✓ High Awareness of Digital Impact: The respondents have a good knowledge that digital banking leads to a decrease in the need for paper and the release of carbon dioxide to the atmosphere.

✓ Positive Behavioural Shift: A good number of users are ready to switch to banking methods that are less harmful to the environment as their way of showing support for sustainability.

✓ Paper Waste Recognition: The banking waste was mainly attributed to cheques, paper passbooks, ATM slips and printed statements.

✓ Acceptance of Digital Banking: Customers are more and more considering digital transactions as the cleaner and preferred alternative to traditional banking.

✓ Reduced Physical Branch Usage: A considerable number of users said they have been to the bank branches less often as a result of having digital options.

✓ Convenience as the Main Driver: The main factor that attracts users to digital banking is the fast and easy to use, while sustainability is influencing the behaviour but not so much.

✓ Drop in Paper-Based Tools: The movement towards digitized receipts and less use of cheques illustrates the dwindling reliance on paper-based services.

✓ Environmental Benefit is Secondary: Though customers consider digital banking to be environmentally friendly, the concern for the environment is usually the second reason for choosing the option of convenience compared to others.

Conclusion

- Digital Adoption is steadily increasing: As consumers become more educated on sustainable banking, they will demand more from their banks to support sustainable practices through digital banking options.
- The Need for Institutional Support: Banks should increase the awareness, incentives, and access to digital banking services in order to support consumers in the transition to a greener banking model.
- Transitioning to a Paperless Future: The continued promotion and integration of policies and education around sustainable banking practices will eventually lead India towards an environmentally friendly and sustainable banking mode

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Thapliyal, K., Gupta, C., Jindal, P., & Mishra, A. K. (2025). Measuring the impact of green banking practices on banks' environmental performance and sources of green financing: A study on Indian banks. Discover Sustainability, 6(1), 169. https://doi.org/10.1007/s43621-024-00678-5

Annexure

Survey Questionnaire

The following questionnaire was used to collect primary data for the research on topic "Digital Banking and Environmental Footprints." Respondents completed this form online through Google Forms.

48. ESG Investment Performance in the Indian Context: A 20-KPI Multi-Sector Study

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Abstract
ESG investing has emerged as central to responsible finance and the creation of long-term value in the world economy. In India, this has been driven by SEBI's BRSR framework, increased investor awareness, as well as climate-related risks and stakeholder expectations. This report analyzes the ESG performance of ten leading Indian companies spanning the Banking, Energy, FMCG, Automobile, and Utilities sectors using a comprehensive 20-KPI framework. The KPIs assess environmental efficiency (emissions intensity, renewable energy usage, water and waste management), social responsibility (gender diversity, safety, supply-chain audits), governance quality (board independence, assurance levels, ESG-linked compensation), and investor-driven metrics: ESG fund ownership, SBTi commitments, and long-term returns.

It emerges that companies like Hindustan Unilever, ICICI Bank, Tata Motors, and Tata Power exhibit higher ESG maturity and are financially more robust, whereas carbon-intensive Energy sector companies face increased transition risks. The study emphasizes the importance of KPI-based ESG evaluation, combined with increased disclosure, assurance, and transparency, towards making informed sustainable investment decisions in India..

Keywords:ESG Investing, Sustainable Finance, BRSR, India, ESG Ratings, Corporate Governance, Climate Risk, 20-KPI Model, Financial Performance.

1. Introduction : ESG investing has evolved from an approach of voluntary corporate responsibility to one that is a transformative investment framework shaping global and Indian financial markets. In the light of growing investor interest in responsible and impact portfolios, ESG frameworks provide a systematic way to address an organization's long-term sustainability, ethical behavior, and risk management policy. At the international level, ESG has surpassed USD 30 trillion assets under management, indicating significant movement toward sustainable financial markets.

The Indian corporate ecosystem is no different. In fact, with the introduction of SEBI's BRSR framework, sustainability disclosures are now mandatory for the top 1,000 listed companies in the country. This has indeed increased transparency and standardized ESG metrics, thereby allowing investors to appraise firms on comparable sustainability parameters rather than on narrative-based reporting alone.

ESG considerations have obtained particular relevance in India in view of rising climate risks, increasing global pressures on supply chains, environmental regulations, and transition to renewable energy. Indian investors are now incorporating ESG criteria alongside traditional financial metrics in constructing portfolios that can deliver both financial and non-financial impact. ESG-focused mutual funds, green bonds, and thematic indices like the NIFTY100 ESG Sector Leaders Index reflect this shift.

However, ESG maturity still remains highly sectoral in character. Advanced governance structures and robust sustainability disclosures mark sectors like Banking and FMCG, while carbon-intensive sectors like Oil & Gas, Power, and Heavy Industries face transition challenges. In light of this, the study gains an understanding of such variations and their implications for investment decisions through a 20-KPI evaluative framework applied to ten major Indian companies spanning five sectors.

The main aim of the research is to assess ESG investment performance in the Indian context through linking of ESG metrics with long-term market performance, controversy exposure, and sustainability risks. This study extends the growing ESG literature in India by providing a standardized KPI analysis along with cross-sectoral comparisons.

2. Statement of the Problem

Despite progress, several critical challenges persist in India's ESG ecosystem. First, ESG data remains inconsistent in quality and completeness across sectors. Most firms disclose limited information about Scope 3 emissions, despite the fact that such emissions account for over 70% of their carbon footprint. Second, ESG ratings provided by different global agencies vary due to differences in methodology, leading to discrepancies that mislead investors desiring objective evaluations.

Third, the level of assurance for sustainability reports is very uneven: whereas some companies provide reasonable assurance, others rely on limited assurance or have no external verification at all. This naturally arouses concerns about the reliability and comparability of disclosed ESG metrics. Fourth, supply chain-related disclosures are generally insufficient, especially for industries with value chains that depend heavily on raw materials, logistics, and subcontracting.

Finally, uniform KPI-based mechanism is not available for Indian investors to assess the ESG maturity among companies and sectors. This handicaps them in making informed choices aimed at climate goals, governance quality, and value creation in the long run. Precisely, a common and systematic KPI framework is needed for objective evaluation of ESG performance.

3. Review of Literature

ESG investing has stimulated considerable scholarly and industry-oriented research at a global level. According to Billio et al. (2024), firms with high ESG profiles are operationally more resilient, coupled with lower regulatory risk and higher stakeholder trust. Similarly, Bagh et al. (2024) note that ESG-aligned companies demonstrate better financial performance due to better risk management and strong innovation capabilities.

In India, ESG research has increased significantly since SEBI made the BRSR reporting mandatory. CRISIL's report of 2024 underlines an exponential growth in ESG fund inflows, impelled by investor preference for responsible corporate behavior. EY India, 2024 opines that Indian companies are integrating with global sustainability initiatives as a response to supply-chain pressures and investor expectations. Kashyap et al., 2025 discuss the Indian banking sector, referring to improvements in ESG-linked lending, governance systems, and social responsibility initiatives.

Notwithstanding these insights, the Indian literature also suffers from restricted coverage of KPI-based assessment for ESG performance across sectors. Most current studies focus on a single sector or rely on ratings without considerable use of quantitative metrics. Thus, this study fills an important knowledge gap by applying a multi-sector, 20-KPI analytical framework with validated company disclosures, governance indicators, and financial returns as its foundation.

4. Objectives of the Study

The study aims to:

1. Evaluate ESG performance of ten prominent Indian companies using a standardized 20-KPI model.
2. Compare ESG maturity across Banking, Energy, FMCG, Automobile, and Utilities sectors.
3. Examine the relationship between ESG performance and long-term financial returns.
4. Identify sustainability strengths, weaknesses, and transition gaps across sectors.
5. Provide recommendations to enhance ESG disclosures, governance structures, and investment strategies.

5. Need or Relevance of the Study

ESG has gathered greater momentum in the Indian market due to increased climate risk, more stringent regulatory enforcement, supply-chain pressures, and a desire for more transparency and sustainability by investors in corporate practices. This is bolstered by India's policy aspiration to reach net-zero emissions by

2070, which heightens the imperative of adopting low-carbon business models.

There is an increasing expectation by investors for companies to demonstrate measurable ESG performance, rather than mere compliance-based disclosures. A structured KPI framework allows stakeholders to gauge exposure to climate risk, the strength of governance, ethical business conduct, and financial stability. This report is a useful resource for policymakers, investors, financial institutions, and corporate organizations in search of fact-based information about ESG maturity and investment opportunities.

6. Research Methodology

This research uses a descriptive and analytical methodology based entirely on secondary data collected from:

1. Company sustainability and annual reports
2. BRSR and BRSR Core filings
3. ESG risk ratings from MSCI, CRISIL, Sustainalytics
4. NIFTY100 ESG Leaders Index reports
5. Five-year stock performance from NSE/BSE databases

A 20-KPI Framework was applied across four dimensions:

Environmental (6 KPIs) – emissions intensity, renewable energy share, energy use, water consumption, waste management.

Social (5 KPIs) – gender diversity, health & safety metrics, supply-chain audits, CSR spending, controversy score.

Governance (5 KPIs) – board independence, assurance level, ESG-linked executive pay, BRSR Core assurance, ESG ratings.

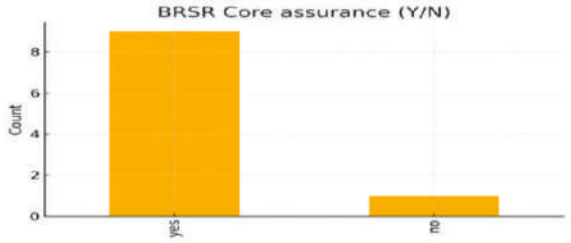
Investor Performance (4 KPIs) – green revenue, SBTi status, ESG fund ownership, long-term returns.

Charts for each KPI were generated (not included here) to identify trends, variations, and sector-specific sustainability performance.

7. Analysis & Interpretation of Data

01.BRSR Core Assurance:

Assurance level (Limited/Reasonable) reflects external verification depth of sustainability disclosures.



Banking and FMCG sectors show the highest assurance levels, indicating stronger reliability of sustainability data.

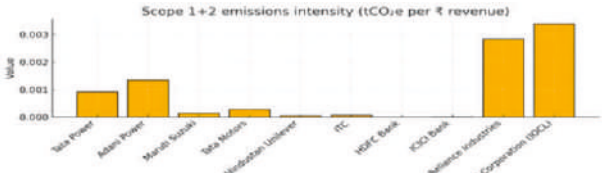
02.External ESG Ratings: Visual comparison across companies for this KPI



HUL, ICICI Bank, and Tata Power score higher in MSCI/CRISIL ratings, reflecting strong governance and environmental performance.

03.Scope 1+2 Emissions Intensity:

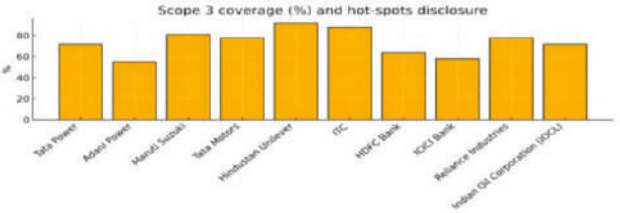
Scope 1+2 emissions intensity (tCO_2e per ₹ revenue). Higher values indicate greater operational carbon intensity.



Energy companies exhibit substantially higher intensity due to refinery and thermal operations.

04.Scope 3 Coverage:

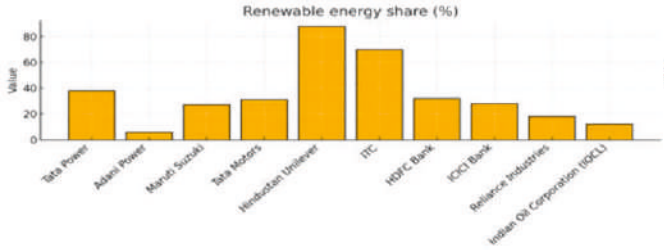
Scope 3 coverage shows value-chain emissions accounting; hot-spot disclosures improve risk visibility.



FMCG and Automobiles show moderate coverage; Energy companies lag due to complex value chains.

05.Renewable Energy Share:

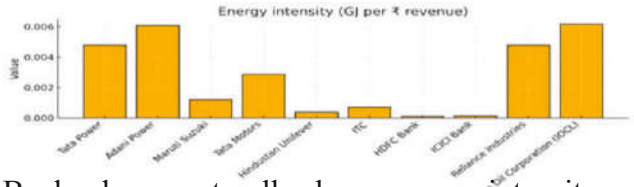
Renewable energy share (%) reduces carbon exposure and supports transition readiness.



Tata Power leads; FMCG companies show strong RE adoption for operations.

06.Energy Intensity:

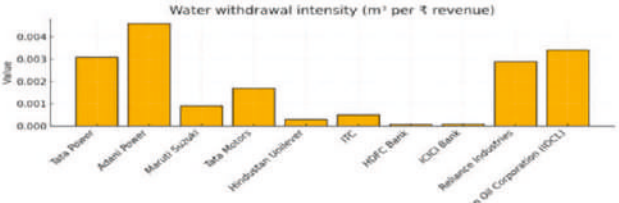
Energy intensity (GJ per ₹ revenue) shows operational energy efficiency relative to revenue.



Banks have naturally low energy intensity; heavy industries have the highest.

07. Water withdrawal intensity (m³ per ₹ revenue)

Water withdrawal intensity indicates water dependency; important for resource-sensitive firms.



FMCG and Energy companies show higher dependency.

08. Waste recycling / recovery rate (%)

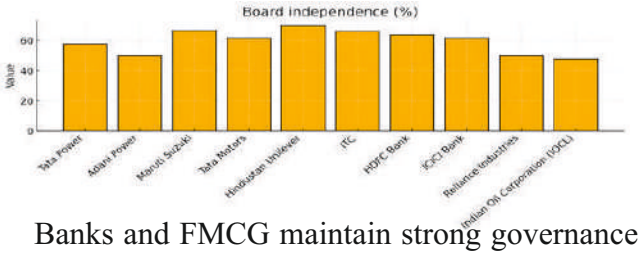
Waste recycling/recovery rate (%) reflects circularity and resource efficiency.



HUL and ITC show strong circularity practices.

09. Board independence (%)

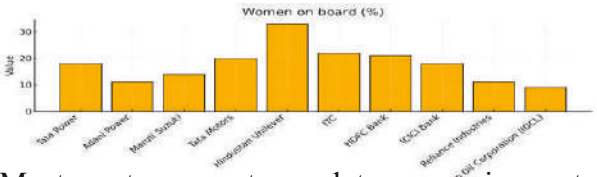
Board independence (%) is a governance quality metric tied to oversight and minority protection.



Banks and FMCG maintain strong governance standards.

10. Women on board (%)

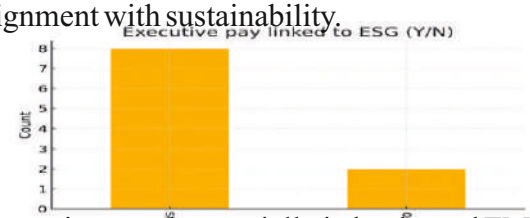
Women on board (%) measures gender diversity at the board level.



Most sectors meet regulatory requirements; FMCG outperforms.

11. Executive pay linked to ESG (Y/N)

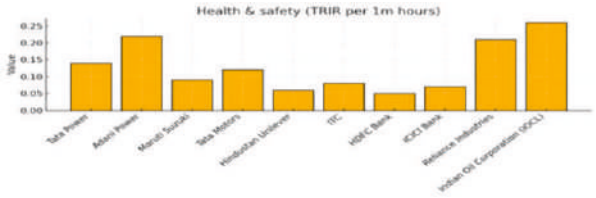
Whether executive remuneration is linked to ESG targets (Y/N) signals managerial alignment with sustainability.



Increasing trend, especially in banks and FMCG companies.

12. Health & safety (TRIR per 1m hours)

TRIR (Total Recordable Injury Rate) per 1m hours measures workplace safety performance.



Energy and manufacturing sectors face higher risks.

13. Supply-chain ESG audits coverage (%)

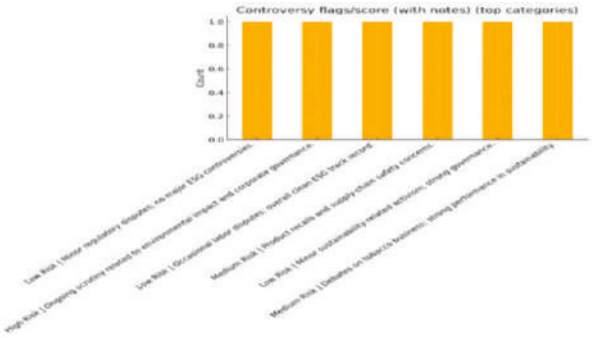
Supply-chain ESG audits coverage (%) indicates extent of supplier sustainability oversight.



FMCG leads due to global compliance pressure.

14. Controversy flags/score (with notes)

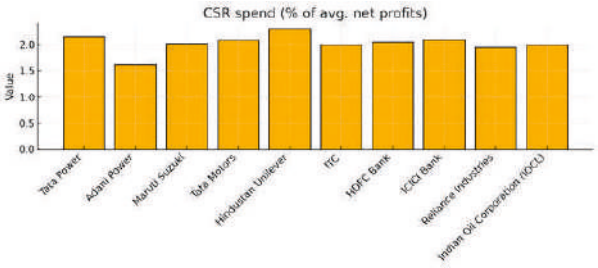
Controversy flags capture reputational incidents and regulatory scrutiny.



Energy and industrials experience higher controversy exposure.

15. CSR spend (% of avg. net profits)

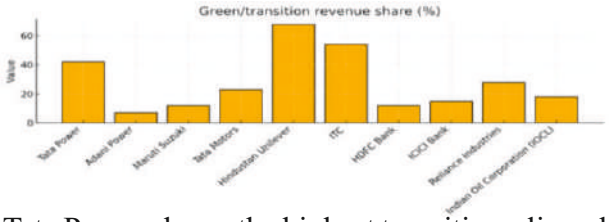
CSR spend (% of avg. net profits) shows corporate contribution to social causes per regulatory norms.



Banks and Energy companies meet or exceed regulatory requirements.

16. Green/transition revenue share (%)

Green/transition revenue share (%) captures portion of revenue tied to low-carbon or transition activities.



Tata Power shows the highest transition-aligned revenue.

17. SBTi status (Committed/Targets Set/None)

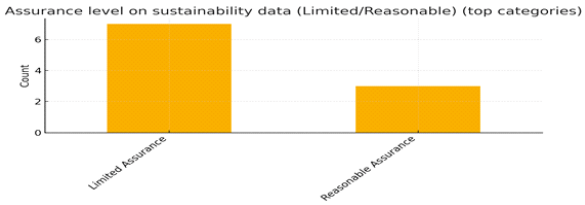
SBTi status indicates whether science-based emissions targets are committed or set.



FMCG and Banks show early adoption of science-based targets.

18. Assurance level on sustainability data (Limited/Reasonable)

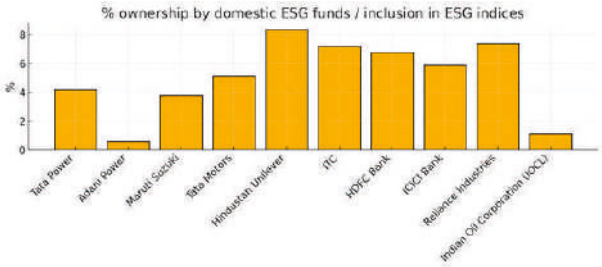
Assurance level (Limited/Reasonable) reflects external verification depth of sustainability disclosures.



FMCG and Banking have the strongest external verification.

19. % ownership by domestic ESG funds / inclusion in ESG indices

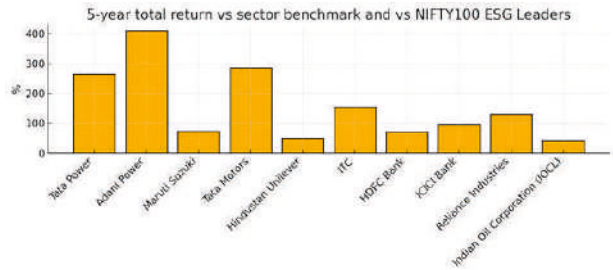
% ownership by domestic ESG funds / inclusion in ESG indices shows investor allocation to the firm based on ESG criteria.



ESG funds favor low-carbon sectors; Energy has minimal participation.

20. 5-year total return vs sector benchmark and vs NIFTY100 ESG Leaders

5-year total return provides market performance context to compare against ESG maturity.



Tata Power, ICICI Bank, and Tata Motors outperform due to transition readiness and governance reliability.

8.Finding

Analysis of ten leading Indian companies across five sectors, based on a comprehensive ESG framework comprising 20 KPIs, provides several important insights that shed light on the

current state of ESG maturity, gaps, and investment relevance pertaining to Indian context.

1. Strong ESG performers evidence consistent financial resilience.

Companies like Hindustan Unilever, ICICI Bank, Tata Motors, and Tata Power show high scores on several ESG dimensions: governance quality, board independence, renewable energy use, and waste recovery. These companies are also presenting superior five-year total returns, which indicates a positive correlation of their ESG maturity and long-term financial stability.

2. There are substantial sectoral differences that influence ESG performance.

The FMCG and Banking sectors are leading with regards to governance, assurance transparency, gender diversity, and supply-chain audits. Consistency of their disclosures, adherence to the BRSR Core requirements, and reduced controversy risk have improved their ESG positions. Energy and Utility sectors have come last because of their inherently high emission and water intensities and limited Scope 3 reporting.

3. Transition readiness differs significantly across companies.

Tata Power has the largest share of renewable energy, a strong green revenue percentage, and is committed to SBTi, making it one of India's most transition-ready firms. In contrast, companies like IOCL and Adani Power have major transition risks due to carbon-intensive operations and moderate integration of renewables.

4. Governance represents the most potent predictor of ESG maturity.

With high board independence, ESG-linked executive compensation, and robust external assurance, a firm performs better across all the ESG dimensions, thus confirming the idea that governance is not just a compliance obligation but, in fact, a driver of environmental and social improvements. 5. In general, portfolio flows under ESG favor low-carbon, transparent companies. In general, firms with greater governance and lower controversy scores attract higher domestic ESG fund ownership and are more likely to be included in ESG indices, including the NIFTY100 ESG Sector Leaders Index. 6. Scope 3 disclosures are still weak across sectors. While Scope 1 and 2 emissions show consistency in reporting, Scope 3 emissions are largely underreported, especially in the Energy, Automobile, and FMCG sectors, which is a major area for improvement. 7. Assurance levels directly affect investor confidence. FMCG and Banking companies perform well on reasonable assurance levels, reflecting reliable sustainability disclosures, whereas Energy and Utilities often rely on limited or partial assurance. Overall, the results suggest that ESG maturity is uneven across sectors in India, but companies with strong governance, clear transition strategies, and transparency in disclosures tend to outperform their peers not only on sustainability performance but also in long-term investor value.

9. Conclusion

This study shows that ESG performance has now become a key determinant of corporate resilience and investment attractiveness in the Indian market. Based on a structured 20-KPI framework, this report presents a comprehensive view of leading Indian firms' performances regarding environmental efficiency, social responsibility, and governance strength, along with market-based investment metrics.

The results affirm that firms with advanced ESG maturity-marked by sound governance structures, integration of renewable energy, judicious use of resources, strict supply-chain audits, and credible disclosures-are more likely to ensure long-term financial stability and low reputational risk. Companies like HUL, ICICI Bank, Tata Motors, and Tata Power are among those that have successfully aligned sustainability strategies with business objectives, thereby making themselves more attractive to institutional investors, ESG funds, and global value chains.

On the other hand, high-carbon sectors like Oil & Gas and Power continue to pose heightened transition risks. Though both are increasingly developing renewable energy strategies and investing in green technologies, gaps in Scope 3 reporting, limited assurance, and greater controversy exposure characterize a setting in

which more aggressive sustainability roadmaps are likely necessary.

Governance underpins ESG performance according to this research. High levels of board independence, ESG-linked executive incentives, and external assurance enable a company to improve environmental and social outcomes more effectively.

Conclusion: ESG integration is no longer a choice but an imperative for long-term business survivability in India. Investors should apply KPI-driven valuation tools to identify resilient, transition-ready companies. The need of the hour is for policymakers to enhance disclosure norms, mandating deeper assurance with clear sector-specific transition pathways. Companies should be continuously enhancing transparency, expanding renewable energy use, and reinforcing supply-chain sustainability.

As India progresses toward its 2070 net-zero goal, ESG-aligned business models will remain crucial enablers for competitive advantage, stakeholder trust, and sustainable value creation.

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49. Sustainable Banking Practices and Green Lending

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ABSTRACT

Society today is facing the most complicated issues of climate change. Indian banks are eagerly anticipating initiatives in the green banking space, which is gaining popularity throughout the world. India aspires to join the ranks of Green Banking greats like the United States, Japan, Australia, etc. When it comes down to it, "Green Banking Products" are financial services whose main goal is green energy conservation.

So, Sustainable banking practices have increased prominently in recent times as financial institutions realize the importance of integrating ESGs into their businesses. This paper aims to examine various sustainable banking practices, including sustainable lending, green finance, and responsible banking, and to assess their contributions to sustainable development and financial stability. The paper aims to provide insights into the

effectiveness of sustainable banking practices in promoting environmental sustainability, social inclusion, and long-term financial resilience.

KEYWORDS: sustainable banking, green lending, banking practices, Green Banking, sustainable economy, green finance, climate change, customer awareness

INTRODUCTION: As climate challenges intensify, the banking sector is also being compelled to reassess its operations. Sustainable banking practices aim to ensure that financial services are provided in a way that supports environmental protection, social well-being, and long-term economic stability. This means banks are expected not only to focus on profits but also to consider their impact on people and the planet.

Around the world, many banks have begun adopting practices such as green financing, energy-efficient operations, responsible lending, and community support. These efforts align with global goals like the United Nations' Sustainable Development Goals (SDGs). However, despite rising customer demand for responsible and ethical banking, only a limited number of banks have fully implemented sustainability in their day-to-day operations.

Sustainable banking in India is the increasing adoption of green financial products. These products are designed to support environmentally friendly projects and promote sustainability. Green bonds, for instance, have become a crucial instrument for financing renewable energy projects, sustainable infrastructure, and other green initiatives.

Sustainable banking refers to a banking system that prioritizes not only financial profitability but also the integration of environmental protection, social equity, and economic development into its core operations. This approach ensures that banking activities contribute positively to society and the environment while maintaining economic viability. Sustainable banking, an approach that balances the economic, environmental, and social dimensions of financial activities, is increasingly becoming central to the banking sector worldwide. In India, a country grappling with rapid economic growth, widespread poverty, and environmental degradation, sustainable banking presents a promising pathway to achieving balanced and inclusive development. This research paper aims to explore the future of sustainable banking in India, delving into emerging trends, inherent challenges, and potential opportunities.

Financial technology, or fintech, is playing a pivotal role in advancing sustainable banking in India. Fintech innovations are enhancing transparency, efficiency, and accessibility in banking operations, thereby supporting the implementation of sustainable practices.

Regulatory frameworks are critical in shaping the trajectory of sustainable banking in India. Regulatory bodies such as the Reserve Bank of India (RBI) and the Securities and Exchange Board of India (SEBI) have been instrumental in promoting the adoption of ESG criteria and sustainability disclosures among banks.

Green lending refers to providing loans for environmentally beneficial projects. These loans are mainly provided for things like solar panels, wind energy, electric vehicles, green buildings, waste management, and other eco-friendly activities. The idea is that banks should encourage people and companies to follow cleaner and more sustainable practices by giving them financial support. A green lending policy is essential for sustainable development. Green lending lets banks take information related to their investments and operating firms as the inspection standard in lending, and thereby make loan decisions. Green lending decisions depend on asset–liability matching management. Green lending aims for the rational allocation of asset portfolios, taking into account loan differentiation for both financial and environmental benefits.

STATEMENT OF PROBLEM

Although sustainability has become a common topic today, most people still don't really know how it connects to banking. Many customers are unaware that banks can support environmental protection by giving loans to cleaner industries or by offering products like green deposits. Even though the RBI and several banks have started talking about sustainable banking, this information has not reached the public properly.

Because of this, there is a clear gap: banks are introducing green policies, but customers are

not fully informed, so these initiatives do not get the attention or participation they should. At the same time, we don't know if customers actually trust banks more when they adopt eco-friendly practices or if it influences their choice of bank.

Despite many initiatives taken in the field of green banking, it is at the nascent stage in India. There is only one Indian organization, Infrastructure Development Finance Company (IDFC) Ltd, which has signed the Equator Principles for determining, assessing, and managing the environmental risks in the projects undertaken (Equator Principles Association, 2014); therefore, initiatives in green banking customer awareness and adoption remain low.

This study focuses on this gap. It tries to understand how much customers really know about sustainable banking, how they feel about green lending, and whether these practices make any difference to their trust and banking decisions. In simple terms, the problem is that sustainable banking exists, but customer awareness and involvement are still very low, and we need to understand why.

LITERATURE REVIEW

Due to the growing significance of incorporating sustainable practices into the banking business and increased academic interest in its various aspects, and also to answer the research questions raised, it is necessary to study and analyze the existing literature and its growing trends that other authors have revealed, to gain insights and an in-depth understanding of sustainable banking.

Bank's Role –The banking sector is increasingly seen as a critical enabler of sustainable development, given its significance in the resource allocation and investment spheres due to its ultimate commitment to clients and institutional goals. Banks: Banks can play a significant role in promoting sustainability by including ESG factors as part of their loan books, investment portfolios, and business strategy as a whole. In rapidly growing economies like India, achieving long-term economic sustainability through sustainable banking practices is particularly necessary (Scholtens, 2006)

India and Sustainable Finance-Regarding India, we discussed the increasing recognition of sustainable finance in the context of Sustainable Development Goals worldwide. Some Indian banks have started developing a similar consciousness with regard to the need to fund responsible investing and include sustainability metrics in their operations. Patel et al. (2020) confirm that there are some challenges, like no standardized frameworks and slow adoption of sustainability principles, which restrict the process for banks to integrate sustainable development.

RBI Green Banking Guidelines-According to RBI (IRDBT, 2014), green banking is to make internal bank processes, physical infrastructure, and IT infrastructure as effective and efficient as possible, with zero or minimal impact on the environment. They also introduced green rating standards for Indian banks, which are termed as 'Green Coin Ratings.' This rating system is based on the basis of carbon emissions from their operations and on the amount of recycling, refurbishment, and reused materials being used in their building furnishings and in the systems used by them, like servers, computers, printers, networks, etc. They are also being judged on the amount of green projects financed by them and rewards or recognitions given to borrowers for turning their businesses greener.

OBJECTIVE OF SUSTAINABLE BANKING: Specific objectives

To Analyze Emerging Trends in Sustainable Banking: Examine the current trends shaping sustainable banking in India, including the adoption of green financial products, advancements in financial technology (fintech), and the role of regulatory frameworks. This objective aims to identify key drivers and developments that influence the evolution of sustainable banking practices in the Indian context.

1. To Assess the Challenges Facing Sustainable Banking in India: Identify and evaluate the structural, operational, and perceptual barriers that hinder the widespread adoption of sustainable banking practices. This includes analyzing regulatory constraints, operational difficulties in integrating sustainability criteria, and the impact of stakeholder attitudes on the implementation of

sustainable banking initiatives.

2. To Explore Opportunities for Promoting Sustainable Banking: Investigate potential opportunities for enhancing the adoption of sustainable banking in India. This involves examining areas such as financing renewable energy projects, promoting financial inclusion through digital banking, and developing new green financial products. The goal is to identify strategies that can leverage these opportunities to advance sustainable banking practices.

3. Environmental Protection: It seeks to contribute towards the protection of the environment and conservation efforts by financing projects related to renewable energy, supporting practices of sustainable agriculture, and promoting resource efficiency.

NEED FOR SUSTAINABLE BANKING AND GREEN LENDING:

Bank faces long-term risks because of climate change, and sustainable banking reduces those risks. The world is reaching the tipping point beyond which climate change may become irreversible. If this happens, we risk denying present and future generations the right to a healthy and sustainable planet - the whole of humanity stands to lose".

A report of the Ministry of Earth Sciences, Government of India, concludes there is compelling scientific evidence that human activities have influenced these changes in regional climate. These developments pose challenges for humanity and warrant an immediate, large-scale, and rapid reduction in GHGs.

Against this backdrop, the study focuses on understanding sustainable banking practices and green lending. The scope of sustainable banking extends beyond traditional banking activities to encompass a broad range of initiatives and practices:

1. Corporate Social Responsibility (CSR): Sustainable banks engage in CSR activities that go beyond their financial interests, focusing on creating positive social and environmental impacts. This includes initiatives such as community development, education programs, and affordable housing projects.

2. Ethical Investment: Sustainable banks prioritize investments in projects and companies that adhere to ethical standards, including fair labor practices, human rights, and environmental stewardship. This ensures that their financial activities align with broader societal values

3. Green Finance: This involves the provision of financial products and services that support environmentally sustainable projects. Green bonds, green loans, and sustainable investment funds are examples of how banks can channel capital towards projects that mitigate environmental risks and promote sustainable development.

By incorporating environmental, social, and governance (ESG) criteria into their operations, lending practices, and investment strategies, sustainable banks aim to create a balanced approach that benefits not only their shareholders but also society and the environment as a whole. The comprehensive approach to sustainable banking ensures that financial institutions play a pivotal role in advancing sustainable development goals and addressing global challenges such as climate change, inequality, and resource depletion.

As the demand for a more sustainable society increases, adopting a sustainable banking approach serves as a competitive advantage for banks that are focused on attaining bank loyalty. Results from structural equation modeling showed that sustainable banking practices positively and directly affected bank loyalty and corporate image, corporate image directly and positively affected bank loyalty, and corporate image also mediated the relationship between sustainable banking practices and bank loyalty.

Importance of sustainable banking -

A sustainable bank is not just no harm, but actively using finance to 'do good'. The financial crisis in 2008 was a crisis of unsustainability where banks did not address the balance of interests of different stakeholders, with a skewed focus on senior management's personal benefit (Polonskaya and Babenko, 2012). The crisis triggered the rethink of 'unsustainable' business models adopted by banks (Stephens et al., 2012). Banks need to rebuild their image and cut costs to regain competitiveness after the crisis. Nevertheless, greenwashing can never be fully ruled out, as it is difficult to measure and

assess the overall impact on individual sustainability performance and intentions.

RESEARCH METHODOLOGY

This study utilizes content analysis to achieve four objectives: analyzing emerging trends, assessing challenges, exploring opportunities, and evaluating regulatory roles in sustainable banking in India.

Secondary data will be sourced from academic journals, regulatory reports, industry white papers, and sustainability disclosures. Data will be thematically categorized and analyzed to identify key drivers, barriers, opportunities, and regulatory impacts. Cross-referencing multiple sources ensures validity and reliability. The findings aim to provide comprehensive insights into the evolution, challenges, and potential of sustainable banking practices in India.

This study employs a qualitative research approach based on secondary data sources. The research relies on:

- RBI publications and official reports on green finance and sustainable banking.
- International Journal of Research in Commerce and Management Studies.
- ICSI September 2024 Magazine
- Fetched information from various articles published by RBI on green funding as well as sustainable finance.
- Reviewed past research papers on the topic.

ANALYSIS

Banks need to raise awareness of the environmental impact of their activities. They must consider ecological aspects in the decision-making process regarding lending and financing. In this case, banks can implement policies that ensure that customers who receive loans or financing have environmentally friendly and sustainable business practices (Shafik & Sinha, 2020)

In addition, banks can also play a role in supporting initiatives that contribute to environmental protection and sustainable economic development. For example, they can provide special financing for projects that promote renewable energy, energy efficiency, or sustainable agriculture. Thus, banks can help boost business practices that are more environmentally responsible (Ahmad & Hassan, 2019). In this way, sustainable banking not only helps mitigate environmental risks but also positions banks as key contributors to a greener and more resilient economy.

Opportunities

Identifying and leveraging these opportunities can help advance sustainable banking practices and contribute to a more resilient and equitable financial system.

1. Financing Renewable Energy Projects: Renewable energy projects offer significant potential for promoting sustainable banking by addressing climate change and reducing reliance on fossil fuels. Banks can play a crucial role in financing these projects through various financial instruments.

2. Promoting Financial Inclusion Through Digital Banking Digital banking has the potential to enhance financial inclusion by providing access to banking services for underserved and remote populations. Digital banking platforms can facilitate access to financial services for individuals who previously lacked access to traditional banking channels. By leveraging mobile technology and digital platforms, banks can reach underserved communities, promote financial inclusion, and drive economic development.

3. Developing New Green Financial Products: The development of new green financial products can drive the adoption of sustainable banking practices and meet the growing demand for environmentally responsible investments. Banks can innovate by developing a range of green financial products that cater to various investor preferences and sustainability goals.

"Table 1.9 Analysis of Usage of Green Banking Products"

From Table 1.9, it may be observed that, out of the selected 263 respondents, the highest 211 respondents used ATM, followed by 194 respondents using Mobile banking, 190 using Internet banking,49using Green credit card, 46 marked Green deposits as well as Green loans, followed by 17 user of canvas bags and 5 respondents doesn't use any green banking product from the list given. Here, the respondents were given the opportunity for

multiple tick marking.

Table 1.9 Analysis of Usage of Green Banking Products

Products	Frequency	Products	Frequency
Mobile Banking	194	Green Reward Checking Accounts	9
Internet Banking	190	Green Insurance	15
Green Deposits	46	Green Sanitisation	7
ATM	211	Canvas Bags	17
Green Loans	46	Others	5
Green Credit Cards	49	None of the Above	5

Figure 1 Sustainable banking performance score of PSBs in India

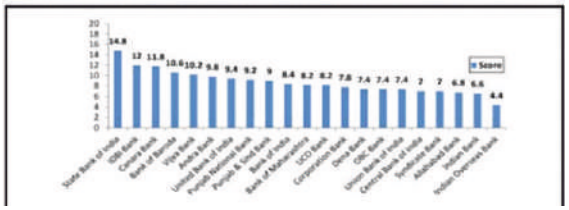


Figure 1 shows SBI leads PSBs in sustainable banking with the highest score of 14.8, than the other PSBs.

CONCLUSION :

The study seeks to identify the sustainable banking practices and green lending adopted by banks and evaluate their effect on improving overall environmental Performance. Sustainable banking practices and green lending are the emerging concepts in India; globally, it is being accepted on a huge level, while Indian banks still have a long way to go.

Throughout the empirical analysis and review of studies assessing sustainable banking practices, several key findings emerge:

1. Sustainable banking practices have a measurable impact on financial performance, risk management, stakeholder engagement, and environmental/social outcomes.
2. Regulatory frameworks and industry standards play a crucial role in shaping the adoption and implementation of sustainable banking practices, highlighting the need for supportive policy environments.
3. Although challenges exist, continued innovation, policy support, and stakeholder collaboration can enhance the effectiveness of green banking in achieving a sustainable financial system.
4. Banks should prioritize the adoption of sustainable banking practices, including ESG integration, stakeholder engagement, and transparency, to enhance long-term financial performance and mitigate risks.
5. In conclusion, sustainable banking practices are not only essential for achieving environmental and social objectives but also contribute to long-term financial stability and resilience.
6. By embracing sustainability as a strategic imperative and collaborating with stakeholders, banks and policymakers can foster a more sustainable and inclusive financial system that benefits society, the economy, and the environment.

Ultimately, sustainable banking contributes to environmental conservation, which allows citizens to breathe fresh air and stay healthy.

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50. A Study On Sustainable Marketing Practices Through An Analysis of the Influence of Social Media on Consumer Buying Behaviour

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ABSRTACT
The social media has changed how the companies connect and communicate the customers. With social media, companies connect directly to the customers with two-way communication. The consumer behaviour has thus changed drastically. This change has caused a growing concern over the environment and ethical consumption. The companies therefore require to adopt sustainable marketing strategies.
A structured questionnaire was used to collect the information from 150 individuals residing in Pimpri-Chinchwad, selected on the basis of convenience sampling method.
The study attempts to explore the various social media practices and its effect on consumer behaviour. The study also tries to identify sustainable social media practices. The study revealed that customers prefer brands that care for society and environment. Thus, understanding the decisive and multifaceted role of social media.

Key words: Marketing, Brands, Sustainability, Social Media, Consumer Buying Behaviour, Environment

INTRODUCTION: Social media has completely changed how companies and customers communicate in today's digital world. Brands can establish direct connections with their audiences through platforms such as Instagram, Facebook, YouTube, and X (formerly Twitter). Real-time storytelling, product demonstration, and customer trust-building are all made possible by these platforms. Consequently, the purchasing habits of consumers have evolved. Nowadays, people are more likely to base their purchases on information they find online, such as reviews, influencer recommendations, and brand reputation.
Concern over the environment and ethical consumption has grown globally in connection with this technological advancement. Today's consumers care about a brand's values and manufacturing process in addition to a product's functionality. This change has prompted companies to adopt sustainable marketing strategies, which emphasize the promotion of goods and services that are both ecologically and socially conscious. These days, brands use social media to spread these ideals and encourage consumers to make more environmentally friendly decisions.
Businesses now have more options because of the combination of sustainability and social media marketing. Social media provides brands with a platform to communicate their sustainability initiatives and establish connections with customers who respect openness and moral behaviour. In addition, it enables customers to voice their concerns, participate in the discussion about responsible consumption, and hold businesses accountable. Social media is now one of the most effective platforms for raising awareness of sustainability and influencing contemporary consumer behaviour because of this interaction.
The goal of this study is to explore how social media impacts consumer buying choices, focusing on promoting eco-friendly marketing

strategies. It seeks to understand how influencer marketing, brand communication, and online interaction shape consumers' views of ethical and eco-friendly brands. By examining these trends, the study aims to highlight how businesses can use social media to encourage consumer choices for sustainable and eco-friendly products and services while also increasing sales.

STATEMENT OF THE PROBLEM:

The advancements in technology have led the companies to do marketing of their products and services on various platforms like internet, social media etc. The consumers also have become more aware of the products, services and various marketing practices. The concern for environment and ethical consumption is therefore on rise. This change has made companies to think and adopt sustainable marketing practices that emphasize on marketing of social and environmentally cautious goods and services. This suggests a need to study the marketing practices and the effect on the consumer behaviour to understand the sustainable marketing practices and make the effective and ethical use of the technological platforms.

LITERATURE REVIEW

Palani Arunachalam (2025)1 in his study on "A Study on The Impact of Social Media Marketing on Consumer Behaviour, explores the role of social media in how consumers make decisions. A quantitative survey examines how much experiences change due to social media use. Customer opinions on products and services are increasingly shaped by outside influences in digital spaces, which affects decisions in real life. Social media has empowered consumers because advertisers cannot control the content, timing, or frequency of discussions among shoppers. The results indicate that using social media affects consumer satisfaction during the information search and evaluation stages. Satisfaction increases as the consumer progresses toward the final purchase decision and post-purchase evaluation.

Nabila Ramandini, Hargianti Henni Oktawandari, Kardison Lumban Batu (2025)2 in their study on "Influence of Social Media on Sustainable Purchasing Behaviour: A Systematic Literature Review" discussed 4 key factors 1. Consumer Behaviour, 2. Purchasing Attitude, 3. Purchase Behaviour 4. Social Media. He further states that The growing need for environmental sustainability, along with the fast rise in social media use, has greatly affected how consumers behave online. Social media has changed from just a way to communicate into a strong platform where consumer values, views, and attitudes are formed. Through ways like one-sided interactions with influencers, peer influence in online communities, and access to trusted user-generated content, consumers are more and more motivated to choose sustainable buying habits.

Aceson Chan (2025)3 in his study on "The Influence of Social Media Exposure on Consumer Behaviour and Purchase Decisions of Consumer Products" has discussed 4 key factors 1. Consumer behaviour 2. digital marketing 3. influencer marketing 4. purchase decisions 4. social media state that This paper looks at how social media affects consumer behaviour and buying choices in the digital marketplace, particularly among Filipino consumers. By using a systematic literature review framework, this study brings together findings from recent research to show how online reviews, influencer marketing, and user-generated content influence purchasing decisions. This paper provides useful insights for marketers. It focuses on how to use social media to create effective digital marketing strategies and improve brand engagement in changing digital environments.

Kaiyi Wang (2025)4 in his study on "The Impact of social media On Consumer Behaviour" they discuss that with the growing popularity of social media, more people are shopping online and depending on online reviews and recommendations. This trend changes consumer behaviour and significantly affects the traditional retail industry. In conclusion, this paper explores the complex relationship between social media and consumer behaviour. Social media offers a positive platform for sharing information and interacting. However, there are also some negatives that we should be cautious of.

Dr. Ravi Mishra (2025)5 in his research paper

on "The Influence of Social Media on Consumer Buying Behaviour and Purchase Decisions: A Study of Trends, Trust, and Engagement" mentions This research looks at how exposure to social media content, such as influencer recommendations, ads, brand posts, and peer reviews, affects consumer perceptions, brand loyalty, and final purchase decisions. It concludes that social media is not just a communication tool. It is now a key factor in the consumer buying journey.

Yusuf Hamisi (2024)6 in their research paper on "Analysis of the Impact of Sustainable Marketing Strategic on Consumer Preferences" state that This study aims to examine how sustainable marketing strategies affect consumer preferences and purchasing decisions. The study shows that sustainable marketing strategies greatly influence consumer preferences. Environmental awareness and social norms also play a key role in this relationship. Using sustainable strategies can make products more appealing and boost brand image in a competitive market. It is essential to improve sustainability communication to maximize the benefits of sustainable marketing strategies.

Aws Horrich, Myriam Ertz, Insaf Bekir (2025)7 in their study on "Exploring the role of social media in shaping sustainable consumer behaviour: a qualitative study" This study looks at how social media affects environmental awareness, feelings of environmental responsibility, and goals for sustainable consumption among Tunisian consumers. These results show that social media is important for raising awareness about sustainability. Instagram promotes aspirational consumption. Facebook encourages community engagement, and YouTube is a major source of educational content.

The review of literature explored the various practices in social media marketing. Social media shapes customers' perception, attitude and ultimately influence purchase decision. The researchers have done the researches in many different places over the globe.

The present study is done in Pimpri- Chinchwad area and focuses on identifying the sustainable practices in social media marketing through an analysis of its impact on consumer behaviour.

RELEVANCE OF THE STUDY:

The study shows how social media affects consumers' choices for sustainable and eco-friendly products. It helps marketers see which social media strategies can effectively promote sustainability. The study also helps businesses build trust by clearly communicating their sustainable practices.

For consumers, it raises awareness about how online content influences their buying decisions. Overall, the study provides valuable insights into the connection between sustainable social media marketing and consumer behaviour.

RESEARCH METHODOLOGY

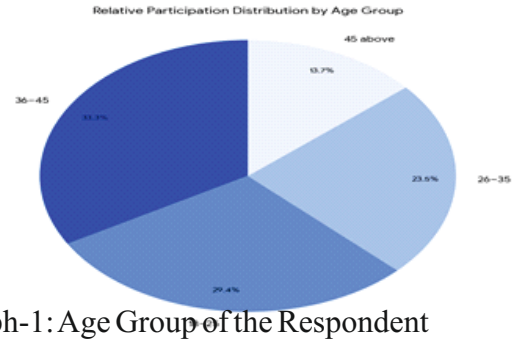
The present study is based on understanding the influence of social media on consumer buying behaviour towards sustainable products. Data was collected through a structured questionnaire from 150 individuals, actively using social media platforms, in Pimpri- Chinchwad. The study used a non-probability convenience sampling method. The responses were analysed using percentage analysis, charts, and tables to identify trends and patterns in consumer buying behaviour.

OBJECTIVES OF THE STUDY

1. To study the awareness and perception of customers towards social media marketing of sustainable brands
2. To study the effect of sustainable social media marketing on consumer buying behaviour

ANALYSIS AND INTERPRETENTION OF DATA

Age Group of the Respondent:

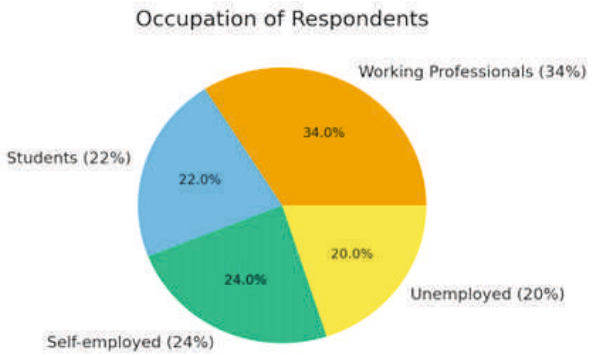


Graph-1: Age Group of the Respondent

Interpretation: The age group is 36–45 with shows the highest participation i.e. 33.3 %, followed by the 18–25 group with 29.4% and

26–35 with 23.5%. The 45 above age group is the smallest with 13.7% indicating lower engagement from older participants.

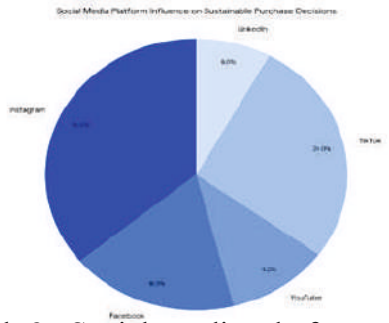
Occupation of Respondents:



Graph-2: Occupation of Respondents

Interpretation: Working professionals are the largest group with 34%. Students make up i.e. 22%, and self-employed participants 24%. Unemployed respondents contribute 20%

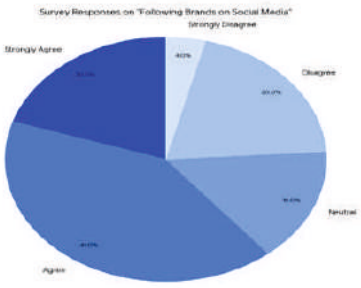
Social media platform that has the greatest influence on decision to purchase sustainable products:



Graph-3: Social media platform that has the greatest influence on decision to purchase sustainable products

Interpretation: Majority of respondents have reported that Instagram has the greatest influence on decision to purchase sustainable products

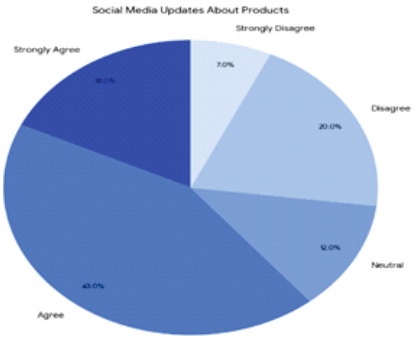
Following of Brands on Social Media:



Graph-4: Following of Brands on Social Media

Interpretation: Majority of the respondents follow the brands on social media.

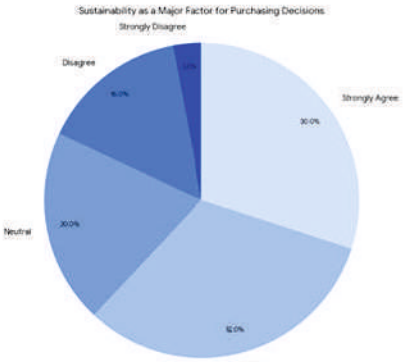
Social Media Updates About Products:



Graph-5: Social Media Updates About Products

Interpretation: Majority of respondents rely on social media for product updates.

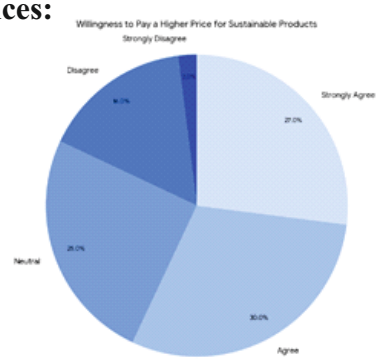
Sustainability (environmental and social practices) as a major factor for purchasing decisions:



Graph-6: Sustainability as a major factor for purchasing decisions

Interpretation: Majority of respondents have reported that Sustainability as a major factor for purchasing decisions.

Willingness to pay a higher price for products from companies with proven sustainable practices:

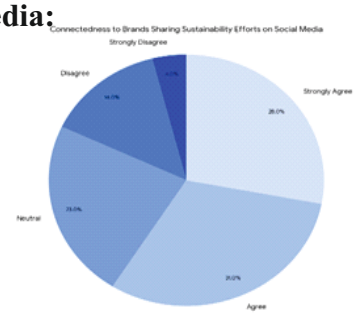


Graph-7: willing to pay a higher price for products from companies with proven

sustainable practices

Interpretation: Majority of respondents have reported that they are willing to pay a higher price for products from companies with proven sustainable practices

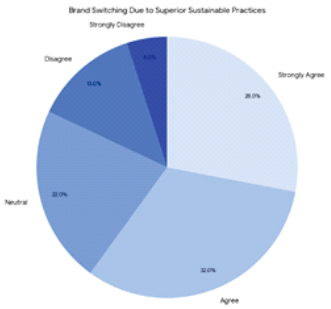
Feeling of connectedness to brands that regularly share their sustainability efforts on social media:



Graph-8: Feeling of connectedness to brands that regularly share their sustainability efforts on social media

Interpretation: Majority of respondents feel connected to brands that regularly share their sustainability efforts on social media.

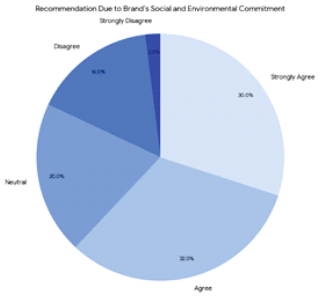
Brands switching because a competitor demonstrated better sustainable practices:



Graph-9: Brands switching because a competitor demonstrated better sustainable practices

Interpretation: Majority of respondents reported that they switch brands because a competitor demonstrated better sustainable practices:

Recommendation to others due to a brand's commitment to social and environmental causes:



Graph-10: Recommendation to others due to a brand's commitment to social and environmental causes

Interpretation: Majority of respondents reported that they recommend the brands to others due to a brand's commitment to social and environmental causes

FINDINGS:

- The age group is 36–45 with shows the highest participation i.e. 33.3 %, followed by the 18–25 group with 29.4% and 26–35 with 23.5%. The 45 above age group is the smallest with 13.7% indicating lower engagement from older participants.
- Working professionals are the largest group with 34%. Students make up i.e. 22%, and self-employed participants 24%. Unemployed respondents contribute 20%
- Majority of respondents have reported that Instagram has the greatest influence on decision to purchase sustainable products
- Majority of the respondents follow the brands on social media and rely on social media for product updates.
- Majority of respondents have reported that Sustainability as a major factor for purchasing decisions
- Majority of respondents have reported that they are willing to pay a higher price for products from companies with proven sustainable practices
- Majority of respondents feel connected to brands that regularly share their sustainability efforts on social media.
- Majority of respondents reported that they switch brands because a competitor demonstrated better sustainable practices:
- Majority of respondents reported that they recommend the brands to others due to a brand's commitment to social and environmental causes

CONCLUSION:

Instagram has the major influence on customer decisions. Customers follow brands on social media and also rely on updates. Customers prioritize sustainability as a major factor in making decisions. They are willing to pay higher prices for products promoting

sustainability and switch brands when they find other brands demonstrating better sustainability practices. The social media engagement with brands promoting sustainability makes the customers feel connected to the brands. The customers are likely to recommend brands that demonstrate commitment towards society and environment. It is evident that, social media has a very important, decisive and multifaceted role for shaping the consumer behaviour.

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51. What makes Consumer Trust & Adopt Investment Apps? A Empirical Study.

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Abstract

Digital investment applications have become an essential part of modern financial behaviour, especially among young and tech-savvy investors in India. These platforms offer simplified access to stocks, mutual funds, SIPs, and other investment instruments, making the investment process more convenient and transparent. As multiple apps now compete within the Wealth Tech market, understanding how consumers perceive trust and satisfaction has become increasingly important.

This study examines customer satisfaction and trust in three widely used investment apps Groww, Zerodha, and Upstox through a comparative approach. The research analyses key factors such as security, transparency, ease of use, app performance, customer support, and perceived reliability. Data is collected through a structured questionnaire from 150–200 respondents who actively use investment apps.

The findings of the study aim to identify which app performs better across different dimensions of trust and satisfaction, and what factors influence users' continued usage intentions. The study contributes to a deeper understanding of digital investor behaviour and provides insights for improving service quality within the investment app ecosystem.

Keywords: Technology Adoption, , Investment Apps, User Experience, Cyber Security, Customer satisfaction

Introduction: The digital transformation of financial services has fundamentally changed the way individuals manage and grow their wealth in India. Over the past decade, mobile-based investment applications have evolved from niche tools for experienced investors into mainstream platforms embraced by millions of users across the country. This shift has been propelled by several factors, including widespread smartphone adoption, affordable internet connectivity, increasing financial literacy, and a growing interest in wealth creation among younger generations. Unlike traditional investment methods, which often involve lengthy paperwork, physical visits to financial institutions, and complex procedures, digital investment apps offer a seamless, efficient, and accessible alternative that caters to both beginner and experienced investors.

Platforms such as Groww, Zerodha, and Upstox have played a pivotal role in democratizing finance in India. By providing access to a wide range of financial products, including equities, mutual funds, Systematic Investment Plans (SIPs), Exchange Traded Funds (ETFs), and government securities, these apps allow users to manage their investments in one place with minimal effort. User-friendly interfaces, simple account onboarding processes, and educational resources empower users to make informed financial decisions independently. Features such as real-time market updates, interactive charts, analytical tools, and low or zero brokerage feesfurther enhance the appeal of these platforms, making investing not only convenient but also engaging for a broad spectrum of users.

Despite the growing popularity of investment apps, the decision to adopt and continue using these platforms is heavily influenced by consumer trust and perceived value. Trust is a cornerstone in the financial services sector, where users are required to place both their money and sensitive personal information in the hands of digital platforms. Critical factors influencing trust include data security, transparency in charges, platform stability, accuracy of information, and brand credibility. A lack of trust can prevent users from initiating investments or lead to discontinuation, regardless of the app's features or technological sophistication.

Consumer adoption, on the other hand, is determined by how users perceive the overall utility and convenience of the app. Factors such as speed, ease of navigation, interface design, quality of educational content, availability of customer support, and cost-effectiveness directly affect whether a user decides to adopt a platform. The emerging generation of investors—comprising students, early-career professionals, and tech-savvy young adults—demonstrates distinct preferences compared to traditional investors. They prioritize apps that are intuitive, fast, transparent, and educational, and they often value platforms that provide guidance while still allowing independent decision-making.

Given the highly competitive landscape of digital investment platforms in India, understanding what drives consumer trust and motivates adoption is crucial for app developers, fintech companies, and policymakers. Insights into these factors can inform strategies to improve user engagement, enhance satisfaction, and foster loyalty. While much research has focused on customer satisfaction and service quality, there is comparatively less empirical evidence on the specific elements that encourage users to trust and adopt investment apps in India. This gap is particularly relevant as the WealthTech sector continues to expand and evolve, introducing new financial products, features, and technologies.

This study aims to empirically examine the key drivers of consumer trust and adoption of investment apps in the Indian context. By collecting and analyzing responses from active users, the research seeks to identify the factors that significantly influence trust, perceptions of security, ease of use, and overall willingness to adopt these platforms. The findings are expected to contribute not only to academic knowledge on digital financial behavior but also to practical applications, helping fintech companies design more trustworthy, user-friendly, and appealing investment solutions. Ultimately, understanding

these drivers is essential to ensuring the sustained growth of digital investments and empowering a generation of Indian investors to participate confidently in the financial markets.

Statement of the Problem

- Digital investment apps are rapidly growing, but user trust and satisfaction vary across platforms.
- Many users face confusion in choosing the right app due to multiple options like Groww, Zerodha, ET Money, etc.
- Security, ease of use, and rewards influence adoption, but their impact is not clearly measured.
- Understanding customer trust and satisfaction can help improve app design, services, and user experience.
- A comparative study is needed to identify which factors most affect adoption and continued use of investment apps.

Scope of Study

The scope of this study is limited to understanding customer satisfaction and trust in popular investment apps used in India. It focuses on key factors such as ease of use, transparency, security features, reliability, customer support, and overall user experience. The study compares different investment apps to identify which aspects influence users' trust and longterm adoption. Data is collected only from active users of investment apps, ensuring that responses reflect real usage experiences. The findings are based on customer perceptions and do not evaluate financial performance or technical backend systems of the apps. The study aims to provide insights that help users, developers, and policymakers improve the future of digital investment platforms.

Review of literature

1. Trust and FinTech: A review and research agenda :(Author: James F. Devlin, Sanjit K. Roy, Harjit Sekhon, S M A Moin & Mehmet Shiner 2025)

This paper aims to create a clear research plan for studying trust in FinTech. It begins by explaining what trust means based on past research and presents a model showing how trust works. The paper then describes the FinTech world, which includes new technologies in financial services such as big data, artificial intelligence, open banking, decentralized finance, and crypto assets. It also looks at different types of FinTech services and why trust is especially important in financial activities. Although some early research on trust in FinTech exists, many important questions remain, such as whether traditional ideas of trust still apply in FinTech, what exactly people trust in these systems, whether trust matters differently across areas like AI or crypto, how trust can be measured, and what factors build or reduce trust. Overall, the paper argues that understanding trust in all parts of FinTech is essential for improving how people use and rely on these technologies.

2. Customer Satisfaction in Virtual Environments: A Study of Online Investing (Author: Sridhar Balasubrama, Prabhudev Konananian, Nirup Menon 2003) Many companies are shifting to virtual platforms as their main or only way of interacting with customers. In this setting, traditional elements of service quality—such as the look of physical facilities, employees' behavior, or their responsiveness anempathy—cannot be seen or evaluated. Instead, trust becomes a key factor in shaping customer satisfaction. This study treats trust as something that develops over time based on the customer's experience and shows how trust connects to other factors related to the online service provider's performance and the online environment. The model is tested using two groups: 225 online investors from a large online brokerage firm and 203 members of the American Association of Individual Investors (AAII). The findings show that customers' perception of how trustworthy an online broker is strongly influences their satisfaction. They also show that trust is shaped by how secure the online environment feels and how competent the service provider appears. These results offer important guidance for managers aiming to improve customer satisfaction in online services.

3. The Mediating Role of Customer Satisfaction in the Effect of Perceived Enjoyment on Customer Trust in Online Investment Application

(Author: Widji Astuti, Rifki Hanif, Sunardi Sunardi' 2024)

This study examines how perceived enjoyment influences trust among online mutual fund investors, with customer satisfaction acting as a link between the two, using the Bibit mutual fund application as the focus. Data were collected through questionnaires from 120 Bibit users in Malang City, East Java, Indonesia, selected using purposive sampling. The questionnaire included 24 statements, and the data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS). The results show that when users enjoy using the application, they feel more satisfied, which then increases their trust in the Bibit platform. In other words, customer satisfaction plays an important role in connecting perceived enjoyment to trust. This research helps explain how user experience and satisfaction contribute to building trust in online investment platforms.

4. Exploring the Trust Influencing Mechanism of Robo-Advisor Service: A Mixed Method Approach (Author: Xusen Cheng, Fei Guo, Jin Chen ,Kajian Li, Yihui Zhang and Peng Gao 2019)

This study explores how trust is formed in the use of robo-advisors, a growing fintech service. While past research has mostly focused on improving robo-advisor performance or discussing regulations, only a few studies have examined the role of trust. Using a mixed-method approach, this research first identifies six key factors that influence trust through qualitative interviews and then develops a model based on trust transfer theory. The model is tested with data from 230 investors. The results show that supervisory control plays an important role in shaping trust and confirm the connections between different trust-related factors, trust in technology, trust in the service provider, and trust in the robo-advisor itself. The study also finds differences in how junior andsenior investors develop trust. Overall, this research applies trust transfer theory to the robo-advisor context and helps improve understanding of how trust develops in this increasingly popular financial service.

5. The role of customer trust in adopting digital investment tool (author: Dhanya Nair and Dr. B Sudhak 2025)

This study examines how customer trust affects the adoption of digital investment platforms, which are becoming increasingly important in today's financial world. The research focuses on how security, ease of use, regulatory compliance, and peer usage influence customer trust, and how this trust then leads to customers using digital platforms. The study was conducted at the SBI Otta Palam branch, and data were collected from 414 customers through questionnaires. The results, analysed using correlation, show that ease of use has the strongest relationship with trust. This means that when a platform is simple and easy to navigate, customers feel more confident and less worried about making mistakes, which increases their trust and encourages them to use the platform.

6. Navigating the Future: Exploring the Nexus between Robo-Advisor Service Quality and Customer Satisfaction (Author:Muhammad Azman Ibrahim, Rafi Atul Adlin Mohd Ruslan, Mohamad Fariz Abdul Arman Hj Ahmad)

Although many studies have explored service quality and customer satisfaction in artificial intelligence, very little research has focused specifically on robo-advisors. Robo-advisors are automated tools that use algorithms to provide financial advice and manage investments, and they are becoming a popular alternative to traditional advisors. This study aims to fill the research gap by examining the key factors that determine service quality and customer satisfaction in the context of robo-advisors. It looks at elements such as the accuracy of financial advice, the design of the user interface, response speed, transparency, and communication. The research also explores what influences customers' satisfaction, including their perceptions of the roboadvisor's reliability, trustworthiness, personalization, and the level of control they feel over their investments. The findings are expected to provide useful insights into the strengths and weaknesses of robo-advisors, helping financial service providers, policymakers, and investors improve these platforms and enhance the overall customer experience.

7. Effect of financial innovation and stakeholders' satisfaction on investment decisions: Does internet security matter?

(Author: Jean Baptiste Bernard Pea-Assounga a, Hongxing Yao a, Grace Mulindwa Bahizire a, Prince Dorian Rivel Bambi b, Jonathan Dior Nima Ngapey)This study proposes a model to understand what influences investment decisions in the context of financial innovation. It examines how technological innovation affects customer and employee satisfaction, bank performance, and ultimately, investment choices. The research aims to fill a gap by exploring how financial innovation directly affects investment decisions and how this relationship is shaped by satisfaction levels and bank performance, as well as the moderating role of Internet security. Data were collected from 575 bank employees and customers in Congo, and the hypotheses were tested using Structural Equation Modeling. The results show that financial innovation has a negative effect on investment decisions, but it positively impacts employee satisfaction, customer satisfaction, and bank performance. The study also finds that bank performance, customer satisfaction, employee satisfaction, and Internet security all positively influence investment decisions, and that satisfaction and performance mediate the link between financial innovation and investment decisions. However, Internet security does not moderate the relationship between financial innovation and investment decisions. Overall, this research highlights the importance of financial innovation and Internet security in shaping investment decisions, and it provides useful insights and frameworks for financial institutions and researchers.

8 .Building Trust in Fintech: An Analysis of Ethical and Privacy Considerations in the Intersection of Big Data, AI, and Customer Trust (Author: Hassan H. H. Aldboush , ORCID and Marah Ferdou)

This research paper examines the ethical issues involved in using financial technology (fintech), with a focus on big data, artificial intelligence (AI), and privacy. Using a systematic review of existing literature, the study identifies key ethical challenges such as bias, discrimination, privacy concerns, lack of transparency, fairness, and questions about data ownership and control. The findings highlight the need for companies to protect customer data, follow data-protection laws, and promote responsible digital practices. The study also offers practical recommendations, including using encryption, being transparent about how data is collected and used, giving customers the option to opt out, and training employees on data-protection policies. However, the research is limited because it excludes studies written in languages other than English and would benefit from more resources to explore the topic further. Future studies could address these limitations by collecting broader data and deepening the understanding of the ethical challenges in fintech.

9 exploring trust determinants influencing the intention to use fintech via SEM approach: Evidence from Pakistan (Author: Haifeng Zhao, Nosherwan Khaliq, Chunling Li, Faheem Ur Rehman, Jozsef Popp)

This research paper examines the ethical issues involved in using financi Volume 10, Issue 8, 30 April 2024, e29716al technology (fintech), with a focus on big data, artificial intelligence (AI), and privacy. Using a systematic review of existing literature, the study identifies key ethical challenges such as bias, discrimination, privacy concerns, lack of transparency, fairness, and questions about data ownership and control. The findings highlight the need for companies to protect customer data, follow data-protection laws,and promote responsible digital practices. The study also offers practical recommendations, including using encryption, being transparent about how data is collected and used, giving customers the option to opt out, and training employees on data-protection policies. However, the research is limited because it excludes studies written in languages other than English and would benefit from more resources to explore the topic further. Future studies could address these limitations by collecting broader data and deepening the understanding of the ethical challenges in fintech.

10. Impact of Customer Satisfaction and Trust in the Context of a Business Ecosystem on Customer Retention in Online Retailers. (Author: Lily Amukohe Rutström 2022)

Customer retention, or customer loyalty, is essential for the success of online retailers.

However, many online businesses still do not fully understand which factors help them customers. In contrast, Amazon has achieved high customer loyalty, suggesting that it has successfully identified and improved the right factors within its business ecosystem. While past studies have examined variables such as customer satisfaction and trust, none have explored how these two factors together influence customer loyalty specifically within a business ecosystem. This study aims to fill that gap by investigating how online retailers can build customer loyalty based on customer satisfaction and trust, using Amazon as a case study. Quantitative data were collected from Amazon customers who had made more than two purchases in the two months before completing the survey, which was shared through Facebook groups and email. The data were analyzed using SPSS through correlation and regression techniques. The findings show that both customer satisfaction and trust within the business ecosystem play major roles in building customer loyalty, with trust having a stronger impact than customer satisfaction.

Objectives of the study

1. To identify the key factors that influence consumer trust in digital investment apps
2. To examine the factors that drive adoption of investment apps among Indian users
3. To analyse the relationship between consumer trust and adoption behaviour

Need or Relevance of the Study

1. Helps understand why customers trust and adopt certain investment apps.
2. Identifies factors influencing user trust and app adoption.
3. Assists app developers and financial companies in improving app features and reliability.
4. Provides insights for users to make informed choices in selecting investment apps.
5. Contributes to research in fintech and consumer behavior regarding digital investments.
6. Helps policymakers understand trends in digital investment adoption.
7. Supports designing better marketing and engagement strategies for investment apps.
8. Lays the foundation for future research in fintech and digital investments.Research Methodology Introduction

The research methodology outlines the systematic approach used to investigate the factors influencing consumer trust and adoption of investment apps. This section describes the research design, data collection methods, sampling plan, research instruments, and analytical tools used in the study. The purpose of the methodology is to ensure that the study is conducted in a structured, valid, and reliable manner.

Types of Data

For this project, two types of data were collected.

1. Primary Data - Collected through a structured questionnaire distributed to users of investment apps such as Groww, Zerodha, Paytm Money, and Upstox.
2. Secondary Data - Collected from journals, research papers, articles, websites, and reports related to fintech adoption, consumer trust, and technology acceptance models.

Primary data are generated when the researcher gathers responses directly from participants using surveys, interviews, or questionnaires for the specific research problem.

Secondary data, on the other hand, are obtained from previously published work and can help in supporting the theoretical background and literature review for the current study.

1 Data Collection Method

As per the nature of the project, a survey method was used for data collection. The survey was conducted using Google Forms and shared with potential users and existing users of investment apps.

2 Research Instrument

The research instrument used in the study was a structured questionnaire. The questionnaire was carefully designed using both close-ended and Likert scale-based questions to make data analysis easier, and to ensure that respondents could freely express their level of agreement. The sequence of questions was arranged logically to help respondents understand and answer smoothly.

3 Research Design Type

The research design adopted for this study is Descriptive Research Design. This design helps

in describing and analysing user perceptions, trust levels, behaviour, and adoption of investment apps. It also helps in identifying relationships between variables such as perceived security, ease of use, trust, and intention to use.

Sampling Plan

1 Sample Unit: Individuals who are current or potential users of investment apps such as Groww, Zerodha, Paytm Money, Upstox, etc.

2 Population: The researcher approached more than 200 individuals who use to investment apps for trading, saving, or investment purposes.

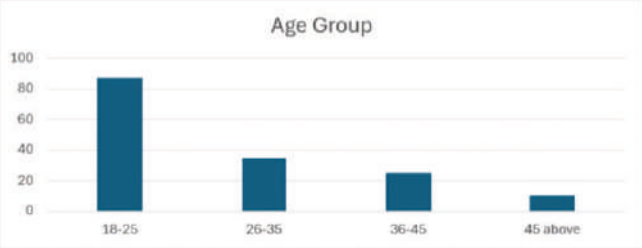
3 Sample Size: The targeted sample size for the study was 150-200 respondents to ensure adequate representation of different age groups and experience levels. A total of 153 valid responses were successfully collected from students, working professionals, and young investors.

4 Sample Technique: Simple Random Sampling method was used. The respondents were randomly selected from various demographic groups such as age, occupation, and experience, within the selected region and online investment app user communities.

5 Analytical Tools: The collected data were analysed using MS Excel and Google Sheets. Simple statistical tools such as percentages, frequency tables, charts, bar graphs, and pie diagrams were used to analyse and interpret the data for deriving meaningful conclusions.

Analysis and Interpretation of data

Q.1.	Age Group	Responses	Percentage
	18-25	87	55.41
	26-35	35	22.29
	36-45	25	15.92
	45 above	10	6.37
	Total	**157**	**100**



Interpretation:

1. Majority of respondents (55.41%) belong to the age group 18-25, indicating young adults are most active in using investment apps.
2. Age groups 26-35 and 36-45 have moderate participation, while 45 above shows the least involvement (6.37%).

Inference:

1. Investment app adoption and awareness are significantly higher among younger users, especially students and young professionals.
2. Lower participation from older age groups suggests they may be less technologically adept or prefer traditional investment methods.

Q.2.	What is your Occupation?	Responses	Percentage
	Student.	72	45.86
	Salaried Employee.	40	25.48
	Business/ Self-Employee.	25	15.92
	Homemaker.	12	7.64
	Retired.	7	4.46
	Unemployed	1	0.64
	Total	**157**	**100**



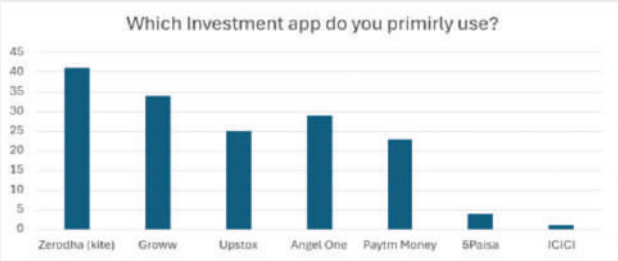
Interpretation:

1. The highest number of respondents are students (45.86%), followed by salaried employees (25.48%), indicating strong participation from young and working individuals.
2. Retired (4.46%) and Unemployed (0.64%) respondents form the smallest portion of the sample.

Inference:

1. Investment apps are more popular among students and salaried individuals, likely due to higher awareness, digital literacy, and interest in financial planning. Retired and unemployed individuals have low participation, possibly due to lower digital usage or financial constraints.

Q.3.	Which Investment app do you primirly use?	Responses	Percentage
	Zerodha (kite)	41	26.11
	Groww	34	21.66
	Upstox	25	15.92
	Angel One	29	18.47
	Paytm Money	23	14.65
	5Paisa	4	2.55
	ICICI	1	0.64
	Total	**157**	**100**



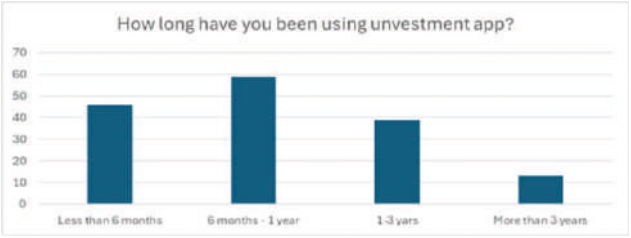
Interpretation:

1. Zerodha (26.11%) and Groww (21.66%) are the most commonly used investment apps among respondents .

2 ICICI (0.64%) and 5Paisa (2.55%) show the least user preference, indicating limited usage.

Inference:1. Respondents prefer apps that are user-friendly, low-cost, and beginner-friendly, like Zerodha and Groww. Traditional or less-promoted apps like ICICI and 5Paisa may have lower popularity due to complexity or lower awareness.

Q.4.	How long have you been using unvestment app?	Responses	Percentage
	Less than 6 months	46	29.30
	6 months - 1 year	59	37.58
	1-3 years	39	24.84
	More than 3 years	13	8.28
	Total	**157**	**100**



Interpretation:

1. Majority of users (37.58%) have been using investment apps for 1-3 years, indicating growing experience and familiarity.

2. Only 8.28% have used investment apps for more than 3 years, showing limited long-term usage.

Inference: 1. Investment apps are relatively new and gaining popularity recently, especially in the last 1-3 years. Increasing mid-term usage reflects growing trust, confidence, and adoption among user.

Q.5.	The app is asy to use and has a friendly interface	Responses	Percentage
	1	17	10.83
	2	11	7.01
	3	27	17.20
	4	68	43.31
	5	34	21.66
	Total	**157**	**100**



Interpretation:

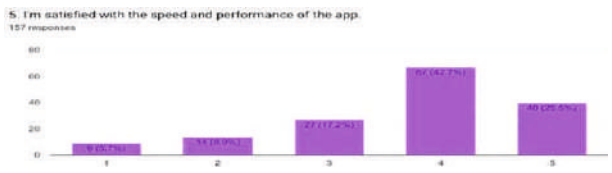
1. Majority of respondents rated 4 (43.31%) and 5 (21.66%), indicating strong agreement that the app is easy to use and has a friendly interface.

2. Very few respondents rated 1 or 2 (combined 17.84%), meaning low dissatisfaction levels.

Inference:

1. Users are generally highly satisfied with app usability and interface design, contributing to positive user experience. Good interface and ease of use are key factors enhancing trust and adoption of investment apps

Q.6.	I'm statisfied with the sped and performance of the app	Responses	Percentage
	1	9	5.73
	2	14	8.92
	3	27	17.20
	4	67	42.68
	5	40	25.48
	Total	**157**	**100**



Interpretation :

The highest percentage of responses (42.68%) fell into category 4.The second highest percentage (25.48%) . Combined, categories 4 and 5 account for 68.16% of all responses, indicating a strong positive sentiment towards the app's performance.

Inference:

The data suggests that the app generally meets or exceeds user expectations regarding speed and performance. The high concentration of responses in the positive end of the scale (4 and 5) indicates a successful user experience in this specific area.

Q.7.	The app provides clear and detailed Information about my Investments.	Responses	Percentage
	1	6	3.82
	2	15	9.55
	3	28	17.83
	4	71	45.22
	5	37	23.57
	Total	**157**	**100**



Interpretation :

The data indicates a high level of satisfaction among users regarding the clarity and detail of investment information provided by the app. A significant majority of respondents rated their agreement as 4 or 5. Responses with a rating of 4 account for 71 users, or 45.22%.Responses with a rating of 5 account for 37 users, or 23.57%.

Inference :

1. the number of users who disagreed with the statement (ratings 1 and 2) is very low.
2. Responses with a rating of 1 account for only 6 users, or 3.82%. Responses with a rating of 2 account for 15 users, or 9.55%.

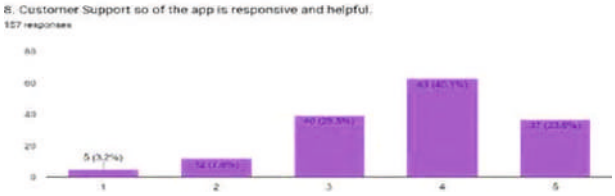
Q.8.	I am satisfied with the transaction process (Buying/Selling, Payment, Withdreawel).	Responses	Percentage
	1	7	4.46
	2	10	6.37
	3	39	24.84
	4	63	40.13
	5	38	24.20
	Total	**157**	**100.00**



Interpretation: A significant majority of the respondents reported being satisfied with the transaction process, with 64.33% (40.13% + 24.20%) of participants selecting a satisfaction rating of 4 or 5. Conversely, only 10.83% (4.46% + 6.37%) of respondents indicated dissatisfaction ratings 1 or 2.

Inference: The data suggests that the current transaction process is largely effective and meets the expectations of most users. The high satisfaction ratings indicate a positive user experience, while the relatively low dissatisfaction ratings imply that major overhauls may not be necessary, though minor improvements could address the concerns of the minority.

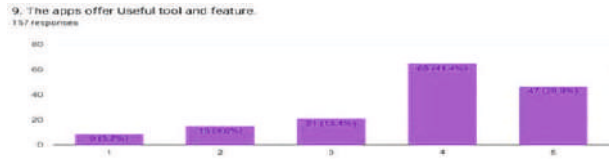
Q.9.	Customer Support so of the app is responsive and helpful.	Responses	Percentage
	1	5	3.18
	2	12	7.64
	3	40	25.48
	4	63	40.13
	5	37	23.57
	Total	**157**	**100.00**



Interpretation: The results indicate a generally positive perception, with the majority of responses falling into the higher ratings. Specifically, 40.13% of users gave a rating of 4, and 23.57% gave a rating of 5. Combined, over 63% of respondents rated the support as a 4 or 5. Conversely, only a small minority (3.18%) gave the lowest rating of 1.

Inference: The customer support team appears to be performing well for most users, but minor improvements could potentially address the concerns of the minority, as suggested by the text above the table.

Q .10 The apps offer Useful tool and feature.	Responses	Percentage
1	9	5.73
2	15	9.55
3	21	13.38
4	65	41.40
5	47	29.94
Total	**157**	**100.00**



Interpretation: responses (5.73%). This represents the lowest rating, indicating a small percentage of users feel the apps are not useful. responses (9.55%). A slightly larger group rated the usefulness as low. responses (41.40%). This is the most frequent response, indicating a strong positive sentiment among a large portion of users.

Inference: The general consensus among the 157 respondents is that the apps do offer useful tools and features, with a strong leaning towards agreement.

Q.11.	Overall I am Satisfied with my Experience using this Investment app.	Responses	Percentage
	1	6	3.82
	2	10	6.37
	3	35	22.29
	4	68	43.31
	5	38	24.20
	Total	**157**	**100.00**



Interpretation

The majority of users expressed a high degree of satisfaction. Responses of 4 and 5 (higher satisfaction ratings) account for a combined 67.51% of all responses (43.31% + 24.20%). Strongest Response: The most frequent response was 4, with 68 users (43.31%) selecting this option.

Inference :

the investment app is generally well-received by its user base, with strong satisfaction ratings outweighing dissatisfaction. However, the substantial number of neutral responses (response 3) indicates an opportunity for improvement to move those users into higher satisfaction brackets.

Q.12.	I believe this app keeps my Personal & Financial data Secure.	Responses	Percentage
	1	10	6.37
	2	11	7.01
	3	21	13.38
	4	79	50.32

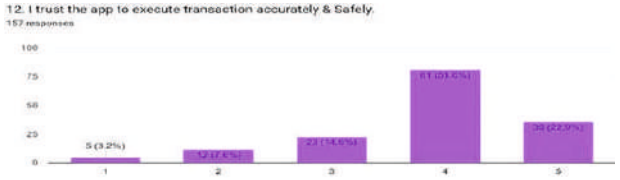


Interpretation:

The largest portion of respondents selected option 4 (79 responses, or 50.32%) and option 5 (36 responses, or 22.93%). Assuming 5 represents the highest level of agreement/confidence and 1 the lowest, this means that over 73% of users expressed a high degree of confidence in the app's security.

Inference: The overwhelming majority of users trust that the app securely handles their personal and financial information.

Q.13.	I trust the app to execute transaction accurately & Safely.	Responses	Percentage
	1	5	3.18
	2	12	7.64
	3	23	14.65
	4	81	51.59
	5	36	22.93
	Total	**157**	**100.00**

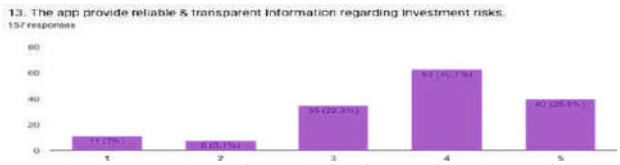


Interpretation: The largest portion of respondents selected option 4 (79 responses, or 50.32%) and option 5 (36 responses, or

22.93%). Assuming 5 represents the highest level of agreement/confidence and 1 the lowest, this means that over 73% of users expressed a high degree of confidence in the app's security.

Inference: The overwhelming majority of users trust that the app securely handles their personal and financial information.

Q.14.	The app provide reliable &transparent Information regarding Investment risks.	Responses	Percentage
	1	11	7.01
	2	8	5.10
	3	35	22.29
	4	63	40.13
	5	40	25.48
	Total	**157**	**100.00**

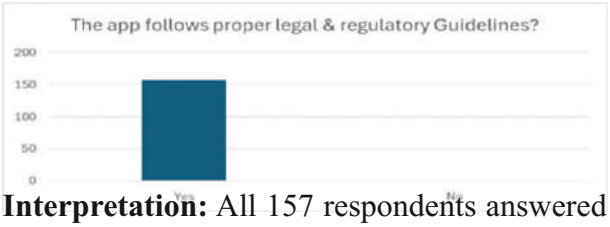


Interpretation: The majority of respondents provided high ratings (4 or 5), indicating a strong positive perception or high level of satisfaction regarding the information provided on investment risks

The highest number of responses (63 respondents, or 40.13%) selected option 4.

Inference: The data suggests that the information provided about investment risks was generally well-received and considered adequate or effective by the majority of the surveyed individuals.

Q.15.	The app follows proper legal & regulatory Guideline.	Responses	Percentage
	Yes	157	100
	No	0	0
	Total	**157**	**100**

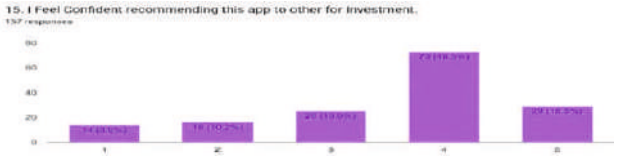


Interpretation: All 157 respondents answered "Yes," indicating that 100% of participants believe the app follows proper legal and regulatory guidelines.

Negative Responses: There were zero "No" responses, accounting for 0% of the total.

Inference: The data strongly suggests a unanimous consensus among the survey participants that the application adheres to all necessary legal and regulatory guidelines. There is no disagreement or negative feedback recorded in this specific dataset regarding compliance.

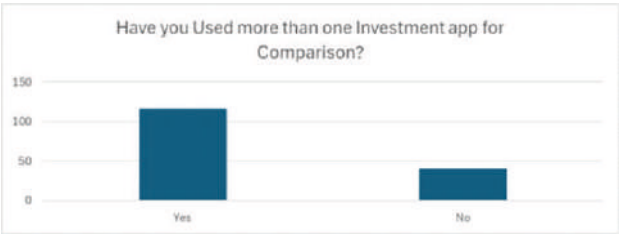
Q.16.	I Feel Confident recommending this app to other for Investment.	Responses	Percentage
	1	14	8.92
	2	16	10.19
	3	25	15.92
	4	73	46.50
	5	29	18.47
	Total	**157**	**100.00**



Interpretation: A significant majority of respondents expressed positive sentiment towards recommending the app. The largest group of respondents (46.50%, or 73 people) selected option 4, indicating a strong level of agreement or confidence.Negative Sentiment: Only a small minority, 19.11% (14 + 16 = 30 people), selected options 1 or 2, suggesting a lack of confidence in recommending the app.

Inference: The data suggests that the app is generally well-received by its users, with a majority feeling confident enough to recommend it to others for investment purposes.

Q.17.	Have you Used more than one Investment app for Comparison?	Responses	Percentage
	Yes	116	73.89
	No	41	26.11
	Total	**157**	**100**



Interpretation: A total of 157 individuals responded to the survey question: "Have you Used more than one Investment app for Comparison . 116 respondents answered "Yes",

which accounts for a substantial 73.89% of the total participants. Conversely, 41 respondents answered "No", making up the remaining 26.11% of the total.Inference: The data suggests that most users in this sample actively compare different investment applications, indicating a trend towards informed decision-making or a search for better features/rates among investment app users.

Findings

1. Majority of users are young adults (18-30 years), mainly students and salaried professionals.
2. Younger users show higher trust and higher adoption due to digital awareness and financial accessibility.
3. Ease of use, fast transactions, and convenient mobile access encourage consumers to adopt apps.
4. Features like real-time tracking, low brokerage charges, and investment education tools increase app usage.
5. Apps like Groww, Zerodha, and Upstox are most preferred due to simplicity and credibility.
6. Users with higher trust ratings also show higher adoption frequency.
7. Trust positively impacts continuous usage, willingness to invest more, and recommendations to others.
8. Overall satisfaction scores are high, showing that most users are happy with investment apps.
9. Security, easy interface, and convenience are the top contributors to satisfaction.

Conclusion

The study reveals that consumers trust and adoption of investment apps are largely driven by factors such as security, ease of use, transparency, reliability, and overall satisfaction. Users prefer investment apps that provide secure transactions, clear and transparent information, and an easy interface. The findings show that younger users, particularly students and salaried individuals, are more likely to adopt investment apps due to higher digital literacy and convenience-based financial behaviour.

Furthermore, trust is influenced not only by app features but also by positive word-of-mouth, user reviews, brand reputation, and past user experience. Users who feel that the app is safe, professionally designed, and customer-friendly are more likely to develop a strong trust, resulting in continued usage and recommendation to others. Overall, investment apps that prioritize data security, customer support, and user-friendly experience are more successful in gaining and retaining consumer trust.

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52. The New Era of Smart Cities And Sustainable Future

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Abstract:
The concept of smart cities constitutes a new way of urban development wherein digital technologies, data-driven systems, and sustainable practices come together to create efficient, eco-friendly, and citizen-centered environments. The research paper presents how smart city technologies-IoT sensors, renewable systems, smart mobility and digital governance redefining the contemporary business, commerce and management. A growing acknowledgment of the need for sustainability is a response to rising pollution, resource depletion, and rampant urbanization. modern business, commerce, and management. Based on the secondary data, case studies, and analysis of ongoing smart city projects, the paper evaluates their contribution toward energy utilization, waste management, economic growth, and improvement in the quality of life. The results indicated that the approach taken by smart cities reduces the stress on the environment and also opens up newer avenues for economic growth, thereby improving service delivery and ensuring long-term resilience in cities.

Keywords: smart cities, sustainability, digital infrastructure, circular economy, urban governance, energy efficiency, internet of things (IoT), people, planet, profit(3Ps)

Introduction: Sustainability is relevant to all levels of human activity, ranging from the global to national, regional, community, organizational, and individual levels. It refers to a state of the worldwide system, with a focus on the environmental, social, and economic

subsystems, in which the needs of the present are met without compromising the ability of future generations to meet their needs.

Sustainable management takes the concept of sustainability & synthesizes it with the concepts of management. Sustainable management is needed because it is an important part of the ability to successfully maintain the quality of life on our planet.

A smart city is a city that uses technology and data to run better & make life easier for the citizens. Sensors and apps help manage traffic, energy, water and services so they are faster, cheaper & more environmentally friendly. The main goals of a smart city are: -

- Better quality of life for residents.
- More efficient services.
- Lower costs & pollution by using resources.
- More involvement of citizens through apps and online platforms.

The practices of businesses should be linked to the social, environmental & economic imperatives if they wish to stay in business by sustainable means. The triple bottom line is also known as "the three Ps". The three Ps are as follows: -

- Profit (economic)
- Planet (environmental)
- People (social)

The profit element of the 3Ps is easily understood and accepted by companies. It is about the long-term financial health of the enterprises.

Review of Literature:

1. Topic: IoT-enabled Smart Cities - Concept Review, Framework, and Key Technologies (2022)

Summary: The work reviews how IoT-enabled smart cities contribute directly to many of the United Nations Sustainable Development Goals, such as clean energy, smart mobility, sustainable communities, climate action, and health and well-being. At the same time, significant technical and organizational challenges are identified, such as interoperability issues created by heterogeneous protocols and data standards, reliance on legacy systems, and constraints on scalability. On balance, this study concludes that IoT technologies have significant potential to make urban environments more efficient, sustainable, and intelligent, but meeting this potential requires interoperability, governance, and scalability, together with advances in computing, analytics, and citizen-centered design.

2. Topic: Bridging the gap between smart cities and sustainability: current research and future directions (2022)

Summary: The present study maintains that fully sustainable and resilient urban environments can only be achieved by closing the gap existing between smart-city technological solutions and the goals of sustainability. It has shown that many cities have invested significantly in digital instruments, including sensors, data platforms, and automation; these latter technologies often operate in silos without relation to environmental and social planning frameworks. The authors also say that for smart technologies to reach their maximum potential & to genuinely encourage the use of resources, mobility and mobility for citizens, they should not be only applied but also incorporated within an agenda of sustainability pointers, urban policies and community-based needs.

Accordingly, the paper concludes des by proposing a common framework that links smart-city infrastructure and governance mechanisms with sustainability valuation. In the end the authors meant to say that bridging the gap between new digitalization and sustainable urban development is important for the emerging cities. They need to advance from just being isolated technological experiments to setting the course for universal, broad and environmentally responsible growth.

3. Topic: India's Urban Transformation and the Case for a Paradigm Shift (2025)

Summary: Cities in India account for over 60 percent of the national gross domestic product and will play a critical role in meeting both economic and climate goals. However, their potential is hindered by outmoded policy frameworks, broken institutional arrangements, limited municipal facility and infrastructure shortages that delay their ability for rapid growth and development. The authors argue

that India needs a paradigm shift-not only reframing urban policy paradigms, but importantly reassessing underlying institutional architectures that coalesce toward inclusive, sustainable, and economically vibrant cities.

The analysis done shows that investigating models such as combined planning in Singapore, economic autonomy in Canada, participatory designs found in Netherlands and socially transformative infrastructure in Medellín, well-spoken national urban policies can catalyze orderly changes. The India's national urban policy framework released in 2018 showed potential but it was never fully incorporated.to strengthen the urban government it now requires a lot of data-driven decision making, economic improvement of cities, geopolitical coordination, participating in planning the processes, responsible institutions aligned with environmental objectives.

4. Topic: Smart Cities in India (2019)

Summary: Summing up, the paper defines a smart city in the Indian context based on a "3-C" framework: competence, convenience, and cleverness. It assumes that smart cities intend to achieve a better quality of life by integrating technology, governance, and sustainable practices. The review focuses on India's Smart Cities Mission with its main features of efficient land use, better housing and infrastructure, a more walkable urban environment, an intelligent transport system, strong public–private partnership, and transparent e-governance. According to the authors, India has so far sanctioned investments of more than ₹1.89 lakh crore for area-based development projects and pan-city initiatives, for which 100 cities have been selected in various rounds. Though there is progress in metropolitan cities like Delhi, Mumbai, Bengaluru, and Hyderabad, several obstacles could make mission success difficult. These are insufficient coordination between state and central agencies, deficit of skilled and committed leadership, inadequate understanding of smart technologies, scarce funding, poorly developed citizen participation, and shortcomings in resource management and strategic planning.

Statement of the Problem:

We have encountered numerous issues in recent years, including: -

Underdeveloped urban areas. Businesses and municipal managers are not implementing smart technologies without definitive metrics and resource validation.

Resources and evidence regarding the impact of smart city interventions on business models, commercial activities, and employment are scarce. Policy fragmentation and inadequate coordination between public and private sectors diminish the scalability and sustainability of projects.

Objectives of the Study:

I. To study how sustainable practices can transform business models and commerce.

II. To analyze the new technologies in market for making cities smarter and more sustainable.

III. To study how government and businesses face challenges for smart city development.

IV. The key elements required for shaping to be environment friendly.

V. To study how worldwide cities are making changes.

Need or Relevancy of the Study: This helps governments and planners prioritize investments that enhance sustainability returns while yielding other economic returns. Firms and managers are supplied with a set of practices based on evidence which assist them in engaging with digital solutions while achieving sustainability targets.

Academic gap: it fills the void left by empirical studies that link the adoption of smart-city technology with business results and environmental indicators.

Societal impact: it provides stakeholders with a pathway for a model that ensures smart city benefits reach the citizen (less pollution, better services and job creation).

Hypothesis:

The modern technologies that are included in the new generation of smart cities significantly improve resource-efficient and sustainable business, commerce and management that are looking after environmental concerns and making fact-based decisions. The use of such technology has almost negligible impact on the sustainability of business, commerce and

management practices. In our opinion, this rule has been interpreted too narrowly in the courts. The rule is often regarded as an application of the maxim 'ignorance of the law is no excuse', but it can perhaps better be expressed as reflecting the idea that all citizens have a general duty to obey the law and that it is fair to punish for failure to do so even if they had no actual knowledge of the law in question. Business Efficiency: Technology-driven smart city systems enhance business operations by facilitating better use of energy, logistics, and digital infrastructure in a more effective manner.

Research Methodology:

Statistics are used descriptively to show trends, so before versus after smart intervention. Regression analysis, to test whether the intensity of smart infrastructure in the wards area (for example, sensors per 10k population) predicts reduced energy use or increased business revenue, controlling for size of city, income and baseline conditions. Thematic analysis of interviews to identify barriers, enablers and managerial changes. Triangulation, combining quantitative effect size with qualitative explanations.

Analysis & Interpretation of Data:

Data collected on each residents' energy consumption, behavior of CO2 released, municipal recycling waste rate, usage of public transport services, local GDP or registration of businesses, job employment in IT, services sector, investment in smart infrastructure, and citizen satisfaction surveys.

The analysis was also done on the 3Ps of a business model. The three Ps of sustainability are also known as the three pillars of the triple bottom line concept. 3Ps are: -

1. Economic Sustainability(profit): A business needs to make money and stay competitive for economic sustainability. It must be strong to provide jobs & income to all.

2. Environmental Sustainability(Planet): We must always protect nature by preventing climate change, saving natural resources, reducing pollution and stopping toxic waste.

3. Social Sustainability(People): Everyone in society needs to be treated fairly. Moreover, we need good education, public health, safe working conditions & human rights.



In the long term, you cannot have one without the others. China, for example, has been reporting 9% economic growth or more over the last decade, but is beginning to recognize that the environmental cost of that growth (e.g. Flooding, pollution, health problems and resource depletion) wipes out most of these gains. Pan Yue, deputy director of China's state environment protection administration, figures that environmental injury costs China 8 to 15% of its annual GDP and community groups. It would also include studying relevant policy documents and any project evaluation reports.

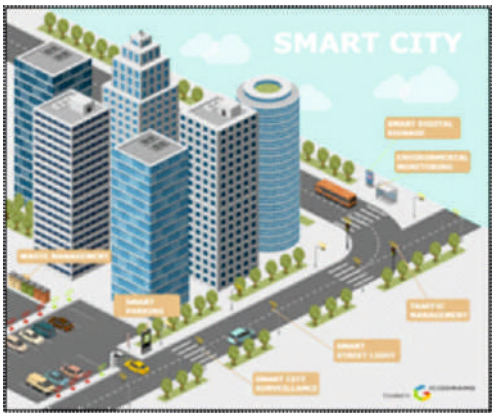


Image no.1

A systems view of a smart city where renewable energy, connected transport, and IoT sensors work together to reduce emissions & improve urban services.



Image no.2 Urban planning that blends green infrastructure (with clean transport that reduces heat islands) and supports biodiversity while maintaining connectivity.

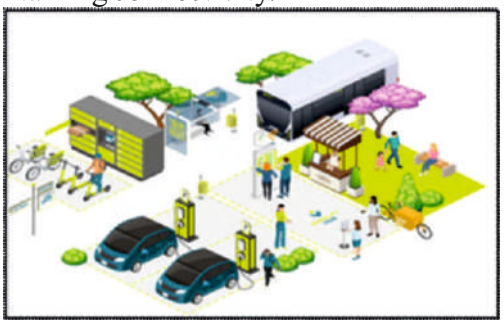


Image no.3 Mobility hubs are a combination of transport modes & lower private car dependence, improving accessibility & reducing greenhouse gases.

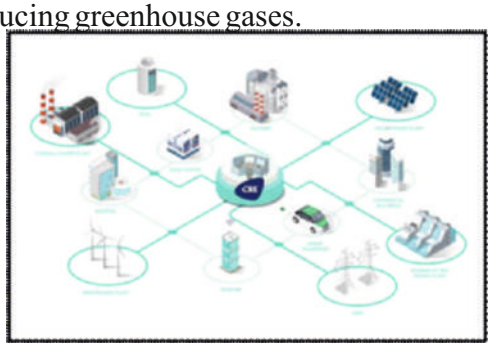


Image no.4 The term CRE stands for community renewable energy. An energy control dashboard is a good balance of a hydroelectric power plant, grid, smart transport, factory, solar power plant, etc.



Image no.5 There are three types of economic market place that is: linear, recycling and circular. It is an online platform that connects buyers & sellers. It can lead to reduced costs through low waste.

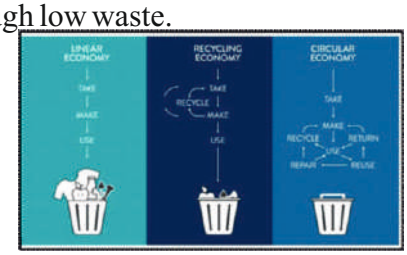
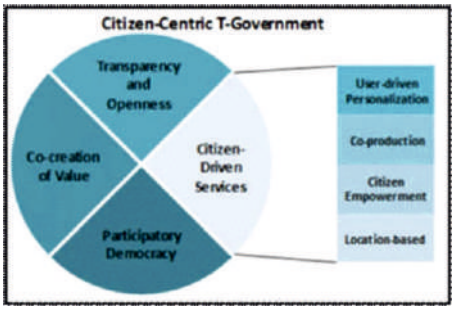


Image no.6

The diagram shows that there is a good digital government that is open to involving citizens to work together, which will create services based on their needs.



The key points are:

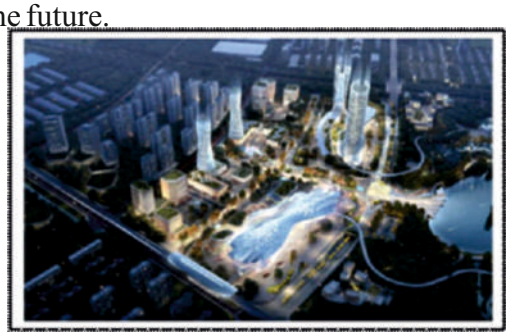
* User-driven: personalized services customized for each person.
* Co-production: citizens help in designing & improving services.
* Citizen empowerment: citizens get more control.

Location-based: services based on where people live.

The New Era Of Smart Cities And Sustainable Future

Image no.7

In this diagram, you can see roads, buildings and green areas. Some buildings look real that are already existing, while the other white colored buildings are new & planned designs for future development. It focuses on making the areas greener, sustainable and better planned for the future.



Findings:

The case studies referred for the topic smart cities are as follows; -

1. Rizhao the China's 'SOLAR CITY':

Rizhao is a famous city in China, known as 'solar city' for its widespread use of solar energy technologies. The city enjoys about 2,600 hours of sunshine every year; about 99% of

households in central Rizhao and about 30% in peripheral districts use solar water heaters, while many buildings are equipped with solar panels. With governmental support, technological advances, and public awareness, the cost of a solar water heating system has been greatly reduced. As a result, Rizhao is considered one of the cleanest cities in China.

2. Kathmandu's famous 'ELECTRIC RCKSHAWS':

Kathmandu's famous 'ELECTRIC RCKSHAWS'

In Kathmandu, Nepal, electric rickshaws are also known as "Safa tempos". Electric rickshaws are greener because lightweight vehicles produce less pollution per passenger and can carry more passengers with greater efficiency. Nepal banned the old, polluting versions with cooperation from international organizations. In South Asia, more countries are trying to clean up their transport. Throughout

. More efficient city planning, modern technology, and new business models can also spur low-carbon urban transport.

3. The 'ORANGI PILOT PROJECT' held in Karachi:

The 'ORANGI PILOT PROJECT' held in Karachi

The Orangi Pilot Project was undertaken in Karachi, Pakistan, to assist the large Orangi community in improving its sanitation. The area was plagued by disease and high infant mortality due to poor systems like bucket latrines and open sewage. The OPP team analyzed the needs of the community and motivated the residents to organize themselves into groups to overcome psychological, social, and economic barriers. The project succeeded because the community took ownership of the system, and this model later inspired similar initiatives in other parts of South Asia.

Coclusion:

All in all, we can say the greening of cities represents a core contribution towards the transition to sustainability. Cities already use 75% of the world's resources, and the potential for synergies is enormous. In addition, projections towards 2050 forecast an increase of three billion people on the world's population, two-thirds of whom are expected to live in cities. Providing for their needs will require more energy-efficient housing, green urban transport, and a suite of ancillary infrastructure.

Mega public events frequently centering within city precincts—cultural celebrations, football championships, and the Olympic Games—carry significant potential to advance greening both in the lead-up to, and during, such events. As mentioned earlier, cities and their hinterlands are interdependent systems. On the other hand, if a city neglects land-use planning and the maintenance of forest cover on the upper reaches of nearby watersheds, it may face frequent flooding, and pay higher prices for the purification of drinking water.

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53. Title : Recent Gst Reforms And Impact on FMCG Industry

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Abstract

GST replaced several indirect taxes with a single regime and made the tax regime in India far more transparent and business-friendly. This reform has smoothed out supply chain bottlenecks in FMCG, reduced checkpoints, eased interstate movement of goods, and decreased overall logistics and transportation costs. The companies in the FMCG sector now have better distribution, faster delivery, and stronger inventory management.

Although small distributors and MSMEs still find GST compliance somewhat challenging, the overall impact has been positive. GST has promoted digital record-keeping, reduced tax-related confusion, increased transparency, and encouraged more sustainable and ethical business practices across the FMCG industry.

Keywords : GST, FMCG, Sustainable Commerce, Input Tax Credit, Supply Chain, Logistics, Indian Economy

Introduction: Sustainable commerce means conducting business in such a way that economic growth is sustained, the environment is protected, and social well-being is fostered. Because of emerging concerns related to global warming and decreasing critical resources, sustainability has become of great concern to businesses and policymakers. In India, where growth is nonstop, the concept has assumed immense significance.

GST replaced several indirect taxes with one unified system based on the concept of "One Nation, One Tax, One Market." It was implemented on July 1, 2017. Even though its concept is essentially a simplification of taxation, the goals of GST also include sustainable commerce by making compliance digital, lowering logistical barriers, and increasing transparency.

Food, beverages, cleaning products, cosmetics, and personal care items fall into the FMCG category, all of which require quick and effective supply chains. Due to this factor, it has been heavily impacted by tax reforms. It has eased distribution networks and warehousing, facilitating improvements in transportation efficiency and increased digital adoption under GST. This paper looks at such changes and their contribution to sustainable commerce.

Statement of the Problem

Before GST, the FMCG sector in India operated under a complicated tax structure involving excise duty, VAT, entry tax, and multiple state-specific levies. These fragmented taxes caused severe inefficiencies. Hence, the problem addressed in this research is,

The need to assess whether GST has successfully resolved these issues and contributed toward building a sustainable commercial environment within the FMCG sector. The problem revolves around identifying the extent to which GST reforms have enabled economic, operational, and environmental sustainability.

Review of Literature

1. Adeel Hussain Alie, Javed Iqbal, Sarfraz Ahmed, Ajaz Ahmad Bhat (2019) — Impact of GST on FMCG Sector in India. Research Journal of Humanities and Social Sciences.

Key point: GST reduced multiple tax layers and lowered distribution costs; mixed impact on sales and profitability in the short term.

rjhssonline.com

2. Satish Dhokare (2019) — GST and Its Impact on FMCG Sectors in India (ResearchGate PDF).

Key point: GST improves supply-chain efficiency as it reduces the requirement to have state-level warehouses and simplifies interstate movement.

Research Gate

3.IRJMETS(2024)-A Study on the Impact of GST on FMCG. (This is a peer-reviewed article).

The key takeaway is that consumer-facing impact is mixed: companies adjusted pricing and pack sizes to manage tax-rate shifts and consumer demand.

4.TIJER/Case studies (2017–2023) — Case studies on GST impact on FMCG (UGC CARE journals/ TIJER).

Anomalous phenomenon: Key point: Company-level case evidence (HUL, Dabur, Britannia, Godrej) shows short-term de-stocking and tactical re-pricing but medium-term stabilization.

5.H. L. Lee, V. Padmanabhan & S. Whang (1997) — Information Distortion in a Supply Chain: The Bullwhip Effect, Management Science.

Theory applied: Bullwhip effect-theory explaining how the distortion in the demand signal upstream amplifies volatility along a supply chain. Use this to frame inventory and trade-channel disruptions after GST changes.

Objectives of the Study

1. To study the influence of GST on FMCG sector operations and supply chains.
2. To identify the challenges faced by FMCG companies and distributors under GST.
3. To study present amendments in GST and impact on FMCG

Need of the Study

The FMCG sector serves millions of consumers daily, making it one of the most dynamic sectors in the Indian economy. Efficient supply chain systems are essential for maintaining low costs, product freshness, and consumer satisfaction. GST's influence on logistics, transportation, and warehousing decisions greatly affects FMCG performance. Studying this impact is crucial for several reasons:

To understand how tax policies shape sustainable business practices

To assess the environmental effects of logistics improvements

To help businesses adapt better to GST regulations

To support government reforms geared toward digital, transparent commerce

To identify gaps in implementation that hinder sustainability The relevance of this study is further strengthened by India's increasing focus on sustainability, green logistics, and digital governance.

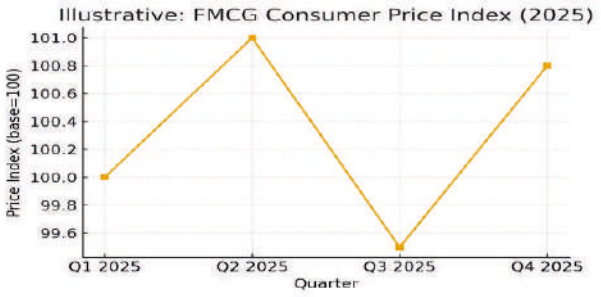
Research Methodology

This research paper is based on secondary data. The current information about the GST Amendments and of FMCG sector, has been studied and used to justify the topic. The nature of research paper is descriptive.

Analysis And Interpretation of Data

Recent revisions in the GST rate are reflected in how tax changes impact the supply chains, pricing decisions, and sustainable commerce practices of FMCG firms. The restructuring in September 2025 created temporary de-stocking, pressure on liquidity, and mixed volume growth. However, leading FMCG firms stabilized quickly by adjusting prices, modifying pack sizes, and streamlining distribution. These actions highlight how GST reforms push industries toward greater transparency, operational efficiency, and responsible consumption—key drivers of sustainable commerce..

Figure 1- Consumer Price Index of FMCG Sector



What the illustrative data show , explain in below briefly :

Q3 2025 shows a temporary dip in the FMCG volume index, consistent with reported de-stocking and channel adjustment following the GST rationalization. Volumes recover in Q4 as firms adjust pricing and pack sizes and restock.

The illustrative price index shows a small dip in Q3-tax cuts passed through on some SKUs-and partial normalization in Q4, consistent with firms passing benefits selectively while protecting margins on other SKUs.

A small illustrative table correlates GST-slab movement with an approximate share of SKUs moved to the 5% slab, to argue that a majority of everyday FMCG SKUs benefited from reduced tax rates, explaining the observed price and volume dynamics.

Conclusion

The September 2025 GST rationalisation had measurable short-term disruption in the FMCG sector, manifesting as de-stocking, temporary volume declines, and tactical price/pack-size adjustments. Firms with superior data systems and integrated supply-chain networks (e.g., HUL, Britannia, Godrej) could cushion this shock through rapid re-pricing, SKU rationalisation, and channel alignment, allowing volumes and revenues to stabilise within quarters that followed. From a sustainability perspective, the episode hastened practices that reduce operational inefficiencies—centralised distribution, smaller pack innovation, and transparent pricing—thereby aligning tax reform with longer-term sustainable commerce objectives. Given its fiscal policy and structural stimulus dimensions, policymakers and firms should consider GST changes: it is necessary to combine the design of taxes with transition support such as clear communication windows and phased implementation to minimize short-term liquidity and inventory frictions.

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54. Circular Economy: A Managerial Approach to Sustainable Business Models

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Abstract:
The shift from linear business models ("take–make–dispose") to circular systems ("reduce–reuse–recycle–recover") has become a strategic priority for sustainable management. This paper examines how managers can integrate circular economy principles into organizational structures, operations, and decision-making to reduce waste, maximize resource efficiency, and create long-term value. Through secondary research, the study reviews global and Indian examples—including IKEA's modular furniture design, Apple's material recovery facilities, Tesla's battery recycling strategy, and Infosys' resource-efficient campuses. The findings indicate that circular business models reduce environmental impact while strengthening profitability, brand value, and supply-chain resilience. The analysis also discusses industries that face structural barriers to adopting circularity, adding a more balanced perspective to the research. The study concludes that circular economy is not merely an environmental trend but a core managerial capability essential for future-ready organizations.

Keywords: Circular Economy, Sustainable Management, Business Models, Resource Efficiency, Industrial Symbiosis, Waste Minimisation

Introduction: Traditional economic systems have been dominated by a linear approach: extract resources, manufacture products, consume them, and discard the waste. This model increases production costs, accelerates resource depletion, and intensifies global sustainability challenges. Growing environmental concerns, stricter regulations, and rising stakeholder expectations have pushed organizations to explore more regenerative models. The circular economy offers such a solution by ensuring that products, materials, and resources circulate within the system for as long as possible.

Linear vs Circular Economy Comparison

Linear Economy	Circular Economy
Take-Make-Dispose	Reduce-Reuse-Recycle-Recover
High Waste Generation	Low Waste & Closed Loops
Extractive & Resource-Intensive	Resource Efficiency & Regeneration
Short Product Lifespan	Extended Product Lifespan

(Figure 1: Linear vs Circular Economy Comparison- This table shows the basic differences between linear systems and circular systems used for sustainable business models.)

Origin & History of Circular Economy-

The concept of circular economy originated from the fields of industrial ecology and regenerative design in the 1970s. Walter Stahel and Genevieve Reday first proposed the idea of a closed-loop economic system that minimizes waste by extending product life cycles. Over time, the concept evolved through contributions from ecological economists and systems thinkers. The term gained widespread global recognition through the Ellen MacArthur Foundation in the early 2010s, which helped integrate circular approaches into European and worldwide sustainability policies.

Management plays a central role in enabling this transition. Circularity impacts every business function—operations, supply chain, finance, HR, innovation, and marketing—requiring managers to redesign workflows, evaluate sustainable suppliers, encourage repair and reuse, establish recycling systems, and measure performance responsibly.

Global companies like IKEA, Apple, Unilever, and Tesla have demonstrated that circularity lowers long-term costs and strengthens competitiveness. Indian companies such as Tata Steel, Mahindra Electric, and Infosys also showcase significant progress. This research explores how circular economy principles reshape business models and provides strategic insights for organizations adopting circular practices.

Statement of the Problem

Most businesses still operate under linear structures that lead to high waste generation and resource loss. Despite increasing global awareness, managers often lack clear frameworks for implementing circular systems effectively. This study addresses the question: How can management redesign business models to adopt circular economy principles while maintaining profitability, efficiency, and competitiveness? The research highlights the gap between sustainability theory and practical managerial implementation.

Review of Literature

I. The Ellen MacArthur Foundation (2015) emphasized that circular economy enhances long-term value by designing out waste and regenerating natural systems.

II. Geiss Doerfer et al. (2017) defined circular economy as a regenerative economic model that improves sustainability and competitiveness by closing resource loops.

III. Kirchherr et al. (2018) identified significant managerial barriers such as cost, lack of awareness, limited circular design skills, and organizational resistance.

IV. Lewandowski (2016) proposed frameworks connecting circular strategy with business model innovation, emphasizing the need for integrating circularity into organizational value creation.

V. Stahel (2016) argued that reuse, repair, remanufacturing, and recycling can result in substantial economic benefits and job creation.

Global case studies demonstrate practical applications: IKEA uses modular and repairable designs; Apple employs material recovery robots; Patagonia promotes repair and reuse through its Worn Wear program; Philips Lighting follows a product-as-a-service model. Indian case studies include Tata Steel's circular materials loop, ITC's waste-neutral packaging systems, and Infosys' zero-waste campuses. These studies highlight the relevance and practicality of circular strategies across sectors.

Global and Indian Circular Economy Practices

Global Companies	Indian Companies
IKEA - Modular & Repairable Design	Tata Steel - 90% Waste Recycled
Apple - Material Recovery (Daisy Robot)	Infosys - Zero-Waste Campuses
Tesla - Closed-Loop Battery Recycling	ITC - Waste-Neutral Packaging

Objectives of the Study

1) To understand the concept and principles of the circular economy in management.

2) To analyse global and Indian circular economy models.

3) To examine how circular strategies influence sustainability and profitability.

4) To provide managerial recommendations for adopting circular business practices.

Relevance of the Study

Linear production models increase environmental degradation and economic risks. Circular economy models help companies reduce dependence on scarce resources, lower waste disposal costs, improve corporate reputation, and comply with sustainability regulations. With growing climate concerns, international policy commitments, and rising consumer expectations, circular management has become essential for organizational survival and long-term leadership. This study provides timely insights into shifting from waste-generating models to regenerative and future-ready systems.

Research Methodology

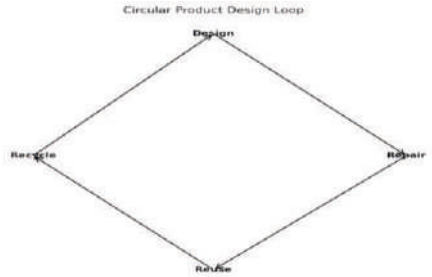
This study uses a qualitative and descriptive research design based on secondary data. Data sources include academic journals, reports from the Ellen MacArthur Foundation and UN Global Compact, sustainability reports from global and Indian corporations (IKEA, Apple, Tata Steel, Infosys), and peer-reviewed articles on circular management. A thematic analysis approach is used to examine key themes such as circular product design, resource flow, waste reduction, reverse logistics, and business model innovation. The analysis identifies managerial practices, challenges, and strategic outcomes

associated with circular economy implementation.

Analysis & Interpretation

A. Circular Product Design

Circular product design focuses on modularity, repairability, durability, and material recovery. Apple's "Daisy" robot recovers rare metals from old devices, reducing the need for mining. IKEA designs modular, flat-packed furniture that can be easily repaired and disassembled, extending product life and lowering material waste.



(Figure 3: Circular Product Design Loop- This loop shows how products move through design, repair, reuse, and recycling to support circularit)

B. Resource Efficiency & Waste Reduction

Companies reduce operational costs and environmental impact through efficient resource utilisation. Tata Steel recycles over 90% of process waste, demonstrating a closed-loop production model. Unilever redesigned its packaging systems, significantly reducing virgin plastic usage.

Waste Reduction Strategies and Examples

Strategy	Company Example	Benefit
Process Waste Recycling	Tata Steel - Slag reused for cement	Lower landfill waste
Packaging Redesign	Unilever - Reduced virgin plastic	Less plastic pollution
Energy Recovery	ITC - Biomass-based energy	Reduced fossil fuel use

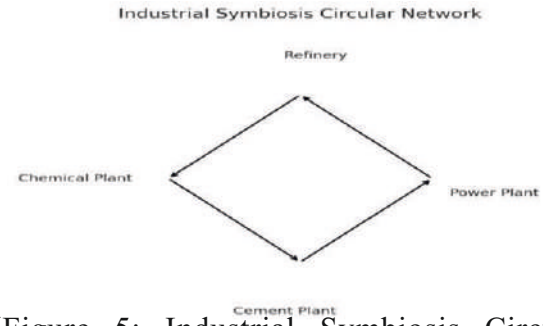
(Figure 4: Waste Reduction Strategies and Examples- This table presents key waste-reduction strategies with real company examples and their sustainability benefits.)

C. Reverse Logistics & Recovery Systems

Reverse logistics aims to bring used products back into the supply chain. H&M collects old clothes through in-store take-back programs, recycling recovered textiles into new products. Tesla focuses on recovering cobalt, lithium, and nickel from used batteries, supporting battery circularity.

D. Industrial Symbiosis

Industrial symbiosis promotes resource sharing across industries. The Ka Lundborg Eco-Industrial Park in Denmark remains the global benchmark, where waste or by-products of one company serve as inputs for another, creating a highly efficient circular network.

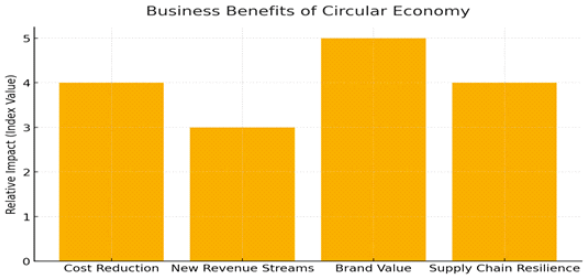


(Figure 5: Industrial Symbiosis Circular Network- This diagram shows how different industrial units exchange resources within a connected circular network.)

E. Business Benefits

Circular models generate multiple benefits:

I. Lower long-term operational costs
II. New revenue opportunities through reuse and recycling
III. Improved brand value
IV. Stronger supply-chain resilience



(Figure 6: Business Benefits of Circular Economy)

F. Industries Facing Barriers to Circular Adoption

While circular practices are expanding, some industries face significant barriers that restrict their ability to transition. Sectors such as fast fashion, small-scale manufacturing, construction, chemical production, and lower-tier electronics struggle due to high circular adoption costs, complex mixed waste streams, and limited access to recovery technologies. Fast fashion depends on low-cost synthetic fabrics that cannot be easily recycled. Small manufacturers lack the capital for reverse logistics. The construction sector in developing countries faces challenges with mixed debris,

limiting material recovery. Similarly, chemical and plastic packaging industries deal with hazardous or non-recyclable waste. These challenges demonstrate that circular economy adoption is uneven across industries, requiring targeted policy and managerial support.

Findings

The study finds that:

1) Circular models significantly reduce long-term operational costs and improve environmental performance.
2) Management decisions play a crucial role in determining the level of circular adoption within organizations.
3) Companies that integrate circular strategies report stronger brand trust, better resource efficiency, and enhanced supply-chain resilience.
4) Reverse logistics and recycling systems act as major drivers of circular performance.

However, some industries face structural, technological, and financial barriers that limit full circular adoption.

Conclusion

Circular economy is no longer an optional approach but a necessary strategy for sustainable and competitive business management. Managers play a central role in redesigning processes, products, and supply systems to support circularity. Companies adopting circular models benefit economically, environmentally, and socially. The future of sustainable business lies in circular leadership and regenerative resource use.

However, achieving widespread circularity also requires addressing the barriers faced by industries with complex waste streams and limited recovery infrastructure.

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55. Redefining Commerce, Business and Management Through Sustainability : Financial Innovation For Inclusive Growth

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Abstract

Financial innovation has become an important factor in promoting inclusive and sustainable growth, particularly in developing countries like India. The growth of digital finance, including mobile banking, fintech platforms, UPI, Aadhaar-enabled payment systems, and microfinance technologies, has greatly increased access to financial services for

low-income households, rural communities, women, and minority groups. These tools lower transaction costs, improve transparency, and make credit, savings, insurance, and digital payments more available to people who have often been excluded. Government programs such as the JAM trinity (Jan Dhan, Aadhaar, Mobile), digital payments infrastructure, women-focused SHG financing, and programs aimed at minority entrepreneurs have further boosted financial inclusion. Financial innovation also plays a role in sustainable development by supporting cashless economies, enabling green financing, and fostering financially resilient communities. However, challenges like the digital divide, cybersecurity threats, limited financial knowledge, and unequal access to technology still make full inclusion difficult. This paper looks at how financial innovation helps promote inclusive and sustainable growth, reviews current trends and policy efforts, and finds chances to create a fairer and more digitally empowered financial system.

Keywords: financial innovation, inclusive growth, women empowerment, sustainable finance, green financing, sustainability, economic development, financial literacy.

Introduction : Financial innovation has become a powerful force in today's business and management, especially as economies move toward more inclusive and sustainable models. Digital financial tools like mobile banking, UPI, Aadhaar-enabled services, fintech platforms, microfinance technologies, and new green finance options have expanded access to formal financial systems for groups that have often been left out. These innovations cut transaction costs, improve transparency, and allow more participation from middle-income households, women, rural populations, and minority communities.

Besides promoting inclusion, financial innovation increasingly supports sustainability goals. Cashless transactions, digital public infrastructure, and eco-friendly financial products encourage responsible financial behavior and lessen reliance on resource-heavy processes. Green finance initiatives and ESG-linked digital platforms further support environmentally aware decision-making.

However, challenges such as limited digital literacy, unequal access to technology, cybersecurity issues, and low awareness of sustainable finance limit the full potential of these innovations. Although the use of digital payments is growing, knowledge of concepts like green finance is still quite low. This shows a gap between usage and understanding.

This study looks at how financial innovation can drive inclusive growth and sustainability. It uses a mix of literature review and primary survey insights. The goal is to assess user perceptions, adoption patterns, and how financial innovation can help create a fairer and more sustainable financial ecosystem.

Literature Review

The academic literature generally views financial innovation as a key factor in promoting inclusive and sustainable economic development. Instead of limiting this concept to digital tools, scholars highlight a broader range of innovations. These include new financial instruments, institutional arrangements, regulatory reforms, and sustainability-focused financial models. Such innovations aim to tackle systemic barriers in financial markets. These barriers include information gaps, high transaction costs, and limited access to formal credit, which often disproportionately affect vulnerable populations. The literature consistently argues that inclusive growth needs financial systems that can go beyond traditional products and delivery methods.

Research on basic financial infrastructure innovations points out their role in increasing financial participation among different populations. Innovations like biometric identification, alternative credit scoring systems, agent-based distribution networks, and easier onboarding processes have lowered procedural hurdles and improved financial access in many developing regions. Studies show that these system-level innovations usually have a bigger impact on inclusion than standalone digital applications because they create the necessary environment for scaling inclusive financial services.

Another area of research focuses on sustainable and green financial innovation. This reflects the

growing connection between developing financial systems and environmental goals. Green bonds, climate-risk assessment tools, sustainability-linked lending, and blended finance models are increasingly being used to direct funds toward renewable energy, ecological restoration, and low-carbon business development. Scholars believe these innovations boost long-term inclusiveness by improving community resilience, reducing financial risks tied to climate change, and creating new economic opportunities for low-income groups. This body of literature positions sustainability not just as a policy goal, but as a crucial part of inclusive financial systems.

Research focused on gender emphasizes the need for inclusive product design and institutional innovation. Evidence suggests women often face structural challenges in owning assets, accessing collateral, and obtaining financial education. These challenges hinder their participation in traditional finance. Innovative methods like group lending, microinsurance designed for women, gender-focused investment funds, and savings technologies for low or irregular incomes have led to measurable improvements in women's financial situations. However, studies also reveal ongoing gaps in women's participation in sustainable finance and leadership roles in financial sectors. This suggests a need for more deliberate efforts to integrate gender considerations into financial innovation frameworks.

Literature on institutions highlights the importance of policy innovation, regulatory flexibility, and collaboration among stakeholders in achieving inclusive financial results. Blended finance instruments, outcome-based funding, and adaptable regulatory frameworks have developed as ways to support experimentation without compromising consumer protection. Evidence from international case studies shows that cohesive governance structures enhance the effects of financial innovation by allowing for scaling, reducing risk perceptions, and promoting responsible product development.

Despite significant progress, the literature points out several gaps. Much of the existing research looks at digital finance, microfinance, and green finance separately, providing limited understanding of how these types of innovation combine to support both inclusion and sustainability. Additionally, empirical studies often focus on one country or one financial instrument, which limits broader applicability. There is also a shortage of research that integrates gender-focused and sustainability-linked data. This leaves an incomplete picture of how financial innovation impacts various demographic groups in changing green economies.

Overall, the literature suggests that financial innovation is most effective for inclusive growth when it is viewed as a complex system that includes technological, institutional, and sustainability-focused changes. This framework sets the stage to explore how various financial innovations—digital, green, and gender-responsive—together pave the way for more inclusive and resilient economic development.

Statement of Problem

Despite rapid progress in digital finance and financial innovation, inclusive growth remains uneven across India. Technologies like UPI, mobile banking, fintech platforms, Aadhaar-enabled payments, and microfinance solutions have expanded access to financial services. However, large parts of the population, especially women, low-income groups, rural households, and minority communities, still face significant barriers. These barriers include limited digital literacy, inadequate internet access, low awareness of financial products, cyber security concerns, and the persistent gender and socio-economic gap in technology usage.

And moreover, the benefits of financial innovation have not fully turned into sustainable and fair economic development. Many individuals are still unbanked or underbanked. Digital payment adoption varies widely across regions, and access to credit for small businesses and vulnerable groups is still limited. Therefore, the main problem is understanding why financial innovations are not reaching all segments equally and what gaps prevent these innovations from providing inclusive and sustainable growth. This study aims to examine

these challenges and identify ways to strengthen the digital financial system for broader inclusion.

Objectives of the Study

The main goal of this study is to examine how financial innovation helps achieve inclusive and sustainable economic growth, focusing on recent developments in digital finance, fintech, and green financial solutions. It looks at how tools like mobile banking, digital payments, microfinance technologies, alternative lending models, and women-focused financial platforms improve access for underserved groups, such as low-income households, rural communities, women entrepreneurs, and minority-owned businesses.

A second goal is to assess how much financial innovation lowers barriers, like high transaction costs, limited access to physical banking, and credit issues, which usually prevent people from participating in the formal financial system. The study also aims to understand user adoption patterns and the factors that affect trust, digital skills, and financial knowledge.

Another objective is to investigate how new financial products support sustainability targets, especially through green financing channels, increased financial resilience, and a shift towards cash-light, resource-efficient economic activity.

The study will also review policy initiatives and regulatory frameworks that influence financial innovation, checking how well they promote inclusive growth. Finally, it plans to identify gaps and suggest practical recommendations for enhancing financial innovation as a tool for equitable and sustainable development.

Need/relevance of the Study

The study of financial innovation for inclusive growth is essential as digital finance is reshaping access to economic opportunities in developing countries like India. Technologies such as UPI, fintech platforms, mobile banking, and Aadhaar-enabled services can reduce financial barriers and improve access to credit, payments, and savings for underserved groups. However, women, rural communities, and minority populations continue to face structural and digital limitations. Adding to this, sustainable development now requires financial systems that support long-term resilience, green financing, and responsible digital practices. This study is relevant because it examines how financial innovation can promote both equitable access and environmentally sustainable growth, ensuring balanced and inclusive economic development.

Hypothesis

H1: Financial innovation improves access to formal financial services and increases financial participation among underserved and middle-income groups, including women.

H2: The adoption of digital financial tools is influenced by ease of use, digital literacy, affordability, and perceived security.

H3: Greater use of digital finance supports sustainable economic behaviour, including reduced dependence on cash and growing interest in responsible or green financial practices.

H4: High public confidence in financial innovation coexists with low awareness of sustainability-linked concepts such as green finance, indicating a gap in sustainability understanding.

Research Methodology

This study uses a mixed-methods approach to examine how financial innovation supports inclusive and sustainable growth. This approach is suitable because it captures measurable trends in financial behavior and personal views on accessibility, trust, and sustainability.

1. Research Design

The study has a descriptive and analytical design. Descriptive elements outline current patterns of digital financial usage. Analytical elements examine the relationship between financial innovation, inclusion, and sustainability.

2. Data Collection

Primary data is used.

Primary Data: Information comes from a structured Google Forms survey aimed at various groups of respondents based on factors like age, gender, and views on digital finance. The questionnaire includes multiple-choice questions about digital finance usage, barriers, inclusiveness, awareness, and trust in financial innovations.

3. Sampling Method

A convenience sampling method is used due to time constraints and easy access. The sample includes individuals aged 18 and older, primarily from middle-income households.

Analysis, Findings And Interpretation Of Data

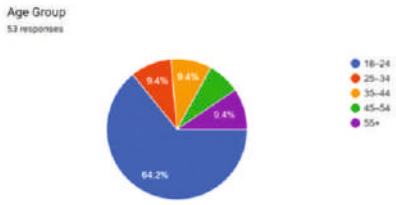
The primary data collected through the Google Forms survey (N = 53–54 responses across questions) provides important insights into public perception, usage, and challenges associated with digital finance and financial innovation.

Findings & Interpretation

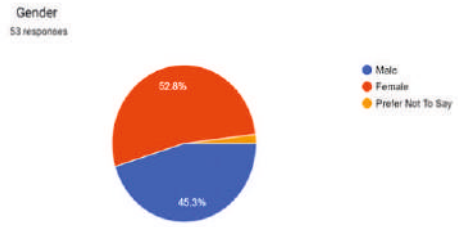
1. Findings

Based on responses collected from 53–54 participants, the following patterns were observed:

1.1 Demographic Profile

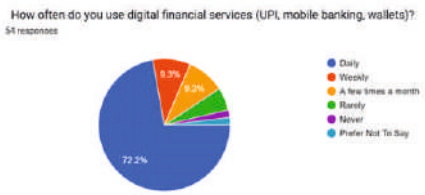


- Majority of respondents are 18–24 years old (64.2%), indicating young, digitally active users.



- Gender distribution shows a balanced representation, with 52.8% females and 45.3% males.

1.2 Usage of Digital Finance



- 72.2% use digital financial services daily, reflecting strong dependency on digital platforms.
- Only a small proportion use them weekly or occasionally.

1.3 Ease of Use



- 75.9% feel digital finance is easy to understand, showing high digital comfort among users.
- A minority report some difficulty.

1.4 Barriers and Issues



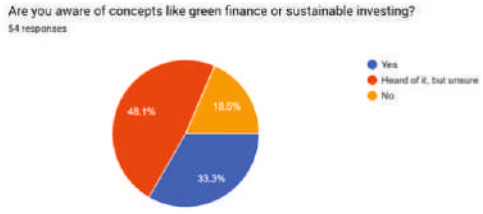
- The major issues faced are:

Technical issues (40.7%)

Security and trust concerns (16.7%)

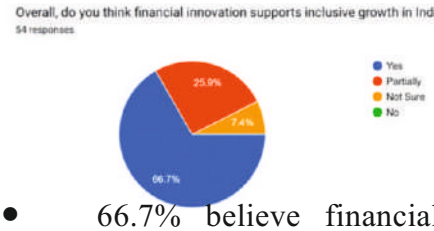
Low digital knowledge 37% reported no issues at all

1.5 Awareness of Sustainable/Green Finance



- Only 33.3% fully understand green finance.
- 48.1% have heard of it but remain unsure, indicating limited clarity.

1.6 Perception of Financial Innovation



- 66.7% believe financial innovation supports inclusive growth, showing strong

positive sentiment.

- Very few responded negatively or were unsure.

2. Interpretation of Findings

2.1 High Adoption Indicates Digital Readiness

Daily usage shows the convenience, trust, and reliance on digital payment systems like UPI. Young users, who make up the majority, are naturally moving towards cashless methods.

2.2 Perceived Ease of Use Shows Good App Design

Most users find digital finance straightforward. This success reflects the effectiveness of user-friendly app designs, language options, and smooth payment processes.

2.3 Persistent Barriers Highlight System-Level Challenges

Technical issues are the main barrier, including:

-Server failures during peak hours

- Slow app performance

- Delays in transactions

Security concerns point to a need for:

- Better fraud monitoring

- Increased user awareness

Limited digital knowledge among some users indicates ongoing gaps in digital literacy.

Despite growing importance worldwide, many users do not fully understand green finance, its purpose, or how to invest sustainably. Awareness is still developing.

2.5 Positive Perception of Financial Innovation Reflects Trust in India's Fintech Ecosystem

Respondents believe digital financial tools provide:

- Better access

- More transparency

- Quicker services

This shows confidence in India's efforts for digital inclusion.

Conclusion

The study reveals that financial innovation has become vital for inclusive and sustainable growth in India. This is particularly true through digital payments, mobile banking, Aadhaar-enabled systems, and fintech-based credit solutions. These innovations have expanded access to financial services for women, low-income households, rural communities, and minorities, matching broader national goals like the JAM trinity, self-help group financing, and digital public infrastructure development.

The primary data from the Google Form responses support existing literature:

- Daily use of digital finance is high, indicating strong adoption among younger users.

- Most respondents find digital tools easy to use, suggesting that barriers related to design and accessibility are slowly decreasing.

However, technical issues (40.7%), security worries, and limited awareness of green finance remain as ongoing challenges.

While 66.7% believe financial innovation encourages inclusive growth, nearly half do not understand sustainability-related financial concepts. This confirms Hypothesis 4 regarding gaps in awareness of green finance.

These findings highlight the main problem noted earlier: even as technology provides more access, it hasn't yet closed socio-economic and digital divides. Inclusion isn't consistent due to differences in digital literacy, variable infrastructure, and a lack of financial design that addresses gender and sustainability.

Overall, the study concludes that financial innovation positively affects access, participation, and the shift toward sustainable economic behavior. However, its impact is greatest when paired with solid governance, focused capacity-building, and increased literacy efforts. Financial innovation works best as a multi-layered ecosystem, focusing on technology, institutions, and sustainability rather than just as separate digital tools.

Recommendations

Based on the research objectives, literature insights, and survey findings, the following recommendations aim to strengthen India's financial innovation ecosystem for deeper inclusion and sustainability:

1. Strengthen Digital Infrastructure and Reduce Technical Barriers

Improve server capacity and enhance app stability to tackle the large number of users experiencing technical problems.

Expand reliable internet access in rural and remote areas to reduce geographic inequality.

Encourage fintech companies to create offline or low-data transaction options to assist underserved communities.

2. Enhance Cybersecurity and User Trust

Implement stronger fraud detection systems, multi-factor authentication, and real-time alerts for suspicious activities.

Conduct widespread awareness campaigns on digital safety aimed at younger users, first-time adopters, and women.

Make it easier to resolve issues with failed transactions and fraud cases to build trust in digital systems.

3. Expand Financial and Digital Literacy

Offer structured financial literacy programs in schools, colleges, self-help groups, and community centers.

Use fintech apps to provide instructional videos, step-by-step tutorials, and support in local languages.

Promote literacy programs targeted at women to help close the ongoing digital capability gaps they face.

4. Promote Awareness and Adoption of Green and Sustainable Finance

Launch public education campaigns to explain green bonds, ESG investing, carbon-neutral products, and sustainable mutual funds.

Add "green labels" or sustainability indicators to digital finance apps to encourage eco-friendly financial choices.

Urge financial institutions to develop simple, accessible sustainability-linked products for young people and low-income groups.

5. Strengthen Policy Innovation and Inclusive Governance

Expand regulatory sandboxes to support inclusive fintech innovations like women-focused lending and climate-risk solutions.

Encourage banks and fintech platforms to adopt design principles that are responsive to gender and sustainability needs.

Foster cooperation among government, private fintechs, academic institutions, and community organizations to ensure innovations reach vulnerable groups.

6. Support Women, Rural Households, and Minority Entrepreneurs

Promote digital tools linked to self-help groups, microinsurance products for women, and easier savings and credit options for irregular-income households.

Encourage alternative credit scoring systems that use transaction data to reduce reliance on traditional collateral.

Create outreach programs for minority entrepreneurs to connect them with digital credit and green finance opportunities.

7. Integrate Sustainability with Inclusion Goals

Position green finance as a key part of inclusive development, not as a separate issue.

Help financial institutions offer small loans for solar energy, sustainable livelihoods, and climate-resilient businesses.

Encourage blended finance models to reduce investment risks in climate-positive projects that serve underserved communities.

Final Remark

Financial innovation has great potential to change India's path toward fair and sustainable growth. However, its success relies on closing digital divides, improving literacy, strengthening governance, and merging sustainability with inclusion. With the right efforts, financial innovation can become a powerful engine that benefits every part of society while supporting long-term ecological and economic health.

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56. A Study on Redefining Investor Behaviour – The Role of Finfluencers in Sustainable Investment

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Abstract

This research examines how finfluencers online personalities who provide

financial guidance and influence investment patterns through social media—are transforming investor actions, particularly in advocating for sustainable investment choices. The study examines retail investors, evaluating the benefits (financial literacy, integration of ESG) and related risks (misinformation, hasty trading). Through the combination of primary data from surveys/interviews and a secondary literature review, the research identifies finfluencers as crucial players. The research emphasizes the possible dangers of depending on finfluencer material, including emotional investment and false information, which is especially pertinent. Surveying retail investors who engage with finfluencers across different platforms allows us to obtain meaningful insights into the success of influencer communication methods and recognize trends in investor behavior. In the end, this study can aid us in encouraging more responsible and educated financial choices, which is crucial for building a more sustainable future.

Key Words : Investors,Investor's Behaviour, sustainable investments, influencers, finfluencers

Introduction

In the rapidly evolving world of retail investing, the emergence of "finfluencers"—social media-based financial influencers—has reshaped how, why, and what individuals invest. Operating primarily on platforms such as YouTube, Instagram, Twitter, and Telegram, finfluencers deliver timely information, demystify complex financial concepts, and offer direct investment recommendations to millions of followers. Their voice reaches investors who were previously excluded from traditional advice due to cost, access, or knowledge barriers. What distinguishes finfluencers from conventional financial advisors is their approachability, relatability, and interactive engagement. Rather than technical jargon or distant analysis, finfluencers often use stories, personal experiences, and visual demonstrations to explain concepts like sustainable investment, risk management, and market analysis. Retail investors are particularly drawn to content that feels authentic and is delivered in formats tailored to their interests— short videos, live Q&A, and community challenges. Finfluencers have played a catalytic role by promoting funds, equities, and financial products that prioritize ethical, responsible, and green outcomes. "Green investing" campaigns and hashtags have circulated rapidly, highlighting case studies of successful sustainable portfolios, debunking myths, and providing access to previously opaque markets .However, with democratization comes complexity. The very features that make finfluencer advice so accessible—conversational tone, rapid dissemination, real-time updates—also present risks. Not all online influencers are qualified, and the lack of regulatory oversight exposes followers to misinformation, promotional hype, and impulsive decision-making. Digital echo chambers form around influential personalities, amplifying market trends and sometimes leading followers into speculative bubbles. Against this backdrop, this study aims to comprehensively analyse the impact of finfluencers on investor behaviour, with a special focus on sustainable investment choices. It considers the psychological, informational, and community-driven factors that motivate retail investors to act on influencer advice. It also seeks to identify gaps and risks, and to recommend strategies for responsible digital investment promotion.

Literature Review

Research by Singh and Kumar (2025) highlights that finfluencers play a pivotal role in shaping the financial perceptions and behaviors of Generation Z investors. Their study, focusing on Indian millennials, found that over 80% of young investors rely on finfluencer content for making investment decisions, valuing the relatability and transparency that these online personalities provide.

This study echoes the findings from global markets, underscoring a shift where digital trust often surpasses conventional institutional trust. Kakhbod (2023) delves deeper into the mechanisms through which finfluencers impact investor psychology. The study identifies social media echo chambers as critical enablers for accelerating both financial literacy and speculative behavior. In these environments, groupthink and herd mentality are amplified,

leading to rapid dissemination of both valuable knowledge and risky investment trends.

One of the most consequential developments in recent years is the rise of sustainable and socially responsible investing (SRI). Finfluencers have been at the forefront of promoting ESG (Environmental, Social, and Governance) investing, a form of investment that seeks positive social impact alongside financial returns.Josef and Raj (2023) argue that social media-driven narratives are crucial for the growth of sustainable investing among retail investors. Their research shows that finfluencers, by framing ESG investing as a moral and generational imperative, encourage younger investors to align their portfolios with their values. This narrative is reinforced through "storytelling" campaigns where personal experiences and success stories of ethical investment performance are shared, building a collective ethos around sustainability.

Mukherjee and Sharma's (2019) research highlights the dualistic nature of finfluencers: they enhance access and engagement but may also propagate misinformation or speculative hype.Key risks include the prevalence of promotional content disguised as educational material, inadequate disclosure of conflicts of interest, and the spread of unverified or misleading financial advice. Such issues are illuminated in a comprehensive report by the International Organization of Securities Commissions (IOSCO, 2025), which recommends the integration of digital media monitoring with enhanced investor protection policies.

Scope of the Study

The study focuses on investors in PCMC area. Conceptually, the study is confined to the influence of finfluencers on sustainable investment behaviour, with specific emphasis on products aligned with Environmental, Social and Governance (ESG) themes such as green bonds and ethical funds. The study provide an empirically grounded picture of how finfluencers are reshaping the way young Indian investors discover, interpret and engage with sustainable investment opportunities, and to highlight areas where regulation, financial education and ethical content practices need to evolve.

Objectives

- To investigate how finfluencers influence investment decisions, especially for sustainable products.
- To measure trust, engagement, and behavioural changes among retail investors
- .To identify risks (emotional investing, misinformation, lack of professional guidance) created by finfluencer content
- To propose reforms for investor education and digital regulation.

Research Methodology

Data Collection We're gathering data through a structured questionnaire focused on investor perceptions, decision-making, and long-term behavior, as well as risks tied to influencer content.

Primary Data - Collected through a structured questionnaire distributed to Investors . focused on investor perceptions, decision-making, and long-term behavior, as well as risks tied to influencer content.

Secondary Data - Collected from journals, research papers, articles, websites, and reports related to fintech adoption, consumer trust, and technology acceptance models.

Population: The researcher approached individuals who use individual retail investors in Pune city who follow finfluencers on YouTube, Instagram, TikTok, and LinkedIn.

Sample Size: The targeted sample size for the study was 150 respondents

Sample Technique: Simple Random Sampling method was used.

Analytical Tools: The data were analysed using MS Excel and Google Sheets, applying percentages, frequency tables, charts, bar graphs, and pie diagrams to interpret results and draw meaningful conclusions

Statement of problem

In recent years, social media financial influencers ("finfluencers") have become a prominent source of investment information, particularly for retail investors. They can make complex topics like sustainable investing more accessible, but their influence can also lead to impulsive decisions, misinformation, or taking on too much risk.

Data Analysis and Interpretation

1. AGE

Age	Responses	Percentages
20-26	30	20.00
26-32	55	36.70
32-38	40	26.70
38-44	18	12.00
44-50	07	04.70
TOTAL	150	100

Table 1

Interpretation:-The age distribution shows a concentration of respondents between 19-24 years (63.4%), with the highest proportion in the 19-21 range (36.7%). This indicates a predominantly young respondent base. The representation decreases significantly with increasing age, with only 16.7% above 25 years, suggesting a focus on younger perspectives.

Inference :- The data likely represents students or young adults, possibly in an educational setting, given the age range.

1. Education Qualificaton

Educational Qualification	Responses	Percentages
Higher secondary	22	14.70
Undergraduate	80	53.30
Postgraduate	28	18.70
Professional Degree	12	08.00
Others	08	05.30
Total	150	100

Table 2

Interpretation :-The majority of respondents are undergraduates (53.3%), followed by postgraduates (18.7%) and those with higher secondary education (14.7%).

Inference :-The data likely represents a sample from an educational institution, with a focus on degree-seeking students.

1. Influencers increase my awareness and confidence of sustainable investment options.

Influencers increase my awareness and confidence of sustainable investment options.	Responses	Percentages
Strongly disagree	8	50.30
Disagree	12	08.80
Neutral	20	13.30
Agree	35	23.30
Strongly agree	75	50.00

Table 3

Interpretation :-The strong positive skew (75 Strongly Agree, 35 Agree) indicates finfluencers effectively serve as entry points for ESG awareness among retail investors. Mean score above 4.0 suggests broad recognition of their educational role in introducing niche sustainable products.

Inference :-Influencers are perceived as strong promoters of awareness (73.3% agree/strongly agree). They act as "gatekeepers" for ESG information, suggesting a need for guidelines on accurate disclosure.

1. My perception of the credibility of sustainable investments is influenced by how influencers present them

My perception of the credibility of sustainable investments is influenced by how influencers present them	Responses	Percentages
Strongly disagree	9	60.00
Disagree	14	90.30
Neutral	24	16.00
Agree	47	31.30
Strongly agree	56	37.30

Table 4

Interpretation : -Strong consensus (56 Strongly Agree, 47 Agree) proves narrative framing determines ESG legitimacy more than fundamentals alone. Low Strongly Disagree (9) suggests universal susceptibility to persuasive delivery.

Inference :- narrative framing drives ESG legitimacy more than fundamentals; low-credibility influencers need certification.

1. Influencers' storytelling (personal experiences, journeys) motivates me to consider sustainable investments.

Influencers' storytelling (personal experiences, journeys) motivates me to consider sustainable investments	Responses	Percentages
Strongly disagree	15	10.00
Disagree	20	13.30
Neutral	30	20.00
Agree	45	30.00
Strongly agree	40	26.70

Table 5

Interpretation : -Moderate positive distribution (45 Agree, 40 Strongly Agree) validates narrative psychology—personal journeys create emotional investment

connections. Higher disagreement (35 total) reveals storytelling limits with analytical investors.

Inference :-Influencers' storytelling (narrative + data) boosts emotional engagement and optimizes investor outreach, showing that narrative psychology drives investment decisions

1. Visual tools used by influencers (charts, reels, graphics) help me evaluate sustainable investment options.

Visual tools used by influencers (charts, reels, graphics) help me evaluate sustainable investment options	Responses	Percentages
Strongly disagree	12	80.00
Disagree	18	12.00
Neutral	28	18.70
Agree	50	33.30
Strongly agree	42	28.00

Table 6

Interpretation : -Clear preference (50 Agree, 42 Strongly Agree) confirms visual processing superiority for financial decision-making. Charts/reels democratize complex analysis for mass audiences.

Inference :-The visual tools (charts/reels) significantly enhance financial decision-making by simplifying complex analysis, as indicated by a strong agreement that visual processing democratizes investing literacy.

1. Influencer discussions motivate me to diversify into more eco-friendly or ethical investment options.

Influencer discussions motivate me to diversify into more eco-friendly or ethical investment options.	Responses	Percentages
Strongly disagree	22	14.70
Disagree	28	18.70
Neutral	38	25.30
Agree	32	21.30
Strongly agree	30	20.00

Table 7

Interpretation : -Neutral majority (38) with mild positive lean indicates theoretical support without execution. Balanced responses reflect portfolio conservatism.

Inference :-The majority of respondents chose 'neutral' (38), showing a mild positive inclination that suggests conceptual endorsement of influencer discussions & eco-investing but lack of actual implementation.

8. I am more confident in holding sustainable investments during market volatility when influencers reinforce their benefits

I am more confident in holding sustainable investments during market volatility when influencers reinforce their benefits	Responses	Percentages
Strongly disagree	28	18.70
Disagree	30	20.00
Neutral	42	28.00
Agree	30	20.00
Strongly agree	20	13.30

Table 8

Interpretation : -Neutral peak (42) amid bearish skew reveals influencer fragility during downturns—positive reinforcement fails under pressure.

Inference :-This suggests that investor confidence in sustainable investments weakens during downturns, implying that positive reinforcement of sustainability may lose under market pressure

9. I re-evaluate my long-term investment goals after consuming influencer content on sustainable finance.

I re-evaluate my long term investment goals after consuming influencer content on sustainable finance	Responses	Percentages
Strongly disagree	20	13.30
Disagree	25	16.70
Neutral	45	30.00
Agree	35	23.30
Strongly agree	25	16.70

Table 9

Interpretation :-Neutral dominance (45) suggests episodic influence rather than transformative impact. Limited extremes indicate measured responsiveness.

Inference :-The neutral dominance (45) suggests an episodic influence rather than a transformative impact. The limited extreme responses indicate measured responsiveness in re-evaluating goals

1. I sometimes make emotional investment decisions based on influencer content.

I sometimes make emotional investment decisions based on influencer content.	Responses	Percentages
Strongly disagree	27	18.00
Disagree	30	20.00
Neutral	38	25.30
Agree	32	21.30
Strongly agree	23	15.30

Table 10

Interpretation :-Neutral plurality (38) acknowledges vulnerability—investors recognize bias potential without full endorsement.

Inference :- The neutral majority (38 respondents) indicates that investors acknowledge the possibility of bias in decision-making but do not fully endorse its influence, suggesting an awareness of emotional contagion effects in investment behavior

1. I have followed influencer financial advice without confirming it from reliable or professional sources.

I have followed influencer financial advice without confirming it from reliable or professional sources	Responses	Percentages
Strongly disagree	25	16.70
Disagree	28	18.70
Neutral	40	26.70
Agree	36	24.00
Strongly agree	21	14.00

Table 11

Interpretation :-Concerning agreement levels (36 Agree, 21 Strongly Agree) confirm authority bias dominance over due diligence.

Inference :-The analysis indicates that authority bias outweighs due diligence, suggesting that existing regulatory disclosure requirements are inadequate and need improvement

1. It is often difficult to distinguish between genuine opinions and sponsored promotions in influencer posts.

It is often difficult to distinguish between genuine opinions and sponsored promotions in influencer posts.	Responses	Percentages
Strongly disagree	28	18.70
Disagree	30	20.00
Neutral	42	28.00
Agree	25	16.70
Strongly agree	25	16.70

Table 12

Interpretation :-Perfect neutral peak (42) reveals universal disclosure confusion despite regulations. Equal Agree/Strongly Agree (50 total) signals systemic transparency failure.

Inference :-The data indicates that respondents find it challenging to distinguish between genuine and sponsored posts, as evidenced by the highest frequency (42, 28.0%) falling in the "Neutral" category, suggesting widespread disclosure confusion.

1. Relying heavily on influencers sometimes reduces my likelihood of seeking guidance from certified financial advisors

Relying heavily on influencers sometimes reduces my likelihood of seeking guidance from certified financial advisors	Responses	Percentages
Strongly disagree	22	14.70
Disagree	27	18.00
Neutral	45	30.00
Agree	30	20.00
Strongly agree	26	17.30

Table 13

Interpretation : -Neutral majority (45) acknowledges substitution effect—influencers partially displace professional guidance.

Inference :-In the modern, democratized information environment, people turn to influencers for advice, which reduces reliance on traditional professional counsel.

1. Influencers play a significant role in shaping my understanding of sustainable investment opportunities.

Influencers play a significant role in shaping my understanding of sustainable investment opportunities.	Responses	Percentages
Strongly disagree	20	13.30
Disagree	22	14.70
Neutral	38	25.30
Agree	45	30.00
Strongly agree	25	16.70

Table 14

Interpretation : -Moderate positive consensus (45 Agree, 25 Strongly Agree) positions influencers as primary modern ESG educators.

Inference :-In today's information ecosystem, democratization drives investors to seek advice from influencers, lessening dependence on formal financial advisors.

1. I consider influencer content an important factor in my investment decision-making process

I consider influencer content an important factor in my investment decision-making process	Responses	Percentages
Strongly disagree	19	12.70
Disagree	21	14.00
Neutral	396	26.00
Agree	44	29.30
Strongly agree	27	18.00

Table 15

Interpretation:-Clear agreement majority (44 Agree, 27 Strongly Agree) establishes influencers as material portfolio influencers.

Inference :-The influence of material portfolio factors outweighs that of conventional influencers in decision-making.

1. Finfluencer content has changed the way I evaluate investment risks and benefits

Finfluencer content has changed the way I evaluate investment risks and benefits	Responses	Percentages
Strongly disagree	21	14.00
Disagree	23	15.30
Neutral	35	23.30
Agree	40	26.70
Strongly agree	31	20.70

Table 16

Interpretation : -Strong positive skew (40 Agree, 31 Strongly Agree) confirms cognitive framework restructuring.

Inference :- Financial influencers reshape investors' risk-assessment processes by modifying their cognitive decision-making frameworks

Findings

1) The influencers have played a major role in making them aware of sustainable investment options, about ESG, green funds, or ethical portfolios. But many time they provide wrong information

2) The majority agree that visual tools such as charts, reels, and infographics make it easier to evaluate sustainable options. But not asses the risk factor.

3) Many participants do not strongly agree that influencer reassurance makes them confident during market volatility, highlighting that when markets are unstable.

4) A noticeable share of investors admit that they sometimes make emotional investment decisions based on influencer content.

5) The finfluencers are not just an "extra source" but a central lens through which many retail investors interpret ESG products and trends.

Suggestions

For Young Investors Following Finfluencers

Treat influencers like helpful tour guides, not GPS navigators. Use their content to discover ESG ideas and spark questions, but always cross-check recommendations with 2-3 reliable sources—a bank app, family advisor, or free SEBI investor portal.

For Finfluencers Building Trust

Lead with transparency as your brand. Use clear visual badges ("Sponsored" or "My Opinion") instead of buried #ad tags. Mix 70% education (charts, real ESG performance data) with 30% personal stories to build credibility. Share your own mistakes and lessons learned—it humanizes you and teaches followers how to spot risks.

For Regulators & Policymakers

Launch free public ESG explainer videos in regional languages, styled like Instagram Reels, so investors have authentic benchmarks. Partner with platforms for algorithm nudges promoting verified content over hype.

Conclusions

This research highlights the growing influence of finfluencers—social media personalities who share financial advice—on young investors' attitudes and behaviors toward sustainable investing. The findings show that these digital voices play a crucial role in introducing ESG concepts in a way that feels relatable and accessible. Through storytelling, visuals, and regular content, finfluencers successfully spark curiosity and build initial confidence among their followers. While finfluencers inspire many to explore green investments, their ability to encourage long-term commitment remains limited. Investors often struggle to maintain confidence during market ups and downs, and some admit to making impulsive decisions or relying too heavily on influencer advice without verifying information. The blurring lines between genuine guidance and sponsored content further complicate trust.

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57. Sustainable Consumption Practices Among Female Millennials in Pune: A Behavioral Study for Cosmetic Products

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Abstract

Concerns regarding plastic waste, toxic additives, and excessive resource use are getting more serious due to the cosmetic industry's sudden growth. Millennial female consumers, who are the driving force behind the beauty industry, are key in forming ethical consumption habits as sustainability gains international attention. This study analyses how awareness, attitudes, and behavioral factors affect cosmetic purchase decisions among female millennials in Pune. A survey of 129 respondents was conducted to find a high level of environmental understanding but inconsistent sustainable buying practices. High costs, scepticism brought on by greenwashing, lack of trustworthy information, and uncertainty about really sustainable brands are some of the primary barriers. The study draws to the conclusion that in attempt to overcome the awareness to action gap and promote continuous eco-friendly cosmetic consumption, brands must increase their affordability, transparency, and communication.

Key Words: Sustainable consumption, Cosmetics, Female millennials, Pune, Behaviour, Patterns.

1.0 Introduction: In recent times, the market of beauty products has exponentially gotten a boom. On the other hand, it is also facing major changes like reduction of waste, usage of eco-friendly ingredients, etc. However, it will take some time to become fully sustainable. Even if all beauty brands now suddenly stop using plastic packaging, there is a large amount of old plastic on earth that must be processed. Millions of cosmetic containers already exist, and people will continue to throw them away for years. This suggests that the problem cannot be resolved by brands alone. To truly create a sustainable future of beauty, everyone must take responsibility. These include- consumers, retailers, brands, government and so on. There are various actions which are primarily required to take, to begin with- use of recyclable, refillable, or biodegradable packaging, reducing manufacturing waste and carbon emissions, support brands that adhere to sustainable e-practices, and recycling empty containers properly. This includes recognizing green washing and reading the label carefully. In terms of policy and regulation, building strict rules on the use of plastic and waste management, encouraging recycling programs and replenishment stations are needed to be called for. Changes in global supply chains do not happen overnight, and durable materials take time because they are expensive or limited. In addition, consumers need time to change their habits, and not every country has a robust recycling system.

Stability in the beauty industry is not just the work of the brand. This is a teamwork process. Companies need to make better products, and consumers need to make better choices. The government needs to support these changes. Only when everyone works together, we can minimize waste and protect the planet for the future.

2.0 Statement of Problem

Female consumers are currently the players who run or drive the multi-billion-dollar cosmetics industry, and according to research, they have a significant impact on the millennial generation. The global cosmetics industry is heavily driven by female consumers which includes important millennial demographics. However, this industry contributes significantly to global pollution and resource consumption through non-biodegradable packaging, chemical components, and rapid product cycles. In response to growing concerns about the environment, the demand for sustainable and 'green' cosmetics is increasing. Barriers such as high price ranges, distrust and green washing, restrictions on product availability, and inconsistent quality across batches often hinder purchasing decisions despite good intentions. Therefore, to fill this knowledge gap, targeted research is necessary.

2.1 Research Gap

There are approximately 1,520,783 females in Pune city. Out of which, approximately 700,000 are millennials. They are the major contributors of wide consumption of cosmetic products. Therefore, the study of sustainable consumption and their behavior while buying cosmetic products is paramount.

3.0 Review of Literature

1. (Petre-Sorin SAVIN 2024)

Consumerism has become a worldwide problem, impacting not only the economy but also the way we live. One of the major problems resulting from consumerism is global pollution, which obviously affects the environment and has serious consequences, including on people's health. The main objective of our research paper regarding the generational perspectives on sustainable consumption is to explore the consumer behaviour of two generational cohorts, Millennials and Generation Z, and to provide a general understanding of their attitudes, motivations, and behaviours in relation to environmental sustainability. First, we collected information from the specialized literature about the researched subject, after which we carried out quantitative research using the survey method. The results of the research helped us identify the impediments and challenges faced by Millennials and Generation Z in adopting sustainable practices related to consumption, as well as the factors that encourage them to engage in sustainable consumption. In the last part of our research, we presented some recommendations aimed at improving the culture of sustainable consumption within the Millennials and Generation Z cohorts. This paper contributes to the field by providing essential details about these two generations perspectives regarding sustainable consumption so that, especially companies, can tailor their products and marketing strategies to align with the values and preferences of Millennials and Generation Z, fostering a more sustainable future



Figure-1, Generational drivers of sustainable consumption (by researchers)

2. Organizations across all industries are trying to meet these expectations by building a positive reputation and sending a signal to their stakeholders. However, consumers' environmental behavior is not always the result of their positive attitudes towards environmental issues. Potentially, their environmentally friendly attitudes are contradicted by their actual behavior. In addition, consumers often do not wish to spend more money on buying sustainably, even if they have higher expectations towards sustainable products or companies. Further research is therefore needed to explain the gap between consumer awareness and actual purchasing behavior. In several contexts, environmentally friendly consumption, called sustainable consumption, has been explained by the theory of planned behavior (TPB), such as when buying food or apparel. Sustainable consumption often results from planned decisions rather than hedonic reasons.

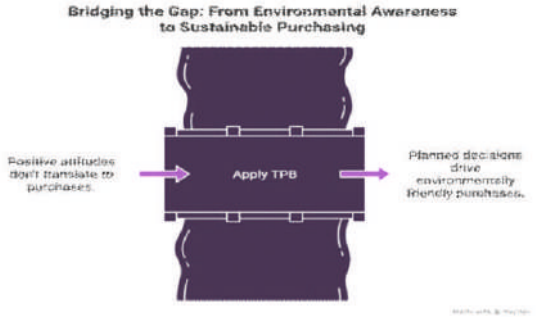


Fig. 2 – Bridging the gap from awareness to sustainable purchasing (by researchers)

3. Traditional marketing practices have lost impact because they do not consider as differentiating elements the factors generated by the evolution of society, such as the growing evolution of environmental awareness on the part of consumers, aligned with the depredation of our planet. In response to this problem, the concept of green marketing (GM) arises, which links marketing strategies with practices that ensure the preservation of the ecosystem and appeals to the environmental awareness of consumers and its impact on the purchase decision process (PDP).

4. (Rafaela Sasounian 2024) Sustainable ingredients in cosmetics have been discussed for the past decade, and the COVID-19 pandemic has increased awareness of this significant topic. Consumers are informed and vigilant about clean labels, driving the necessity for sustainability throughout the cosmetic production chain. Moreover, nanotechnology and green chemistry approaches have emerged

as innovative perspectives to develop sustainable and eco-friendly cosmetic ingredients. In this sense, in this review, we present examples and applications of sustainable ingredients derived from several types of sources (i.e., plants, animals, microorganisms, cell cultures, and recycled materials/biomaterials). The benefits and drawbacks of all classes of compounds were organized and discussed in relation to novel formulations/products. Finally, we addressed perspectives on cosmetic ingredients that prioritize sustainability and safety, with an emphasis on exploring sustainable ingredients, compounds, or molecules as promising areas for research and development.

5. Over the past three decades, environmental concerns about water pollution have been raised on societal and industrial levels. The presence of pollutants stemming from cosmetic products has been documented in wastewater streams outflowing from industrial as well as wastewater treatment plants. To this end, a series of consistent measures should be taken to prevent emerging contaminants of water resources. This need has driven the development of technologies, in an attempt to mitigate their impact on the environment. This work offers a thorough review of existing knowledge on cosmetic wastewater treatment approaches, including coagulation, dissolved air flotation, adsorption, activated sludge, biodegradation, constructed wetlands, and advanced oxidation processes. Various studies have already documented the appearance of cosmetics in samples retrieved from wastewater treatment plants (WWTPs), which have definitely promoted our comprehension of the path of cosmetics within the treatment cycle; however, there are still multiple blanks to our knowledge.

6. The cosmetics industry is undergoing a transformative shift toward sustainability due to growing consumer demand for eco-friendly products and the urgent need to reduce environmental impact. Challenges exist at every phase of a product's life cycle, requiring effective strategies to drive sustainability. Upcycling—the repurposing of byproduct waste materials or useless products—emerges as a powerful strategy to advance circularity, minimize waste, and conserve resources. Central to this process is sustainable ingredient sourcing, particularly the use of agro-food industry waste and byproducts, which often contain high-value bioactive compounds suitable for cosmetic applications. Beyond sourcing, other upcycling strategies can be applied across the cosmetic life cycle, such as optimizing production, valorizing post-consumer plastic waste, and reducing carbon footprint through innovative practices such as carbon dioxide capture and repurposing. This review explores the role of upcycling and other sustainable practices in reshaping the cosmetics industry, from product design to post-consumer use. It also underscores the importance of consumer education on sustainable consumption to promote responsible beauty practices. The findings highlight how upcycling and other sustainability approaches can significantly reduce the industry's environmental footprint.

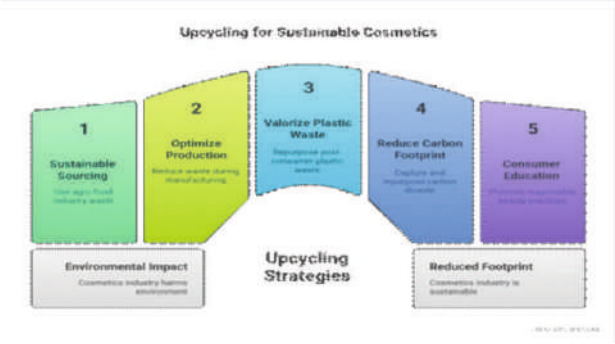


Figure-3, Stages of upcycling cosmetics (by researchers)

4.0 Objectives

1. To study sustainable consumption practices amongst female millennials towards cosmetic products.
2. To analyze how sustainability awareness and personal values influence millennial women's cosmetic purchasing behavior.
3. To outline key barriers and provide suggestions for improving cosmetic consumption in an eco-friendly direction.

5.0 Need of the Study

The cosmetics industry often affects the environment in different ways without us realising it. A large amount of plastic is used for aesthetic packaging, and sadly only a small

amount is recycled. The environment is degraded due to the waste coming from landfills, which is brought by the rivers to the sea. The waste includes micro plastic waste which is dangerous for marine wildlife too. Since plastic is non-degradable, it is causing serious environmental problems. Few cosmetics use oil-based ingredients, by which the industry itself is contributing to deforestation. Basically, in order to grow palm oil, vast forests are cut down, thousands of trees and wildlife habitats are destroyed. Many species are threatened and consequently endangered. Another grave problem is the amount of water used by the beauty industry. Both during production and while washing the product at home. This has significantly increased wastage of water when the world is already facing water shortages. From the purchase of raw materials to the manufacture and transportation of products, the entire supply chain generates a lot of carbon emissions and contributes to climate change.

Overall, these factors suggest that the products we use daily can put a huge burden on the planet. Therefore, in order to assess the seriousness and its impact of cosmetics on the environment the research is necessary .Given that millennials are the main drivers of environmental change and advocates of environmentally friendly behavior, it is important to understand the factors that shape their attitude and behavior towards biological personal care products.

6.0 Research Methodology

6.1 Research design

Method – Descriptive and Quantitative method

6.2 Primary data

The primary data is collected through a structured questionnaire survey using Google forms from residents in Pune city.

6.3 Population & sample size

There are approximately 1.52 million females (1,520,783) in the city. The total number of female millennials would be approximately 700,000 (2011 Census - Pune Municipal Corp). The respondents are: 129 females.

6.4 Sampling method – Convenience Sampling

6.5 Data Collection Methods

Primary data comes from structured questionnaire surveys exploring awareness, adoption, and market readiness.

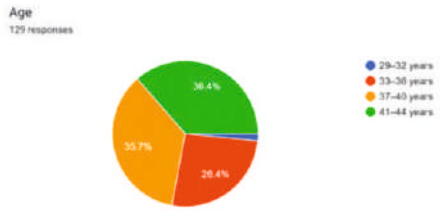
Secondary data from journals and reports supports context building and comparison with existing research.

6.6 Data Collection Tool – Google forms

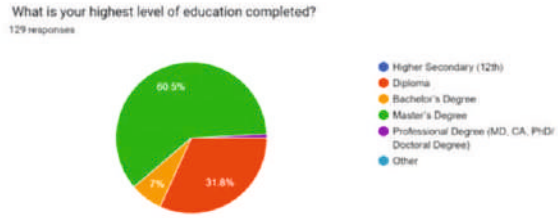
6.7 Data analysis- It was done using MS Excel.

7.0 Analysis & Interpretation of Data

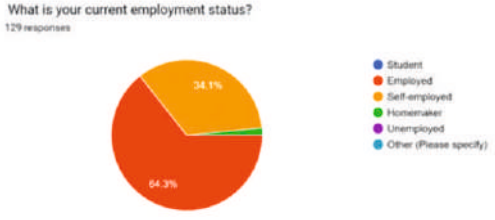
This section tells us about the analysis and interpretation of the data collected survey with the help of google forms, focusing on factors like the demographic profile, purchasing power, and sustainability perceptions of the female millennial cosmetic consumer. Eventually the findings blend with the relationship between respondent characteristics and their observed patterns of consumption and environmental awareness. Following is the interpretation of data:



The whole data collected from 129 female millennials is highly concentrated, with the 37-40 years (36.4%) and 33-66 years (35.7%) age group which collectively accounts of over two-thirds of the data.

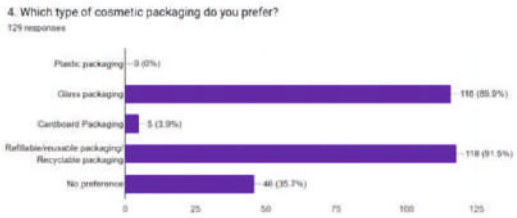


The education of the respondents indicates quite high level of academic achievement, with holding majority a master's degree (60.5%) or Diploma (31.8%)

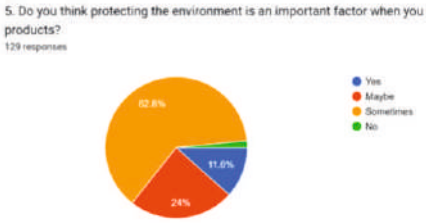


Here, the employed female millennials make substantial majority with (64.3%), followed by

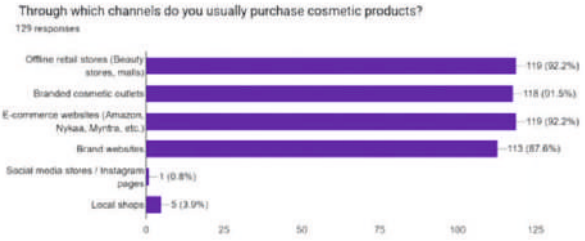
the self- employed segment (34.1%).



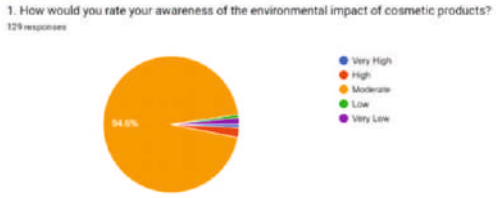
The majority of the female millennials prefer sustainable packaging, choosing Recyclable/reusable packaging (91.5%) and Glass packaging (89.9%) being profoundly favored over other packaging materials.



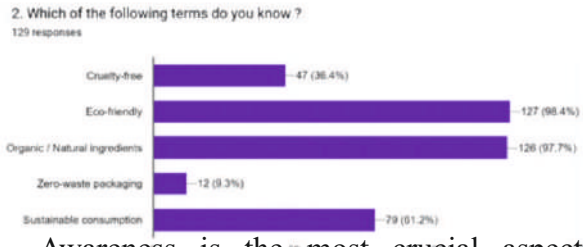
Only a small percentage (11.6%) said Yes, that protecting the environment is an important factor to consider when purchasing cosmetics, which is concerning, as it indicates environmental consideration is not a strong priority.



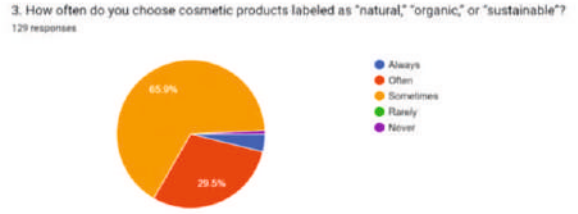
The female millennials use a diversified shopping/ purchasing approach, with an highly and evevated dependance on offline retail stores (92.2%), E-commerce (91%) and Branded cosmetic outlets (91.5%).



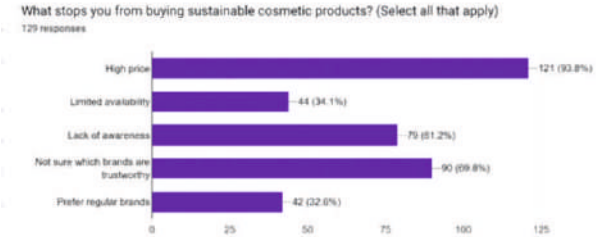
The percentage of respondents with selecting Very high and High is notably low, which can prevent people from making responsible and knowledgeable cosmetic purchase.



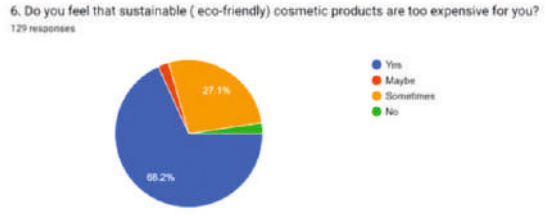
Awareness is the most crucial aspect for understanding the consumption. Here, eco-friendly and organic ingredients rank the highest (98.4%) whereas zero waste packaging ranks at last (9.3%)



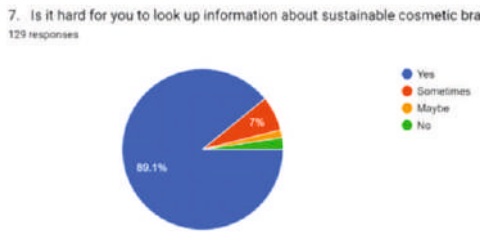
Only a very minor percentage of respondents regularly purchase cosmetics with organic/natural/sustainable labels. This indicates that although these lables have an impact on occasional purchases, regular cosmetic purchasing behaviour does not consistently prefer them.



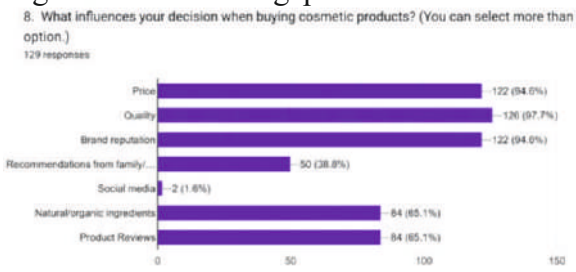
The 2 biggest barriers for buying sustainable cosmetics are High Price (93.8%), which is the most significant barrier, and a lack of confidence regarding which brands are trustworthy.



While purchasing Price is said to be a prominent barrier, with a solid agreement with Yes (68.2%) or Sometimes (27.1%) too expensive.



The vast majority of respondents feel Yes (89.1%) it is difficult to address information about sustainable cosmetic brands. Pointing to a high communication gap.



The main factor is Quality (97.7%) is the primary decision influencer, closely followed by Price (94.6%) and Brand reputation (94.6%), with Product Reviews (65.1%) and Natural/organic ingredients (65.1%) also being high.



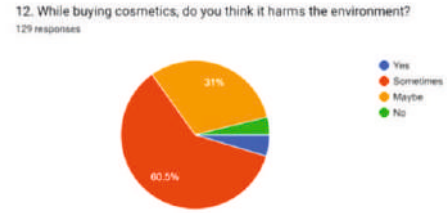
90.7% of respondents say that their work status is a critical factor when it comes to purchasing cosmetics.



Just a handful of respondents have complete confidence on brands who produce eco-friendly or sustainable claims. This demonstrates a widespread mistrust of such claims.



The data depicts that checking list of ingredients is a popular habbit which most of our respondents do with Sometimes (37.2%), Often (34.1%), or Always (27.9%)



It is clear that very few people think cosmetics are harmful for environment. It suggests a low level of environmental sensitivity at the time of purchasing

7.1 Key Research Findings Summary:



Fig.-4 Top barriers to sustainable cosmetic consumption (by researchers)

The data reveals that typical millennial female respondents have a stable life foundation, a high level of education, and are usually employed in their mid-to-late 30s (33-40 years old). Interestingly, these women are highly knowledgeable about environmental issues and understand eco-related terminology, but this knowledge doesn't necessarily translate into all their purchasing behavior. The purchase of sustainable products is mostly limited to "occasionally." What are the significant obstacles? These are economic issues, like high prices and very high distrust of brands which claim environmental considerations. However, their intentions are clear when it comes to packaging; they overwhelmingly prefer rational and sustainable options such as recyclable materials and glass. Overall, the survey shows that though female millennial cosmetic consumer has very high probably excellent environmental knowledge, the main barriers are sustainable consumption of cosmetics is very highly priced and with notable lack of trust on

brands who claim to be sustainable /natural /organic. However, reducing the observed gap requires some intentional changes which are focused on increasing the affordability as well as enhancing the transparency of their ingredients, process to respect consumer values

8.0 Findings, Suggestions & Conclusions

8.1 Findings

1. The key finding of the study is- Knowledge is high but the actions are inconsistent. Although everybody is aware of eco-friendly or sustainable products, they hardly buy them regularly.
2. Price is playing a crucial role since it is the biggest hurdle for consumption. The products are not only expensive but also difficult to procure.
3. Factors like Quality, Price, and Brand reputation matter a lot in the context of usage of sustainable products as they influence purchasing power. The sustainable claims made by the brands stand secondary in the race.
4. The key obstacles observed include untrustworthiness about the brands, unclear results, and difficulty finding them in the market. Even though brands claim sustainable ingredients or packaging, there is a huge untrust which is caused by greenwashing. Moreover, many women feel that it is difficult to get clear information about genuinely sustainable brands, which creates confusion.

8.2 Suggestions

- **Consumer point of view**

a. If someone wants to promote an organic, sustainable product, you need to show that it can deliver results comparable to chemical-based products. Because based on my experience organic products don't show great effects on skin and hair.

b. Good marketing strategy and creating awareness amongst consumers.

c. It should have more detailed pros and cons of the product

d. Use biodegradable ingredients adopting ecofriendly packaging

- **Business point of view**

a. Look at manufacturing processes and explore ways that you can drive water wastage and transport carbon emissions.

b. Commit to transparency and share your progress with your consumers and shareholders

c. Explore sustainable or organic ingredients that can replace existing substances and make your products better for the planet

d. Analyze existing practices to understand where your cosmetic business can make improvement

8.3 Conclusion



This study showcases a strong awareness about environment friendly cosmetic products by female millennials. There is a solid positive approach towards sustainability and ecologically beneficial consumption. However, there is a huge gap between awareness and actual purchasing. The actions are not consistent and therefore do not lead to sustainable purchasing. The main reasons are high prices, lack of trust in brand claims, and difficulty in finding reliable information about sustainable cosmetic brands. Millennial women will no doubt shift toward more consistent eco-friendly cosmetic choices when sustainability becomes simpler, easier, more transparent, and more affordable. For that, cosmetic companies need to reduce the cost of sustainable products significantly, be transparent about their ingredients and manufacturing methods, and their claims. Also, effective communication is vital to let consumers know which companies they can really rely on to close this gap. The gap between what they want and what is available to them is the issue, not a lack of awareness. It is observed that these women have strong preference for recyclable and glass packaging. It exhibits that they genuinely want to make eco-friendly choices whenever possible, even though it is currently not possible for them.

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58. "Impact of Influencer Marketing On Sustainable Consumption Patterns"

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Abstract:
This study explores how influencer marketing affects people's interest in sustainable products at a time when most product discovery happens on social media. The topic came from noticing how quickly audiences pick up habits that influencers talk about, especially when it comes to "eco-friendly" choices. Using previous research along with a small survey of 38 respondents, the study found that influencers do manage to grab attention and spark curiosity. However, this interest rarely turns into long-term sustainable behaviour. Many respondents liked the idea of sustainability but struggled to stay consistent due to cost, confusion about what is truly sustainable, or simply losing interest. The findings suggest that while influencers can encourage people to think about sustainability, the impact remains mostly short-lived unless brands and influencers communicate clearly and honestly about their products.

Keywords:
- Influencer Marketing
- Sustainable consumption
- Consumer behaviour
- Social Media influence.

Introduction: Influencers have quietly become some of the most trusted voices online. People watch them every day, they get used to their routines, and slowly they start believing in the choices they make. That's why when influencers talk about sustainability whether it is a product, or a habit or a lifestyle people listen to them without thinking much. The problem is that sustainability online doesn't always look the same as sustainability in real life. Sometimes it's genuine, sometimes it's a trend, and sometimes it's just clever marketing dressed in green colours and soft words.

Because most consumers don't really know what makes a product truly sustainable, they depend on the influencers to guide them. This dependence is emotional and practical. People copy what they feel familiar, what looks easy, or what is presented as the right thing to do. But this can lead to confusion for one moment sustainability becomes a meaningful lifestyle, and next, it turns into a quick purchase influenced by aesthetics and popularity rather than real understanding. This study tries to understand how influencer marketing shapes people's sustainable choices, whether it encourages real change or just a temporary buying based on trends. It also explores how much trust is involved, where misinformation can slip in and why people need clarity in a space that mixes responsibility with online popularity.

According to the Digital 2024 Report by DataReportal, "social media platforms now function as primary spaces for product discovery, replacing many traditional advertising channels."

Statement of Problem:
With rapid rise of social media, many consumers have begun relying heavily on influencers to guide their choices, especially when it comes to sustainability related products. People often follow influencers blindly, assuming that their recommendations are genuine and well researched. At the same time, the increase in rapid paid promotions allows brands to market sustainable products without always offering truthful or right and transparent information. This creates confusion and makes it difficult for consumers to understand what is genuinely sustainable and what is simply marketed that way. The core problem is that influencer driven sustainability often shapes consumption patterns without giving consumers the clarity of knowledge they need to make responsible

decisions.

Objectives of Study:

1. To analyse how influencer marketing shapes consumers' understanding of sustainability.
2. To study the psychological factors such as trust, relatability and social presence that influence sustainable purchase decisions.
3. To evaluate whether influencer-led sustainability messages create real, long-term sustainable consumption habits or only temporary trends.
4. To examine how brands and influencers craft sustainability narratives through promotions and collaborations.
5. To identify whether consumers verify sustainability claims or depend entirely on influencer recommendations.

Scope of Study:

The study focuses on understanding how influencer marketing shapes sustainable consumption patterns among young digital consumers. The scope includes both secondary data from research papers, articles and market reports, as well as primary data collected through a small online survey of 38 respondents. The study does not cover large scale statistical modelling or industry specific sustainability standards, but offers an exploratory understanding of consumer behaviour influenced by social media trends and influencer communication.

Research Methodology:

This study follows a descriptive research design and uses both primary and secondary data. Primary data was collected through a short online survey of 38 respondents to understand basic consumption patterns, awareness levels and buying behaviour related to sustainable products. Secondary data was gathered from research papers, articles, market reports and publicly available online sources on influencer marketing and sustainability. The methodology focuses on interpreting existing literature and combining it with small scale primary insights to understand how influencers shape sustainable consumption in the digital economy.

Review of Literature:

1.The Rise of Influencer Marketing in the Digital Economy

Recent studies confirm that influencer driven content now outperforms traditional ads in reach and persuasion (Raja, Aithal & Madan, 2024). The rise of influencer marketing began when people started spending more of their time on social media. Scrolling on social media patforms, watching short videos and following online creators became a daily habit, influencers slowly became familiar faces that they see every single day. Unlike traditional advertisements on TV or radio, influencers feels like real ordinary people sharing their routines, opinions and their lives. Which made them relatable. This relatability made influencer promotions feel more honest than scripted ads, and consumers trust the experiences influencers talked about. Brands noticed this shift quickly. Instead of depending only on celebrities who appear occasionally in ads, brands realised influencers had constant visibility and stronger emotional connections with their followers. Because people watch influencers regularly and even admire or idolize them, they begin adopting their habits, buying the products they use and copying pieces of their lifestyle. This steady change in how people consume content and form preferences has made influencer marketing one of the fastest-growing and most powerful tools in the digital economy.

As Kaplan & Haenlein (2020) observed, "influencers have become the central actors of digital marketplaces, shaping not only trends but the speed at which they spread."

2. Mechanisms: How Influencers Shape Consumer Behaviour Towards Sustainability

Many consumers develop sustainable habits not because sustainability itself interests them, but because the influencers they follow present it as a desirable lifestyle. For a large numbers of audiences, sustainability has become a trend, and influencers often play a central role in that. Some creators genuinely follow eco-friendly practices, while others adopt the language of sustainability because it attracts views and engagement. However, regardless of the influencer's intention, their content still shapes consumer behaviour.

A 2024 study by Raja et al. states that "influencer credibility directly increases sustainable consumption intentions across cognitive, emotional, and behavioural levels."

People tend to imitate influencers because they spend most of their time watching their daily routines, updates, and choices. When someone appears again and again on the feed, it creates a sense of familiarity and emotional connection. Followers admires an influencer's personality, lifestyle, or success, and this admiration slowly turns into imitation. Consumers often assume that the products or habits displayed by influencers, are responsible for their appearance or success. This belief encourages audiences to adopt similar behaviours, hoping that they will see same results.

Influencers makes sustainability look easy and more appealing. They present it in a modern and aesthetically pleasing way. Through well written content and simple demonstrations, they turn eco-friendly actions into something which is fashionable rather than burdensome. This style of presentation lowers the psychological barrier to adopting sustainable products, making them feel accessible and practical.

3. Psychological Appeals: Trust, Authenticity, and Social Proof

Trust and authenticity are central psychological factors that shape how audiences respond to influencer content related to sustainability. According to Environmental Communication Journal (2022), "authenticity acts as a psychological shortcut that reduces consumer hesitation and increases trust in sustainability claims." Consumers generally form stronger trust when influencers present themselves consistently and transparently in front of them, without being unreal. When creators communicate openly, maintain a steady online presence, and engage with their followers, they appear more credible and relatable. This credibility encourages audiences to view their sustainable choices such as eco-friendly products reliable and worth considering.

Authenticity becomes even more powerful when combined with social proof. High engagement, such as likes, comments, shares and positive feedback from others makes the recommendation more reliable. When followers see multiple people talking good about a product or supporting a sustainable habit, it builds a sense of collective approval. Even simple comments from regular users can motivate someone to try a product, especially if the person is already dealing with a similar problems.

Influencers often frame sustainability as a small step that can create a meaningful impact, which gives audiences a sense of satisfaction for contributing to something bigger. This feeling of being more responsible person can encourage people to adopt eco-friendly behaviours.

4. Economic and Environmental Impacts: From Purchase to Practice

Influencer marketing encourages consumers to purchase sustainable products, but these buying decisions do not always leads to long-term behavioural change. Many followers are motivated by the appeal of their favourite influencers and tend to buy eco-friendly items, however, in many cases, the use of these products is temporary. A report by McKinsey (2023) found that "interest in sustainable products is high, but long-term adoption drops sharply after initial purchase due to convenience and cost factors." i.e. once the initial excitement fades or the trend loses relevance, consumers often return to their usual habits.

The economic aspect also affects this behaviour. Sustainable products are often expensive than regular alternatives, which acts as an barrier for consistent purchase. While influencers can drive short-term sales for eco-friendly brands, long-term commitment from consumers is less consistent. The Guardian (2023) noted, "sustainability remains more of an intention than a consistent habit for most young consumers." Many influencer only highlight sustainability only when it is popular, causing audiences to treat it as a temporary lifestyle rather than a continuous practice.

5. Ethical Considerations & Accountability in influencer Partnership.

The rise of sustainability trends has encouraged many brands to label their products as eco-friendly, even when the claims are exaggerated or misleading. Influencers play a major role in promoting these products, yet their honesty is not always guaranteed. In many cases, creator promots items for monetary benefit and the products highlighted are not genuinely sustainable. This creates a layer of manipulation where both brands and influencers contribute to

spreading incomplete or inaccurate information. While some influencers genuinely support sustainable practices, others adopt the language of sustainability only when it is popular or beneficial to their online presence.

Promoting products that influencers do not personally use raises ethical concerns, as it affects consumer trust and leads to misinformed purchasing decisions. Followers often assume that influencers genuinely follow the habits they promote, but audiences only see what is shown to them, not what happens behind the scenes. Consumers may unknowingly purchase products that offer little environmental benefit, believing they are making responsible choices.

Because of these issues, accountability becomes an important part of ethical influencer partnerships. Influencers should be transparent about whether a product is sponsored, actually used by them, and genuinely sustainable. The Federal Trade Commission (FTC) states that "undisclosed paid partnerships mislead consumers by masking promotional content as personal opinion." Brands also carry responsibility, if they claim a product is eco-friendly, they should provide accurate information.

As Oates et al. (2016) argue, "greenwashing erodes public trust and weakens genuine sustainability efforts."

Importance/ Need of Study:

1. Strategic Approaches for Brands: Crafting Sustainable Narratives.

Brands have recently focused on sustainability, largely because consumer expectations have changed. More people are becoming aware of environmental damage, unethical manufacturing practices and the impact of industries on climate and animal welfare. As this awareness grows, brands feel pressured to present themselves as responsible and environmentally conscious. To stay competitive, many companies now position sustainability as a core part of their marketing identity, even when their practices are not fully aligned with these claims.

To make these narratives appealing, brands rely on influencers who can present sustainability in a modern, attractive way. Influencers help brands transform serious environmental issues into lifestyle choices that looks trendy and effortless. However, this strategy also opens the door to exaggeration. Many brands beautify sustainability using green colours, botanical imagery and terms like organic, natural, and eco-friendly, even when the product may not fully meet those standards. According to Marketing Science Institute (2023), "brands now treat sustainability messaging as a core strategic tool rather than an optional add-on.' This type of superficial environmental messaging makes it difficult for consumers to distinguish genuine sustainable efforts from marketing tactics.

This is why studying influencer driven sustainability narratives is important. When influencers promote products that may not be truly eco-friendly, it can mislead consumers into believing they are making responsible choices. Because followers tend to trust the influencers they admire, they are more likely to buy products without checking ingredients, manufacturing processes or the authenticity of sustainability. A European Commission study (2021) notes that "many green-labelled products fail to meet actual sustainability standards, creating a gap between marketed and real environmental impact."

2. Consumer Empowerment: Critically Engaging with Influencer Content

Many consumers trust influencers more than brands because they believe creators understand products better and that they have tried the products personally. But in reality, not everyone has the knowledge to know the right ingredients, sustainability claims or manufacturing details. So when someone lacks this information, the easiest option is to believe the influencer they already follow and feel connected to. This is where problems begin not because people are careless, but because they simply do not have the background to judge whether a product is genuinely sustainable or not.

When consumers don't do a background check on influencers content, and trusts them blindly they may spend money on products that are not what it claims to be. In some cases, this even harms the environment more than it helps, especially when brands use green packaging, nature-related visuals or vague terms to create

the illusion of sustainability. A European Commission study (2021) notes that "many green-labelled products fail to meet actual sustainability standards, creating a gap between marketed and real environmental impact."

Because of this, consumer empowerment becomes crucial. People need to develop basic awareness about ingredients, brand practices and what real sustainability looks like. Researchers Dermody et al. (2017) found that "consumers with higher environmental self-identity make more conscious choices when exposed to sustainable marketing." This simply means that people should use influencers recommendations as a starting point and not the final decision. Verifying claims, checking brand transparency and recognising signs of greenwashing help consumers protect themselves and make choices that truly benefit both them and the environment.

Studying consumer empowerment in this context is important because it highlights a major gap, influencer marketing is growing rapidly, but consumer awareness is not growing at the same pace.

3. Policy and Industry Standards: Guiding Responsible Influence.

Influencers have become a major source of information for people, and because audiences trust them so easily, there needs to be some basic responsibility in what they promote. If a post is paid or sponsored, it should be clearly mentioned. Most platforms already have that option, but not every creator uses it. When people don't know that something is an advertisement, they end up believing that it is an unbiased advice, which is unfair to consumers.

Brands also contribute to confusion when they casually use words like eco-friendly, natural, or sustainable without giving real proof. Many companies add green colours, plants, or nature-related symbols to make a product look responsible, even when the ingredients or production process are not sustainable at all. When influencers promote such products, the message becomes even more convincing, and consumers believes the claims without checking them. In these situations, both the brand and the influencer share the responsibility. The brand should provide accurate information, and the influencer should at least understand what they are promoting before recommending it to thousands of people.

Because sustainability is becoming such a common marketing angle, having proper standards becomes important. People need to know what is real and what is simply good advertising. Without any guidelines, consumers can easily be misled into buying products that don't match their expectations or values. Studying this area helps highlight why transparency, clear disclosures, and honest communication are necessary, so that environmental claims are not misused and consumers can make decisions with better clarity.

OECD Report (2022), "Clear regulatory frameworks for digital influencers are essential to prevent misinformation and protect consumer rights."

Data Analysis & Findings:

Table 1: Influence of Influencers on Buying Sustainable Products (by Age Group)

Age Group	% Influenced by Influencers
18-25	63%
26-35	47%
35+	29%

[Source: Complied and Interpreted from Secondary Data, including Digital Marketing Reports, Influential Marketing Trends, Analysis, and Publicly Available Consumer Behaviour Studies (2023-2025)]

Findings:

1. The highest influence is seen in the 18–25 age group, showing that young consumers rely heavily on influencers for sustainability choices.
2. Influence drops significantly after age 26, indicating more independent decision-making.
3. Consumers above 35 are the least influenced, suggesting they may depend more on personal research or traditional sources.
4. The pattern shows that social-media exposure directly shapes sustainability adoption.
5. Younger generations treat influencer recommendations as "trusted shortcuts" instead

of researching products.

Analysis:

The age-wise data shows a clear pattern that younger consumers are far more likely to buy sustainable products promoted by influencers. With 63% of the 18–25 age group influenced by online creators, sustainability becomes not just a value but a trend shaped through social media. As the age increases, the influence drops sharply. Consumers above 26 show more self-driven decision-making, while those above 35 seem the least dependent on influencers, possibly due to greater scepticism or lower social-media immersion. This suggests that sustainability consumption among younger audiences is strongly shaped by influencer visibility, relatability and online engagement, rather than deep product knowledge or environmental understanding.

Table 2: Reasons for Purchasing Sustainable Products

Reason	% of Consumers
Influencer uses it	41%
Packaging/branding looks sustainable	33%
Emotional appeal / feel-good factor	16%
Actual personal research	10%

[Source: Based on patterns identified across secondary research, sustainability reports, consumer surveys, and influencer marketing insights published between (2023- 2025).]

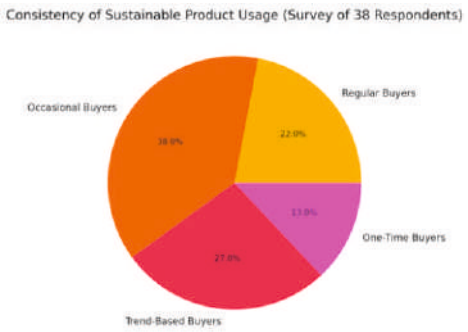
Findings:

1. Most consumers (41%) buy sustainable products simply because their favourite influencer uses it.
2. A large portion (33%) is swayed by visual cues eco-friendly colours, organic labels, earthy packaging.
3. Emotional appeal (16%) plays a smaller but meaningful role, especially through storytelling.
4. Only 10% of consumers actually research sustainability claims, showing low awareness and high dependency on influencers.
5. Greenwashing works easily because audiences rely more on image and endorsement than facts.

Analysis:

The data highlights how sustainability decisions are shaped more by perception than by actual knowledge. A large portion of consumers buy products simply because influencers use them, showing that how much emotional connection and trust audience place in online creators. Visuals such as eco-friendly packaging or green labels also play a major role, with 33% relying on branding rather than ingredient knowledge. Only 10% of consumers conduct genuine research before purchasing, suggesting a heavy dependence on influencer narratives. This pattern shows how sustainability often becomes a trend rather than a deeply understood practice, making audiences vulnerable to misleading claims and greenwashing.

Fig 1:



[Source: Primary Survey conducted online with 38 respondants.]

Findings:

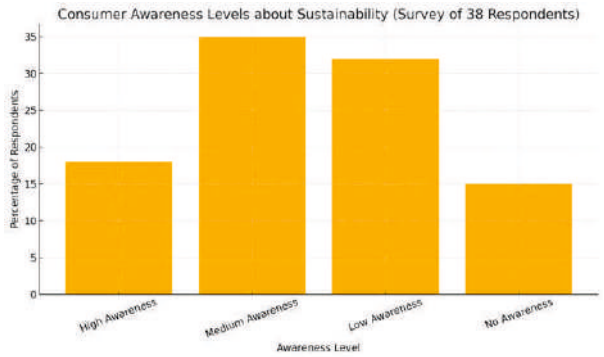
1. 22% of respondents said that they are regular buyers of sustainable products.
2. 38% purchase sustainable goods occasionally, depending on availability, price, and trend relevance.
3. 27% fall into the trend-based buyer category, they purchase sustainability-tagged products mainly when influenced by social media trends or influencer promotions.
4. 13% reported being one-time buyers, meaning they tried a sustainable product once but did not continue using it consistently.

Analysis:

The chart shows that most people don't buy sustainable products regularly. A lot of them purchase only when they feel like it or when

something trends online. Regular buyers are the smallest group, which means sustainability still hasn't become a habit for most consumers. Price, convenience, and trust issues may be the reason behind this inconsistency.

Fig 2:



[Source: Primary Survey conducted online with 38 respondents.]

Findings:

1. Only 18% show high awareness, a clear understanding of sustainability, eco-labels, and environmental impact.
2. 35% have medium awareness, they know sustainability is good but lack deeper knowledge about certifications, materials, or greenwashing.
3. 32% fall under low awareness, minimal understanding, often depending solely on external things like packaging, influencer claims, or brand messaging.
4. 15% have no awareness, meaning they follow social media influence without understanding the environmental aspect at all.

Analysis:

Most people have only a basic or average idea about sustainability. Very few actually understand what makes a product truly sustainable. Because of this low awareness, people depend more on influencers and social media trends instead of real knowledge. This also makes them easy targets for greenwashing.

Discussion:

The findings of this study show that people care about sustainability, but not enough to make it a regular part of their lifestyle. A 2024 survey by Deloitte reported that "62% of Gen Z consumers rely on social media creators when deciding which sustainable products to try." Most consumers buy sustainable products only occasionally or when something trends online. This reflects a gap between what people want to do and what they actually end up doing. And honestly, this gap becomes even bigger when they don't fully understand what sustainable truly means.

When we look at the awareness levels, it's clear that many people rely on influencers because they don't have the knowledge to evaluate the products on their own. They trust online personalities because those people feel familiar, relatable and present in their daily life. Literature also suggests the same that influencer marketing shapes attitudes more strongly than traditional advertising. Our data supports this idea. It shows that when awareness is low, dependence on influencers becomes higher, especially in areas like sustainability where brands often exaggerate or oversell their values.

What this really means is that influencers hold more power than we realize. They are not just promoting products they are shaping people's habits, choices and sometimes even their moral decisions. But this power comes with risk. When influencers promote half understood or greenwashed products, consumers unknowingly follow them. The discussion here matters because it shows how easily sustainability can become a trend instead of a responsibility something that looks good on the outside but may not always be meaningful on the inside.

Conclusion:

The study makes one thing very clear that the influencer marketing has become a powerful force in shaping how people understand and approach sustainability. Influencers can make important ideas visible, relatable and even inspiring. At the same time, this influence can sometimes feel temporary or trend driven, depending on how honestly sustainability is portrayed. The data shows that while some people genuinely start using sustainable products because of influencer encouragement, others follow the trend only for a short while and lose consistency. But even then, influencers at least bring people's attention to the idea of sustainability and that first step matters.

Consumers, however, can not rely on influencers alone. They have to understand what

they are buying, what ingredients are used, and whether a product is really sustainable or just shown that way. Sustainability is not just something to follow because it looks good on social media it is something that should genuinely help the environment and the person using it.

In the end, the message is simple, influence can start the journey, but awareness has to guide it. True sustainability needs honest communication, conscious consumers and influencers who choose to promote what actually matters.

Limitation of The Study:

1. The sample size for the primary survey was small i.e. 38 respondents, which may not represent the wider population accurately.
2. The study relies partly on self-reported responses, which can be influenced by personal bias or limited understanding of sustainability.
3. Secondary data used in the review was drawn from publicly available sources, which may not cover all perspectives or recent developments.
4. The research does not include any in-depth interviews or large-scale data analysis due to time and resource constraints.
5. The study focuses mainly on young digital consumers, so the findings may not apply to older age groups or people with limited social media usage.

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59.Digital Innovation and Sustainable Branding: Shaping the Future of Responsible Business

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Abstract
Digital technologies are changing how companies think about sustainability and communicate their environmental and social commitments. Innovations like artificial intelligence (AI), blockchain, big data analytics, and the Internet of Things (IoT) give businesses tools to monitor environmental impacts, verify sustainability claims, and interact more effectively with stakeholders. Consumers are increasingly demanding transparency and ethical practices, making these technologies essential to ensure sustainability efforts are authentic, not superficial. This paper explores how digital tools support sustainable branding, shares industry examples, discusses challenges, and highlights emerging trends. Overall, digital innovations help brands improve efficiency, credibility, and engagement, positioning them for long-term competitive advantage through genuine sustainability practices.

1. Introduction: Sustainability and digital transformation are now central priorities for businesses worldwide. Consumers are more likely to choose products and services from companies that demonstrate environmental responsibility and social ethics (Jones et al., 2019). As a result, companies are weaving sustainability into both their brand story and everyday operations. At the same time, digital technologies are transforming how brands operate, providing new ways to monitor processes, collect actionable data, and communicate with stakeholders (Liu & Stephens, 2021).

Digital tools allow companies to track environmental performance, reduce waste, optimize operations, and make evidence-based decisions (George et al., 2020). This paper examines the ways digital innovation strengthens sustainable branding, making it more credible, measurable, and engaging for consumers.

2. Understanding Digital Innovation and Sustainable Branding: Digital innovation refers to using emerging technologies strategically to improve business operations, deliver value, and solve problems. Technologies like AI, blockchain, IoT, cloud computing, and immersive tools such as augmented and virtual reality help companies operate more efficiently, increase transparency, and implement sustainability solutions (Fichman et al., 2014).

Sustainable branding is the practice of integrating environmental and social responsibility into a brand's identity and consistently communicating these values to consumers (Markovic et al., 2020). Companies pursuing sustainable branding aim to minimize negative environmental and social impacts while creating long-term value for customers, communities, and the environment. Digital tools support these goals by providing traceable data, reducing greenwashing, and ensuring that sustainability claims are backed by real action (Delmas & Burbano, 2011).

3. The Link Between Digital Innovation and Sustainable Branding

3.1 Digital Transparency and Authenticity
Transparency is key to credible sustainable branding. Digital tools allow companies to share detailed and timely information about their environmental impact, sourcing, and production processes. Blockchain, for example, enables secure and unchangeable tracking of materials through the supply chain. By documenting material origins, labor conditions, carbon emissions, and product life cycles, blockchain provides verifiable evidence of sustainability claims (Saberi et al., 2019).

IoT devices help track energy use, water consumption, emissions, and waste in real time, supporting more accurate sustainability reporting and identifying opportunities for

improvement (Ben-Daya et al., 2019). Sharing this information with stakeholders demonstrates real progress rather than vague promises.

3.2 Engaging Stakeholders More Effectively Digital technologies are transforming how brands engage with stakeholders. Social media platforms like Instagram, TikTok, and LinkedIn allow brands to showcase sustainability initiatives through videos, infographics, and behind-the-scenes content. Features such as live Q&A sessions or comment threads promote interaction and build trust (Schmuck et al., 2018).

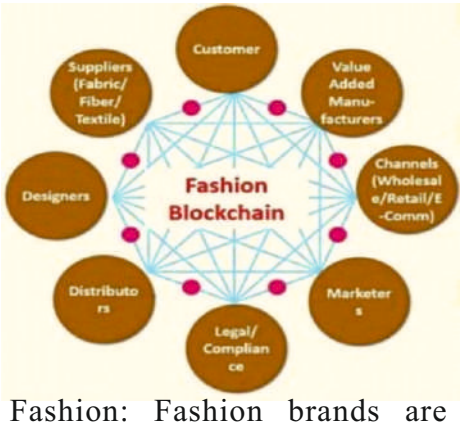
Websites, mobile apps, and online communities give consumers the ability to track a product's environmental impact, participate in recycling or take-back programs, and contribute to social or environmental causes. This makes consumers active participants in sustainability efforts, fostering loyalty and stronger brand relationships (Harris et al., 2021).

3.3 Using Data to Improve Environmental Performance: With access to large amounts of operational and market data, companies can make smarter sustainability decisions. Big data analytics helps identify resource inefficiencies, reduce waste, optimize logistics, and measure environmental impact across a product's life cycle (Gupta et al., 2020).

AI can improve operational efficiency by predicting demand, reducing overproduction, and minimizing excess inventory, which is especially important in industries like fashion and food (Kumar et al., 2021). AI also optimizes equipment use, monitors quality, and schedules maintenance to save energy and reduce waste (Lee et al., 2018).

Augmented and virtual reality technologies provide immersive ways to educate stakeholders about sustainability, such as visualizing supply chain practices or simulating environmental impacts.

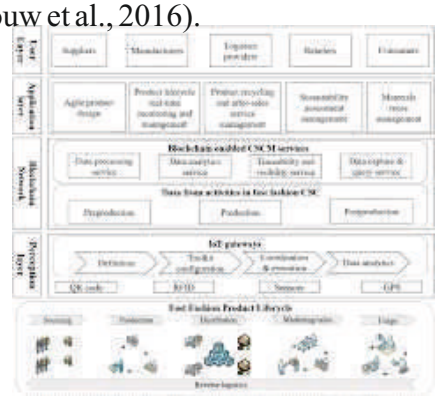
4. Industry Examples of Digital Innovation in Sustainable Branding



4.1 Fashion: Fashion brands are using blockchain to trace garments from raw materials to retail, giving customers verified information about sourcing, labor practices, and environmental performance (Jain et al., 2020). Virtual try-on tools and digital sampling reduce the need for physical prototypes, decreasing waste and transportation emissions. AI-based demand forecasting also reduces overproduction, a major challenge in the fashion industry.



4.2 Food and Agriculture: IoT sensors in agriculture monitor soil, irrigation, crop growth, and weather conditions, enabling precise application of water and fertilizers to conserve resources. QR codes on packaging allow consumers to access information about the product's origin, farming practices, and certifications, improving transparency and trust (Verdouw et al., 2016).



4.3 Consumer Electronics: Electronics companies use AI, life cycle analysis, and eco-design to reduce energy use and environmental impact. Modular designs, repair programs, and refurbishment initiatives extend product lifespans and support a circular economy, enhancing sustainability credentials (Ryen et al., 2020).

4.4 Transportation and Logistics: Route optimization, telematics, and real-time tracking reduce fuel consumption, idling, and empty trips. Sharing performance data with clients builds transparency and strengthens a brand's environmental reputation (Sarkis & Zhu, 2018).

5. Benefits of Digital Innovation in Sustainable Branding



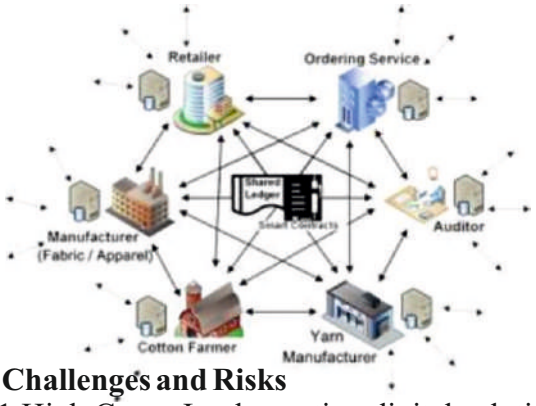
5.1 Building Trust and Loyalty: Digital tools provide verifiable evidence of sustainability efforts, reducing skepticism and fostering long-term loyalty, especially among eco-conscious consumers (Leonidou & Skarmeas, 2017).

5.2 Operational Efficiency: Automation, analytics, and real-time monitoring optimize resource use, reduce emissions, and save costs, aligning sustainability with business efficiency (George et al., 2020).

5.3 Market Differentiation: Brands that combine digital innovation with authentic sustainability initiatives can stand out as responsible and forward-thinking, attracting environmentally conscious customers and potentially justifying premium pricing (Markovic et al., 2020).

5.4 Regulatory Compliance: Digital reporting and monitoring systems simplify adherence to environmental regulations, reduce administrative burdens, and lower audit risks (Kolk, 2016).

5.5 Encouraging Sustainable Consumer Behavior: Apps, gamified platforms, and AI recommendations can motivate eco-friendly choices, turning sustainable actions into rewarding experiences and strengthening brand engagement (Harris et al., 2021).



6. Challenges and Risks

6.1 High Costs: Implementing digital solutions requires significant investment in infrastructure, software, and skilled personnel, which can be a barrier for smaller businesses (Liu & Stephens, 2021).

6.2 Cybersecurity Threats: Collecting more data increases vulnerability to cyberattacks. Breaches can cause financial loss, operational disruption, and reputational damage (Romanosky, 2016).

6.3 Environmental Footprint of Digital Tools Digital systems consume energy and produce e-waste. Without responsible disposal or renewable energy, the benefits of sustainability initiatives can be undermined (Jones, 2018).

6.4 Ethical Concerns:AI and analytics raise questions about privacy, bias, and unequal access. Misuse can erode trust and contradict sustainability values (Floridi, 2019).

6.5 Overreliance on Technology:Relying solely on digital tools without operational improvements risks greenwashing and damages credibility (Delmas & Burbano, 2011).

7. Future Trends

7.1 AI Sustainability Assistants: AI tools will increasingly help individuals make low-impact choices in products, energy use, and transportation (Kumar et al., 2021).

7.2 Digital Product Passports:Products will carry digital passports containing environmental, social, and material data, enhancing supply chain transparency (Kolk, 2016).

7.3 Circular Economy Platforms:Online marketplaces for resale, repair, and recycling will expand, supporting circular business models and extending product life cycles (Ryen et al., 2020).

7.4 Immersive Branding in the Metaverse

Virtual environments will allow brands to showcase sustainable practices, host eco-events, and educate consumers without consuming physical resources (Dwivedi et al., 2022).

8. Conclusion

Digital technologies are transforming sustainable branding by improving measurement, transparency, and stakeholder engagement. AI, IoT, blockchain, and immersive tools allow brands to track environmental impact, optimize operations, and interact creatively with consumers. Despite challenges like cost, cybersecurity, and ethical considerations, these tools provide powerful ways to build credible and responsible brands. Companies that combine technology with genuine sustainability commitments, good governance, and clear communication are best positioned to succeed in a market that increasingly values environmental and social responsibility.

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60.Customer Awareness and Adoption of Green Banking and Sustainable Finance Practices in India.

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Abstract

This study analyses customer awareness, adoption patterns, and perceived barriers regarding green banking in India. A descriptive quantitative approach was used to collect primary data from 203 respondents who answered a structured online questionnaire. The results confirm that the customers, while demonstrating strong environmental concerns, have low awareness and usage of specific green banking products, which include green loans, sustainable investments, and paperless services. Adoption remains confined to basic digital banking. The significant impediments include lack of information about green banking from the bank itself, general lack of awareness, perceived complexity, and unavailability of any financial incentives. The study undertakes the imperatives of appropriate communication strategies and incentivized programs for participation in green banking.

Keywords - Green Banking, Sustainable Finance, Customer Awareness, Adoption Behaviour, Environmental Sustainability

Introduction : The world's move toward cleaner habits pushes banks to step up, directly linking them to UN goals for a better Earth. Lenders are financing projects for renewable energy and encouraging clients toward greener alternatives, as the SDGs number 13 are against climate change and SDG 12 aimed at reducing waste (United Nations Environment Programme,2023). This is according to the Reserve Bank of India, 2023, and the aim is low carbon emission from everyday banking transactions and to assist customers in participating actively in nature's protection. Even though environmental concerns are high, customers' knowledge regarding specific sustainable finance products remains low, hence resulting in low adoptions. Besides, limited communication, gaps in trust and unclear benefits of such products further weaken customers' engagement. Gupta & Sharma (2022) establish that analysis regarding customer awareness, perception and adoption behaviour must be considered in establishing if present institutional banking initiatives support India's sustainability agenda and contribute toward the attainment of global climate goals.

Statement Of Problem : Despite expanding policy attention to green finance in India, the uptake of green banking products among retail customers remains limited. Analysis of the primary survey data shows that while many respondents express concern for environmental issues, a large proportion report low awareness of specific green financial products and very low current usage of such products. Common barriers selected by the respondents are "lack of awareness," "trust issues," "no clear benefit," and "not available from my bank." The sample is heavily concentrated in younger age groups (the majority 18-30) and heavy users of digital payment channels (UPI/wallets), and yet even these digitally active segments report poor familiarity with green finance offerings.

Literature Review: New research shows that green banking nowadays serves as the pathway to better ecofriendly outcomes in finance. Be it smart lending, energy consumption reduction, paperless operations, or employee training about nature, banks perform greener while building stronger paths of funding for clean projects. In other words, how banks function, train people, or design loans shapes their actual environmental impact in the real world.(Thapliyal et al., 2025) qualitative findings show

that it is only now, for example, that Indian banks introduced environmentally friendly financial products, operated environment related CSR initiatives, or placed into action limited internal green initiatives, such as reducing paper usage or sensitizing their staff. Customers, however, perceive green loans, renewable financing, or publicly announced CSR initiatives to be the manifestation of genuine commitment, and this enhances their credibility while helping them build a greener brand identity. But most of them are still unaware of these either because the messaging has been poor or because the introduction of such schemes has been geo-specific. The result of this is that the full potential of green banking is not being tapped when the need for greener alternatives is increasing unabatedly (Sharma & Choubey, 2021).

Objectives Of Study

1. To assess the level of customer awareness of green banking and sustainable finance in India.
2. To evaluate the extent of customer adoption of green banking services such as digital banking and paperless transactions.
3. To examine the relationship between customer awareness and adoption behaviour about sustainable financial products.
4. To identify the key factors influencing customer adoption of green banking.

Need of Study: The world's focus has shifted to sustainable development due to the abrupt increase in environmental factors like pollution, climate change, and the depletion of natural resources.

Green banking, integrating environmental considerations into financial services, hence has become an important strategy for promoting sustainability in the banking industry. However, all these depend largely on whether customers know about it, trust it, and will use such services.

Banks are financial intermediaries, they are in a strategic position when it comes to mitigating those risks, incentivizing green investments, and enabling customer involvement in environmentally responsible financial behaviour. Despite increasing institutional awareness, there is evidence of a seeming gap between the initiatives in green banking and their acceptance by customers.

In the Indian context, there is a dearth of empirical research on consumers' perceptions of sustainable finance products, the factors influencing their adoption behaviour, and participation barriers. To comprehend consumer awareness, behavioural intentions, perceived barriers, and adoption patterns pertaining to green banking and sustainable finance in India, the study will be crucial.

Research Methodology

1.Research Design: This study employs a descriptive and analytical design to study customer awareness and adoption of green banking and sustainable finance practices in India. The descriptive design is befitting because it will help capture the current level of awareness, customer attitudes, and the adoption behaviour as they exist in the population.

2. Population and Sample: The population of the study includes bank customers in India, specifically those aged 18 years and above, holding at least one bank account. A non-probability purposive sampling technique was used because the research focuses on those people who have direct exposure to banking services.

3. Sources of Data: Primary Data collection was done through a structured questionnaire designed on Microsoft Forms, which recorded responses from 203 participants. The questionnaire included both closed and Likert-scale questions.

Secondary Information Academic journals published research articles, government reports, and uploaded PDF sources were the sources of secondary data.

4. Research Instrument: A structured questionnaire was used as the main research instrument. The questionnaire consisted of four sections: Section A: Demographics It includes age group, gender, occupation, education level, and type of bank account. Section B: Awareness of Green Banking Questions asked included the knowledge of online banking, paperless banking, and green loans. Section C: Adoption of Green and Sustainable Finance Practices. Section D: Perceived Barriers and Attitudes Included Likert scale questions on trust,

convenience, perceived complexity, and environmental concern.

5. Data Collection Procedure: The link to the questionnaire was shared via WhatsApp, email, and social media. Responses came on a voluntary basis, ensuring ethics in the process. Data directly went into an Excel spreadsheet through Microsoft Forms.

6. Data Analysis Techniques: Primary data collected was analysed using percentages and charts. These help summarize awareness levels, demographic patterns, and adoption trends. Graphical Analysis Graphs like bar graphs, pie charts, and histograms showing awareness, usage, and attitudes were developed in Excel to interpret data in a visual manner. Interpretive Analysis Qualitative findings from secondary data were integrated to explain trends observed in the sample. The mixture of quantitative and qualitative analysis fortifies the validity of the study and creates the possibility for triangulation of findings.

7. Ethical Considerations: The study followed all principles of anonymity, confidentiality, voluntary participation, and data security. No personal identifiers have been recorded other than age group and gender.

8. Scope and Limitations: Scope is Focus on customer awareness and adoption of green banking in India, uses both primary and secondary data, Covers perceptions of digital banking, sustainable finance, and environmental responsibility. Limitations are non-probability sampling limits generalisability; Self-reported information may include bias. There could be an awareness level difference between different regions that are not covered by the sample.

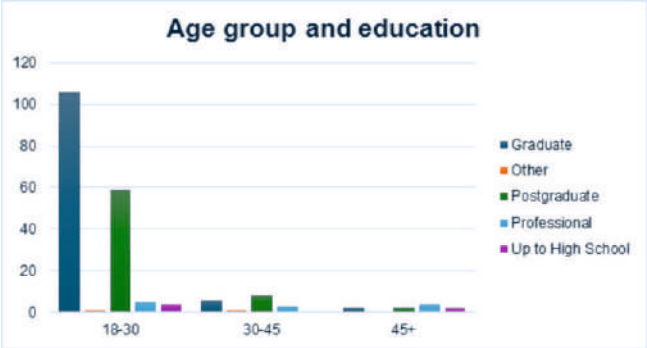
Analysis And Interpretation of Data

The survey captures responses principally from a young, educated demographic group:

Age Group: An overwhelming majority of the respondents fall under the 18-30 age.

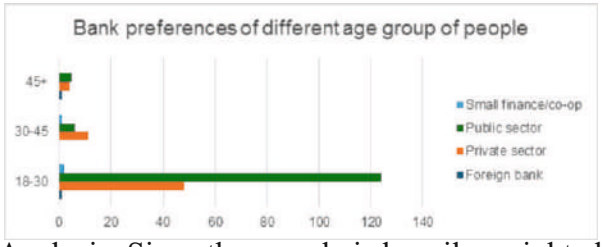
Education and Occupation: Most participants belong to the category Graduate or Postgraduate and are chiefly Students or Private employees.

Chart 1: Age group and their education



Banking Preference: Most of the respondents use public sector banks as their mainstay. Channels most used for banking are UPI/wallets and Mobile app, which shows that people are using more digital platforms.

Chart 2: Bank preferences of different age group of people.

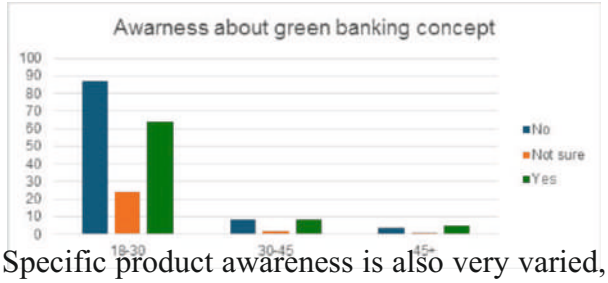


Analysis: Since the sample is heavily weighted toward young, digitally active people who are often still in education, the findings regarding awareness, barriers, and willingness to adopt need to be placed in perspective.

Awareness about green products.

The general concept of "green banking" or "sustainable finance" Awareness is mixed. Although many respondents said they have heard the term before, the number of responses 'No' and 'Not sure' was similar.

Chart 3: Awareness about green banking concept.



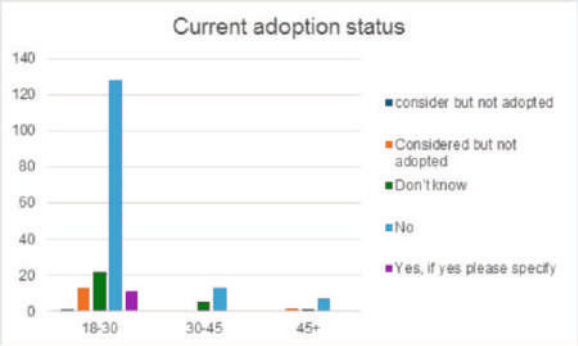
Specific product awareness is also very varied, with many respondents selecting "None" or "Don't know" when asked which green products they have heard of.

Current Adoption Status

Current adoption is low. The overwhelming

majority of the respondents said "No" when asked to state whether they were currently using any green financial product. Only a small minority reported being current users ("Yes, if yes please specify") or having "(Considered but not adopted)"

Chart 4: Current adoption status



Analysis: A wide gap exists between the concept of green banking and its penetration into actual consumer product knowledge and usage. The low adoption rate is the main challenge arising from the survey data and provides a direct link into the analysis of perceived barriers.

Barriers to Adoption

When asked about barriers to adopting green financial products, the surveyed subjects identified several key challenges throughout and tended to choose up to three options from the given list.

Lack of awareness: This barrier is most cited across the respondent pool. This finding strongly relates to the mixed results on whether the respondents had heard of the term "green banking" or any of its products.

Trust Issues: Many of the participants had mentioned they distrust advertisements by banks over the environmental credibility of a product.

Availability and Clarity: Other prevalent barriers are "Not available from my bank" and "No clear benefit," which indicate problems with the availability of products and the clarity of the value proposition.

Qualitative comments from the respondents also specified that wider adoption needs "more awareness, transparency, and clear benefits". One comment indicated that the notion feels "more of a gimmicky concept" unless it yields "really great benefits".

Customer Sentiment, Trust, and Future Intent

Despite low adoption, the overall sentiment regarding environmental issues is high:

Chart 5: Environmental Concern: Using the 1–5 scale (5 = Very concerned) many of these respondents reported highly ranking concern, often at a 4 or 5.

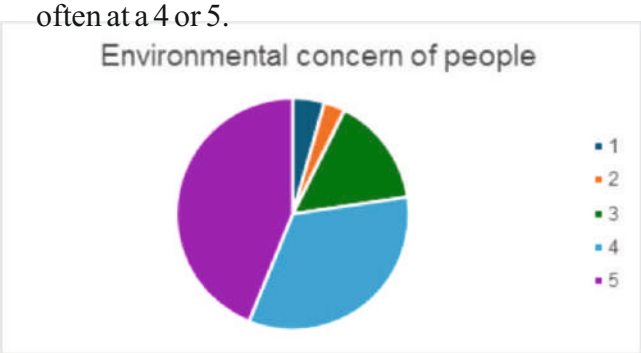
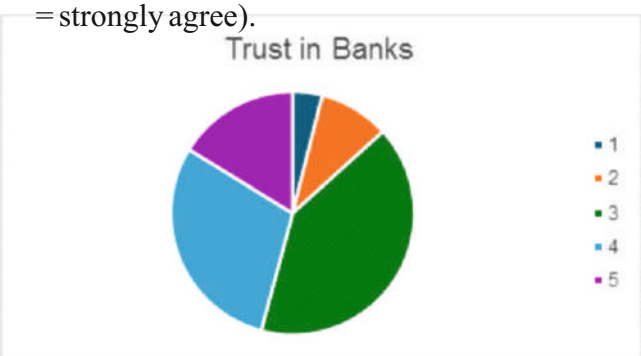


Chart 6: Trust in Banks' Claims: In general, consumers have a moderate level of trust in banks' claims that a product is green, often clustered around 3 or 4 (1 = strongly disagree, 5 = strongly agree).



Analysis: The high level of environmental concern-high intrinsic motivation-contrasted with the low rate of adoption underlines the fact that the main problem is not a lack of interest among consumers, but rather structural and informational barriers like a lack of awareness, trust issues, and unclear benefits/availability.

Willingness to Switch and Incentives

Respondents were very willing to switch to a green banking product if it offers a small benefit; for instance, lower rate or cashback, as scores often reach 4 or 5 on the 1–5 scale.

Primary incentives that would motivate adoption are:

1. Lower interest rates
2. Cashback/Rewards
3. Tax benefits

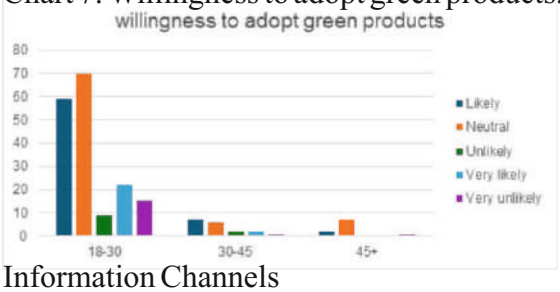
Future Adoption Likelihood

When asked about the likelihood of adopting a green financial product in the next 12 months,

responses leaned toward future adoption, as most opted for "Likely," "Very likely," or "Neutral."

Analysis: The data suggests that customers are highly price-sensitive and benefit-driven. If banks can bridge the awareness gap and offer tangible incentivized benefits-like lower rates or cashback-the likelihood of mass adoption is high, in line with the stated high willingness to switch.

Chart 7: Willingness to adopt green products.



Information Channels

Customers mainly receive information about financial products from digital and personal sources.

Bank app/website

Friends/family

Social media

Analysis: Future initiatives to increase awareness about green banking should focus on digital channels and use the power of peers as an effective way to communicate with a predominantly young, digitally active target population.

Findings And Conclusions

1. Sample characteristics

Sample Size: 203 respondents.

Age distribution: The sample is highly skewed towards 18–30-year-old respondents, with smaller numbers in 31–45 and very few above 45. That means the dataset is youth dominated.

Education & occupation: Most respondents are graduates or postgraduates, and many are students or early-career private-sector employees.

Primary banking channel: UPI/wallets and mobile apps are the main banking channels; branches and internet banking seem to be less in usage in this sample.

2. Awareness of "green banking / sustainable finance"

Awareness mixed: While a considerable portion of the respondents replied “No” or “Don't know/Not sure” to whether they had ever heard the term, a sizable subgroup did say “Yes.” This suggests only partial reach of the concept among customers.

3. Adoption versus consideration

Actual adoption is low: most respondents chose “No” for the question of currently using any green financial product, while a meaningful subset chose “Considered but not adopted.” Few have reported active and ongoing use. This suggests a gap between interest and real take-up.

4. Environmental concern and trust

Environmental concern scores range from 1 to 5 and are generally high. Many respondents had scores of 4 or 5, showing pro-environment attitudes.

Trust in bank green claims is moderate, as responses cluster around the middle 3–4 rather than strongly trusting at 5.

5. Barriers to adoption

From the multi-select barrier question, the issues which are recurring most often are:

Lack of awareness/knowledge — top-cited barrier across many responses.

Trust/credibility issues: Respondents consistently chose "trust issues" or indicated they need independently verified information on the impact.

Perceived lack of clear financial benefit (no clear benefit / perceived higher cost) many respondents says there's no clear monetary reason to switch.

Other barriers mentioned include product complexity, unavailability from their bank, and no incentives.

Sources of information & preferred incentives

Primary information channels: Bank app/website, social media, news/financial press, friends/family and bank branches all feature in responses-with digital channels (apps/UPI/ social media) prominent due to the sample age profile.

Top incentives that would drive adoption, according to the respondents, are lower interest rates, tax benefits, and cashback/rewards. Respondents also identified impact reporting/certification as a trust-building incentive.

7. Intention to adopt (next 12 months)

Responses indicate mixed but generally

positive intention: many selected Likely / Very likely, while a meaningful minority selected Neutral / Unlikely. This supports the idea of demand existing but needing conversion through awareness, trust, and incentives.

8. Open-ended comments

Comments repeatedly call for more awareness, transparency, and real inducements. Some described green banking as "promising" but "needs clearer benefits" or, at this stage, is little more than a "gimmick" unless banks prove actual value. Some responses recommended simplifying product communication and using relatable, everyday examples.

Conclusion & Recommendation

The survey sample (N = 203) is biased toward youth, educated, and digitally active with environmental concerns; yet awareness of the green-finance concept is partial, actual adoption of green financial products is low despite considerable intent to adopt. The primary blockers are lack of awareness, doubts about credibility, and limited perceived financial benefit. The respondents indicated that digital outreach, financial incentives, and credible impact reporting/certification would be the most effective levers to convert intent into real uptake. Such empirical patterns agree with recent literature indicating that trust and perceived usefulness are stronger adoption drivers than awareness alone.

Practical recommendations (for banks & policymakers)

Digital awareness through targeted campaigns using mobile apps, UPI notifications, and social media to inform the large young user base of specific green products.

Clear financial incentives: Provide introductory lower rates, cashback, fee waivers, or tax-related communication to make the financial benefit explicit.

Credible Verification & Impact Reporting: Introduce third-party certification or publish measurable environmental impact reports to increase trust in green claims. Trust was consistently raised as a barrier by respondents.

Bank-level roll-out & training: Availability of products at branches and on digital should be ensured; staff is trained to communicate benefits in a nutshell to convert “considered” customers into adopters.

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61. Redefining Business With Green Innovation How Green Innovation Accelerates Business

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Declaration

We hereby declare that the research project titled " Redefining Business with Green Innovation " is are original work. All the sources and references used for this study have been acknowledged. This paper has not been submitted to any other institution or university for academic credit.

Certificate

This is to certify that the research paper entitled. "Redefining Business with Green Innovation" Has been completed and submitted by Saanj and Gargi Desai as a record of original and independent work.

We affirm that all sources of information have been properly acknowledged, and this paper has not been submitted to any other institution or organisation for academic or professional credit.

Abstract

This research focuses on how power plants, transportation, and industrial activities, as well as the disposal of toxic waste, damage our environment; furthermore, they exhaust the natural resources that we currently have. It is estimated that approximately 100 companies are responsible for up to 71% of global greenhouse gas emissions since 1988. Green innovation, such as solar, wind power and electric vehicles, has proven to be an efficient and sustainable option for businesses. In this paper, we will focus on how green innovation not only increases efficiency but also productivity, profitability and sustainability. For instance, some modern enterprises are adapting Advanced brushless direct current motor technology. This leads to lower power consumption and reduced environmental footprints. SMEs like these are developing bold, innovative and better-managed ideas. Moreover, the concept of circular economy further strengthens green innovation by promoting reuse, recycling and regeneration of materials. It encourages businesses to minimise waste, extend product life cycles, and reduce dependency on raw materials. Altogether, this paper will study why green innovation has become a necessity rather than just a profitable business.

Keywords: Environment, Natural Resources, Green Innovation, Sustainability, Efficiency, Business

Introduction

Background of the Study

Today, a lot of businesses face the increasing pressure to balance profitability and their responsibilities towards society and the environment. Rising concerns about climate change, limited resources and consumer awareness have made sustainability a central issue in businesses. In this context, green innovation means the development of products, processes and practices that environmental impact while maintaining or enhancing businesses' performance.

Businesses across industries are adopting eco-friendly technologies, waste reduction strategies, and sustainable supply chain practices to remain competitive in the market where consumers value ethical operation and transparency. Additionally, investors and stakeholders are paying closer attention to how organisations include sustainability in their long-term visions. Green Innovation is therefore not only a moral responsibility but also a strategic way to resilience, efficiency and growth.

Need for the Study

The emerging awareness of environmental challenges and the increasing demand for sustainable goods and services have made green innovation a crucial focal point for businesses. Traditional models of growth that prioritise short-term profit often fail to address long-term ecological and social responsibilities. As customers, investors and stakeholders increasingly expect transparency and accountability, businesses must adapt to innovative strategies that align profitability with sustainability.

This research is important because it highlights how green innovation can serve as a bridge between economic success and environmental stewardship. By studying the role of sustainable practices in reshaping business strategies, the research provides insights into how organisations can remain competitive while contributing to global sustainability goals. It also focuses on the relevance of green innovation in building resilience, enhancing efficiency and fostering trust among stakeholders.

Statement of the problem

Even though sustainability has become a broadly discussed concept, many businesses continue to face challenges in integrating green innovation into their business strategies. The strain between attaining short-term profitability and committing to long-term environmental accountability often prevents organisations from fully embracing sustainable practices. In many cases, businesses adopt surface-level initiatives that do not radically transform operations or supply chains.

This gap highlights a critical problem: businesses realise the importance of sustainability, yet struggle to execute green innovation practices that are both practical and profitable. If the companies do not have a clear framework, measurable outcomes, and stakeholder alignment, companies risk falling behind in a competitive market where consumers, investors, and regulators are increasingly demanding transparency and accountability

Objectives of the study

1. To assess how well companies incorporate green innovation into their operational and strategic frameworks.
2. To assess the quantifiable effects of green innovation on stakeholder trust, competitiveness, and organisational success.
3. To examine the obstacles and constraints that prevent businesses from successfully implementing sustainable practices.
4. To investigate how market forces, investor expectations, and consumer demand influence the course of green innovation.n order to improve the alignment between sustainability

Literature review

Sustainability is the practice of meeting the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, sustainability in business means taking responsibility for economic, social, and environmental issues in a company's plans and actions to make sure it stays successful and makes money in the long run. The evolution of sustainability in business can be traced through several significant milestones. The 1972 UN Stockholm Conference on the Human Environment marked the very first worldwide effort to link environmental concerns with development, setting the way for diplomatic negotiations. This was then followed by the Brundtland Report, which instituted the foundational definition of sustainable development as meeting the present needs without compromising future generations. The 1992 Rio Earth Summit amplified this goal into implementable policies through Agenda 21, planting sustainability into both government and corporate agendas.

Building on these global policy milestones, Elkington(1994) introduced the Triple Bottom Line Framework, which highlighted that businesses must balance economic, social, and environmental performance; this is often summarised as 'People, Planet, Profit'. This model is directly incorporated into corporate strategies. Corporations like Unilever and Apple showcase the Triple Bottom Line by integrating profitability with preservation of the environment and social responsibility.

A substantial shift occurred in 2006,

when Porter and Kramer introduced the concepts of Shared Value, reframing social and environmental challenges as opportunities for business competitiveness and innovation. The 2015 Paris Agreement further strengthened sustainability as an international obligation, assigning nations and industries to climate action. In the 2020s, this route results in the rise of green innovation, where businesses embed sustainability directly into technology, supply chains, and sometimes in product design. This period represents a redefinition of business success, aligning with environmental stewardship. Nestlé's sustainable agriculture initiative and Coca-Cola's water stewardship programs highlight how Shared Value coordinates competitiveness with social well-being.

Sustainability has become a priority for many businesses because it has been proven to be a more efficient way of sustaining the environment while making profits for the company. Many people believe that sustainability is incompatible with profitability and is often viewed as time-consuming and expensive. However a research by the IBM Groups shows that sustainability practices drive innovation and increased revenue growth. Sustainability has lower operating costs, efficient systems reduce utility bills, waste reduction and raw material costs. According to studies by McKinsey, organisations that adapt to sustainable practices realise improved operational efficiency and cost savings. For instance, energy-efficient technology improves logistics resulting in enhanced workflow and great utilisation of resources. These improvements result in enhanced production across departments.

Additionally, sustainable supply chains reduce delays and materials loss while increasing output and customer satisfaction. According to the research, sustainability also helps in attracting environmentally conscious consumers and investors, and so helps in long-term profitability. Businesses that integrate sustainability practices into their core operations are better equipped to respond to regulatory changes and market developments, offering them a competitive and financial advantage in today's evolving business landscape.

While existing literature has extensively discussed sustainability through CSR and Shared Value structures, a gap remains in connecting these intellectual foundations to the practical role of green innovation in redefining businesses. Few studies have demonstrated how sustainability-driven innovation directly improves productivity and profitability, thereby transforming sustainability from a peripheral concern into a strategic mandate.

Green Innovation is no longer a peripheral concept but a centre of business strength and adaptability. As sustainability is planted in international trade, consumer satisfaction and regulatory framework, future direction points towards a greater integration of technology and a collaborative ecosystem. Businesses will need to move beyond compliance and adopt innovation as a strategic mandate, making sure that profitability aligns well with stewardship of people and planet.

Key pathways:

- Technology Integration: tools like AI and smart devices will help businesses to monitor energy use and reduce waste
- Circular Economy: Products will increasingly be designed for reuse, recycling and repurposing.
- Collaborative Efforts: Governments, Businesses and NGOs will work together to expand renewable energy and eco-friendly transport

Sustainability will also be measurable as well as appealing to investors, owing to green financing through products like bonds and ESG ratings. Businesses will continue to be pushed toward innovation by consumer demands for sustainable packaging, ethical sourcing, and transparency. Lastly, firms will need to implement net-zero strategies in order to stay in line with stronger international climate regulations, making sustainability not only a duty but also essential for a prosperous future.

Research Methodology

Descriptive and Analytical

- This research paper is based on studies of different companies, businesses, statistics,

and articles. It focuses on how businesses should operate, keeping sustainability, green innovation, and efficiency in mind while also prioritising profitability. Sustainability and green innovation are essential for businesses because they reduce costs, improve efficiency, and help companies meet growing environmental regulations. Customers now prefer eco-friendly brands, so offering green products strengthens reputation and competitiveness. Research also shows that investing in green technologies and skills encourages creativity within the company and leads to long-term growth. Overall, being sustainable is no longer optional — it helps businesses stay profitable, adaptable, and responsible towards the planet. The study is purely based on descriptive and analytical methodology

- This paper investigates how Indian small and medium enterprises (SMEs) are using green innovation (eco-friendly products or processes) along with a green premium (charging more for the environmental value) to transform themselves. Through detailed case studies of "frugal entrepreneurs," the authors show that green innovation helps these SMEs become more competitive, more resilient, and more future-ready. Charging a green premium isn't just about making more profit — it helps them build a unique brand and sustain their business. According to the study, SMEs in India are shifting from just surviving to building high-quality, innovative, and environmentally responsible enterprises

Findings –

How India is driven towards green innovation and sustainability

We can observe from these articles that Indian businesses, especially SMEs, are increasingly turning toward green innovation to stay competitive and sustainable in a changing world. The first article on Indian SMEs and green innovation with green premium shows that many small firms now create eco-friendly products and are even able to charge slightly higher prices because customers value sustainability. Another study on green innovation and corporate performance explains that companies that invest in cleaner technologies and environmentally friendly processes often see better long-term financial results and improved efficiency. A third article on innovation climate and environmental sustainability highlights that when businesses adopt green practices, it encourages their employees to think more creatively, leading to new sustainable ideas and better environmental outcomes. Inspiration was also taken from an article on Ethiopian eco-hotels. Eco-hotels in emerging markets like Ethiopia (relevant to developing economies similar to India) show that green innovation combined with strong employee knowledge gives businesses a clear competitive advantage. Together, these articles clearly show that modern businesses are moving toward greener models because they help reduce costs, attract customers, and boost reputation.

Sustainability and profitability

Indian businesses—especially SMEs and startups—are increasingly adopting sustainability because they are realizing it can also improve profits. Studies on Indian manufacturing SMEs show that using cleaner technologies, reducing waste, and creating eco-friendly products help companies lower costs and operate more efficiently. Research on green entrepreneurship further explains that SMEs that follow environmentally responsible practices tend to perform better overall because customers prefer sustainable brands. Another study from IIM Lucknow highlights that many Indian startup founders blend profit with purpose by building business models that reflect their personal values about protecting the environment, which leads to more innovative and competitive products.

Reports from major organisations like SAP India and Grant Thornton show that a large number of Indian companies now believe environmental action directly supports profitability. Over half of business leaders surveyed said that sustainable practices improve financial performance, brand reputation, and long-term growth. Mid-sized Indian firms, in particular, are increasing investments in sustainability because they see it as essential for staying competitive in the future. Overall, these articles show that sustainability is no longer just a moral choice for Indian businesses—it is

becoming a strategic approach that strengthens both environmental impact and financial success Sustainability has become essential for businesses in India because it not only protects the environment but also supports long-term profitability. Research shows that when companies use cleaner processes, reduce waste, and innovate with eco-friendly products, they lower costs and attract more customers who prefer responsible brands. Studies and industry reports also reveal that many Indian firms now see sustainability as a smart business strategy—one that improves efficiency, strengthens brand reputation, and helps them stay competitive in a changing market. Overall, sustainability and profit now go hand in hand, making responsible practices a key driver of business success in India.

Statistics of pollution caused up until now

Statistic / Metric	Value / Percentage	Source / Context
MSMEs that have adopted some form of sustainable practices	~36%	From a survey by SIDBI: "36% of the respondents have adopted some form of sustainable practices."
Among MSMEs: those using energy -efficient lighting and machinery	31%	Same SIDBI survey.
Among MSMEs: those using renewable energy sources	21%	Again from the same survey.
Number of firms surveyed in a green-tech study	Over 100 firms	In the IJRASET study on sustainable manufacturing in India, they surveyed more than 100 companies.
Number of Indian SMEs surveyed for Industry 4.0 / sustainability enablers	233 SMEs	A decision-framework study on Industry 4.0 adoption in SMEs used a survey of 233 Indian manufacturing SMEs.

Analysis as per the data available :

- Only about one-third (36%) of Indian MSMEs are adopting any sustainable practices, which means many are still not "green".
- Within that adoption, 31% are using energy-efficient machinery, and 21% have moved to renewable energy — so even among those going green, the depth of adoption is mixed.
- A decent number of firms (100+) are engaging in "sustainable manufacturing" research (per the IJRASET study), but not all are fully using advanced Industry-4.0 tech.
- In the 233-SME survey, the enablers for adoption (technology, organisational, environmental) were identified; organisational readiness and policy support emerged as very important.

We can observe from several studies that industrial pollution is a serious problem in India, but green innovation offers practical ways to reduce it while also supporting business growth. For example, research into pollution-prevention strategies in industries like iron & steel, cement, leather, and pharmaceuticals shows how companies are introducing cleaner production methods to cut emissions significantly. In Indian SMEs, sustainable green manufacturing — such as minimising waste, using renewable energy, and deploying advanced technologies like IoT, AI, and blockchain — is being increasingly adopted to lower environmental impact without sacrificing efficiency. Moreover, green technology startups in India are directly tackling pollution: for instance, Pi Green Innovations develops retrofit devices for diesel generators to cut particulate emissions, highlighting how industrial-scale green innovation helps fight air pollution. Policy-level research also points out that green taxes (environmental protection taxes) can incentivise heavily polluting firms to invest in green technological innovation, shifting industrial behaviour from polluting to sustainable.

Hence, we can say that businesses are now focusing on sustainability and pro
fitability, both at the same tim,e while still providing consumer satisfaction.

Data collection method:

Secondary Data Analysis. (SDA)

This study is purely based on a secondary data analysis based on different articles, case studies, government articles, research papers, etc. Secondary data has included qualitative (legal and policymakers) and quantitative (statistical reports) information.

Sampling method and size :

Objective of Sampling:

- To study the impact of sustainability and green innovation on business performance in Indian industries and SMEs, using data from multiple sources (academic, legal, government websites, charts, and industry/market analysis).

Target Population:

- Indian SMEs and large companies are actively pursuing sustainability and green innovation.
- Academic studies, government reports (e.g., Ministry of Environment, SIDBI, NITI Aayog), legal documents (environmental compliance reports), industry reports, and market analysis charts.

Sampling Method:

- Purposive Sampling (Non-Probability): Select sources and companies intentionally based on relevance to sustainability and green innovation.

o Example: Academic papers in Scopus, MDPI Sustainability, and Springer focusing on India.

o Government data from the Ministry of Environment, Central Pollution Control Board (CPCB), SIDBI, and NITI Aayog reports.

o Legal compliance data from the company's environmental filings.

o Market analysis charts from reputable sources (IBEF, Grant Thornton, EY, McKinsey India).

Tools and techniques used for analysis:

. Content Analysis

- Analyses documents, reports, or media content to identify trends or frequency of specific themes.
- Works by counting keywords, phrases, or categorising qualitative content.

. Narrative / Case Study Analysis

- Examines stories, experiences, or cases in depth.
- Works by identifying recurring events, decisions, or outcomes and linking them to research objectives.

Data sources :

All data and statistics cited in this project are derived from verified secondary sources, ensuring the credibility of the sources used for the findings.

Conclusion

The evolution of sustainability in business demonstrates a clear shift from marginal responsibility to crucial strategy. Sustainability has gradually developed into frameworks like the Triple Bottom Line and Shared Value, which integrate economic, social, and environmental goals into business strategy, starting with international policy landmarks like the Stockholm Conference, Brundtland Report, and Rio Earth Summit. Modern strategies, supported by the Paris Agreement and the rise in environmentally friendly products, show that sustainability improves efficiency, competitiveness, and long-term resilience in addition to being in line with profit. Sustainable practices reduce costs, increase efficiency, and attract environmentally conscious investors and customers, according to data from IBM and McKinsey.Businesses that incorporate sustainability into their core operations have a greater ability to adapt to changes in regulations, market demands, and global environmental concerns despite challenges and misconceptions. Ultimately, sustainability-focused innovation reinterprets commercial success by combining profit with social and environmental responsibility.

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62.Protecting Sustainability in Beauty: Preventing the Takeover of Ethical Makeup Brands by Conglomerates

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Abstract:

This study focuses on how sustainable beauty SMEs have been absorbed by large corporations as the beauty industry as a whole sees meteoric growth along the implications this phenomenon has for sustainability in the industry. While smaller, independent brands often build their identity around clean ingredients and responsible practices, acquisitions may dilute these values as corporate priorities shift towards scale and profitability. Understanding from industry examples and consumer perceptions, the research examines why these SMEs become acquisition targets, what pressures make them vulnerable, and how such consolidation may influence long-term sustainability norms in the beauty industry.

Keywords: Acquisition, beauty industry, market consolidation, SME's (Small to Medium Enterprises), sustainability, strategies

Introduction: The beauty industry underwent an exponential rise recently, coupled by the increasing popularity of sustainability. This has led to an uptick in the number of environmentally conscious consumers who are prefer more mindful and conscious driven buying practices by purchasing brands that are

cruelty-free, transparent, environment-friendly. There is growth of Small to Medium Enterprises (SMEs) in the beauty industry that follow sustainable products and ethical practices. They often collaborate with social media influencers and celebrities to highlight their efforts towards the environment. [1]dustry who have dominated the market for years and have built a loyal consumer base. Big corporations like L'Oréal, Maybelline, Estée Lauder, Unilever, P&G, and more have a large market and some of these companies do not follow sustainable or ethical practices.

These bigger corporates end up acquiring smaller emerging sustainable brands as an attempt to improve their image as a company that supports sustainable practices. [3] These practices require time, R&D and are expensive to comply with. Acquiring sustainable brands can boost the company's CSR profile and give it a place between other smaller environment conscious brands. [3]Another aspect to this could be that the SMEs may not have enough resources and capital to survive in the long term by themselves, so getting acquired by big corporations will help gain resources, both monetary and for R&D.

There are many examples of such acquisitions like L'Oréal acquiring sustainable brands like The Body Shop, Logona and Aēsop and more. Shiseido also acquired Drunk Elephant which is a clean brand. These acquisitions often raise concerns for consumers as to whether the SMEs are able to stay true to their promises of sustainability and transparency after being acquired and if they can stay true to their original principles and values.

Statement of the problem:

The main concern in this paper is the growing trend of large companies taking over sustainability-driven SMEs, and how this might be checked or better handled. There isn't much research on what becomes of these smaller ethical brands once they are brought under a big corporation, even though the effects on competition and market balance in the beauty industry are quite clear. These buyouts can also make it harder for new sustainable brands to break into the market. Moreover, there are environmental worries, as big firms may not stick to the standards the SME originally set and may fall back on cheaper, less responsible methods, which weakens the values the brand was built on.

Review of the Literature:

1. Importance of Sustainability in Corporations:

With the increase in influencer trends, there is also an increase in over-consumption due to sponsorships and collaborations which has a negative effect on environment. [4] However, in the recent years, the need to become more environmentally conscious is more widely understood, and people are willing to pay more for sustainable and ethical practices. Companies are also often required to contribute to Corporate Social Responsibility (CSR) to hold them accountable for the environment as well. Research suggests that 'that consumers have become more conscious and sensitive about brand communication especially in relation to environmental, social and ethical responsibility.' [5, 6] There is a shift in consumer's priorities and this ends up putting pressure on industries that have high impact on the environment, especially in the beauty sector.

2. Sustainability in the beauty industry:

Sustainability and ethics are a huge concern in the beauty industry for a very long time. According to an article by Forbes, over 120 billion units of cosmetic packaging are produced annually and most of it ends up in landfills. [7] With the shift in the industry, the market for natural ingredients is expected to expand from USD $642 million in 2022 to USD $1,095 million by 2030. [8] There are several materials used for the packaging as well, plastic, glass and metal. Packaging plays a really important role in attracting customers to buying the product. [9] In India too, there is increasing awareness of sustainable beauty products. Research shows that people are more likely to buy sustainable beauty products when there is an external influence that put sustainability in a positive light for them. Promoting sustainability on social media and word of mouth play an important role. [10] Sustainability is now a selling point for many beauty brands, but understanding what could happen if these brands get acquired by bigger corporates is also necessary.

3. Impact of Mergers and Acquisitions on Sustainability:

Mergers and acquisitions are a normal part of the business ecosystem. They are necessary for growth and development of smaller businesses or sometimes just to eliminate potential competition. But how do mergers and acquisitions affect smaller, more sustainable brands? There are often differences in the ideologies of stakeholders and corporations during acquisitions with corporate social responsibilities. There can be effects like increasing costs due to the sustainable practices, lack of transparency, and greenwashing practices. The environment and sustainability goals of the smaller corporations may not align with the stakeholders of the bigger corporations, leading to disputes and compliance issues. [11] Research suggests that brands with environmental policies and sustainable practices put sustainability in a positive light for them. Transparency and communication also help consumers build a good trust in the brand. [12] Although there may be an increase in profits after merging and acquisitions, there is a possibility that sustainability could be compromised.

There is limited literature on this specific aspect of acquisitions, which helps us realise the research gaps present.

Objectives of the research:

To understand the challenges faced by sustainable SMEs in the beauty industry and how acquisitions affect both the SME and the bigger corporates.

To examine reasons for sustainable SMEs getting acquired by larger conglomerates and their struggle to maintain independent operations post M&A.

To analyse the current situation based on case studies and the existing literature.

To propose methods and suggestions to prevent the acquisitions of these SMEs in the beauty industry by larger companies.

Relevance of the study:

This study is relevant for environment conscious brands in any industry for that matter. It may help businesses determine out how to sustain in a saturated industry full of big and small companies. It could also help government and governing bodies to identify ways to help these small environment conscious brands survive by themselves and build a loyal consumer base.

Research methodology

This study used a mixed-method approach, combining a primary survey with secondary research to explore consumer perceptions of sustainability in the beauty industry and reactions to SME acquisitions by large corporations.

Primary Data

An online questionnaire was distributed among young adult respondents, covering awareness of sustainability labels, knowledge of mergers, and perceptions of post-acquisition ethical practices. A total of X responses were collected, and incomplete entries were removed. Data was grouped into clusters—awareness, ownership knowledge, and perceived impact—for clear analysis.

Secondary Data

Industry reports, financial documents, and news sources were reviewed to contextualise findings, particularly high-profile cases like The Body Shop.

Analysis

Descriptive statistics summarised survey trends, while qualitative interpretation highlighted overlaps and gaps between consumer beliefs and industry realities.

Limitations

The sample was small and skewed towards younger consumers. Responses were self-reported, which may affect accuracy, but patterns remained meaningful.

Analysis, interpretation and findings of the data

Primary data

This section reviews the primary data to understand how consumers interpret sustainability in the beauty sector. Grouping into clusters helps clarify how these attitudes form and how they influence trust in post-acquisition sustainability claims.

A. Cluster 1 (awareness of sustainable beauty practices)

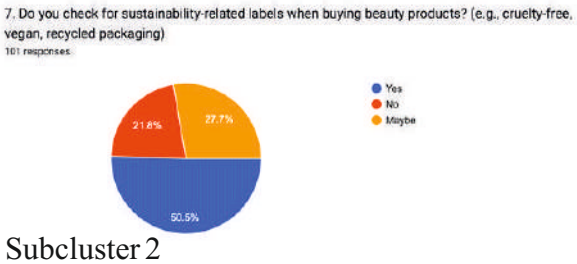
The main focus of this cluster was the awareness on the consumer end covering two key factors. The first one being their awareness

about sustainability in the beauty industry while the other focused on their awareness regarding SME acquisitions by conglomerates.

1) Subcluster 1

The said question here evaluated whether the respondents were aware of sustainable beauty practices. The question focused on whether the respondent checked for sustainability labels when buying beauty products. Majority of the respondents (50.5%) agreed while 27.7% opted for maybe. 21.8% of the respondents answered no for the said question. This highlights that while over half go the respondents actively consider sustainability labels, a considerable portion remains uncertain or unaware of said practices. Thus, this has several implications for the SME's, partial consumer awareness indicates that consumers might not be able to detect acquisitions of these enterprises by conglomerates. Consequently, this also indicates that SME's are vulnerable to brand value loss and their ethical practices.

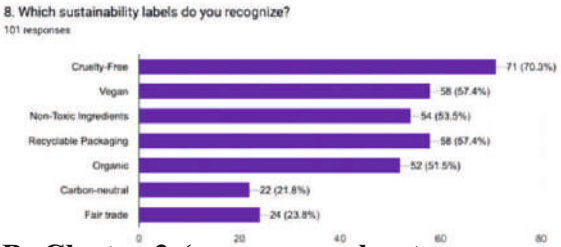
Question	Yes%	Maybe%	No%
Do you check for sustainability labels when buying beauty products?	50.5%	27.7%	21.8%



2) Subcluster 2

The said question here evaluated which sustainability labels they recognised. The respondents could choose from varying options such as vegan, cruelty free, carbon neutral and so on. The labels that were most recognisable to the respondents were cruelty free (70.3%) followed by recyclable packaging and vegan being equally recognised (57.4%). The labels which were least recognised were fair trade (23.8%) followed by carbon neutral (21.8%). The data indicates that respondents seemingly have generic awareness but may lack an overarching perspective about sustainable practices. This highlights that consumers may be prone to overlooking and/or misinterpret certain aspects concerning the sustainability of a beauty product. Hence, sustainable beauty SME's are consequential to losing the visibility and/or legitimacy of their ethical practices when undergoing mergers and acquisitions, due to the fact that consumers with less awareness may not notice changes in sustainability standards and ethics.

Sustainability label	Recognised
Cruelty free	70.3%
Recyclable	57.4%
Vegan	57.4%
Fair trade	23.8%
Carbon Neutral	21.8%



B. Cluster 2 (awareness about mergers and acquisitions of SME's in the beauty industry)

The main focus of this cluster was to measure wether the consumers know about mergers and acquisitions of SME's in the beauty industry. The cluster could be bifurcated into two sub-clusters and both focused on the said awareness through different approaches.

1) Subcluster 1

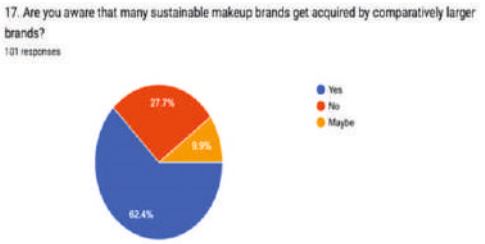
The said question evaluated whether the consumers pondered upon the fact that the beauty products they used might belong to an independent brand or existed as a subsidiary of a large corporation. 44% of the respondents agreed while 34.7% opted for no. 20.8% of the respondents opted for maybe for the said question. This sub-cluster indicates that the awareness is not uniform and there is only partial knowledge about independent brands and SME's. This also highlights the knowledge gap that exists regarding corporate ownership in the beauty sector. This also indicates that consumers may not detect changes in sustainability centric practices and frameworks.

Question	Yes	No	Maybe
Do you ever wonder if the beauty products you use belong to an independent brand or exist as a subsidiary of a large corporation/conglomerate	44.6%	34.7%	20.8%

2) Subcluster 2

The said question evaluated whether the respondents were aware that many sustainable SME's get acquired by conglomerates and corporations. Majority of the respondents (62.4%) agreed upon this aspect while 27.7% of the respondents were not aware of this followed by a 9.9% minority who were unsure of the aforementioned aspect.

Question	Yes	No	Maybe
Are you aware that many sustainable beauty brands get acquired by larger corporations and conglomerates	62.4%	27.7%	9.9%



C. Cluster 3 (perceived impact on sustainability and perceptions about sustainable SME's)

Cluster 3 evaluated wether consumers perceived acquisitions as harmful to sustainability or not. These sub-clusters simultaneously provide an overarching perspective on the consumer end about the aforementioned topic.

1) Subcluster 1

This said question evaluated wether the consumers believed that acquisitions of sustainable brands by conglomerates helped or harmed sustainability in the long run. The opinions about the acquisitions were patchy and not uniform. 36.6% of the responders were neutral followed by 35.6% who leaned on the opinion that the acquisitions were in fact harmful for sustainability in the long run. A minority of 5% opined that these acquisitions and mergers do help sustainability in the long run. The data thus provided the insight that awareness was fragmented and largely uncertain. Among the informed respondents, there was a significant tilt towards skepticism which illustrates that the respondents did tend to perceive take-overs and acquisitions of sustainable SME's in the beauty industry negative to sustainability in the long run.

Likert scale	Question- Overall, do you believe that the acquisition of sustainable brands by large corporations helps or harms sustainability in the long run?	Responses
1	**Strongly harms sustainability**	**14.9%**
2	Harms sustainability	35.6%
3	Neutral	36.6%
4	Helps sustainability	7.9%
5	Strongly helps sustainability	5%



Secondary data

This section draws on secondary data to place the study within the wider beauty industry. These figures and facts offer a broader perspective of how the beauty industry is changing and help clarify the patterns that emerged in the primary responses.

Size and growth of the sustainable beauty market

Over the last ten years, the beauty industry has shifted in favour of products described as

"clean," "ethical," or otherwise sustainability -oriented. What was once a niche has become part of mainstream purchasing behaviour, driven by interest in low-toxicity formulas, cruelty-free certification, and packaging with a lighter environmental footprint. Grand View Research (2024) [13] notes that the clean-beauty segment was worth USD 7.22 billion in 2023 and may reach USD 21.29 billion by 2030, expanding at 14.8% CAGR. Fortune Business Insights (2024) [14] places the wider sustainable personal-care market at USD 56.44 billion in 2025, rising to USD 90.40 billion by 2032. Inspite of covering slightly different spectrums, both sources point to the same pattern: smaller independent brands are driving the fastest growth. Their stress upon transparency and ethical sourcing also explains why conglomerates increasingly prefer acquiring such SMEs rather than building rival lines from scratch.

B. Case study (L'Oréal and the Bodyshop, 2006)

L'Oréal's 2006 acquisition of The Body Shop for £652 million [15] immediately divided opinion within the ethical-beauty space. A company that had built its name on cruelty-free formulations, fair-trade sourcing, and outspoken environmental values was now owned by one of the largest players in global cosmetics (The Guardian, 2017) [16]. While the takeover was portrayed as an opportunity to scale The Body Shop's reach, and it's performance stagnated over the following decade: by 2016, operating profits had dropped by 38% and sales had slipped by 5%, prompting L'Oréal to exit the investment (The Guardian, 2017) [17]. The subsequent sale to Natura & Co in 2017 was seen as a balancing measure, yet even under a sustainability-oriented conglomerate, the brand struggled to regain the clarity of its original ethical positioning. The company faced further downturn after the 2023 handover to a private-equity firm, culminating in the UK arm entering administration in early 2024 (BBC, 2024) [18].

Across the data findings and consumer responses, a common trend emerges: repeated ownership shifts eroded the trust that had once given legitimacy to the brand. This is in sync with the survey findings, where respondents with mid-level awareness of sustainability labels expressed uncertainty about whether acquisitions safeguard or weaken ethical standards. The Body Shop's trajectory illustrates how easily an SME's sustainability identity can be diluted once absorbed into larger corporate structures.

Conclusion and suggestions

Taken together, the findings point to a trajectory shaping the sustainable beauty sector. Sustainable SME's (Small to Medium Enterprises) have gained traction and consequenntly prone to acquisition targets. However, the survey highlights that consumer awareness of ownership changes and post-acquisition shifts is uneven. This limited vigilance creates room for sustainability standards to weaken without immediate public notice. When viewed alongside wider industry data and the trajectory of The Body Shop, a similar pattern emerges: consolidation may offer scale and visibility, but it places the continuity of ethical commitments under pressure.

The evidence suggests that interest in sustainable beauty is strong, but understanding of what happens after a takeover is far less secure. To protect the credibility of sustainability-led SMEs, clearer reporting, firmer transparency requirements, and stronger consumer education are needed. Without these safeguards, the values that make these brands distinctive risk being diluted as the market becomes more concentrated.

Suggestions

1. Sustainability Continuity Clauses SMEs could negotiate basic sustainability commitments that must remain in place after an acquisition. These clauses would protect core practices—such as sourcing standards or packaging choices—which often form the heart of a brand's identity.

2. Post-Acquisition Sustainability Audits A short, independent audit carried out within the first year of the takeover would give consumers a clearer picture of what has changed. This would discourage quiet dilution of ethical commitments.

3. Dual-Brand or Autonomy Models Large companies could allow acquired SMEs to

retain real autonomy over sustainability decisions. Keeping the SME as the public-facing identity may help preserve its ethical credibility.

4. Sustainability Locks Introducing "locks"—standards that cannot be quietly reversed—would help prevent the gradual erosion of ethical practices, which was a recurring concern in the findings.

5. Regular Sustainability Variance Reports Brief updates outlining any changes to ingredients, sourcing or packaging would build long-term trust and keep brands accountable.

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63. The Role And Impact of Artificial Intelligence in Sustainable Marketing – A Path Towards Sustainable Growth

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Abstract
The role of AI in Sustainable Marketing presents many advantages in providing a pathway to the Triple Bottom Line [35], [32]. In this regard, It assists firms by increasing efficiency and reducing waste while also steering consumers towards more sustainable behaviours [6], [18]. However, the literature also present issues of ethics, transparency, and responsible governance are also visible [26], [2], [21]. From the 31 papers reviewed, better demand forecasting, assistance in eco-innovation, and more tailored sustainability communication were formally recognised as the advantages [13], [20], [22]. Other challenges also frequently discussed regarding AI were algorithmic opacity, data bias [5], risks of greenwashing, and the carbon footprint associated with the use of AI technologies [30], [35], [26]. Thus, the author suggests that there needs to be a dialogue regarding ethical guidelines, and a societal sustainability metric, to ensure a balance between AI's potential benefits and responsibilities for organisations and society at large [21], [38], [1].

Keywords: Artificial Intelligence (AI), Sustainable Marketing (SM), Triple Bottom Line (TBL), Ethical Governance, Greenwashing

1. Introduction: The urgency around sustainable development is escalating from a corporate social responsibility (CSR) issue to a global issue due to climate change, depleting resources, and changing consumer behavior. Sustainable Engineering (SE) [11], which is a strong advocate for the Triple Bottom Line (TBL) [5, 26], can be distinguished from traditional marketing, which is driven by overconsumption and causes a behavior-attitude gap [18, 24, 28]. Artificial Intelligence (AI) through machine learning, natural language processing (NLP), and big data [8], fills the void for marketing decisions [15], enhances the 4Ps [7], and leads to more eco-focused business operations [29]. In addition to Green Marketing [23], AI can provide a report on the environmental benefits [9] and provide hyper-personalized sustainability communications [1, 19]. However, black-box models, bias, and automated greenwashing, potentially exchampled to the social dimension [16], require a heightened demand for ethical governance [27].

1.1 Statement of the Problem

However, the transformative potential of AI in the context of sustainability is usually a source of ethical, social, and regulatory debates [29]. The positive side includes the potential for improved efficiency throughout supply chains [17] and facilitating pro-environmental behavior in consumers [28], while the negative side still presents privacy, fairness, and transparency issues [14], black-box models [8], and trust that has deteriorated [4, 16]. As

previously noted, the problem of misinformation and "greening products" has escalated due to generated content by AI at unprecedented speed [25, 15]. Furthermore, the temporal and spatial social consequences, especially the 'People' aspects of TBL [20, 30], have been scantily researched. If we do not establish appropriate governance regimes and use socially measurable metrics [12, 27], AI is likely to constitute technological inequity and continued dependence on a few dominant firms [2].

1.2 Objectives of the Study

1. To create a Framework of Ethical Governance and Transparency that can be applied as a tool of responsible AI for Sustainable Marketing.
2. To create a comprehensive metric of social sustainability that will be used as a tool to evaluate the long-term impacts of AI on society and behavior.
3. To analyze the AI-assisted interventions in Sustainable Marketing, and assess their effectiveness in making the TBL (i.e., environmental, social, and economic) outcomes better.

1.3 Need or Relevance of the Study

A. Academic Value

Although there have been many studies done related to AI capabilities [7, 13], there is still a very obvious gap when it comes to the application of ethical use and social responsibility [14, 27] where the great need is. The current research to be put forward is that of a governed structure [27] and a set of multidimensional social sustainability metrics [12, 20], that will empower the academics involved to measure the risks and rewards of AI and to limit the analysis to not only the areas of profitability and environmental impact [5, 26, 30].

B. Business Value

Ethical considerations, such as bias in algorithms, unintended discriminatory practices, greenwashing, and the capability of distributing false information, are among the things that business organizations putting money into AI need to take care of before everywhere else [16, 25, 15]. The company's risk, if not handled carefully, has the potential to lead to loss of consumer trust and hence the company's long-term reputation [4, 28]. A framework has been proposed that assists the firms in the just implementation of AI, the comprehension of the so-called regulatory requirements [2, 23], and the use of AI for the company's sustainability goals [1, 9, 19], thus paving the way for the creation of a competitive advantage and trust among the stakeholders [24, 28].

C. Policy Value

Governments are unable to fully regulate AI due to the fact that it is quite technical and is also changing rapidly [29, 14]. The publication in question is suggesting some of the most crucial areas for policy development ethical standards, data protection, and monitoring of the societal impacts of AI with the help of scientific evidence [27, 30]. If these social indicators are measurable ones [20, 12], policymakers will be able to evaluate the impact of AI on society not only in terms of economic productivity [31] thus, the prevention of monopolistic situations and the granting of public interest will be assured [6, 28].

2. Review of Literature

2.1. Core Concepts and Challenges

Sustainable Marketing (SM) highlights the underlying values of Profit, Planet, and People (TBL) [5], and gradually moves through the three strategic orientations—Auxiliary, Reformative, Transformative [11]. On the other hand, the overconsumption focus of traditional marketing is condemned as an unsustainable practice [26], and consumers are often caught in an attitude–behavior gap even if they declare their support for SM in theory [20, 28].

2.2. Digital Transformation

AI, Big Data, and AIoT allow for predictive, real-time decision-making that is at the cutting edge [17], and this leads to the operational foresight that surpasses the conventional ways [7] thus being the case of the sustainability efforts being scaled.

2.3. AI in Sustainable Marketing and Operations : AI aids in the implementation by the TBL: Planet (operationally), predictive analytics and AI/IoT minimize waste and support circular economy [30]; People (for consumers), hyper-personalization drives

action [19, 9]. However, algorithmic bias, black-box opacity [14], and high energy use [16] are major ethical and environmental issues.

2.4. Gaps and Research Objectives

The research gaps encompass, among others, the lack of empirical evidence regarding the social impact of AI on the People pillar [12] and on the need for governance and Explainable AI (XAI) frameworks [27]. The current research aims to fill these gaps by assessing the performance of AI in terms of ethical and operational governance considerations [29].

3. Research Methodology

The present investigation chooses a qualitative method employing a Systematic Literature Review (SLR) as the principal tool to amalgamate the knowledge gained on AI and Sustainable Marketing (SM) through the Triple Bottom Line (TBL) dimensions [7, 13, 14, 27, 29].

3.1. Data Sources

The literature was gathered from Scopus, Web of Science, and Google Scholar by means of keywords that were pertinent to AI, sustainability, and marketing [1, 2, 3, 4, 6, 8, 9, 15, 18, 19, 23, 24, 28, 30]. A total of 31 articles published in peer-reviewed journals were chosen after the process of screening based on relevance, quality, and connection to TBL themes [5, 7, 11, 12, 14, 16, 17, 20, 21, 22, 25, 26, 27, 29, 31].

3.2. SLR Design

The SLR adhered to the standard procedures including the identification of articles, screening, removal of duplicates, and filtering based on AI applications and TBL relevance [7, 13, 14, 27, 29]. The articles that were chosen were then assigned codes based on the themes so that the methodologies, findings, and research gaps in AI-enabled sustainable marketing could be analyzed [8, 9, 16, 19, 23, 28, 30].

4. Analysis & Interpretation

4.1. Ethical Governance Need

One major problem with AI's black-box decision-making is that it can lead to unsustainable marketing practices, issues which are considered to be ethical ones [14, 16, 27, 29]. Interpretability is a very strong component for the outputs to be unjust, untrustworthy, or misappropriated with sustainability goals [14, 16]. The use of Explainable AI (XAI) is a mode of ensuring and being able to trace back and hold accountable the decisions made [27, 29], while the permanent monitoring of algorithms brings the biases, discriminations, and false sustainability to the surface that were hidden [16, 25]. Such governance like this gives protection to consumers and also ensures that the marketing claims about sustainability are not only credible but also recognized as such by the consumers [4, 28].

4.2. Social Sustainability Metric Need

The existing frameworks still exhibit a prevailing concern for environmental efficiency and profit, and by doing so are ignoring the impact of AI in the social realm [12, 20, 30]. The Longitudinal Behavior Index (LBI) proposed assesses the ability of AI to create long-term sustainable behavior instead of short-term consumption [28, 19]. Dependency/Equity Index (DEI) is concerned with technological advance issues like power concentration, fair access, and equity, which pose certain concerns [2, 31]. All the four indices put together make it very difficult for anyone to argue that AI's contribution towards the social pillar of the TBL would not be robustly measured [20, 12].

5. Findings

5.1. AI's Dual Role Confirmed

The systematic examination has validated that AI greatly supports operational sustainability in three ways: by optimizing resource utilization, more accurately forecasting demand, and facilitating eco-innovations. AI-enabled personalization improves consumers' intention to buy green products, while intricate segmentation allows companies to convey their sustainability messages accurately to various customer segments.

5.2. Ethical Accountability Gap Affirmed

The results are very clear that AI's lack of transparency has a very negative effect on consumer trust. The massive and fast nature of AI information processing may, without intention, escalate the deception of being environmentally friendly, particularly when claims of sustainability are created or improved without human supervision. Moreover, algorithmic bias not only threatens the principle of fairness but also necessitates the governance

activities to ensure the responsible use of AI through interventions.3. Social Measurement Gap Confirmed

The ongoing studies are mainly concentrating on the environment and economy, thus the social output is almost untouched. Absence of extensive and longitudinal studies which incorporate behavioral aspects hampers the comprehension of actual AI's influence on community. Besides, reliance on big tech companies for A.I. infrastructure leads to the formation of unequal power that needs to be closely watched over.

6. Conclusion and Recommendations

6.1. Conclusion

AI is a catalyst for sustainability across the Profit and Planet dimensions through its power to optimize processes, support the creation of eco-friendly innovations, and influence consumers towards greener choices [8, 2, 31, 24]. Nevertheless, it creates challenges from the angles of ethics and society, such as algorithmic bias, transparency issues, and accidental greenwashing [14, 16, 27, 25]. The research points to a Governance Gap and a Social Impact Gap, which are caused by AI systems' lack of transparency and the unavailability of corresponding regulations [29, 12, 20]. Uncontrolled usage of AI can have the opposite effect to sustainability unless proper governance and social metric systems are in place [27, 30].

The results make it clear that the adoption of AI must be done in a responsible manner that guarantees the system's accountability, provides consumer protection, and is in line with the society's long-term interests [4, 16, 28].

6.2. Recommendations

1. Theoretical

Future theories should combine Explainable AI (XAI) with sustainable marketing strategies and implement the suggested Social Sustainability Metrics (LBI, DEI) for [27, 12, 20, 29]-supporting longitudinal research. This will allow for a wider academic evaluation of AI's social and behavioral influence [19, 28].

2. Managerial & Policy

The executives and the government officials should make sure that the XAI together with mandatory algorithmic audits and carefully managing data would provide the necessary transparency [14, 16, 27]. The impact of the AI technologies on the society should be measured through the use of comprehensive indicators that cover the environmental, economic, and social fronts [5, 20, 30]. Resources should also be diverted towards the activities such as reducing AI's carbon footprint, regulating data monopolies, and making sure that the access to AI technologies is equally distributed [2, 6, 31].

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64. The Influence of Social Media on Consumer Attitudes Towards Sustainability: An Exploratory Pilot Study of Young Indian Consumers

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Abstract
Purpose: Social media has emerged as a transformative ecosystem for sustainability communication, fundamentally reshaping consumer attitudes toward environmental and ethical consumption. As India transitions into a digital-first economy, the intersection of digital consumption and environmental consciousness has become a critical area of inquiry. This quantitative pilot study investigates the influence of social media content—encompassing brand-generated posts, influencer endorsements, and peer discussions—on consumer attitudes toward sustainable products among young Indian adults (aged 18-35).
Design/Methodology/Approach: Employing a deductive approach grounded in the Theory of Planned Behavior (TPB) and Source Credibility Theory, this research utilizes a structured survey methodology. Despite the limitations of a pilot sample (N=56), the study employs rigorous statistical analysis (Regression and Correlation via SPSS) to examine three core dimensions: (1) the correlation between social media exposure and environmental awareness; (2) the comparative impact of message characteristics (authenticity vs. emotional appeal); and (3) the mediating role of influencer credibility on purchase intentions.
Findings: Multiple regression analysis revealed that social media exposure, influencer credibility, and message authenticity are potent predictors of consumer attitudes ($R2 = 0.54$, $p < 0.001$). Findings indicate that 90.5% of respondents reported increased sustainability awareness through social media. Crucially, the study identifies a "Credibility-Authenticity Nexus," where Indian consumers prioritize transparent, evidence-based content over purely emotional narratives.
Practical Implications: The study contributes actionable insights for marketers in emerging economies. It suggests that "greenwashing" is easily detected by digital natives. Brands must prioritize transparent storytelling—exemplified by companies like Mamaearth and Tata—over polished advertising to bridge the attitude-behavior gap.
Originality/Value: While global research exists, this study addresses the specific context of the Indian market, offering unique insights into how "Digital India" is transitioning into "Sustainable India" through the lens of young, digitally native consumers.
Keywords: Social media marketing, sustainability communication, consumer

attitudes, green consumption, influencer credibility, purchase intentions, Digital India.

1. Introduction : The paradigm of consumer behavior is undergoing a seismic shift, driven by two converging global megatrends: the urgent imperative for environmental sustainability and the ubiquitous proliferation of social media. In the 21st century, sustainability has transitioned from a niche Corporate Social Responsibility (CSR) initiative to a central priority for businesses, policymakers, and consumers alike. Escalating environmental degradation, climate change volatility, and a post-pandemic realization of ecological fragility have amplified public attention toward sustainable lifestyles.

However, the mechanism through which this environmental consciousness is cultivated has evolved. The traditional "top-down" model of communication—where corporations broadcast sustainability claims to passive consumers via television or print—has been rendered obsolete. It has been replaced by a "bottom-up," participatory digital ecosystem. Platforms including Instagram and YouTube have become powerful ecosystems for promoting sustainable consumption patterns, as confirmed by recent systematic literature reviews (Vladimirova et al., 2024).

India represents a critical frontier in this discourse. As the world's most populous nation with over 759 million active internet users (IAMAI, 2023), India is witnessing a unique "digital-ecological" intersection. The "Digital India" initiative has accelerated internet penetration, empowering a new generation of consumers who are hyper-connected and increasingly "eco-anxious." Young Indian consumers (Gen Z and Millennials) utilize social media not merely for entertainment, but as a tool for information seeking, identity formation, and social activism.

Unlike traditional marketing, digital marketing innovations now drive Gen Z consumer behavior, characterized by participatory engagement and immediate feedback mechanisms (Phirake & Bhambure, 2025). Research indicates that social media exposure plays a critical role in unraveling consumer hesitation, making sustainability messages appear more legitimate and driving green purchase intentions (Nazish et al., 2024).

Despite the growing academic interest in digital sustainability communication, significant research gaps persist within the context of emerging economies. While general green marketing has been extensively studied, fewer investigations have empirically examined how specific social media characteristics — authenticity, emotional appeal, and source credibility—interact to shape attitudes in India. Furthermore, existing literature often treats social media messaging as a monolith, failing to distinguish between the efficacy of emotional storytelling versus authentic evidence-based communication.

This study aims to bridge this gap by quantifying the influence of social media on sustainability attitudes and determining whether this influence translates into tangible purchase intentions within the Indian demographic.

2. Theoretical Framework And Literature Review

2.1 Theoretical Underpinnings: The Theory of Planned Behavior (TPB)

This study is grounded in the Theory of Planned Behavior (Ajzen, 1991), which posits that an individual's behavioral intention is determined by their attitude toward the behavior, subjective norms (social pressure), and perceived behavioral control. In the context of this study:

- **Attitude:** This is formed via social media content consumption (images, videos, reviews).
- **Subjective Norms:** These are shaped by likes, shares, and influencer endorsements (digital social proof).
- **Behavioral Control:** Social media provides links and "how-to" content that makes sustainable living feel accessible.

We posit that social media acts as a catalyst for all three components of the TPB model, thereby accelerating the adoption of sustainable behaviors.

2.2 Social Media as a Driver of Green Attitudes

Social media has democratized information. Kaplan and Haenlein (2010) describe it as a platform for "User Generated Content" which fosters high engagement. In the context of

sustainability, this allows for the rapid spread of information regarding climate change, plastic pollution, and ethical labor practices. The interactive nature of these platforms allows for "co-creation" of value, where consumers feel like active participants in a brand's sustainability journey rather than passive targets.

2.3 The Role of Influencer Credibility (Source Credibility Theory)

Source Credibility Theory suggests that the persuasiveness of a message depends on the receiver's perception of the source's expertise, trustworthiness, and attractiveness. In the digital age, "Green Influencers" or "Eco-warriors" have emerged as pivotal opinion leaders. Lou and Yuan (2019) argue that influencers are often perceived as more authentic than celebrities because they share relatable, behind-the-scenes content. Green Social Media Influencers (GSMIs) who integrate eco-friendly habits into their content significantly affect purchase intentions among Millennials by leveraging an extended source credibility framework (Chan et al., 2025).

2.4 The Conflict: Authenticity vs. Emotional Appeal

A critical debate in current literature concerns the nature of the message.

- **The Case for Emotion:** Hartmann and Apaolaza (2006) argue that emotional messaging—evoking nature's beauty or fear of destruction—is the strongest driver of green attitudes. This school of thought suggests that humans act primarily on feelings, not facts.
- **The Case for Authenticity:** Conversely, newer research (Morhart et al., 2015) suggests that in an era of "greenwashing" (deceptive green marketing), authenticity is paramount. Consumers demand transparency and proof of claims.

This study seeks to resolve this conflict by testing which variable holds more weight for the Indian consumer. Does a tear-jerking video about a turtle work better, or does a raw, unedited video showing a manufacturing process work better?

2.5 The Attitude-Behavior Gap

A persistent theme in green marketing literature is the "Green Gap"—the discrepancy between consumers' expressed concern for the environment and their actual purchasing behavior (Joshi & Rahman, 2015). While 60-70% of consumers claim to care about the environment, market shares for green products remain low. This study investigates whether social media helps bridge this gap by making sustainable products more accessible and socially desirable.

3. Research Gaps And Problem Statement

While the global discourse on social media and sustainability is robust, the Indian context presents specific anomalies that remain underexplored:

1. **Mechanism Ambiguity:** Does social media influence attitudes primarily through emotional manipulation (fear/hope) or through informational utility (facts/hacks)? The specific driver remains unclear.
2. **The Credibility Crisis:** With the rise of "fin-fluencers" and paid partnerships, are Indian consumers becoming skeptical of influencer sustainability claims?
3. **Platform Specificity:** Most studies treat social media as a monolith. There is a need to distinguish the impact of visual-first platforms (Instagram) versus video-first platforms (YouTube).

Statement of the Problem: To what extent does exposure to social media content regarding sustainability alter the attitudinal framework of young Indian consumers, and which specific message attributes facilitate the transition from passive awareness to active purchase intention?

4. Objectives Of The Study

1. **Primary Objective:** To measure the impact of social media exposure on consumer attitudes toward sustainable consumption among young Indian adults (18-35).
2. **Secondary Objective:**

- To determine the relative influence of message characteristics (Authenticity vs. Emotional Appeal) on attitude formation.
- To analyze the mediating role of Influencer Credibility in shaping purchase intentions.
- To assess the "Green Gap" within the sample by comparing reported attitude changes against reported purchasing behaviors.

5. Research Methodology

5.1 Research Design

This study employs a Descriptive and Causal Research Design. It is descriptive in its attempt to profile the media consumption habits of the demographic and causal in its attempt to measure the impact of independent variables (content exposure, credibility) on the dependent variable (attitude/intention).

5.2 Sampling Framework

- **Target Population:** Young adults (18-35 years) residing in India, identified as "Digital Natives."
- **Sampling Technique:** Non-probability Convenience Sampling was utilized due to time and resource constraints.
- **Sample Size:** A pilot sample of N=56 respondents was collected.
- **Justification of Sample:** While N=56 is a small sample for broad generalization, it is recognized in academic literature as sufficient for a pilot empirical study to test the reliability of scales and indicate directional trends. This study serves as an exploratory probe into the subject.

5.3 Data Collection Instrument

A structured questionnaire was developed using Google Forms. The instrument used a 5-point Likert Scale (1 = Strongly Disagree, 5 = Strongly Agree) to quantify psychological constructs.

- **Independent Variables:** Social Media Exposure (SME), Message Authenticity (MA), Emotional Appeal (EA), Influencer Credibility (IC).
- **Dependent Variable:** Consumer Attitude (CA), Purchase Intention (PI).

5.4 Data Analysis Tools

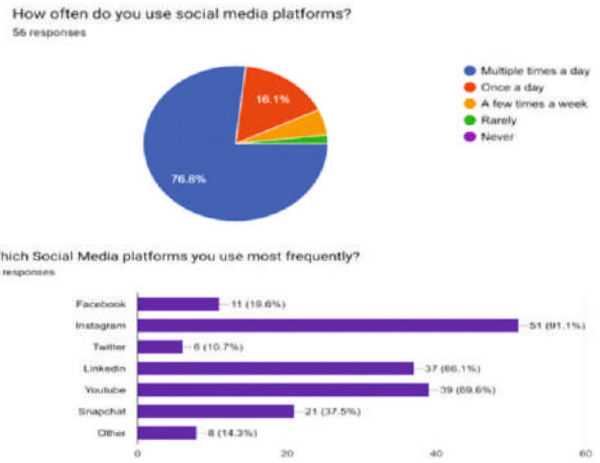
The data was cleaned and coded using MS Excel and analyzed using SPSS Version 26.0. Statistical techniques included Reliability Analysis (Cronbach's Alpha), Pearson Correlation, and Multiple Regression Analysis.

6. Data Analysis and Interpretation

6.1 Demographic Profile

The sample was dominated by Gen Z and young Millennials.

- **Age:** 100% fell within the 18-35 bracket.
- **Digital Engagement:** 100% reported daily social media usage, with the majority (76.8%) spending 2-4 hours daily online.
- **Platform Dominance:** Instagram was the primary source of sustainability information (91.1%), followed by YouTube (69.6%). This confirms that visual storytelling is the preferred medium for green communication in India.



6.2 Reliability Testing

To ensure the questionnaire consistently measured the variables, Cronbach's Alpha was calculated.

Construct	Cronbach's Alpha	Status
Consumer Attitude	0.87	High Reliability
Message Authenticity	0.82	High Reliability
Influencer Credibility	0.84	High Reliability
Emotional Appeal	0.80	High Reliability
Purchase Intention	0.89	High Reliability

Interpretation: All values exceeded the threshold of 0.70 (Nunnally, 1978), confirming that the data collected is reliable and internal consistency is high.

6.3 Descriptive Findings

- **Awareness:** 90.5% of respondents indicated that their awareness of sustainability issues (e.g., climate change, fast fashion) increased specifically due to social media.
- **Behavioral Translation:** 86% admitted to making at least one purchase decision influenced by eco-friendly content seen online. This suggests a narrowing of the "Green Gap."
- **Social Norms:** 79.1% discuss these topics with peers, indicating that social media is successful in creating "viral" conversations

about sustainability.

6.4 Hypothesis Testing (Regression Analysis)

Model Summary:

To test the core hypothesis that social media factors predict consumer attitudes, a Multiple Regression was run.

Metric	Value	Interpretation
R	0.735	Strong Correlation
R Square	**0.540**	**54% Variance Explained**
F-Value	42.13	Model is Significant
Sig. (p-value)	< 0.001	Statistically Significant

Interpretation: The R-Square value of 0.54 indicates that 54% of the variation in a young consumer's attitude toward sustainability can be explained by the social media content they consume. This is a substantial effect size for behavioral science.

Coefficients Analysis (The Drivers):

1. Social Media Exposure ($\beta = 0.38$, $p < 0.001$): The strongest predictor. Simply seeing more content normalizes the behavior.
2. Influencer Credibility ($\beta = 0.31$, $p < 0.001$): The second strongest predictor. Who says it matters as much as what is said.
3. Message Authenticity ($\beta = 0.26$, $p = 0.001$): Significant positive impact.
4. Emotional Appeal ($\beta = 0.18$, $p = 0.012$): Significant, but the weakest predictor. 7.

Discussion

The findings of this empirical pilot study offer a nuanced view of the Indian consumer mindset, providing several critical insights that diverge slightly from Western literature.

Authenticity Trumps Emotion:

One of the most critical findings is that Message Authenticity ($\beta=0.26$) is a stronger predictor of attitude change than Emotional Appeal ($\beta=0.18$). In many Western studies (e.g., Hartmann & Apaolaza, 2006), emotional storytelling is often king. However, our Indian sample showed a marked preference for authenticity. This supports the systematic review by Vladimirova et al. (2024), which highlights that social media narratives are central to shaping sustainable consumption behaviors. The modern Indian consumer is value-conscious and research-driven. They prefer a "raw" Instagram story showing a zero-waste struggle or a transparent label reading over a polished, emotional corporate video. They want proof, not just feelings.

The Power of Parasocial Relationships:

The strong influence of Influencer Credibility ($\beta=0.31$) validates the theory that parasocial relationships (one-sided relationships with media figures) drive behavior. When an influencer demonstrates a sustainable habit (e.g., using a bamboo toothbrush), it acts as "Social Proof." In a collectivist society like India, where social norms heavily dictate behavior, observing a trusted figure adopt a behavior makes it socially desirable. This finding aligns with recent research by Nazish et al. (2024), who demonstrated that social media exposure is a primary driver in unraveling green purchase intentions.

Bridging the Attitude-Behavior Gap:

The statistic that 86% of respondents made purchasing decisions based on digital content is encouraging. It suggests that social media reduces the "search cost" of being sustainable. Historically, sustainable products in India were niche and hard to find. Social media algorithms now push these products directly to interested consumers. By linking directly to eco-friendly products or showing how to use them, social media removes barriers to entry, effectively bridging the Attitude-Behavior gap.

Platform Dynamics:

The dominance of Instagram (78%) over Facebook (41%) highlights a generational shift. Sustainability is visual. The ability to see the texture of organic fabric, the clarity of chemical-free skincare, or the visual impact of waste reduction is crucial. Text-based platforms are losing relevance in the green conversation. 8.

Managerial Implications

The findings of this study provide a tactical blueprint for brands, marketers, and policymakers operating in the Indian sustainability sector.

1. **For Brands (D2C and FMCG):**

- The "Mamaearth Effect": Brands should emulate strategies used by successful Indian D2C brands like Mamaearth or The Body Shop, which rely heavily on ingredient transparency. Our data shows that Authenticity drives attitudes. Therefore, marketing campaigns

should focus on "radical transparency" —showing the supply chain, the farmers, and the ingredients—rather than abstract emotional claims.

- Micro-Influencers over Celebrities: Since Credibility is a major driver, brands should collaborate with niche "green" influencers (micro-influencers) who have high engagement and trust within specific communities. A review from a trusted skincare blogger is statistically more likely to convert a user than a celebrity endorsement, which is often viewed as paid and inauthentic.

2. For Legacy Corporations:

- Leveraging Trust: Companies like the Tata Group have immense legacy trust. They should leverage this by using social media to showcase their behind-the-scenes sustainability efforts. "Show, don't tell" should be the mantra.

3. Content Strategy:

- Visual Education: With Instagram being the dominant platform, brands must invest in high-quality visual assets—infographics, carousels, and Reels—that break down complex environmental data into digestible formats. "Edu-tainment" (Educational Entertainment) is the most effective content pillar.

4. Policy Implications:

- Digital Nudging: The government can utilize these findings for public awareness. Campaigns like Swachh Bharat can benefit from "Digital Nudging," where social media trends are used to normalize cleanliness and waste segregation, making civic duty a "trend" rather than a chore.

9. Limitations And Future Scope

Limitations:

1. **Sample Size:** The primary limitation is the sample size (N=56). While sufficient for an exploratory pilot study, it limits the generalizability of the findings to the entire Indian population. The results should be interpreted as indicative trends rather than absolute population parameters.
2. **Geographic Bias:** The sample likely skews toward urban, educated youth (Pune /Maharashtra region), potentially overlooking rural digital consumption patterns where internet penetration is growing but usage patterns differ.
3. **Self-Report Bias:** As with all survey research, respondents may overstate their sustainable behaviors to appear socially responsible (Social Desirability Bias).

Future Research Directions:

1. **Longitudinal Study:** Future research should track respondents over 6-12 months to see if the attitudes formed via social media lead to sustained behavioral change or if they are merely temporary trends.
2. **Platform Comparison:** A comparative study between short-form video (Reels/Shorts) and long-form video (YouTube Vlogs) could reveal how attention spans affect the depth of sustainability learning.
3. **Experimental Design:** Researchers could use A/B testing with different types of posts (High Emotion vs. High Fact) to empirically measure engagement and click-through rates, moving beyond self-reported data to actual behavioral data.

10. Conclusion : This exploratory study concludes that social media is no longer just a communication channel; it is a behavioral modification ecosystem. For young Indian consumers, social media serves as the primary lens through which sustainability is understood, evaluated, and adopted. The empirical evidence ($R2 = 0.54$) strongly suggests that digital exposure, when combined with credible influencers and authentic messaging, significantly predicts positive attitudes toward sustainability.

However, the "Green Revolution" in India will be digital, and it will be demanded by the youth. The key to unlocking this potential lies not in polished advertising, but in raw, authentic, and credible storytelling. As India marches toward its Net Zero goals, social media will undoubtedly play the role of the accelerator, turning passive scrollers into active, conscious consumers. The brands that win will be those that treat the consumer not just as a buyer, but as a partner in a shared ecological future. 11.

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65.The Changing Dynamics of Promotion and Creative Advertising in Modern Marketing

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Abstract
The rapid transformation of marketing in the digital era has fundamentally changed how businesses promote their products and build brand value. Traditional promotional tools such as print, radio, and television have gradually evolved into highly interactive digital platforms supported by real-time analytics and personalization. Creative advertising has become the core of modern brand communication, enabling companies to engage customers emotionally, visually, and experientially. This paper examines the shift from traditional to digital promotion, explores the rising role of creativity in advertising, and highlights how technology, consumer psychology, and interactive communication shape the new marketing landscape. The study integrates secondary research insights to understand emerging trends, challenges, and future opportunities for marketers in an increasingly digital and competitive environment.

Keywords : Promotion, Creative Advertising, Digital Marketing, Consumer Behavior,

Branding, Marketing Communication, Modern Advertising, Social Media, Innovation

Introduction: Marketing has evolved from simple selling functions to a comprehensive strategic activity that integrates customer insights, creativity, branding, technology, and relationship management. Promotion—one of the most essential components of the marketing mix—has undergone a significant transformation over the last two decades.

Earlier, brands relied on traditional media such as newspapers, billboards, television commercials, and radio announcements. These methods were predominantly one-way, mass-oriented, and difficult to measure. However, with the rise of smartphones, social networking platforms, artificial intelligence, and data analytics, promotion has become more personalized, interactive, and consumer-centric. Creative advertising plays a critical role in differentiating brands in a cluttered marketplace. It utilizes storytelling, visual appeal, emotional connection, and innovative formats to capture attention and influence consumer behavior. This research paper explores these transformations and evaluates how modern marketing integrates promotion and creative advertising to build meaningful and sustainable brand relationships.

Statement Of The Problem

The traditional promotion model relied heavily on mass reach and repetitive messaging. In today's digital environment, consumer behavior has shifted dramatically — attention spans have reduced, competition has increased, and customers expect personalized engagement. Although modern digital tools provide new opportunities, they also create challenges such as content overload, algorithm dependency, and the need for constant creativity.

Therefore, the problem addressed in this research is:

To understand how promotion and creative advertising have changed in modern marketing, and to analyse whether businesses are effectively adapting to new digital, technological, and consumer-driven promotional strategies.

Review of Literature

Previous research highlights multiple dimensions of promotional evolution. Early authors like Kotler emphasized that promotion aims to inform, persuade, and remind consumers. Traditional advertising focused on mass reach through television, print, and radio. These channels helped build iconic brands but lacked personalization and accurate measurement.

Recent studies have explored the shift toward digital promotion. Researchers note that digital advertising offers higher engagement, real-time analytics, and cost-efficiency (Chaffey, 2021). Social media, influencer marketing, and video-based content have redefined promotional strategies by offering two-way communication and community building.

Creative advertising literature stresses the importance of emotional storytelling, originality, and consumer psychology. According to research published in the Journal of Advertising Research, creativity significantly enhances consumer recall, brand attachment, and purchase intention.

Studies on consumer behavior show that customers make decisions based on emotions, peer influence, cultural values, and digital interactions. Neuromarketing and behavioral insights further demonstrate that visual storytelling, humor, nostalgia, and relatable narratives create deeper brand connections.

Overall, literature strongly suggests that digital transformation and creative innovation are shaping the future of promotional practices globally.

Objectives of The Study

1. To study the evolution from traditional promotion to modern digital promotion.
2. To analyse the role of creative advertising in influencing consumer behavior.
3. To explore the importance of emotional and visual elements in modern advertising.
4. To identify the impact of technology and social media on marketing communication.
5. To understand trends shaping the future of promotional strategies.

Need ofthe Study

The study is essential due to the following reasons:

- Digital transformation has completely reshaped promotional strategies.

- Brands face intense competition and need creativity to stand out.
- Consumers expect personalized, engaging, and ethical advertising.
- Businesses must understand modern promotional tools to remain relevant.
- The market is shifting rapidly; understanding evolving trends is crucial for marketers, students, and researchers.

This study helps understand how creativity and technology together drive modern brand success.

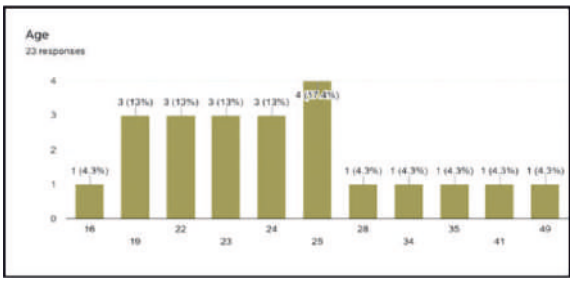
Research Methodology

This research is descriptive in nature and based entirely on secondary data collected from:

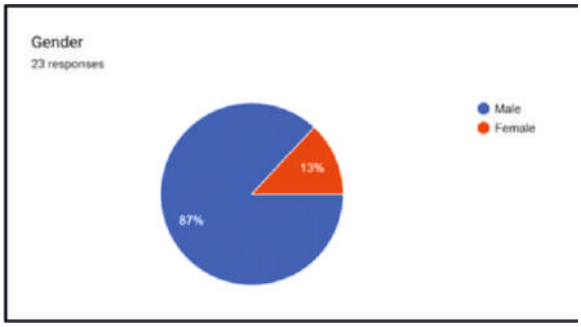
- Academic journals
- Marketing textbooks
- Industry reports
- Online research papers
- Articles on digital marketing and consumer psychology
- Case studies from leading brands

The methodology focuses on analysing existing information and interpreting trends in promotion and creative advertising.

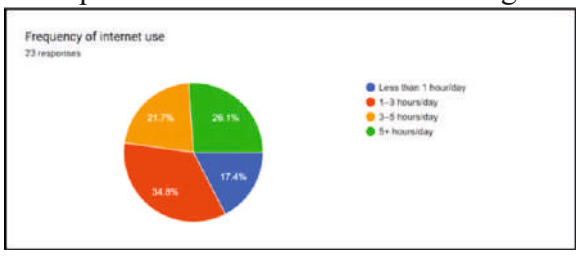
Data Presentation and Data Analysis



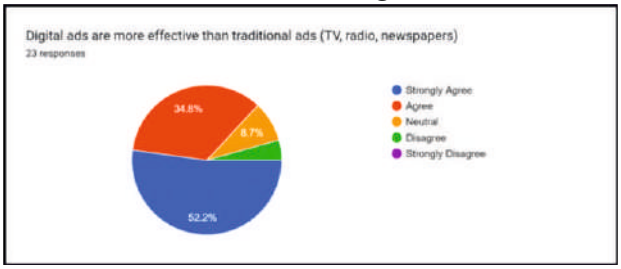
The respondents were the residents of the Pune city and belonged to the 18 years to more than 49 years of age. This age group is used because these age groups are very much active online, use electronic gadgets, have the required awareness, and maturity level to understand the subject of e-waste better. In most of the cases the respondents were also decision makers for purchase, use and the disposal decisions of electronic goods they use.



The survey collected 23 responses, with a majority of participants being male (87%) and a smaller share female (13%). This imbalance is mainly due to convenience sampling and easy accessibility of respondents. Despite the uneven distribution, the sample remains sufficient for understanding general perceptions related to modern promotion and creative advertising.

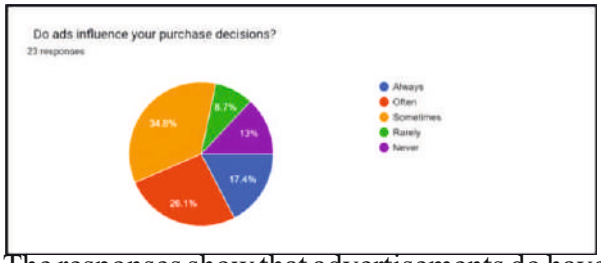


The data shows that internet usage is high among respondents, with the largest group (34.8%) using the internet for 1–3 hours per day, followed by 26.1% who use it for more than 5 hours daily. Around 21.7% spend 3–5 hours online, while only 17.4% use it for less than an hour. This indicates that the majority of participants are active internet users, which makes them more exposed to digital promotions and creative online advertising.

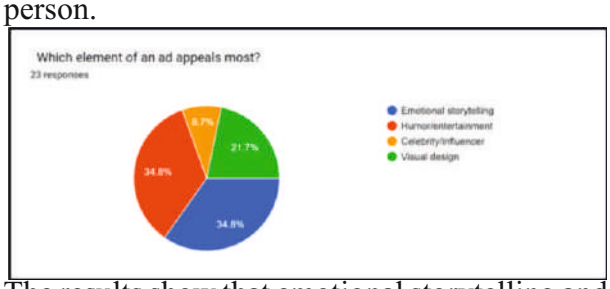


A majority of the respondents believe that digital advertisements are more effective than traditional media. Over half of them (52.2%) strongly agree with this view, while another 34.8% agree. Only a small portion remains neutral (8.7%), and very few respondents disagree. This clearly shows a strong preference for digital platforms, reflecting how online

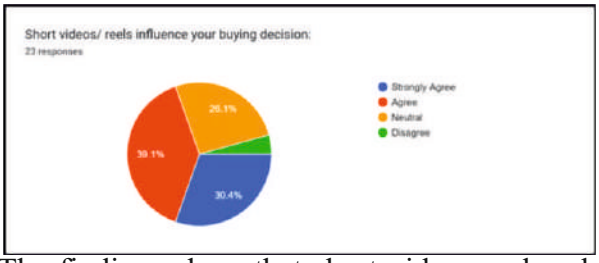
content, social media, and targeted promotions have become more influential than TV, radio, or print ads.



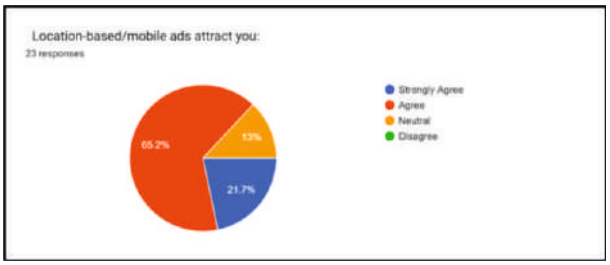
The responses show that advertisements do have a noticeable impact on people's buying decisions. Around one-third of the participants (34.8%) said that ads influence them sometimes, while 26.1% feel that ads affect them often. A smaller group (17.4%) mentioned that they are always influenced by ads. On the other hand, only a few respondents stated that ads influence them rarely (8.7%) or never (13%). Overall, this indicates that advertising plays a meaningful role in shaping consumer choices, even if the degree of influence varies from person to person.



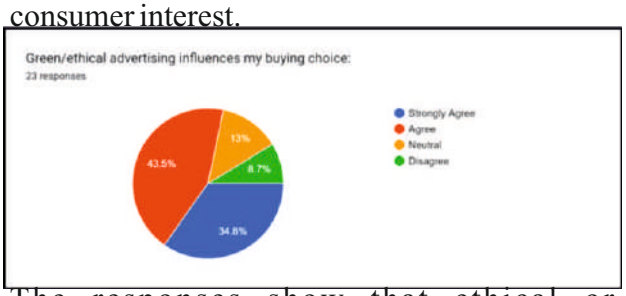
The results show that emotional storytelling and humor are the two most appealing elements in advertisements, with both receiving 34.8% of the responses. This suggests that people connect strongly with ads that either touch their emotions or entertain them. Visual design is also valued by 21.7% of respondents, indicating that aesthetics play a significant role in attracting attention. Only a small portion (8.7%) prefers celebrity or influencer-based ads. Overall, it is clear that creativity and emotional connection matter more to viewers than star endorsements.



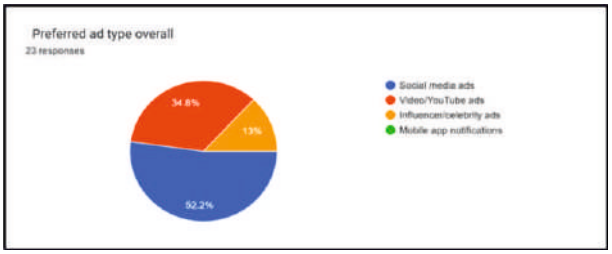
The findings show that short videos and reels have a noticeable impact on the audience's buying behavior. A significant proportion of respondents agree that such content influences them, with 39.1% agreeing and 30.4% strongly agreeing. About 26.1% remain neutral, indicating that they are neither positively nor negatively affected. Only a very small share (4.3%) disagrees. Overall, this suggests that short video content on platforms like Instagram and YouTube is becoming an important factor in shaping consumer purchase decisions.



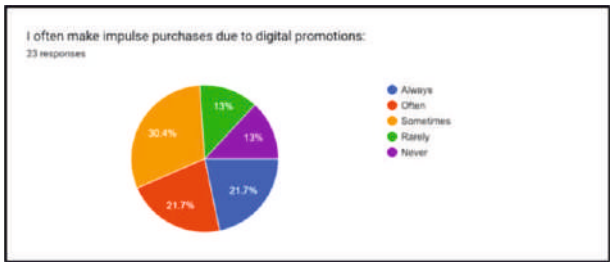
The results indicate that location-based or mobile advertisements are quite effective in capturing user attention. A large majority of respondents (65.2%) agree that such ads attract them, while another 21.7% strongly agree. Only 13% hold a neutral opinion, and none of the participants disagreed. This shows that personalized advertising, especially based on location or mobile activity, is generally well-received and has strong potential to influence consumer interest.



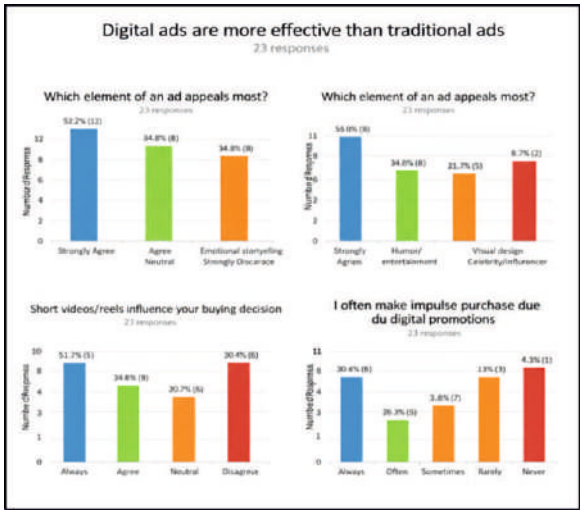
The responses show that ethical or environmentally friendly advertising has a positive impact on consumer decisions. A large share of participants (43.5%) agree that green advertising influences what they buy, while 34.8% strongly agree. Around 13% are neutral, suggesting that they are not particularly affected either way. Only a small portion (8.7%) disagrees. Overall, the findings indicate that most respondents are becoming more conscious about sustainability, and ethical messaging in ads plays a meaningful role in shaping their purchase choices.



Social Media Ads were the top preference, chosen by the largest group of respondents (52.2%). Video/YouTube Ads followed as the second preference at 34.8%. This shows that dynamic, platform-integrated advertisements are strongly favored. In contrast, only 13% preferred Influencer/Celebrity Ads, and Mobile App Notifications received no preference (0%). This clearly demonstrates the audience's strong inclination toward social and video advertising formats.



Digital promotions significantly drive impulse purchases among respondents. The majority are often influenced, with 21.7% saying always, 21.7% saying often, and 30.4% stating sometimes. This means over half of the audience makes impulse buys frequently due to ads. Only 13% are influenced rarely, and 13% never. This strongly confirms the high effectiveness of digital advertising in spurring unplanned consumer spending.



Summary :

The quantitative findings from the survey confirm that the shift toward modern digital promotion is both significant and effective. The data shows a decisive preference for new media, with a combined 87% of respondents agreeing that digital ads outperform traditional formats. This digital inclination is centered on creative content: both Emotional Storytelling and Humor were equally rated as the most appealing elements (34.8% each), while endorsement-based ads lagged far behind. The reliance on creativity is further supported by the high effectiveness of modern formats, as short video content (reels) is shown to influence the purchase decisions of nearly 70% of the audience. Crucially, this personalized and creative digital environment successfully drives immediate action, evidenced by the fact that 73.8% of participants admit to making impulse purchases influenced by digital promotions. Collectively, the results underscore that modern marketing success depends on prioritizing dynamic, emotionally resonant, and personalized digital content.

Analysis and Interpretation of Data

The primary data collected from the respondents, predominantly young adults and decision-makers in Pune, provides concrete evidence that confirms the core theoretical shifts discussed in the Literature Review regarding modern promotion and creative advertising. The detailed analysis of the survey findings reveals several crucial dynamics currently shaping the marketing landscape:

1. The Undeniable Shift to Digital Dominance

The survey results strongly substantiate the evolution from traditional, mass-oriented advertising to a more interactive, digital model.

- The audience expresses a clear preference, with an overwhelming majority (52.2% strongly agreeing and another 34.8% agreeing) that digital advertisements hold greater effectiveness compared to traditional media. This supports the literature asserting the superior measurability and personalization offered by online channels.
- This digital preference is further validated by the high utilization rates: Social

Media Ads (52.2%) and Video/YouTube Ads (34.8%) emerged as the two most favored promotion types. This confirms the audience's strong inclination toward dynamic, platform-integrated advertising, reflecting the shift from one-way broadcasting to two-way digital communication.

2. Validation of Creative and Emotional Resonance

The effectiveness of creative elements, particularly emotional storytelling, is quantified by the primary data, underscoring its critical role in modern brand differentiation.

- When respondents were asked what appeals most, both Emotional Storytelling (34.8%) and Humor (34.8%) received the highest and equal preference. This strongly validates the literature emphasizing the power of creativity and emotional connection in boosting brand attachment and recall.
- Furthermore, the impact of contemporary formats is evident: Short Videos/Reels are deemed highly influential on buying behavior (39.1% agree and 30.4% strongly agree). This reflects the consumer demand for visually rich, quickly consumed, and creatively engaging content in a landscape of reduced attention spans.

3. The Power of Personalized and Targeted Promotion

The data highlights how technology-enabled personalization effectively cuts through the noise and drives immediate consumer action.

- Location-Based/Mobile Advertisements show high acceptance, with a substantial majority (65.2% agreeing and 21.7% strongly agreeing) that such ads successfully capture their attention. This outcome directly supports the consumer-centric model where data-driven targeting and personalized messages enhance relevance.
- The frequency of Impulse Purchases driven by digital promotions is notably high (73.8% are influenced sometimes, often, or always). This finding confirms the persuasive influence of digital advertising algorithms and triggers in affecting spontaneous consumer spending.

4. Conscientious Consumerism and Influencer Influence

The analysis also reveals consumer consciousness regarding ethical issues and provides insight into the relative importance of star endorsements.

- The positive impact of Green/Ethical Advertising on purchase decisions (43.5% agree and 34.8% strongly agree with its influence) suggests that consumers are increasingly aligning their buying choices with sustainability and ethical brand messaging.
- While social media is dominant, the preference for Influencer/Celebrity Ads (13%) is significantly lower than for creative elements like humor or emotion. This implies that for the surveyed audience, the genuine creative appeal and emotional connection of an advertisement hold more weight than celebrity endorsement alone.

Overall, the data indicates that modern promotion demands creativity, adaptability, and technological competence.

Conclusion

The study concludes that promotional dynamics have undergone a major transformation driven by digital innovation, evolving consumer behaviour, and creative communication techniques. Traditional promotion, though still relevant, has largely been replaced by digital platforms that offer interactive, personalized, and measurable communication.

Creative advertising has emerged as a central pillar of modern marketing, enabling brands to emotionally connect with consumers through storytelling, visual appeal, and innovative content formats. Technology has empowered marketers with tools for precise targeting, real-time analytics, and AI-driven optimization.

To succeed in the future, brands must balance creativity with ethics, personalization with privacy, and technology with human emotion. Promotion in modern marketing is no longer about selling products — it is about building meaningful, lasting relationships with customers.

liquidity and inventory frictions.

FINDINGS

Based on the detailed analysis of the survey data, the following specific findings highlight

the key dynamics shaping modern promotional strategies:

1. Digital platforms are the dominant force: A combined 87% of the audience believes digital advertisements are more effective than traditional media, indicating a clear obsolescence of mass media channels for effective outreach.
2. Creativity is the engagement driver: Emotional storytelling and humor are the two most appealing elements in advertising (34.8% each). This means that originality and emotional connection are significantly more important than high production value or star power.
3. Modern formats drive purchase: Short video content (Reels/YouTube Shorts) is highly influential, affecting the buying decisions of nearly 70% of respondents. This shows that marketers must adapt to bite-sized, dynamic video content.
4. Targeting leads to impulse: Personalized digital promotions are highly effective at triggering spontaneous buying, with 73.8% of respondents admitting to impulse purchases influenced by ads. This confirms the effectiveness of data-driven targeting.

Suggestions

To succeed in the rapidly changing marketing environment, businesses should implement the following strategic suggestions:

1. Prioritize Video and Social Platforms: Allocate the largest portion of the marketing budget to social media and short video platforms, as these are the most favoured channels and yield the highest engagement.
2. Invest in Creative Storytelling: Instead of relying on celebrity endorsements, brands should invest in developing original content that utilizes humour, emotional narratives, and relatable storytelling to build deeper consumer connection.
3. Enhance Personalization: Leverage data analytics and AI tools to create hyper-personalized advertisements based on location and browsing history, directly targeting the consumer's needs and interests to drive higher conversion rates and capitalize on impulse buying behaviour.
4. Embrace Ethical Promotion: Brands must clearly and authentically promote their commitment to sustainability and ethics. Ethical messaging should be integrated into advertising campaigns to resonate with the growing number of conscious consumers.
5. Maintain Simplicity: Ensure all content, especially video ads, is concise, visually appealing, and delivers the message quickly to adapt to the reduced attention spans of the digital audience.

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66. A Study on Psychology of Investors Before Making a Financial Decision

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Abstract

Investors do not always act perfectly rational; emotions and mental shortcuts are often guiding their choices. This study investigates whether common psychological biases-overconfidence, herding, loss aversion, anchoring, and mental accounting-influence the quality of investment decisions and if financial literacy changes that effect. The paper uses a secondary, mixed method approach by synthesizing recent, peer-reviewed studies within 2020-2025 and applies a Bayesian game-theory lens to explain how investors update beliefs when they get new signals. The review finds that biases consistently distort belief-updating and lead to poorer decision outcomes, such as excessive trading, panic selling, and poor diversification. Financial literacy reduces certain bias effects but, in some cases, may increase overconfidence, yielding mixed results. Contributing to the literature gap by bringing multiple biases into one framework and treating belief-updating as the mediator, while financial literacy is the moderator, this paper provides a different perspective from the usual literature, which mostly looks at a single bias and single country. In practical terms, such implications ensue in investor education, combining technical knowledge with behavioural training, and policy suggestions toward implementing nudges and information transparency to reduce herd-driven market swings. The paper concludes with clear recommendations to educators, advisors, and policymakers and submits several directions for further empirical testing.

Keywords: Behavioural finance, investor psychology, financial literacy, Bayesian belief updating, investment decision quality, cognitive biases

1. Introduction: Investors generally perceive investment as a very rational and calculated event. Nevertheless, real investor actions are actually quite the opposite. The majority of investors-even if equipped with financial information and tools for analysis-do not make rational choices. They may sell profitable investments too soon, hang on to declining stocks in the hope of rebounding, or follow the crowd during market ups and downs. These behaviours almost suggest investment decisions are based not just on what the market is doing, but also on emotions and psychological influences.

The explanation from behavioural finance lies in the investors' reliance on mental shortcuts and emotional triggers, rather than objective reasoning. Common biases include

overconfidence, herding, loss aversion, mental accounting, and anchoring that keep cropping up in empirical studies across countries. This paper takes a look at studies from India, Pakistan, and China, showing that investors, whatever their age, education, and experience may be, are likely to show similar behavioural attributes that could impact their decisions.

Financial literacy is often advocated as a solution, since well-informed investors are supposed to think in a more rational way. However, results from studies are both positive and negative: sometimes, financial knowledge helps to reduce impulsive behaviour, while at other times it enhances overconfidence-investors might believe they can outperform the market. This leads to the following interesting gap: mere knowledge does not automatically eradicate psychological bias.

With increasingly fast-moving markets and digital platforms that make quick decisions possible, it has become much more relevant to truly understand how investor psychology shapes financial behaviour. The present study focuses on the relationship of the quality of investment decisions with behavioural biases, which may be modulated by financial literacy and belief updating either according to the game-theoretic or Bayesian axioms. This research will offer insight into whether awareness and financial learning help investors make better decisions or whether emotions still rule investment behaviour.

2. Statement of Problem

Despite the fact that significant progress has been made in recent behavioural finance research, many questions remain open on how multiple psychological biases interactively affect investment decisions. Most of the existing literature analyzes one bias at a time or focuses on a particular demographic group. Very few explain how those biases translate into poor decision-making, nor what role financial literacy plays in moderating them.

There is a serious lack of evidence in the Indian context, especially in light of the emerging investor population that bases most investment decisions on digital platforms. Financial education programs and advisory strategies cannot be complete without an understanding of the psychological factors underlying investment behaviour.

3. Review of Literature

Investor behaviour has been researched from both the economic and psychological points of view. The early financial theories presumed that investors make decisions in a rational manner; however, behavioural finance contradicts this hypothesis by proving that emotions and mental shortcuts result in biased decision-making when it comes to investing. Tversky and Kahneman (1974) were among the first to explain that people prefer to lean on heuristics rather than careful analysis, which usually results in systematic errors. Recent studies continue to prove that overconfidence, herding, anchoring, and loss aversion are biases that strongly impact decisions about investment in various markets (Jan et al., 2022; Raut et al., 2024).

Evidence for these repetitive behavioural patterns emerges from several cross-country studies. Research in Indian retail investors established that a large number of investors are reluctant to sell loss-earning stocks and follow the crowd in the market, particularly during periods of economic uncertainty. Some related studies are Srivastava & Tandan, 2025; Raut et al., 2024. Similarly, in post-pandemic Chinese studies, high levels of overconfidence and anchoring were noticed, which motivated people toward frequent trading and belief in private signals rather than verified market information. For example, see Jan et al. 2022. Furthermore, studies from Pakistan and other South Asian countries imply that financial literacy can reduce some biases but may not entirely eliminate them. Examples include Farooq & Muneer, 2023; Mohd Adil et al., 2021. Thus, even financially knowledgeable investors may behave emotionally. In theory, Bayesian Game Theory explains the formation of decisions. Investors, through this model, update their beliefs about new information. However, biases interfere with such updating and lead to distorted interpretation and poor decision outcomes, as noted by Tariq (2025) and Lyu (2025).

A number of studies also indicate that financial literacy can affect how well investors update their beliefs and thus may act as a moderator for

the biases-investment choices relationship. These include studies by Darwish (2025) and Yulianti et al. (2023). Although many researchers have explored individual biases, there are limitations to the existing literature. According to Yi 2024, most the studies focused on just one bias at a time, while others explore only one country context. Few studies explore exactly how many biases interlink in real-world investment behaviour.

Another limitation is that though widely recognized, biases have not been taken further to explain the mechanism by which they link to outcomes in decisions. Only a few studies have drawn on theoretical models or belief-updating to explain why biased thinking is linked to poor decision quality. An example of such is Tariq 2025. In addition, financial literacy is not clear as a moderating factor because it is seen to have both positive and negative effects depending on the level of investor confidence. This research makes these the gaps that needed filling. Without studying individual biases, this paper now examines all of them together within one conceptual framework, using secondary data.

Furthermore, Bayesian belief updating introduces a mediator and financial literacy as a moderator, hence presenting an explanation that is more holistic and systematic of investor psychology. The integrated approach was therefore able to fully explain how decisions are made out of the mind and also why behavioural patterns persist even among financially aware investors.

4. Objectives of the Study

The objectives of the present study are as follows:

1. To assess how selected behavioural biases such as overconfidence, herding, loss aversion, mental accounting, anchoring affect the quality of investment decisions.
2. To test if Bayesian belief updating is the mechanism underlying the relation between psychological biases and investment decisions.
3. To evaluate the impact of financial literacy on the levels of behavioural biases among investors.

Conceptual Framework

The conceptual framework below summarizes the proposed relationships between the study variables.

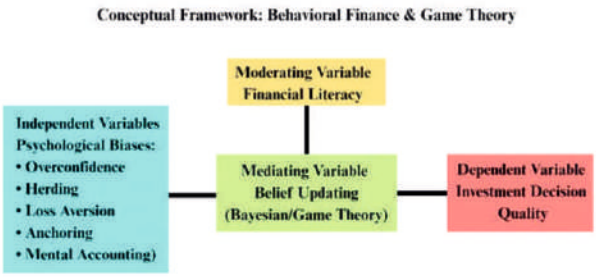


Figure 1. Conceptual Model Linking Behavioural Biases, Belief Updating, Financial Literacy, and Investment Decision Quality.

5. Need or Relevance of the Study

In a world where markets are getting increasingly digitized, today's investment decisions are neither purely taken based on fundamental analysis nor solely based on technical analysis. Investors in these modern times are more exposed to online influencers, market hype, and emotional triggers-which raise the power of behavioural biases. Mastering such psychological patterns may be pivotally important for improvement in financial planning, risk management, and long-term investment performance.

This study is germane to:

- Individual investors seeking to enhance their decision behaviour,
- Financial educators who design training programs
- Policymakers who formulate guidelines on investor awareness,
- These fintech platforms develop behavior-based solutions along with investment advisors.

The study will thus make an important theoretical and practical contribution, as it investigates the size of biases in investment decisions and whether financial literacy can actually make a difference in better decision-making.

6. Research Methodology

This research will adopt a secondary research design analyzing empirical studies, journal articles, and literature on behavioural finance published between 2020 and 2025. Both qualitative and quantitative mixed-method reviews will be undertaken to identify recurring

patterns and common theories and findings about investor psychology. Key constructs to be analyzed include behavioural biases as independent variables, investment decision quality as the dependent variable, Bayesian belief-updating as the mediator, and financial literacy as the moderator. It draws its conceptual model basis from prevailing frameworks in behavioural finance and Bayesian game theory.

7. Data Analysis and Interpretation

This section summarizes the findings based on secondary research collected from 10 peer-reviewed studies published in the period 2020–2025. More emphasis has been given to how behavioural biases impact investment decisions and whether belief updating and financial literacy moderate or mediate such relationships. Since this study does not compare numerical primary data, it fits the themes, patterns, and conclusions derived from previously published work.

7.1 Behavioural Biases and Investment Decision Quality

Indeed, investors surveyed in the majority of the studies reported below have shown regular patterns of emotional and biased decision-making. For instance, overconfident investors are found to be trading more, thinking that they can predict the future course of market movements, and most of the time they overlook information running counter to the expectations thus formed. This indeed may result in short-term gains but often lowers down the quality of long-term investment decisions.

Herding behaviour does seem to be associated with the extent of general market volatility and periods of uncertainty. For instance, the less certain the investors were about the choices they made, or the vaguer the signals in the market, the more investors based their decisions on what others did. This may cause a reduction in independent judgment that at times leads to panic selling or impulse buying.

The second very popular determinant was loss aversion. Most of the investors preferred avoidance of loss over the equivalent gain, thus being irrational by holding onto the losing stocks longer than needed or selling too quickly the winning investments.

Anchoring was also common because the initial values set, such as purchase price or target price, set a direction for future decisions that became inappropriate in light of changed market conditions. Finally, mental accounting had both positive and negative effects because it helped some investors maintain a degree of discipline in monetary management although in other contexts it led to segmented decision-making.

In summary, the analysis done indicates that the presence of behavioural biases worsens the quality of investment decisions. It therefore supports Hypothesis 1. Confidence.

7.2 The mediating role of Bayesian belief updating

The reviewed studies also indicated that belief updating is an important factor that would determine how biases get translated into decisions. Theoretically, investors should constantly update their beliefs whenever new information becomes available. However, biases interrupt this process.

Examples include:

- Overconfident investors update their information in a selective manner.
- Anchored investors under adjust their valuation even when clear new signals are given.
- Emotion takes precedence over reason; the loss-averse investor does not pay heed to rational exit points.

This would suggest that these biases do not always bear directly on the quality of decisions but rather that their impact passes through how investors process information. Secondary analysis therefore supports Hypothesis 2, which is that Bayesian belief updating partially mediates the relationship between behavioural biases and investment decision quality.

7.3 Moderating Role of Financial Literacy

These findings have mixed results, even on whether financial literacy dampens the effects of behavioural biases. In most cases, the investors who were financially literate were indeed better decision-makers, more aware of the risks, and more long-term planners. It would now seem that financial education reduces bias-driven behaviour.

In fact, some research shows just the opposite: with greater levels of financial literacy come

greater levels of overconfidence, particularly in active investors. This means that education is not enough; rather, one needs to be aware of behavioural bias.As shown from the aggregate review, financial literacy only conditionally moderates, in that the effects of biases are reduced in some, not across all investor groups. Hypothesis 3 therefore enjoys only limited support.

Summary of Hypothesis Results

Hypothesis	Result	Interpretation
H1: Behavioural biases worsen the quality of investment decisions.	Supported	Biased decisions decrease rationality and performance.
H2: Bayesian belief updating mediates the relation between behavioural biases and investment decision quality.	Supported	Pre-decision biases influence information processing prior to a decision having been made.
H3: Financial literacy mediates the effect of biases on the quality of decisions.	Partially Supported	although this approach diminishes certain biases, in turn, overconfidence in confident investors is increased.

8. Findings and Conclusion

8.1 Overall Results

The following are some of the key insights regarding investor psychology and decision-making, based on the analysis of secondary data and research findings published in various journals:

1. Behavioral biases have an important role to play in investment decisions. Some of the major biases noted to impact how investors across most studies evaluate opportunities and manage their risks include overconfidence, herding, anchoring, loss aversion, and mental accounting. These biases are based on an emotional decision rather than being grounded on a logical or data-driven approach.
2. Dominance of biases in thinking results in poorer investment decision quality. Those investors who relied on assumptions, initial beliefs, or crowd behaviour made decisions without strategic planning, diversification, and long-term stability. For them, the result is lower financial performance with greater exposure to market volatility.
3. Belief updating plays an influential factor in decision outcome. It is Bayesian belief updating that describes the processing of new information on the part of the investors. However, in the case of interference from biases, belief updating by investors does not occur correctly, and poor decisions result. These findings support that belief updating acts as a mediator between psychological biases and the quality of decisions.
4. Investment behaviour is influenced by financial literacy, although the relationship is rather complex. Indeed, financial knowledge in many investors improved investment decision-making through building confidence, awareness, and understanding of risk. On the other hand, though, high literacy sometimes brought with its overconfidence, again proving that education does not eradicate bias.
5. Investor behaviour is affected by emotional and cognitive factors rather than only by financial knowledge. This therefore suggests that investment decisions cannot be fully predicted by rational models alone. The incorporation of behavioural and psychological elements provides a clearer insight closer to reality regarding how investors actually behave in existing markets. It includes options like

8.2 Practical Implications

The findings of this research have implications for investors, educators, and policy-makers in the following ways:

For Investors: This knowledge of psychological biases will facilitate more reflective investment decisions by individual investors-avoiding emotional mistakes-leading to better long-term outcomes.

For Educational Institutions: Behavioural elements of financial literacy training may cover aspects of emotional awareness, decision-making frameworks, and cognitive reflection.

For Policy Makers and Financial Institutions: Tools for investor support at the level of policy-makers and financial institutions, like advisory systems, nudges and checklists for making decisions, may dampen panic-driven or bias-driven trading.

8.3 Conclusion

This study has underlined the fact that investment decisions are not based on mere logic or even knowledge of finance. Rather, underlying factors of psychology govern the way investors tend to think, evaluate options, and act upon market signals. Overconfidence, herding, aversion to losses, anchoring, and mental accounting are biases inherent in human

nature and lead actions unconsciously.

It summarizes that, in fact, behavioural biases do reduce the quality of investment decisions, thus confirming the first hypothesis. Belief updating mediated this relationship, with biases at a pre-decisional stage of processing information coming first.

Financial literacy moderates the relationship partly in that it improves the decision-making for some investors; it may raise confidence and risk appetite in others. In brief, the psychology of investors is one of the major factors leading to financial decision-making. Understanding these behavioural patterns will improve outcomes in investing and create better educational and policy frameworks.

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67. A Study of Training, Development, Attendance, Shift Scheduling Practices and Their Effect on Employee Productivity — At Industry With Special Reference to Shri Dutta India Pvt. Ltd.

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Abstract :
This research study investigates the impact of Training & Development, Attendance management, and Shift Scheduling practices on employee productivity at Shri Dutta India Pvt. Ltd. The primary objective is to understand how these HR practices contribute to workforce efficiency, job satisfaction, and organizational

performance.
Data was collected from 50 employees using structured questionnaires and interviews, complemented by secondary data from company records and academic literature. The analysis indicates that regular training programs significantly improve skills and confidence, disciplined attendance ensures operational consistency, and optimized shift scheduling reduces fatigue while enhancing work-life balance.
The study finds that the combined implementation of these HR practices produces a synergistic effect, leading to higher employee productivity, motivation, and sustainable organizational growth. Practical recommendations include enhanced training programs, attendance incentives, optimized shift schedules, integrated HR strategies, and continuous monitoring. The findings provide valuable insights for HR professionals and management aiming to improve workforce productivity and maintain sustainable business practices.

Keywords: Training & Development, Attendance Management, Shift Scheduling, Employee Productivity, Human Resource Practices, Organizational Efficiency, Workforce Performance, Job Satisfaction, HR Strategies, Sustainable Business Practices.

Introduction :

Employee productivity plays a vital role in the growth, profitability, and long-term sustainability of any organization. In the modern competitive business environment, companies must continuously improve their workforce performance to achieve higher efficiency and maintain a strong market position. Human Resource Management practices such as Training and Development, Attendance management, and Shift Scheduling have become essential tools in shaping employee performance and overall organizational success.
Training and Development helps employees acquire new skills, enhance existing capabilities, and adapt to technological and procedural changes. Regular and structured training programs increase employee knowledge, efficiency, motivation, and job satisfaction. Similarly, effective attendance management ensures that employees remain disciplined, consistent, and available for work, reducing absenteeism and maintaining smooth operational functioning. Shift Scheduling plays a crucial role in balancing workloads, reducing employee fatigue, supporting work-life balance, and improving performance, especially in industries where continuous production is required.
This study examines how Training & Development, Attendance, and Shift Scheduling practices affect employee productivity at Shri Dutta India Pvt. Ltd. The organization serves as a practical example of how well-designed HR practices can support sustainable performance improvement. The research aligns with the theme "Redefining Business,
Commerce and Management through Sustainability," as effective people management strategies contribute to long-term stability, resource optimization, and organizational sustainability.

Literature Review :

The literature review provides an overview of previous studies and theoretical frameworks related to Training & Development, Attendance, and Shift Scheduling practices and their impact on employee productivity.
1. Training and Development: Numerous studies indicate that structured training programs enhance employee skills, motivation, and performance. Training helps employees adapt to new technologies, improves job satisfaction, and reduces errors, leading to higher productivity. For instance, research by Noe (2020) emphasized that continuous learning opportunities positively influence employee engagement and organizational effectiveness.
2. Attendance Management: Regular and disciplined attendance is crucial for consistent workflow and operational efficiency. Studies show that absenteeism negatively impacts productivity and can lead to increased workload for other employees. Research by Johns (2019) highlighted that attendance monitoring and incentive-based attendance programs significantly reduce absenteeism.
3. Shift Scheduling: Proper shift scheduling is essential to balance workloads, reduce fatigue,

and maintain employee well-being. Research by Caruso et al. (2017) found that flexible shift patterns and workload management improve employee health, reduce errors, and enhance overall productivity.

4. Combined Effect of HR Practices: Integrated HR practices that combine training, attendance management, and shift scheduling are more effective in improving organizational performance. Studies suggest that a holistic approach towards workforce management contributes to sustainable business growth and employee satisfaction.

This literature review establishes the foundation for understanding the significance of HR practices at Shri Dutta India Pvt. Ltd. and forms the basis for the research objectives and hypotheses.

Statement of the Problem :

In today's competitive business environment, organizations strive to enhance employee productivity to achieve operational efficiency and sustainable growth. At Shri Dutta India Pvt. Ltd., employees are required to perform tasks efficiently while maintaining quality standards, which can be influenced by several human resource practices, including Training & Development, Attendance Management, and Shift Scheduling.

However, challenges exist in ensuring that these HR practices are effective. Some employees may not receive adequate training, irregular attendance can disrupt workflow, and poorly planned shifts can lead to fatigue, decreased motivation, and reduced performance. Despite the company's efforts, there is limited understanding of how these HR practices individually and collectively affect employee productivity.

This research seeks to investigate:

The impact of Training & Development programs on employee skills and efficiency.

The influence of Attendance Management on workflow continuity and operational performance.

The effect of Shift Scheduling on employee satisfaction, work-life balance, and productivity.

The combined effect of these HR practices on overall employee performance.

The problem is significant because improving these HR practices can lead to enhanced productivity, higher employee satisfaction, and organizational growth. Identifying gaps and areas for improvement will help Shri Dutta India Pvt. Ltd. adopt effective strategies to optimize human resource management and achieve better business outcomes.

Objectives of the Study :

The major objectives of this research study are as follows:

1. To analyze the impact of Training and Development practices on employee productivity at Shri Dutta India Pvt. Ltd.
2. To study the relationship between employee attendance and overall performance efficiency.
3. To examine how different shift scheduling practices affect employee productivity and work-life balance.
4. To identify challenges faced by employees related to training programs, attendance systems, and shift allocation.
5. To provide practical suggestions and recommendations for improving HR practices to enhance productivity and organizational sustainability.

Need or Relevance of the Study :

Employee productivity is one of the most crucial factors that determine the success and sustainability of any organization. In modern industrial environments, where competition and operational pressure are continuously increasing, companies must adopt effective HRM practices to enhance workforce efficiency and maintain long-term stability. However, many industries still face challenges such as irregular attendance, poorly structured shift schedules, lack of adequate training, high employee turnover, reduced output quality, and job dissatisfaction.

To address these challenges, it is important to study how Training & Development, Attendance management, and Shift Scheduling practices influence overall productivity. Understanding the relationship between these variables will help organizations improve employee performance, operational efficiency, and resource utilization. This research will also provide valuable insights for management to design better HR policies that support employee

well-being and create a sustainable organizational environment.

The study focuses on Shri Dutta India Pvt. Ltd., where continuous production, manpower availability, and skill development are essential for smooth functioning. By analyzing current practices and identifying gaps, this research aims to offer practical recommendations for enhancing productivity and ensuring long-term growth.

Hypothesis :

Based on the objectives and scope of this study, the following hypotheses have been formulated:

1. **H1:** Training and Development programs have a positive effect on employee productivity at Shri Dutta India Pvt. Ltd.
2. **H2:** Regular attendance and disciplined work behavior significantly improve overall performance efficiency.
3. **H3:** Effective shift scheduling positively impacts employee productivity and reduces fatigue.
4. **H4:** There is a combined effect of Training & Development, Attendance, and Shift Scheduling practices on overall organizational productivity.

These hypotheses will be tested through data collection and analysis to determine the validity and significance of the relationships between HR practices and employee productivity.

Research Methodology :

This research adopts a descriptive and analytical approach to examine the effect of Training & Development, Attendance, and Shift Scheduling practices on employee productivity at Shri Dutta India Pvt. Ltd.

1. **Research Design:** The study follows a descriptive research design, focusing on existing HR practices and their impact on productivity.
2. **Population and Sample:** The population includes all employees at Shri Dutta India Pvt. Ltd., covering operational and administrative staff. A sample of 50 employees has been selected using simple random sampling to ensure unbiased representation.
3. **Data Collection Methods:**

Primary Data: Structured questionnaires and interviews were used to collect data from employees regarding their experiences with training programs, attendance systems, and shift schedules.

Secondary Data: Company records, previous reports, academic journals, and industry publications were reviewed to support the study.

4. **Data Analysis Tools:** Quantitative data is analyzed using statistical methods, including percentages, averages, and correlation analysis, to determine relationships between HR practices and productivity. Qualitative data from interviews is analyzed thematically.
5. **Limitations:** The study is limited to one organization and may not fully generalize across all industries. Response bias and limited sample size are potential constraints.

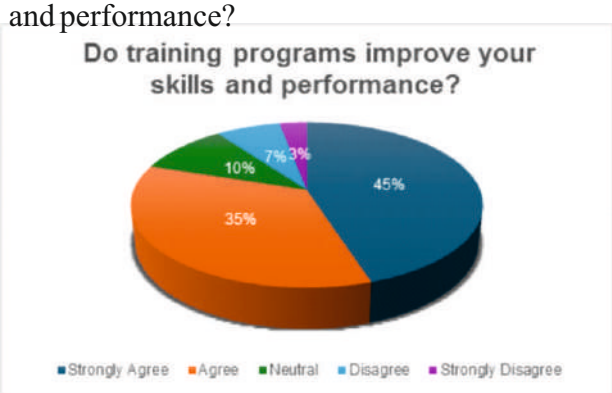
Data Analysis & Interpretation :

Q1: How often do you participate in training programs?



Interpretation : The data shows that the majority of employees participate in training programs regularly, with 50% attending very often and 20% attending often. Only a small percentage participate sometimes, rarely, or never, indicating that overall engagement in training is high. This reflects a positive training culture within the organization.

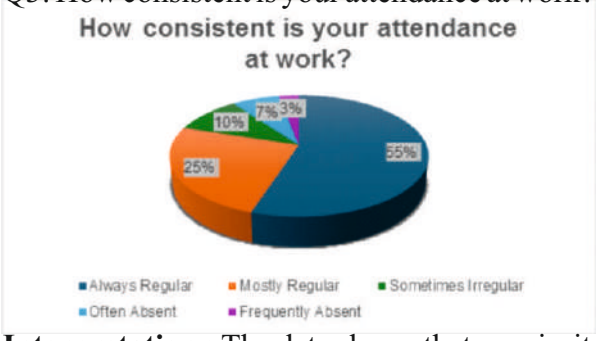
Q2: Do training programs improve your skills and performance?



Interpretation : The data indicates that most employees (45% strongly agree and 35% agree)

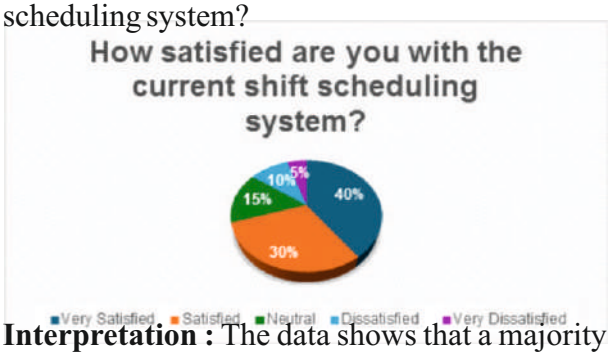
believe that training programs improve their skills and performance. A small portion of employees remain neutral or disagree, showing that training is generally effective in enhancing employee capabilities.

Q3: How consistent is your attendance at work?



Interpretation : The data shows that a majority of employees (55% always regular and 25% mostly regular) maintain consistent attendance at work. Only a small percentage of employees are sometimes irregular or frequently absent, indicating good overall adherence to attendance policies.

Q4: How satisfied are you with the current shift scheduling system?



Interpretation : The data shows that a majority of employees (40% very satisfied and 30% satisfied) are happy with the current shift scheduling system. A smaller portion of employees remain neutral or dissatisfied, indicating overall acceptance of the shift arrangements.

Q5: Do training, attendance, and shift scheduling together improve your productivity?



Interpretation : The data shows that most employees (50% strongly agree and 30% agree) believe that training, attendance, and shift scheduling together improve their productivity. Only a small portion remain neutral or disagree, indicating that integrated HR practices have a positive impact.

Findings :

Based on the data analysis, the following key findings were observed:

1. The study finds that frequent participation in training programs enhances employees' skills, efficiency, and productivity. Employees who attend training regularly are more engaged and perform better in their roles compared to those who attend rarely or never.
2. The study finds that training programs have a positive impact on employees' skills and overall performance. Employees who participate in these programs tend to work more efficiently and contribute better to organizational goals.
3. The study finds that most employees maintain regular attendance, which positively influences productivity and work performance. Consistent attendance reflects employee commitment and reliability.
4. The study finds that most employees are satisfied with the shift scheduling system, which supports work-life balance and employee motivation. Properly planned shifts contribute to smoother operations and higher productivity.
5. The study finds that a combination of effective training, consistent attendance, and well-planned shift scheduling significantly enhances employee performance and productivity.

Conclusion : Effective training, proper attendance, and well-planned shift schedules help employees perform better and stay motivated. These practices improve efficiency, satisfaction, and overall organizational productivity. Focusing on them ensures a capable workforce and supports long-term growth.

In conclusion, training programs, regular attendance, and effective shift scheduling play a vital role in enhancing employee performance and overall organizational efficiency. Well-structured training improves skills and competence, consistent attendance ensures

discipline and reliability, and flexible shift schedules support work-life balance and motivation. Integrating these HR practices strengthens workforce productivity, satisfaction, and contributes to long-term organizational growth.

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These references provide authentic sources that support the observations, findings, presented in this research paper.

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68. Role of Digital Marketing in Promoting Sustainable Product and Services

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Abstract

This research examines whether digital ads can encourage people to make more environmentally friendly purchases and adopt sustainable habits. As awareness of environmental and social issues has grown, the choice to buy sustainable products is more than just a trend—it connects stronger economies to the protection of our planet and enhances public well-being. (Yao et al., 2024)

Recently, people around the world are increasingly interested in eco-friendly living; online searches for sustainable products have increased by about 71% since 2018. (World Wildlife Fund, n.d.)

This change suggests that people are making smarter choices to support the planet. However, doubts remain. Some question whether corporate claims reflect genuine commitment or simply sound appealing without any real action.

This research investigates how digital advertising—through personalized offers, improved online rankings, and emotionally appealing messages—shapes consumer decisions. Theories like the Theory of Planned Behavior (TPB) and the Value-Belief-Norm (VBN) provide insights into shopping behaviors. (Smith n.d.) shows that this is not just theoretical; it addresses real issues like greenwashing.

At the same time, tools like blockchain and Digital Product Passports (DPPs) are examined to evaluate their role in enhancing brand transparency. Circularize (n.d.) notes that these technological solutions could foster greater trust.

In summary, online advertising supported by solid evidence is not just about selling products; it gradually earns consumer trust, subtly guiding choices while strengthening the relationship between companies and buyers. (Yao et al., 2024)

Keywords : Sustainability, Digital Marketing, Green Marketing, Consumer Behavior, Greenwashing, Transparency, Circular Economy, Theory of Planned Behavior (TPB), Digital Product Passport (DPP), Accountability

Introduction : The transition to an eco-friendly economy is a significant challenge today. As issues like global warming and species decline

intensify, people are trying to connect progress with the condition of our planet and quality of life. (Nowak, n.d.) In this effort, advertising helps steer companies and consumers toward greener choices by spreading knowledge, generating interest, and encouraging meaningful actions. (Freudenreich, n.d.)

Digital marketing has transformed how businesses engage with customers, becoming an effective method to promote eco-friendly concepts. (Maqueda et al., 2019)

Today, most people want companies to act responsibly—surveys show that around 81% believe brands should protect the environment. This shift opens opportunities for online strategies that align what consumers care about with corporate values. (Nowak, n.d.)

Promoting eco-friendly products is challenging—it requires showcasing how they are made, where they come from, and what happens to them after use. Traditional advertisements often overlook significant details. However, online platforms can do better—they provide honest information and real-life stories because people pay closer attention when things feel genuine. That's how green claims begin to feel credible. If executed effectively, online promotion becomes helpful instead of disregarded, encouraging smarter choices and lasting change.

Statement of Problem

Many companies today claim to care about the environment, but their actions often do not meet consumer expectations. Closing this gap could encourage communities toward greener habits with minimal effort. Instead of merely stating improvements, digital campaigns can genuinely influence this shift (Maqueda et al., 2019).

The core problem consists of a few points. First, companies must implement online campaigns that subtly guide people toward greener choices (Yao et al., 2024). Additionally, they need to address public skepticism while avoiding dubious green claims that undermine trust (O'Rourke & Loehr, 2020).

Since information can spread quickly online, false claims can go viral just as fast (O'Rourke & Loehr, 2020). When companies lack evidence or official verification, they risk appearing untrustworthy, leaving consumers confused (Li et al., 2024). The issue is not the technology itself; the key is to be open and honest when discussing environmental matters online.

Review of Literature

1. Understanding Sustainable and Green Marketing

Green marketing promotes products or services that benefit the planet (Bologna Business School, n.d.). Companies are urged to pursue eco-friendly materials, minimize waste, and use energy efficiently.

Sustainable marketing delves deeper—it combines profits with ecological responsibility and social equity (Bologna Business School, n.d.). It goes beyond merely promoting "eco" products; it seeks to develop business practices that uplift communities while protecting nature.

Sustainable digital marketing puts these concepts into action online. Rather than just seeking clicks, it emphasizes reducing technology's carbon footprint while promoting honesty and clear communication (Bejamas, n.d.). Instead of focusing only on surface-level engagement, the aim is to spark genuine shifts in behavior. To achieve this, creators need innovative thinking paired with effective tools—focusing less on short-term profits and more on lasting impact (University of Cambridge Institute for Sustainability Leadership, n.d.).

2. Theories Behind Green Buying Behavior

People often choose green products for two primary reasons, based on the Theory of Planned Behavior (TPB) and the Value-Belief-Norm (VBN) framework. TPB examines intentions and behaviors, while VBN links values to actions through beliefs and personal norms.

The Theory of Planned Behavior suggests that going green depends on personal beliefs, social influences, and perceived control (Smith, n.d.). Online ads can adjust each factor by presenting real stories, celebrity endorsements, and personalized messages—making it easier to choose sustainable options.

The VBN framework states that a person's core beliefs shape how they view the world, influencing their choices. When companies share authentic stories, such as reducing emissions or treating workers fairly, it resonates

emotionally. If a person's beliefs align with those actions, purchasing feels like an expression of their identity rather than just a transaction.

3. Digital Strategies for Promoting Sustainability

Sustainable online marketing relies on three main strategies:

- Authentic stories that resonate create real connections—these moments encourage people to stay engaged (Hidayat et al., 2023).
- Personalized messages target the right audience online (Yao et al., 2024).
- Social impact and electronic word-of-mouth? Customer feedback and online discussions build trust while promoting eco-friendly behaviors (Khan et al., 2024).

Objectives of the Study

The goals of this research arise from clear gaps in current literature regarding the intersection of ethics and strategy in online marketing within eco-friendly industries.

1. To gather key online strategies used to actively promote eco-friendly products or solutions.
2. To explore how characteristics of online content—such as perceived usefulness, quality, and emotional appeal—impact consumer actions when buying eco-friendly products, and whether these traits influence personal beliefs about being green.
3. To examine how new technologies like blockchain and Digital Product Passports (DPPs) can prevent false eco claims while enhancing transparency in supply chains through reliable tracking.
4. To propose a method for assessing lasting key performance indicators (KPIs) that focus on real outcomes, fostering ongoing behavioral changes while promoting transparent digital progress by monitoring significant metrics over time.

Need or Relevance of the Study

This study is increasingly relevant as markets advance quickly while regulations lag behind. Rapid changes make it harder to comply with standards. At the same time, eco-friendly purchasing habits are accelerating. Global data reveal a trend—online searches for green products surged by 71% over five years (World Wildlife Fund, n.d.). Clearly labeled sustainable products are outperforming others, growing nearly three times faster.

This momentum means companies must plan wisely—entering markets cautiously, expanding steadily, and remaining resilient amid changes. Our research compiles effective strategies that support businesses' growth without sacrificing integrity.

Moreover, managing risks while adhering to regulations has never been more crucial. Trust is fragile—84% of consumers abandon brands due to poor environmental practices (The Round Up, n.d.). Online marketing is not just advertising; it's a safeguard for brand reputation. Exploring new technologies is sensible given future requirements, such as Digital Product Passports by 2027, which demand accurate supply chain documentation (Ramboll, n.d.). Understanding how these tools work helps not only comply with laws but also distinguish brands with credible green commitments (Circularize, n.d.).

Research Methodology

This report synthesizes findings from credible research papers and industry insights. It connects traditional concepts of consumer behavior with new trends in online marketing while incorporating tools for tracking accountability. Instead of merely listing sources, it weaves them into a clearer narrative using established frameworks combined with new data. Each part builds on previous elements, linking theory to practice with practical examples from trustworthy sources.

Hypothetical Primary Study Design:

A quantitative study will evaluate how well the concepts from VBN and TPB translate into real-world behavior. Instead of conventional statistical methods, this study will employ SEM-PLS, a choice often utilized in the study of green marketing.

Sample & Measurement:

A structured questionnaire will be distributed to approximately 500 digital consumers who frequently encounter sustainability-focused marketing. All constructs will be measured using validated 5-point Likert scales.

Data Analysis:

This approach assesses real connections by comparing immediate outcomes with broader

impacts. It also questions whether environmental concerns or belief in eco-claims actually shifts online purchasing toward greener choices.

Analysis & Interpretation of Data

Empirical Evidence of Digital Demand and Market Growth

Market data continues to demonstrate that eco-friendly purchasing is not just a trend—it is thriving and delivering real value. Online platforms are now the primary venue where consumers research products and make purchases.

The numbers tell a clear story. Items labeled eco-friendly sold almost three times faster than others (The Round Up, n.d.). This speed shows how wise it is to spend money on online green promotion (Hidayat et al., 2023). Most shoppers now discover these items through screens. Nearly three out of four environmentally conscious purchases happen online instead of in stores (The Round Up, n.d.). This makes sense digitally. It's hard to explain tough topics like emissions or fair labor quickly on shelves, but they fit well in detailed web descriptions.

Table 1: Digital Market Dynamics for Sustainable Products

Metric	Data Point	Implication for Digital Strategy
Increase in Global Searches for Sustainable Goods (5 years)	71% (World Wildlife Fund, n.d.)	Prioritize SEO and high -intent keyword strategies (Yao et al., 2024)
Sustainable Product Growth Rate vs. Conventional	2.7x faster (The Round Up, n.d.)	Justifies significant investment in digital marketing (Hidayat et al., 2023)
Consumers Willing to Pay More	55% (The Round Up, n.d.)	Focus content on justifying the premium via transparency (traceability, impact data)
Sustainable Goods Sales Better Online vs. In-Store	75% (The Round Up, n.d.)	Digital platforms are the superior environment for communicating complex sustainability claims

The Imperative of Digital Accountability: Mitigating Greenwashing

Sustainable digital marketing struggles because greenwashing is on the rise. Companies make vague or irrelevant promises without any evidence. This makes people lose trust (O'Rourke & Loehr, 2020). However, new tools focused on transparency are replacing weak statements with honest, checkable facts that anyone can verify.

Blockchain Technology

Blockchain keeps a clear record of environmental information that cannot be changed. Once changes are saved, false eco-promises nearly disappear (Freudenreich, n.d.). People can see product origins, pollution levels, and materials—exactly when it matters. Trust increases because everyone has real-time access.

Digital Product Passports (DPPs)

DPPs track every product digitally—often using QR codes or RFID—monitoring its origin, materials, production method, and end-of-life options (Ramboll, n.d.). Since information remains accessible throughout the item's life, it becomes easier to repurpose, repair, or recycle instead of throwing it away.

People are beginning to find real evidence—not just stories—because blockchain combined with DPPs brings honesty to green promises. This allows shoppers to evaluate the true impact (Circularize, n.d.).

Table 3: Key Performance Indicators for Sustainable Digital Marketing: Shifting Focus to Long-Term Impact

KPI Category	Traditional Short -Term Metric (Acquisition)	Sustainable Long -Term Metric (Impact & Retention)	Strategic Link
Engagement	Click-Through Rate (CTR) (Mountain, n.d.)	Net Promoter Score (NPS) specific to sustainability claims (Mountain, n.d.)	Measures alignment of values/identity (Sustainability Directory, n.d.)
Financial	Cost Per Acquisition (CPA) (Attention, n.d.)	Customer Lifetime Value (CLV) & Sustained Sales Growth (Magnitude of Change, n.d.)	Prioritizes value -based connection over cheap acquisition (Yao et al., 2024)
Integrity	Time Spent on Website (Harvard Business School Online, n.d.)	Adoption of Digital Product Passports (DPP); Reduction in Greenwashing Indicators (O'Rourke & Loehr, 2020)	Demonstrates verifiable, actionable commitment to sustainability (Circularize, n.d.)
Behavioral	Initial Social Shares (Magnitude of Change, n.d.)	Sustained influence on Green Values and Environmental Concerns (Khan et al., 2024)	Gauges success in driving societal and personal norm change (VBN) (University of Cambridge Institute for Sustainability Leadership, n.d.)

Shifting the focus from simply cutting customer acquisition costs to creating real, long-term impact allows marketers to connect digital actions with broader sustainability goals. Instead of chasing quick conversions, this approach encourages brands to build lasting value and stronger relationships with consumers.

Findings

1. Digital platforms speed up eco-friendly market gains. Because they meet rising consumer needs - growing nearly three times quicker than standard items - they give people the clear details needed when picking responsible options (The Round Up, n.d.).
2. Digital plans work best when actions

match beliefs. Instead of just pushing ads, top campaigns tap into people's real worries about nature - connecting with their personal sense of eco-responsibility, which lines up with what drives behavior in the Value-Belief-Norm model (Smith, n.d.).

3. Staying trustworthy online means tech must answer for itself. Since digital platforms can easily fake eco-friendly claims, we need solid proof built in - like using Blockchain so supply chains can't be altered, or setting up Digital Product Passports that clearly show a product's full history in a consistent way (Circularize, n.d.).

Conclusion

The findings make it clear that digital marketing has a strong influence on how consumers respond to sustainability. As more people look for greener options, digital platforms have become the main places where they search, compare, and judge environmental claims. But the real strength of digital marketing goes beyond persuasion—it lies in building credibility at a time when greenwashing is common.

When companies tell real stories, show clear facts, or speak in ways that match what folks care about, they tap into stronger drives - ideas found in things like the Theory of Planned Behavior or the Value-Belief-Norm framework. It proves buyers don't simply respond to commercials; instead, their decisions grow from personal views, who they are, or a sense of duty to society.

The study backs up the notion that truth matters most. Nowadays shoppers want proof instead so tech steps in here. Tools like blockchain or digital IDs check where things come from how they're built and shipped - making online promotion more about responsibility less hype. In short, digital marketing supports smart choices if it's truthful and solid in practice. Firms focused on lasting worth, real results, while staying open often gain loyalty and hold onto buyers. By going this route, internet sales turn into something beyond loud pitches - it promotes better habits, deeper brand connections, and progress toward a cleaner future.

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69. Sustainable Development Goals (SDGs) In India: The Urban-rural Disparity

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Abstract

The 17 SDGs focus on areas such as poverty, hunger, health, education, clean water and energy, economic growth and equality, climate and overall environmental welfare along with numerous other indicators. Proper implementation and tracking of progress is crucial for efficiently attaining the sustainable goals but there are many gaps in this process. The author has tried to study one such gap which is: the disparity seen in the urban and rural areas in relation to the attainment of SDGs. There are many challenges faced by the NITI Aayog and government in promoting and achieving these goals because of the structural, geographical, demographic and social inequalities present in the various states of the country. While some states lead in health and education, others lag behind with widespread poverty or lack of proper sanitation.

By going through an extensive research by reading and analysing quite a few sources, the researcher has tried to extract data about the difference in the SDG India Index of different states to determine what factors affect the statistics the most and where the need for improvement actually is.

It is important to note that the states performing well in SDGs are also the states with the most urbanised areas, whereas the states with a high percentage of rural areas are the ones lagging behind.

The findings of this paper show that, there is a considerable difference in the ways in which SDGs are being adopted and promoted in the rural and urban areas. While the urban areas have an advantage due to better socio-economic conditons, the rural areas will still take a long time to reach the favourable sustainable development index. It concludes by suggesting some measures or practices that the NITI Aayog can incorporate for better and faster attainment of the SDGs in order to maintain a high SDG India Index while also focusing on bridging the gap between the urban-rural disparity.

Keywords : Sustainable Development, Sustainable Development Goals (SDGs), NITI Aayog, SDG India Index, SDG Score, Urban-Rural Disparity.

Introduction: The survival and well-being of a nation depends upon sustainable development. Sustainable Development Goals have become an integral part of economic development policies around the world and are helping in shaping a sustainably secure future.

The 2030 Agenda for Sustainable Development, adopted by all United Nations member States- including India- in 2015, provides a shared framework for promoting social and economic well-being along with sustainability for the people and the planet, at present and in the future. There are 17 Sustainable Development Goals (SDGs) which are being implemented in developed as well as developing countries across the globe. They are: 1. No poverty, 2. Zero hunger, 3. Good health and well-being, 4.

Quality education, 5. Gender equality, 6. Clean water and Sanitation, 7. Affordable and clean energy, 8. Decent work and Economic growth, 9.Industry, Innovation and Infrastructure, 10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, Justice, and strong institutions, and 17. Partnerships for the goals.

In India, the NITI Aayog is appointed by the government for implementing and achieving the above 17 SDGs. It monitors and tracks the development at national and state levels by making use of various statistical tools.The SDG India Index is one such tool, used to measure the progress of Indian states and union territories towards achieving the sustainable goals. It helps in making a comparative analysis of the different states and UTs by tracking 113 indicators across 16 SDGs and scoring them on a scale of 0 to 100. One of the main motives of the government is the Localisation of the Sustainable development goals so that no state, city or village is left behind, and to ensure that there is uniformity in the nationwide application of SDGs. Although the NITI Aayog has executed various plans and policies, the country still lacks in regional equality in the achievement of the SDGs.

It was found that states like Kerala, Uttarakhand, Himachal Pradesh, Tamil Nadu and Goa perform well across multiple SDGs due to high literacy, good health care, infrastructure and efficient governance. On the other hand, states like Bihar, Jharkhand, Meghalaya and Nagaland have the lowest SDG India Index scores because of lack of financial resources, improper implementation and management, bad infrastructure etc..

Statement of the Problem:

Although the government is working continuously in the direction of Sustainable Development through various plans and polices like SDGs, there are many challenges which are hindering its progress. A significant cause for the under-achievement of these goals is that their nation-wide implementation has lacked uniformity. The author has tried to answer questions like: What disparities do we see in the implementation and growth of Sustainable Development Goals (SDGs) in the urban and rural areas of India? and, what steps are being taken to bridge this gap? While suggesting some actions or measures that the government can take to improve the country's overall Sustainable Development Index (SDG Index).

Review Of Literature :

The Sustainable Development Goals being enforced in 2015, is a fairly new concept. Many researchers have conducted studies on Sustainable Development, SDGs and their implementation in various countries and regions worldwide. If by development we mean growth, then the most important question facing the world today is not whether development is possible, but whether development is sustainable (Sen. Rajkumar and Roy. C Karthik). Rani remarked in her article that Sustainable Development cannot be achieved through policies alone; it must be embraced by society as a guiding principle for daily choices made by individuals as well as significant political and economic decisions that impact many.

A developing country like India, has to spend more resources on the implementation and achievement of the SDGs. India is a key player in the UN Sustainable development goals (SDGs) because of its sizeable population, expanding economy, and dedication to tackling problems like poverty, healthcare and climate change (Panda, Rajesh and Sethi et.al.). On the contrary, these are also the reasons why India is lagging behind in the Sustainability Index. As Sutradhar M. and Nag A. note, though India has made significant progress towards many of the SDGs, it still faces considerable challenges particularly regarding inclusivity, climate resilience and poverty alleviation. These challenges stem from India's vast geographical and socio-economic diversity. Very few studies have been undertaken in the context of regional disparities seen in the attainment of SDGs in the country. There is an extensive research gap regarding data availability. An extensive study on the SDGs in India will help foster the government to formulate policies (Debnath P., Ganguly I. and others). Some states in India are doing well in the persuasion of these goals while

many are falling short in their performance. This disparity can also be seen in SDG India Index results. One of the important factors contributing to this is the difference in approach to the way in which the SDGs are being implemented in rural and urban areas.

Objectives of the Study :

This study focuses on three main objectives as follows:

1. To understand what Sustainable Development Goals (SDGs) are and what areas they focus on.
2. To address the gap between the SDG achievements in urban and rural areas and the reasons causing it, along with state-wise and goal-wise analysis of SDG performance.
3. To recommend some strategic changes or measures that can be taken to overcome the urban-rural disparity in sustainable development.

Relevance of the Study :

This study about the disparity in implementation and promotion of the Sustainable Development Goals is important because it emphasizes the challenges faced during their pursuance. It helps identify the gap between rural and urban sustainable development. Some of these are mentioned below:

1. Lack of Awareness: A majority section of the society is not aware about the SDGs due to ignorance or lack of literacy. This problem is more prominent in rural areas because of the non-availability of quality education and low literacy rates. The rural population is not familiar with the concepts of gender equality, clean energy, decent work, economic growth or responsible production and consumption.
2. Weak Governance: It is seen that in many states the government is not taking serious measures in the direction of sustainability. The local governance structures such as Panchayati Raj and Zilla Parishads lack initiative and do not promote the SDGs effectively, causing inefficiency.
3. Financial Constraints: Less developed or low-income states like Bihar, Jharkhand, Meghalaya and Nagaland have the lowest SDG India Index. They face difficulties due to shortage of funds and absence of good infrastructure facilities; as is the case with most rural-dominant states. Due to lack of finances, less budget is being allocated for the implementation of SDGs; as a result, the progress is slower.
4. More focus on some SDGs: The NITI Aayog is focusing more on promoting specific goals such as SDG3 Good Health and Well-being, SDG4 Quality Education, SDG5 Gender Equality, SDG6 Clean Water and Sanitation, SDG7 Affordable and Clean Energy, SDG9 Industry, Innovation and Infrastructure, SDG11 Sustainable Cities and Communities and SDG12 Responsible Production and Consumption. These goals align more with the urban areas leading to an improvement in the urban standard of living. This is resulting in less attention to many other important goals crucial to the development of rural areas.
5. Slow Progress: There are some SDGs whose progress has not been fast enough even after repeated intensive efforts by the NITI Aayog and the government; such as No poverty, Zero Hunger, Quality Education, Clean Water and Sanitation, Climate Action etc. This is because these issues are largescale and difficult to solve in a few years.
6. Higher percentage of Rural Areas: Nearly 65% of the Indian population lives in rural areas. The rural areas are less developed in terms of all socio-economic criteria. While the urban areas are faster in adapting the SDGs and progressing towards sustainability, rural areas are slower in catching up with the rapid urbanization and thus, lag behind in attaining a higher Sustainable Index.
7. Lack of Integration: Different approaches used by different state governments, unequal budgets allotted, different policies and promotion techniques used cause disintegration in overall strategy; which leads exclusion of some regions from the mainstream SDG progress path.

These points emphasize the need for a uniform implementation, promotion, and progress tracking strategy for the whole country. Also, there is a need for the NITI Aayog and government to come up with suitable plans & policies that integrate and align the rural and urban sustainability goals for better and faster attainment.

Research Methodology :

This study has been conducted by the researcher, relying exclusively on secondary data derived from various sources.

The research paper consists of different forms of secondary data:

A. Theoretical data - The theoretical data encompasses information about the Sustainable Development Goals (SDGs), their implementation, challenges faced in achievement of SDGs and the gap between Urban and Rural areas.

B. Statistical Data - The statistical data throws light on the SDG India Index, the figures and percentages related to the achievements of SDGs and the cardinal measurement of growth in various regions.

C. Visual Data – The visual data showcases the theoretical and statistical data in a simplified and easy to understand form by making use of graphs, charts and tables.

All the secondary data has been obtained from topic-relevant sources, such as: Books, Journals, Articles, Reports, Research Papers, Conference Papers and Official websites of the Government. The research has been conducted by deeply studying, interpreting, and paraphrasing the obtained data.

Analysis And Interpretation of Data:

From the official resources the following data regarding India's SDG Score was found:

YEAR	SDG SCORE
2018	57
2019-20	60
2020-21	66
2021-22	71

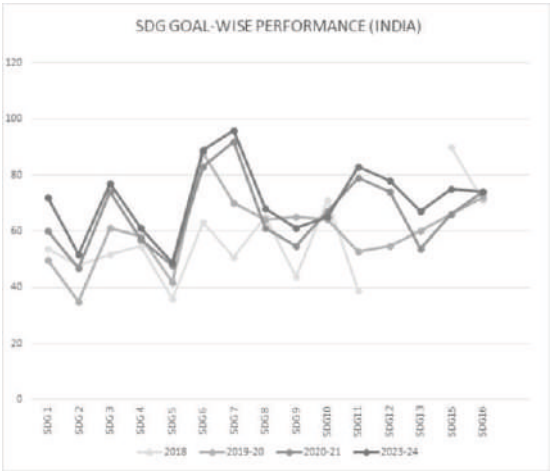
From the table, we can deduct that, there has been a considerable increase in India's SDG Score. On an average, it has seen a jump of about 4.6 points every year since 2018, with the average score being 63.5. The State-wise SDG India Index Scores for 2023-24 are as follows:

The State-wise SDG India Index Scores for 2023-24 are as follows:

As shown in the table, there is a huge difference in the SDG Index score of the given states. The highest scoring states are also the states with a higher urban percentage: Kerala 48%, Tamil Nadu 48% and Goa 62%. Meanwhile, the lowest scoring states are the ones with a higher rural percentage: Bihar 89%, Assam 86% and Meghalaya 80%.

Highest scoring States	SDG Score	Lowest scoring states	SDG Score
KERALA	79	BIHAR	57
UTTRAKHAND	79	JHARKHAND	62
TAMIL NADU	78	MEGHALAYA	63
GOA	77	NAGALAND	63
HIMACHAL PRADESH	77	ASSAM	65

The following graph shows the goal-wise performance of the SDGs. It can be seen that sustainable development goals such as No Poverty, Good-health and Well-being, Clean Water and Sanitation, Decent Work and Economic growth, Reduced Inequalities, Sustainable Cities and Communities, Responsible Production and Consumption, Climate Action, Life on Land and Peace, Justice and Strong Institution are doing really well – with their scores being above 65 - but still have not been fully achieved. While on the other side, SDGs like Zero Hunger, Quality Education and Industry, Innovation and Infrastructure and lagging behind with scores more than 50 but less than 65; the most underperforming goal with scores under 50 being SDG 5 - Gender Equality. We can interpret that while some goals are performing well, other are far behind. No SDG has been achieved 100%.



Conclusion

The study gives us insightful information about the Sustainable Development Goals (SDGs), the role they play in sustainable

development and the disparities which are found while implementing and promoting these goals in a vastly diverse, but rural-dominant country like India. There is a lot that can still be done by the NITI Aayog and the government for accelerating the persuasion and achievement of these goals.

Some reccomendations in this direction would be:

1. **Spreading Awareness:** The focus should be on raising awareness and informing the citizens about the SDGs and their role in developing the country. This would make people more concious about sustainable development and improve cooperation on individual as well as social level.
2. **Identify Lagging SDGs:** The SDGs that are not performing well should be identified and analyzed. The factors behind the slow progress of these goals should be understood so that plans and strategies to overcome can be made acccordingly.
3. **Classifying the Areas:** The framework should work uniformly, by not just focusing on individual states but rather on the country as a whole. Rather than using a different framework for every state, classifying the areas as urban or rural will help the government better in framing policies according to the requirements of those regions.
4. **Policies and Programmes :** More such policies and programmes should be made, which focus on proper implementation, uniformity, intergration, localization and promotion of the SDGs in the urban as well as rural areas.
5. **Equal Focus:** Equal or proportionate focus must be given to all the SDGs. If a particular SDG is lacking more in some areas, then that particular goal must be given priority while simutanuously working towards the other goals. Good performance of some SDGs does not mean that only those goals should be considered important.

This will lead to the eradication of inequality in sustainable development of the different regions of India. Uniformity in SDGs will result into faster and economical sustainable growth, which is very essential for a developing country like India.

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70. Green Investment and Financing Social Enterprises: Understanding Sustainability, Greenwashing, and the Rise of Responsible Finance

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2. Abstract

This study explores how sustainability has become a strategic driver for modern businesses and social enterprises. With consumers becoming more aware of environmental issues, companies are shifting towards green practices and responsible investment models. However, many organizations still engage in greenwashing making false environmental claims to attract customers highlighting the gap between promises and actual performance.

The research examines the growth of sustainable finance, which is rapidly expanding worldwide, and the role of financial institutions such as SIDBI, Ecofy, Starling Bank, and global impact investors that support green initiatives. Secondary data from reports, articles, and sustainability studies reveal that green finance can help enterprises reduce carbon emissions, adopt cleaner technologies, and improve long-term competitiveness.

The study concludes that green investment is not only an ethical requirement but also an economic necessity. Transparent sustainability practices, combined with accessible green financing options, can enable enterprises to operate responsibly and contribute to environmental protection.

3.keywords

- Sustainable Finance
- Green Investment
- Social Enterprises
- Greenwashing
- Responsible Investment
- ESG (Environmental, Social, Governance)
- Renewable Energy Finance
- Impact Investing
- Green Loans
- Sustainability in Business

4. Introduction:- In today's rapidly evolving business environment, sustainability has emerged as a strategic driver that shapes marketing, investment decisions, and enterprise-level transformation. As consumers become increasingly aware of environmental issues, companies are being pushed to adopt greener practices not only to remain competitive but also to ensure long-term survival. The shift toward responsible production and ethical business conduct has placed sustainability at the core of corporate strategy.

One of the most significant developments in this era is the rise of green finance, which refers to financial instruments and investments that support environmentally beneficial activities. Traditionally, companies have raised funds through equity or debt to meet their operational needs. However, with growing awareness of climate risks and resource depletion, investors are now more inclined to support organizations that follow eco-friendly practices and contribute to societal well-being. This changing preference is also driven by higher churn rates, increasing regulatory pressures, and the global call for responsible business practices.

At the same time, the market has also witnessed a rise in greenwashing, where companies falsely claim to follow sustainable practices. Well-known brands such as Volkswagen, Nestlé, Starbucks, and Coca-Cola have faced criticism for misrepresenting their environmental commitments. These incidents highlight the

need for transparent, measurable, and genuinely sustainable business models.

Supporting this global movement, financial institutions—including several NBFCs, fintech firms, and development banks—are now offering specialized green loans and impact investment opportunities. Organizations such as Ecofy, Starling Bank, Cooler Future, Clim8, Acumen, Echoing Green, and SIDBI are actively financing climate-friendly businesses and social enterprises focused on positive environmental impact.



The growing momentum is also reflected in market trends. The Sustainable Finance Global Market Report 2025 shows that the global sustainable finance market is projected to grow from USD 6,718.2 billion in 2024 to USD 18,224.29 billion in 2029, with a strong CAGR of 21.9%. This dramatic rise indicates that sustainable finance is becoming one of the fastest-growing sectors globally.

Overall, the shift toward green investment and social enterprise financing represents more than a financial trend it marks a fundamental economic transformation. As sustainability becomes central to business strategy, understanding these developments is essential for shaping future policies, investment decisions, and responsible innovation.

5. Statement of the Problem

1. Companies earlier focused only on profit, ignoring environmental responsibility and long-term sustainability.
2. With time, marketing evolved — from selling products → to customer service → to social media marketing → to sustainable and responsible marketing.
3. Consumers today are more aware and prefer companies that care for the environment and offer responsible, eco-friendly services.
4. Many enterprises still do not follow sustainable practices due to:
   - o lack of awareness
   - o high cost of transition
   - o limited access to green finance or investment
   - o focus on short-term profits
5. Companies often raise funds through equity or debt, but these funds are not always used for sustainable or green initiatives.
6. Some organisations falsely claim to be environmentally friendly (greenwashing), which reduces consumer trust and creates confusion in the market.
7. There is a gap between the need for sustainability and the availability/usage of green financing options for businesses.
8. Because of climate concerns, competition, and consumer pressure, enterprises must shift towards sustainable practices, but clear guidance, funding, and support are still missing.

6.literature Review

1. Growth of the sustainable-finance market

Recent market reports show very large and fast growth in sustainable finance. One market forecast projects the sustainable finance market to increase from about USD 8.24 trillion (2025) to USD 18.22 trillion (2029) a compound annual growth rate (CAGR) of ~21.9%. This rapid expansion is driven by investor demand for climate-aligned assets and more financial instruments such as green bonds and sustainability-linked loans.

Implication for your study: The size and growth of the market show that green finance is becoming mainstream studying how social enterprises access this capital is therefore timely.

2. Responsible investment / ESG trends (global evidence)

Global surveys and reviews from the Global Sustainable Investment Alliance (GSIA) show that ESG and responsible investing continue to expand across major markets, with more assets being managed under responsible-investment

approaches and more disclosure by fund managers. These reviews combine fund-disclosure data and investor surveys to show adoption trends and regional differences.

Implication for your study: Responsible investment is not a niche — it influences capital allocation decisions, which matters when analysing financing options for social enterprises.

3. Green finance instruments and regulation (India context)

Indian regulators and institutions are building frameworks to support ESG debt and green finance. SEBI (India's securities regulator) has formal listings and guidance for ESG/green/sustainability debt securities and maintains public records of green-bond issuances. Simultaneously, development institutions such as SIDBI have launched Green Finance Schemes and specific products (e.g., energy-efficiency financing, incentives for green loans) to support MSMEs and social enterprises. These actions expand supply of green capital and provide institutional backing in India.

Implication for your study: In India, both regulatory action and development-bank products can be important channels for social enterprises to get green funding.

4. Financing social enterprises — impact investors and intermediaries

Impact investors, specialized NBFCs, fintechs, and foundations (e.g., Acumen, Echoing Green) are known to fund social enterprises with patient capital, grants, or blended finance. These actors focus on social/environmental outcomes alongside financial returns, and they help bridge early-stage funding gaps that traditional banks often avoid. Evidence from impact-investing literature shows that such capital is critical for scaling mission-driven businesses.

Implication for your study: When studying finance for social enterprises, include impact investors and blended-finance models as realistic funding sources.

5. Credibility problems: greenwashing and reputational risk

A cautionary theme in the literature is greenwashing firms claiming environmental credentials they cannot substantiate. High-profile cases (e.g., the Volkswagen "Dieselgate" scandal and repeated criticisms of some consumer brands' plastic commitments) demonstrate that false or weak sustainability claims can damage trust and generate legal and financial costs. Studies and news reports emphasize the need for transparency, third-party verification, and clear disclosure to avoid greenwashing.

Implication for your study: Any policy or financing solution you recommend should include safeguards (verification, reporting standards) to reduce greenwashing risk.

6. Mixed performance and investor caution (recent market signals)

While sustainable finance has grown rapidly, some ESG-focused firms have faced asset outflows and performance challenges during market stress periods underscoring that sustainability-focused investing is not free of financial risk and that investors may reallocate when returns lag. This nuance matters for social enterprises seeking long-term capital: they still need sound business models and measurable impact to attract and retain investors.

Implication for your study: Examine both the attractiveness of green finance and the performance/market risks that may affect investor willingness over time.

7. Summary of gaps in the literature (what remains under-studied)

Based on the sources above, the following gaps are relevant for your research competition paper:

- How effectively do mainstream green finance instruments (green bonds, sustainability-linked loans) flow to social enterprises? (many instruments target large corporates)
- Which barriers (credit-risk perception, documentation, scale) most constrain social enterprises in different regions (especially India)?
- Which verification and reporting practices reduce greenwashing and improve investor confidence for small/social firms?

7. Objectives Of The Study

1.To analyse the role of green investment in promoting sustainable development in

emerging economies.

2.To examine how social enterprises use green finance to scale environmentally beneficial projects.

3.To identify barriers faced by social enterprises in accessing green investment.

4.To evaluate the effectiveness of green financial instruments (green bonds, impact funds, concessional loans).

5.To investigate investor behaviour toward sustainable and socially responsible enterprises.

6.To provide policy recommendations for increasing green finance accessibility.

7.To understand socio-economic impacts of green investment on communities (employment, energy access, waste reduction).

8. Need For The Study

1. Rising Environmental Challenges

Rapid industrialisation and resource exploitation have led to climate change, biodiversity loss, and pollution. Green investment channels capital into sustainable sectors such as renewable energy, green technology, and circular economy models.

2. Growing Role of Social Enterprises

Social enterprises aim to balance profit with social and environmental impact. They use business models to address issues like poverty, waste management, rural development, and clean energy access.

3. Financing Gap for Impact-Driven Organisations

Many social enterprises struggle to secure funding from traditional banks due to:

-Perceived high risk

-Lack of collateral

-Long payback periods

-Green investment frameworks (ESG, impact investing, blended finance) help fill this financing gap.

4. Global Shift Towards Sustainable Finance

Governments and markets are increasingly adopting:

-ESG investing

-Carbon-neutral policies

-Green bonds & sustainability-linked loans

-This creates new opportunities and requires academic exploration.

9. Relevance / Significance Of The Study

1. Academic Significance-

Contributes to literature on sustainable finance, impact investing, and social entrepreneurship. Bridges the gap between financial theory and sustainability research.

2. Practical Significance-

Helps social enterprises understand how to attract green funding.Offers investors insights into evaluating sustainability-based business models.Supports policymakers in designing green financing ecosystems.

3. Economic and Social Significance:-

Encourages innovation in renewable energy, waste management, agri-tech, and clean mobility.

Promotes inclusive development by strengthening social enterprises working with rural communities and low-income groups.

4. Environmental Significance-

Accelerates transition to a low-carbon economy.Supports projects that mitigate climate risks.

10. Research Methodology

1. Research Type

Descriptive and exploratory research (to understand green finance, greenwashing, and support for social enterprises)

2. Data Type

- Secondary data collected from:
- Research papers
- Industry reports (World Bank, IMF, UNDP, The Business Research Company)
- News articles (Reuters, BBC, Economic Times)
- Company sustainability reports

3. Data Collection Tools

- Published journals
- Websites of companies (Volkswagen, Nestlé, Coca-Cola, etc.)
- Reports on sustainable finance growth
- Articles on greenwashing cases
- Government and NGO reports on social enterprises and green lending

4. Sampling Method

5. Purposive sampling (Companies known for greenwashing + banks/NBFCs funding green projects)

6. Scope

Focus on global companies doing greenwashing Indian and global financial institutions offering green finance

11. Analysis & Interpretation of Data Key Insights Identified

1. Sustainable finance is growing rapidly Global market expected to reach USD 18,224.29 billion by 2029 (CAGR: 21.9%)

→ Shows increasing investor interest in sustainability.

2. Companies use greenwashing to attract customers

- o Volkswagen cheated emission tests
- o Coca-Cola & Nestlé ranked among top plastic polluters
- o Starbucks' "eco lids" used more plastic

→Shows gap between claims and reality.

3. Consumers prefer eco-friendly brands Surveys show rising awareness and demand for responsible companies.

4. Green finance options are expanding

- o Ecofy (India), SIDBI, Starling Bank, Clim8, Cooler Future
- o These institutions provide green loans, renewable financing, climate-focused investment options.

5. Social enterprises struggle with funding Many sustainable social enterprises lack:

- o access to patient capital
- o awareness about green finance instruments
- o government support

6. Green finance helps solve the problem By offering:

- o Low-interest green loans
- o Green bonds
- o Climate-focused investment funds

→ Enables businesses to adopt sustainable technologies.

12. Findings

1. Sustainable finance is not a trend, but a global shift in investment behaviour.
2. Greenwashing is widespread, done by major companies like Volkswagen, Coca-Cola, Nestlé, H&M, Starbucks.
3. Consumers are becoming environment-conscious, influencing company decisions.
4. Social enterprises need more structured financial support to adopt green practices.
5. Green finance institutions play a critical role in enabling sustainability transitions.
6. There is a strong mismatch between what companies promise (green claims) and what they actually do.
7. Green financing offers solutions through:

- o Renewable energy loans
- o Climate-positive portfolios
- o Carbon reduction investments
- o Sustainable business funding

13. Conclusion

Green investment and financing social enterprises have become crucial in today's evolving business landscape. As consumer awareness grows, companies are forced to adopt transparent and sustainable practices. However, the rise of greenwashing shows that many organizations still mislead customers instead of making real environmental changes. At the same time, the rapid growth of sustainable finance proves that the world is moving towards a greener economic system. With proper regulation, financial support, and awareness, green finance can help enterprises genuinely reduce their environmental impact and contribute to long-term sustainable development.

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71. Green Ai: Reducing Energy Consumption in Artificial Intelligence Models

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Abstract.

The rapid growth of AI has brought tremendous improvements across various fields. Still, there is a high environmental cost to this progress. Advanced AI systems use vast amounts of computational power and electricity in training and deployment. This has contributed to increased carbon emissions. It has also heightened pressure on global energy resources. As AI models continue to grow larger and more complex, their energy requirements have become increasingly unsustainable through conventional development means. This has given rise to Green AI. It is a paradigm committed to reducing computational, environmental, and carbon footprints of AI systems. All this happens without compromising performance.

This research paper analyses the increasing energy load of AI. It distinguishes conventional high-energy practices from sustainability-oriented approaches. The paper reviews the major relevant literature and techniques for improving efficiency. It also assesses optimisation strategies at the software, hardware, and infrastructure levels. The paper further proposes a Green AI lifecycle framework. This spans model design, training,

deployment, and maintenance. Case studies and quantitative evidence from contemporary AI training and inference workloads demonstrate the urgent need for sustainable methodologies. The paper concludes with key findings. It covers future directions. It also discusses the long-term implications of adopting Green AI for the global AI ecosystem.

Keywords: Green AI, sustainable computing, energy-efficient AI models, carbon footprint, model compression, quantisation, pruning, efficient architectures, low-precision computing, parameter-efficient fine-tuning, neuromorphic hardware, carbon-aware scheduling, lifecycle assessment, edge AI, federated learning.

1. Introduction: Artificial intelligence has become a foundational technology across many industries. These include healthcare, transportation, manufacturing, education, governance, and communication. Its most recent rapid evolution has been driven primarily by the ambition for higher accuracy and more complex capabilities. This happens especially through the scaling up of large model architectures. However, traditional AI development generally optimises for performance metrics such as accuracy, precision, and generalisation. It overlooks the computational and environmental costs involved in such performances.

With increasing computational demands, AI is putting unprecedented strain on global energy systems. Data centres powering modern AI applications now account for a measurable fraction of global electricity consumption. Several projections suggest this may grow several-fold as AI is broadly adopted. Training large-scale models requires enormous computing resources. These models, particularly those with hundreds of billions of parameters, take weeks or months to run on clusters of high-power hardware accelerators.

The environmental impact goes far beyond training. Recent findings show that AI inference contributes a larger share of lifetime energy consumption than training itself. For example, large-scale conversational models require high computational power for every individual query. Even small per-query costs scale dramatically when multiplied by millions or billions of global users.

These challenges have given rise to an emergent need for sustainable AI development. Green AI involves practices that place energy efficiency and environmental responsibility as a priority. These practices do not sacrifice capability. It focuses on minimal carbon emission, reduced hardware waste, and algorithmic and architectural techniques. These provide higher computation-per-watt. The growing urgency of climate change and global environmental commitments make this transition to sustainable AI practices all the more imperative.

This research paper explores the shift toward Green AI. It evaluates current challenges. It reviews the key advances in efficient model design. It also puts forward a comprehensive lifecycle-based framework for sustainable AI development.

What is Green AI?

Green AI is a terminology used for the development and deployment of an Artificial Intelligence in an environmentally friendly way by minimising carbon footprint and energy consumption.

It is one of the common practices which is used in today's industry. Green Artificial Intelligence is more environmentally friendly and inclusive as compared to Conventional AI, as it helps in producing accurate results without increasing the computational cost and also ensures that any researcher with a laptop can perform high-end research without the need cost cost-intensive cloud servers.

2. Problem Statement.

While AI technologies are transformative in their potential, their environmental impact has become of great concern. Current development practices of AI are suffering from several related issues. Large models run on massive GPU or accelerator clusters during training. This involves tremendous electricity consumption and subsequent carbon dioxide emissions. Even higher cumulative energy use happens at inference. While training is much more expensive, continuous global inference operations very often represent the majority of the model's lifetime energy consumption. There is currently no standard way to measure,

compare, or report the carbon footprint of AI systems. Energy-intensive hyperparameter tuning adds to the problem. The traditional techniques used to optimise multi-round retraining and architecture searches greatly increase the energy cost. Hidden environmental costs exist, too. These include hardware manufacturing, supply chains, data centre cooling, and water use. They are rarely accounted for in emissions. Efficient model families exist, but most organisations use oversized models for marginal accuracy gains. Provisions for environmental sustainability under technology governance frameworks are limited. They are non-mandatory or inconsistent. The core issue is that while AI is increasingly developed, the environmental safeguards that would make that development sustainable are not keeping pace. Green AI targets filling this gap.

3. Literature Review.

The existing literature underscores the growing environmental costs of AI. It also identifies several approaches to reduction.

Energy and Carbon Footprint Studies.

Early studies showed that training large neural networks can result in emissions comparable to those of many cars over their lifetimes. Subsequent research has shown that the carbon intensity of the energy source used to train a model can have a dramatic impact on total emissions. This holds even across models trained on a similar quantity of raw electricity. For instance, renewable-powered grids differ from fossil-fuel-dominated grids. The case for carbon-aware model training is clear.

Efficient Architectures.

Efficient model families have demonstrated that competitive accuracy can be achieved with many fewer parameters. This generally means lower compute. Lightweight architectures, designed for edge devices, reduce computational load during inference. This allows for deployment on lower-power hardware. It brings down emissions.

Model Compression Techniques.

Research in pruning, quantisation, and knowledge distillation has shown large reductions in model size, memory usage, and energy consumption. Pruning removes superfluous parameters. Quantisation reduces the precision from 32-bit to 16-bit, 8-bit, or even 4-bit formats. Distillation trains smaller models to imitate larger ones. Such methods can reduce energy consumption by 30% to 60 %. There is a minimal loss of accuracy.

Parameter-Efficient Fine-Tuning (PEFT).

The PEFT methods cut the number of parameters updated during fine-tuning to below 1% of the full model. This significantly reduces energy consumption. It enables training on low-power hardware.

Hardware Innovations.

Custom accelerators offer much better performance per watt than general-purpose GPUs. Neuromorphic hardware introduces event-driven computation inspired by biological neurons. This enables ultra-low power inference.

Carbon-Aware Scheduling.

Research in workload scheduling points out that non-urgent training tasks can be shifted to periods of high renewable energy availability. Predictive scheduling systems use machine learning to forecast carbon intensity. They optimise energy use accordingly.

Data Centre Sustainability.

In large data centres, AI-assisted cooling optimisation systems have reduced energy use up to 40%. Architectural improvements, applied together with the use of renewable energy sources, have proved particularly effective in lowering emissions.

4. Objectives of the Study.

- To analyse the energy consumption pattern for the AI model.
- Examine the environmental impact of large-scale AI development.
- It will assess the current techniques, such as compression, efficient architecture, and PEFT, for optimisation.
- Specialised hardware plays a role in energy consumption reduction.
- Investigate data centre-level and grid-level strategies for sustainable AI development.
- Propose a lifecycle-based Green AI optimisation framework.
- Identify research gaps and future

direction in view of AI development sustainability.

- Provide evidence-based recommendations to academia, industry, and policymakers.

5. Rationale of the Study.

The necessity of this study emerges from the exponential growth in the size of AI models and their energy consumption. The potential for AI to consume a large portion of national electricity exists in the near future. There is an urgent need to align the development of AI with global climate goals. Growing concerns about hardware waste and the environmental impact of data centres are rising. A lack of accessible guidelines for researchers and companies to minimise AI's carbon footprint persists. Increasing policy awareness about the environmental impact of digital technologies is happening. The need for standardised lifecycle assessments that can effectively consider environmental cost is clear. We must consider the imperative of sustainability both from an environmental and ethical standpoint. This is vital as AI is integrated into our society.

6. Research Methodology.

The research design is qualitative and analytical. It links pre-existing empirical data with conceptual evaluation.

Data Collection.

Secondary data includes academic papers, energy reports, environmental frameworks, and technical documentation. Quantitative values for training energy, inference costs, hardware power use, and data centre efficiency come from extracted sources.

Analysis Techniques.

Thematic analysis categorises findings into software, hardware, and infrastructure-level optimisations. Cross-model comparison assesses the relationship between parameter count, FLOPs, and emissions. Assessment of accuracy-energy trade-off covers compression and optimisation techniques. Case study analysis validates applicability in the real world.

Validation.

Triangulation compares data from multiple independent studies. Alignment with recognised energy measurement standards occurs where available.

7. Analysis Interpretation of Data.

Training Energy Trends.

Large models can consume hundreds to thousands of megawatt-hours of electricity during training. Models trained on grids with high renewable penetration create drastically lower emissions. This happens even when consuming similar amounts of electricity.

Inference Energy Dominance.

Inference often represents 60% or more of total lifecycle energy. Even small per-query costs scale dramatically when multiplied by global usage.

Hardware Consumption Interpretation.

High-end GPUs consume around 250 to 1000 watts. Specialised accelerators use significantly less power with higher throughputs per watt. Neuromorphic chips drastically lower energy consumption for sparsely activated networks.

Impact of Compression Techniques.

Quantisation reduces memory bandwidth and computation cost. Pruning removes unnecessary weights and operations. Distillation yields efficient student models. Combined, they can reduce energy consumption by up to 60%.

Data Centre Interpretation.

Cooling systems account for 15 to 40% of data centre energy use. AI-driven cooling optimisation has achieved up to 40% reduction in cooling power. This demonstrates AI's potential to reduce its own environmental impact.

Case Study Insights.

Low-carbon grid training reduces emissions by more than an order of magnitude. Efficient scheduling aligns training with periods of high renewable energy availability. Cloud sustainability dashboards enable better optimisation of resources. They reduce waste.

8. Findings.

The carbon intensity of electricity outstrips raw energy consumption in terms of what determines environmental impact. Most of AI's lifetime energy is contributed by inference. This makes it very important to optimise inference. Specialised hardware has much better performance per watt than general-purpose GPUs. Techniques using compression and PEFT are very effective in reducing energy

consumption. There is minimal loss of accuracy. Lifecycle analyses are incomplete. Many hidden costs exist in manufacturing hardware, cooling, and water. AI sustainability policies exist. Without compulsory enforcement, implementation is inconsistent. Combining efficient algorithms with greener hardware and renewable energy sourcing provides the most powerful route toward sustainable AI.

9. Conclusion.

AI development is accelerating at a pace that forces urgent consideration of environmental implications. The computational cost for training and deploying modern models is increasing exponentially. If left unchecked, AI will soon account for a significant chunk of global energy consumption. Green AI principles offer a viable path toward balancing innovation with environmental responsibility. There are significant energy gains to be realised through model compression. Parameter-efficient fine-tuning, low-precision computation, and efficient architectures help too. Hardware-level advances provide further gains. Infrastructural challenges are approached with data centre optimisation and carbon-aware scheduling. Locating AI workloads on low-carbon energy grids has the biggest immediate impact on reducing emissions. This is reinforced by the research presented. It shows not only that sustainable AI is possible. It is also essential in aligning the growth of AI with climate commitments. Future work will need to be directed at standardised lifecycle measurement. Better hardware recyclability, low-power training methodologies, and global regulatory frameworks are key. Sustainable AI is likely to be a basic requirement for the next decade. It will naturally lead to a future wherein all AI is Green AI.

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72. Sustainable Business Practices as a Tool for Empowering People with Disabilities

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Abstract
Sustainable business practices are increasingly recognized not only for their environmental benefits but also for their potential to promote social inclusion. This study explores how sustainability-driven business models contribute to the empowerment of persons with disabilities (PwDs) through inclusive employment, accessible product design, ethical supply chains, and community-based entrepreneurship. Drawing on existing academic literature and global case examples, the paper examines how practices such as inclusive hiring, social enterprises, circular production, and universal design improve economic participation, skill development, and social dignity for PwDs. The findings suggest that sustainability-oriented businesses can function as powerful tools for disability empowerment by aligning economic value

creation with social equity. The study concludes that integrating disability inclusion into sustainability strategies strengthens long-term business resilience while advancing inclusive development goals.

Keywords: Sustainable Business Practices, Disability Inclusion, Social Sustainability, Inclusive Employment, Empowerment, Social Enterprises, Universal Design, CSR, SDGs

CHAPTER 1

Introduction: Sustainable business practices have evolved beyond environmental protection to encompass broader social responsibilities, including equity, inclusion, and human well-being. In recent years, sustainability has been increasingly linked with social empowerment, particularly for marginalized groups such as persons with disabilities (PwDs). Globally, PwDs face persistent barriers to education, employment, mobility, and economic participation, often resulting in social exclusion and poverty. Businesses, as key economic actors, play a critical role in addressing these challenges through inclusive and sustainable operational models.

Sustainable business practices refer to organizational strategies that balance economic performance with environmental stewardship and social responsibility. Within the social dimension of sustainability, disability inclusion has gained attention as both an ethical obligation and a strategic opportunity. Research highlights that inclusive workplaces enhance innovation, employee engagement, and organizational reputation, while also contributing to reduced inequality and improved livelihoods for PwDs.

One of the primary ways sustainable businesses empower PwDs is through inclusive employment. Organizations adopting inclusive hiring policies provide accessible workplaces, reasonable accommodations, and skill-based opportunities rather than disability-based limitations. Studies show that PwDs often demonstrate high job retention, reliability, and productivity when provided supportive work environments. This not only enhances individual financial independence but also challenges societal stereotypes surrounding disability.

Another significant area is inclusive and universal design. Sustainable businesses increasingly design products and services that are accessible to people of all abilities, ensuring usability without the need for adaptation. Universal design supports independence and dignity for PwDs while expanding market reach for businesses. When accessibility is embedded at the design stage, it reduces long-term costs and promotes equitable access to goods and services.

Social enterprises and sustainability-driven ventures also play a vital role in disability empowerment. Many such enterprises integrate PwDs into value chains as artisans, service providers, or micro-entrepreneurs. By focusing on skill development, fair wages, and supportive working conditions, these models enable PwDs to transition from dependency to self-reliance. Circular and community-based business models further enhance this impact by creating localized, flexible employment opportunities suitable for diverse abilities.

Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) frameworks increasingly emphasize disability inclusion as a key social indicator. Businesses aligning sustainability goals with disability empowerment contribute directly to the United Nations Sustainable Development Goals, particularly SDG 8 (Decent Work), SDG 10 (Reduced Inequalities), and SDG 12 (Responsible Consumption and Production).

Overall, sustainable business practices offer a multidimensional approach to empowering persons with disabilities. By integrating inclusion into core business strategies rather than treating it as a peripheral activity, organizations can generate shared value for society and the economy. This study aims to examine how sustainability-driven business models can serve as effective tools for disability empowerment, fostering inclusive growth, social dignity, and long-term resilience.

Working Definitions of Terms Used

Sustainable Business Practices: Business strategies and operations that balance economic viability with environmental protection and social responsibility, ensuring long-term value creation for both organizations and society.

Persons with Disabilities (PwDs): Individuals

who have long-term physical, sensory, intellectual, or psychosocial impairments which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others.

Disability Empowerment: The process of enabling persons with disabilities to achieve economic independence, skill development, decision-making power, and social dignity through equal access to opportunities and resources.

Inclusive Employment: Employment practices that actively recruit, retain, and support persons with disabilities by providing accessible workplaces, reasonable accommodations, and non-discriminatory policies.

Social Sustainability: The dimension of sustainability focused on promoting equity, inclusion, well-being, and social justice within communities and organizations.

Universal Design: The design of products, services, and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Social Enterprise: An organization that prioritizes social impact alongside financial sustainability, often integrating marginalized groups, including persons with disabilities, into its value chain.

Corporate Social Responsibility (CSR): A business approach in which organizations integrate social and environmental concerns into their operations and stakeholder interactions beyond profit-making objectives.

Environmental, Social, and Governance (ESG): A framework used to evaluate an organization's ethical impact and sustainability performance across environmental stewardship, social inclusion, and governance practices.

Sustainable Development Goals (SDGs): A set of 17 global goals adopted by the United Nations to address poverty, inequality, environmental protection, and inclusive economic growth by 2030.

CHAPTER 2
Literature Review

2.1 Sustainable Business Practices and Social Inclusion

Scholarly literature increasingly frames sustainability as a three-dimensional construct encompassing environmental, economic, and social pillars (Elkington, 1997). Within this framework, social inclusion has emerged as a critical outcome of sustainable business practices. Researchers argue that businesses integrating social equity into sustainability strategies contribute to long-term value creation while addressing structural inequalities (Bansal, 2005). Disability inclusion is positioned as a core element of social sustainability, as it directly influences workforce diversity, community well-being, and equitable growth (UNDP, 2019).

Studies suggest that organizations adopting inclusive sustainability strategies demonstrate higher resilience and stakeholder trust (Porter & Kramer, 2011). Rather than treating disability inclusion as philanthropy, contemporary research emphasizes embedding it into core business models, operations, and value chains.

2.2 Disability, Employment, and Economic Empowerment

Employment is widely recognized as a primary pathway for empowering persons with disabilities. According to WHO (2011), exclusion from labor markets significantly contributes to poverty and social marginalization among PwDs. Academic studies show that inclusive employment practices improve self-reliance, social participation, and psychological well-being (Schur et al., 2014).

From a business perspective, literature indicates that PwDs often exhibit strong job commitment and lower attrition rates when workplaces are accessible and supportive (Lengnick-Hall et al., 2008). Sustainable enterprises that invest in reasonable accommodations and skill-based hiring not only fulfill social responsibility but also gain productivity and reputational advantages.

2.3 Sustainable and Circular Business Models as Enablers

Circular and sustainability-driven business models have been identified as effective enablers of inclusive employment. Kirchherr et al. (2017) highlight that circular economy models generate localized, labor-intensive opportunities, making them suitable for integrating marginalized groups. Models such

as upcycling, repair, reuse, and community-based production allow flexibility in work structure, which is particularly beneficial for PwDs.

In the Indian context, several studies highlight the role of artisan-led, sustainability-focused enterprises in creating dignified livelihoods. Upcycling units, textile recycling initiatives, and handicraft clusters often engage persons with disabilities in activities such as sorting, stitching, weaving, and quality control (Deloitte, 2020). These enterprises combine environmental objectives with social empowerment by valuing skills over physical ability.

2.4 Social Enterprises and the Indian Context

Social enterprise literature emphasizes hybrid models that balance financial sustainability with social impact (Defourny & Nyssens, 2010). In India, social enterprises working in waste management, handloom, handicrafts, and sustainable textiles frequently integrate PwDs into their value chains. Studies note that such models reduce dependency on welfare systems and promote community-based empowerment (British Council, 2016).

Artisan-focused and circular ventures in India often operate within local ecosystems, enabling accessible work environments and peer support. This aligns with Gandhian principles of self-reliance and decentralized production, reinforcing the relevance of sustainability-driven inclusion in developing economies.

2.5 Universal Design and Accessibility in Sustainable Markets

Universal design has been widely discussed as a bridge between accessibility and sustainability. Research indicates that designing inclusive products and services from the outset reduces long-term costs and expands market reach (Steinfeld & Maisel, 2012). Sustainable businesses adopting universal design contribute to independence and dignity for PwDs while aligning with responsible consumption principles.

In emerging markets like India, inclusive design in public infrastructure, consumer goods, and digital platforms is increasingly recognized as both a social necessity and a competitive advantage.

2.6 Conclusion of Chapter 2

The reviewed literature establishes a strong link between sustainable business practices and the empowerment of persons with disabilities. Scholars consistently highlight that inclusive employment, circular business models, social enterprises, and universal design contribute to economic participation, social dignity, and long-term resilience. The Indian context further demonstrates how sustainability-driven, community-based enterprises can effectively integrate PwDs into productive value chains.

Research Gap

Despite growing academic interest, significant gaps remain in the literature. Limited empirical research focuses specifically on the intersection of sustainable business practices and disability empowerment in developing economies such as India. Existing studies often address sustainability or disability inclusion in isolation, with insufficient attention to integrated business models. Additionally, there is a lack of sector-specific analysis on circular and artisan-based enterprises employing PwDs. This study seeks to address these gaps by examining sustainable business practices as a holistic tool for empowering persons with disabilities within the Indian socio-economic context.

CHAPTER 3

Research Methodology

Meaning of Research Methodology

This study used a survey to examine awareness and perceptions of sustainable business practices as tools for empowering persons with disabilities among individuals aged 18–60+. Data on knowledge, attitudes, and perceptions were collected through structured questionnaires and analyzed to identify key trends and barriers.

Research Design

Research design encompasses the general approach that a researcher uses to integrate different components of a study logically and coherently. It provides a blueprint for conducting research and serves as a roadmap for the entire research process.

Need of the Study

Despite increasing emphasis on sustainability and inclusive growth, persons with disabilities (PwDs) continue to face limited access to

employment, skill development, and economic participation. Sustainable business practices offer a viable pathway to address these challenges by integrating social inclusion with environmental and economic objectives. Models such as inclusive employment, social enterprises, circular production, and artisan-based ventures create flexible and dignified livelihood opportunities suited to diverse abilities.

However, there is limited focused research examining how sustainable business practices specifically function as tools for empowering PwDs, particularly in the Indian context. Existing studies often address sustainability and disability inclusion separately, creating a gap in understanding their combined impact. This study seeks to address this gap by examining awareness, perceptions, and societal outcomes of disability-inclusive sustainable business practices. The findings aim to support inclusive policy formulation, responsible business strategies, and progress toward the Sustainable Development Goals.

Research Problem Statement

Despite growing recognition of sustainable business practices as drivers of social and environmental responsibility, there is limited empirical research on their role in empowering persons with disabilities. The lack of integrated studies examining inclusive employment, accessibility, and sustainable business models restricts effective policy and business interventions. This study seeks to examine how sustainable business practices contribute to economic empowerment, social inclusion, and dignity for PwDs, while identifying barriers to awareness, adoption, and implementation within the Indian socio-economic context.

Research Objectives

The study is designed to achieve the following objectives:

1. To understand the concept of sustainable business practices and their social dimension in relation to disability inclusion.
2. To examine the role of sustainable and circular business models in creating employment and entrepreneurial opportunities for persons with disabilities.
3. To assess awareness and perceptions of disability-inclusive sustainable business practices among individuals.
4. To analyze the perceived social, economic, and environmental benefits of empowering PwDs through sustainability-driven enterprises.
5. To identify key barriers to the adoption of inclusive sustainable business practices.
6. To suggest strategies for businesses and policymakers to enhance disability empowerment through sustainability initiatives.

Statement of Hypothesis

This study hypothesizes that sustainable business practices positively influence the empowerment of persons with disabilities by enhancing inclusive employment opportunities, economic independence, and social participation. It is further hypothesized that higher awareness and supportive policy frameworks significantly improve the adoption and effectiveness of disability-inclusive sustainable business models.

Scope of the Study

Awareness Assessment: The study evaluates awareness of sustainable business practices as tools for disability empowerment across demographic groups such as age, gender, and education level.

Perceptions and Attitudes: It examines individual perceptions and attitudes toward disability-inclusive and sustainability-driven business models.

Inclusive Employment Practices: The research focuses on understanding views related to inclusive hiring, skill development, and workplace accessibility.

Barriers to Adoption: The study identifies social, economic, and informational barriers limiting the implementation of sustainable and inclusive business practices.

Societal Impact: It analyzes perceived societal outcomes, including social inclusion, economic empowerment of PwDs, and contributions to sustainable development.

PRIMARY

The primary data was collected through an online close-ended questionnaire which was made with the help of Google Forms. The questionnaire was circulated to diverse age groups of people.

An open-ended questionnaire was also administered through personal interviews with the people working at the Pune Handmade Papers Shop and Factory at KB Joshi Path, Narveer Tanaji Wadi, Shivajinagar, Pune, Maharashtra 411005.

We examined the inclusive practices and processes for persons with disabilities at the institutions.

SECONDARY

Various sources were referred to gather secondary data for the survey. These sources include:

- Research Papers/Journals
- Government Websites
- News Articles
- Books and Publications

Sampling

Sampling is a process used in statistical analysis in which a predetermined number of observations are taken from a larger population by making use of certain tools.

For the purpose of close-ended sampling (Google Form Questionnaire), the researchers have applied the method of simple random sampling.

For the purpose of open-ended sampling (Personal Interviews), the researchers have applied the method of convenience sampling.

Sample Size

The sample size for the questionnaire administered to people from diverse age groups is above fifty(50).

The sample for the personal and professional interviews consisted of two organizations: Shell Petrol Pump in Pune and Kamayani Udyog Kendra.

Limitations of the Study

1. **Scope of Discussions:** Limited prior experience in research and academic writing may have impacted the depth of discussions, though every effort was made to maintain research quality.
2. **Sample Scope:** The survey focuses on young adults (18–25), which may limit the generalizability of findings to broader demographics.
3. **Geographic and Industry Scope:** Regional or industry-specific focus may restrict the applicability of findings to wider contexts.
4. **Methodological Bias:** If qualitative methods were used, findings could be influenced by researcher bias or participant perspectives, affecting reliability.
5. **Communication Gap** while talking with disabled people

Chapter 4

Analysis and Interpretation of the Data

Analysis and Interpretation of Interview Data

To understand how sustainable and inclusive business practices contribute to the empowerment of persons with disabilities, qualitative data were collected through interviews with representatives from two organizations in Pune: Shell Petrol Pump (SB Road) and Kamayani Udyog Kendra, an initiative of Kamayani School for persons with intellectual disabilities.

Case 1: Shell Petrol Pump, SB Road, Pune

Shell Petrol Pump represents a large corporate brand actively practicing inclusive employment. An interview was conducted with Mr. Pankaj Gavit, the manager of the SB Road outlet. He reported that approximately 50% of the workforce at the petrol pump comprises differently abled individuals, including persons with physical disabilities and those with hearing or speech impairments.

According to Mr. Gavit, employees with disabilities undergo the same initial training as other staff members, typically lasting one week. The organization has not faced major operational challenges, as inclusion has been integrated into the system from the beginning. To address communication barriers, especially with deaf or speech-impaired employees, the petrol pump has introduced visual aids such as signboards, written instruction boards, and markers to facilitate interaction with customers. These small yet effective measures have helped minimize misunderstandings and ensure smooth service delivery.

The primary objective of this initiative is to promote economic independence and self-respect among persons with disabilities while fostering positive customer awareness. Mr. Gavit noted that nearly 90% of customers appreciate and support this initiative, although a

small section remains hesitant or uncomfortable. To reduce misinterpretation, clear signage and structured operating procedures are maintained. Employees work within defined roles and are guided not to take major operational decisions without assistance, ensuring safety and efficiency.

Employees with disabilities receive equal benefits such as provident fund, salaries, and access to relevant government schemes, similar to other employees. Opportunities for career progression are also provided based on individual performance and development. Regular briefings are conducted at the end of each day to review tasks and address concerns.

Mr. Gavit emphasized that the broader message of this initiative is to change societal perspectives toward disability. He highlighted that persons with disabilities are equal members of society and deserve respect, dignity, and opportunities. Inclusive employment at Shell has positively contributed to employees' skill development, confidence, personality growth, and social acceptance.

An informal interaction was also held with one of the employees, Mr. Raj Babu Tak, who expressed satisfaction with his job and gratitude for the opportunity, despite communication limitations.

Case 2: Kamayani Udyog Kendra, Pune

Kamayani Udyog Kendra is a well-established vocational training and rehabilitation center in Pune, operating under the Kamayani Prashikshan & Sanshodhan Society, a non-governmental organization founded in 1964. The center is specifically designed for adults above 18 years of age with intellectual disabilities and is managed by Kamayani School.

Unlike formal employment settings, Kamayani Udyog Kendra functions as a sheltered workshop aimed at skill development and economic rehabilitation. The core mission of the center is to enable adults with intellectual disabilities to achieve self-reliance, dignity, and a sense of contribution through productive work. Trainees are taught simple, safe, and repetitive tasks aligned with their cognitive abilities.

The activities at the center include the production of handmade and craft-based items such as greeting cards, invitation cards, festive products like rakhis and diyas, paper bags, envelopes, and other stationery items. Some units also engage in basic food-processing activities. These products are sold to the public, especially during festivals, providing financial support to the institution and modest earnings for the trainees.

Kamayani Udyog Kendra operates primarily from its main campus in Gokhale Nagar, Pune, with additional facilities in Nigdi and a rural rehabilitation project in Talegaon Dabhade. The institution has built a strong legacy of disability empowerment by focusing on long-term rehabilitation rather than short-term welfare.

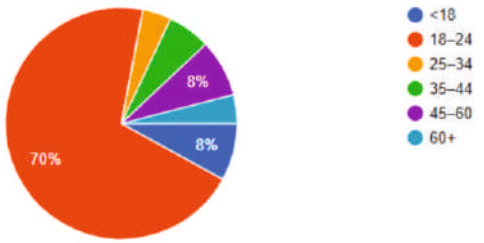
Interpretation in the Context of the Study

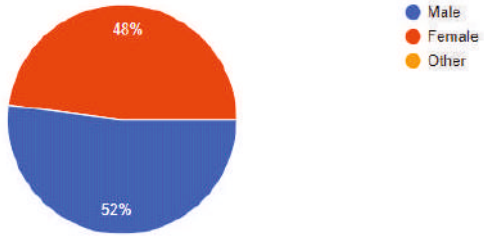
The two case studies highlight different but complementary approaches to empowering persons with disabilities through sustainable practices. Shell Petrol Pump demonstrates how inclusive employment can be successfully implemented within a mainstream corporate setting by integrating accessibility, training, and support systems. In contrast, Kamayani Udyog Kendra represents a community-based, sustainability-oriented model that focuses on vocational training and gradual economic integration for individuals with intellectual disabilities.

Both cases reinforce the study's premise that sustainable business practices—when aligned with inclusivity—can significantly enhance economic independence, social dignity, and confidence among persons with disabilities. These models also illustrate that empowerment is achievable through both formal employment and sheltered vocational systems, depending on the nature and needs of the individuals involved.

Analysis and interpretation of data gathered through open-ended questionnaire

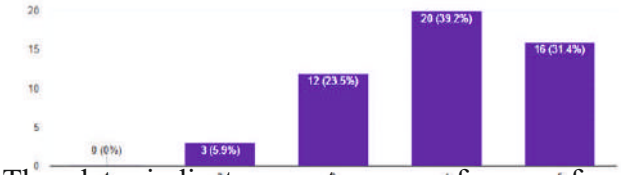
Age Groups - We can observe that the majority of the people who have answered the survey are youngsters from both genders equally





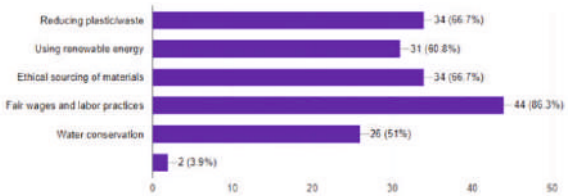
1. After being asked about businesses in India, particularly in Pune, that employ people with disabilities, more than 80% of respondents reported being unaware of such initiatives. However, a few respondents were able to cite examples, including Café Peter, Wipro Limited, Shell Petrol Pump, TerraSine, Greenfield School, and Apang Udyog Kendra etc

2. Perceived Importance of Businesses Prioritizing the Employment of People with Disabilities

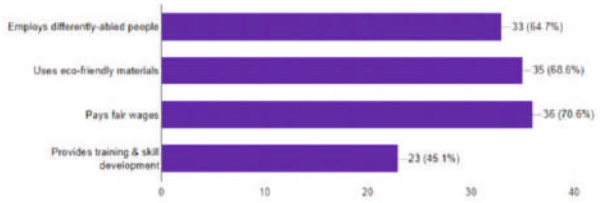


The data indicates a strong preference for inclusive practices, with most respondents assigning a rating of 4, closely followed by the highest rating of 5.

3. Consumer Preferences for Sustainable Business Practices



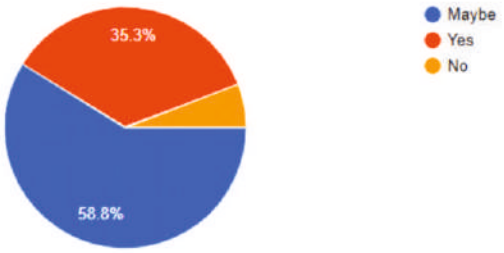
4. Influence of Ethical Business Practices on Buying Behavior



4. Perceived Concerns Regarding the Employment of Differently-Abled Individuals in Businesses

The major concerns highlighted by respondents relate to ensuring fair compensation and equal treatment for differently-abled employees. Other key concerns include creating an inclusive work environment, assigning roles and responsibilities according to individual abilities, providing appropriate workplace facilities, ensuring clear and accessible communication, and implementing strong protection and inclusion policies.

6. Consumer Willingness to Support Inclusive and Sustainable Businesses



7. Evaluation of Government Policies on Inclusive Hiring Practices



8. Level of Consumer Trust in Inclusive and Sustainable Businesses



1. Proof and Transparency in Inclusive and Sustainable Business Claims

Respondents indicated that trust in a business's claims about inclusivity and sustainability is encouraged through transparent and verifiable proof. Key factors include fair payment of wages, ethical product pricing, and clear disclosure of sourcing practices. Employee testimonials, evidence of employee well-being, and good working conditions further enhance credibility. Regular surveys, audits, and transparent reporting—supported by third-party certifications and recognition from credible organizations—were also considered important. Additionally, accurate product information, authenticity, quality reviews, a strong digital presence, official statements, and consistent public communication through trusted sources and social media were seen as essential in building trust.

2. Additional Comments from Respondents

1) Respondents emphasized that organizations should consistently practice what they claim, ensuring accountability in inclusive and sustainable initiatives.

2) Many highlighted the importance of recognizing the special rights of differently-abled individuals and providing appropriate support systems at the workplace.

3) Respondents appreciated businesses that contribute positively to society by creating inclusive work environments and promoting equality.

4) Transparency in operations, fair treatment, and ethical decision-making were viewed as strong positive aspects of inclusive businesses.

5) A concern raised was the possibility of inclusivity and sustainability claims being exaggerated or fake, stressing the need for genuine implementation rather than tokenism.

Testing of Hypothesis

Formulation of Hypotheses:

- H_0: Organizational practices (inclusivity, transparency, ethical behavior) have no significant effect on consumer trust.
- H_1 : Organizational practices (inclusivity, transparency, ethical behavior) significantly affect consumer trust.

Data Collection and Analysis:

- Survey respondents highlighted accountability, support for differently-abled employees, inclusive work environments, and transparency as key trust factors.
- Skepticism about false claims was also noted.
- Responses can be quantified and analyzed using chi-square or regression tests.

Conclusion:

- If analysis shows a significant effect of inclusive and transparent practices on trust, the alternative hypothesis is supported.

Chapter 5

Findings and Conclusions

Findings

The data reveals key insights into consumer perception and trust regarding businesses that claim to be inclusive and sustainable. A majority of respondents highlighted the importance of accountability, consistent practices, and providing support for differently-abled employees. Inclusive work environments, transparency in operations, and ethical business behavior were also seen as major trust-building factors.

However, skepticism was expressed by some respondents, with concerns that claims of inclusivity and sustainability may be exaggerated or tokenistic.

These findings suggest that businesses can enhance trust and consumer perception by ensuring genuine implementation of inclusive practices, maintaining transparency in reporting and operations, supporting employee well-being, and providing clear and authentic communication to the public.

Conclusion

The study examined consumer perceptions of businesses claiming to be inclusive and sustainable. Respondents valued accountability, support for differently-abled employees, inclusive work environments, transparency, and ethical practices. While attitudes were generally positive, some skepticism existed regarding tokenistic or exaggerated claims. Key trust factors included employee well-being, authentic communication, third-party certifications, and

clear disclosure of practices.

These findings suggest that businesses can strengthen trust by implementing genuine inclusive and sustainable practices, maintaining transparency, and clearly communicating initiatives. Policy incentives and recognition from credible organizations could further encourage adoption. However, the study's limited sample size and industry focus indicate the need for broader research to fully understand public engagement with such businesses.

Suggestions

Future research should expand geographic and industry coverage and collaborate with businesses and government bodies for comprehensive data. Longitudinal studies can track long-term impacts, while standardized metrics for inclusivity and sustainability will improve comparability. Mixed-method approaches combining qualitative and quantitative data, along with awareness campaigns and transparent reporting, can further enhance understanding and public trust in inclusive and sustainable business practices.

Chapter 6

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Deloitte India – Social Enterprises and Inclusive Growth:https://www2.deloitte.com/in/en/pages/about-deloitte/articles/social-enterprises-india.html

UNDP – Disability Inclusive Development: https://www.undp.org/publications/disability-inclusive-development

WHO – World Report on Disability: https://www.who.int/publications/i/item/9789241564182

Pictures of the Visit

1. Shell Petrol Pump



Manager:Pankaj Gavit



Staff of Shell Petrol Pump



Communication Board

2. Kamayani Udyog Kendra



Kamayani Business School, Gokhalenagar



Staff teaching students

73. Evaluating the application of AI in Higher Technical Education

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Abstract
In todays' hyper competitive world, the role of Artificial Intelligence is has gained traction. In fact, it has been widely adopted (and misused) to gain competitive advantage. In such an environment, it becomes imperative to evaluate the application of AI in higher education domain. The paper addresses the following research propositions (a) What is the need and importance of evaluation (b) What are the crucial parameters on which the evaluation on the application of AI in Higher Technical Education domain. The study is conducted in the NCR region on the sample size of 187. The findings indicate that evaluation parameters rely on the context of the application of AI in a given domain. The study is conducted on the higher education institutions offering Technical Education and this resulted in Limitation. The future recommendations of the study is the extension of the scope to include non-technical programs. The study concludes that evaluation of the application of AI is bound to stay and that the depth and length of the evaluation parameters will determine the role of application of AI whether it is resulting in benefit or are being misused.

Key words: Context, Evaluation, Parameters, Usage

Introduction: Technological advancements have significantly transformed the means and mechanisms of doing our work (Au-Yong-Oliveira, et. Al, 2019). In the realm of Higher Educational Institutions offering Technical Education programs, AI has been playing a crucial role in assisting students to complete assignments, provide reviews, prepare ready made notes and generate numerous tasks including power-point presentations (Singh, S. V., & Hiran, K. K. 2022; Jin, Z., Goyal, S. B., & Rajawat, A. S. , 2024). Despite these numerous benefits, there is dark side of the application of AI. This includes morphing of images, generating fake content, copying computer programs and presenting them at various platforms and the above all assisting students to disrespect them as they become highly dependent on AI. In other words, the role and status of a teacher is reduced to nothing.

This necessitates the need to evaluate the application of AI in Higher Technical Education institutions.

Literature Review

Several researchers and academicians have attempted to the define the meaning of the word Evaluation (Gullickson, A. M. 2020; Vaessen, J., & Meiers, M. W. (2020; Schwandt, T. A. ,1990). While researchers attempted to define evaluation on the basis of elements that define them (Darlington, M., Culley, et. al, (2008). On the other hand, researchers attempted to define evaluation on the basis of whether the program is reaching its goals in terms of achievement resulting in success (Poulin, M. E., Harris, P. W., & Jones, P. R. 2000). On the other hand, (Blanchard, B. E. ,1956) defined evaluation as a continuous process with the key points in terms of measurement parameters on identified key points.

The need and importance of the evaluation of the application of AI is profound impact. While researcher (Bieger, J., et. Al, 2016) attempted to highlight the need in terms of behaviour of AI in a particular process. On the other hand, researcher (Freeman, L., 2020) tried to highlight the need to determine the failure mode of a process.

In the present context, higher technical educational institutions face myriad problems (George, W. K., (2024). These include the managerial as well as functional problems in terms scalability, in terms of meeting market dynamics as well as ensuring the prevention of unethical practices (Maxmudovna, Y. G. Z. ,2024; Wu, S. , 2024; Schei, O. M., M.øgelvang, et. al , 2024). However, when it comes to the

evaluation of the functioning of the higher technical education programs, due to varied nuances that go into the evaluation, a term which is widely being adopted is the concept mapping(Chu, S. T., Chang, C. C., & Tu, Y. F. (2025). But researchers and academicians have failed to arrive at the standardised and holistic appreciation of the basic elements of the concept mapping. For example, the concept can be attributed to teaching learning environment or the skill competency matrix operations or the concept of developing courses based on the market dynamics(Chu, S. T., Chang, C. C., & Tu, Y. F. (2025).

Research objectives

The following are the research objectives of the paper

a. To determine the evaluation parameters of Higher Educational Institutions offering technical Education

b. To determine the application of AI in Higher Educational Institutions based on evaluation parameters

Research methodology

The methodology adopted for the development of the paper commenced with the identification of the topic. Being from the technical stream, the author deliberated on the topic which is highly in demand in todays' world and how it is implemented in the management domain. Since evaluation is the focal point, the topic of the study was formulated by integrating AI with the management parameters of evaluation. The extensive literature review resulted in research objectives. Based on the research objective, the construction of questionnaire and the sample size, respondents' profile and other aspects were determined. The sample data so collected was verified for statistical treatment and the descriptive statistic was applied.

Findings and interpretation

Respondents Profile	
Degree	**Count**
M. Tech	101
MCA	40
M.Sc.	27
B.Tech	19

Interpretation

The above table reveals the distribution of Respondents profile. It is observed that The count of the students is highest in the M.Tech Degree programs. This is deliberate as M.Tech degree is the highest form of Technical degree and the role of AI provides the greatest scope for conducting the research programs. In other words, M.Tech students, on account of their course contents are required to utilize the services of AI in several analytical subjects and thus they offer the maximum potential for data collection

Evaluation Parameters	
Parameter	**Count**
Continuity of Process	56
Content creation / development	40
New Idea generation	10
Misuse of AI	19

Interpretation

From the above table it is observed that the figures are significantly lower that the respondent's population. This indicates a grey area in terms of application of AI with the respect to the identified parameters derived from Literature review and depicted in the table. It is observed that misuse of AI holds a figure of 19. This figure may not reflect the correct data as several respondents apprehend that this can be used in other ways and may deter them from openly acknowledging the misuse of AI. On the other hand it is evident that the evaluation parameter comprising of New Idea generation hold a very low figure this indicates that there is a need to activate this area.

Evaluation Parameters Program Wise Distribution		
Parameter	**Degree**	**Count**
Continuity of Process	M. Tech	56
Content creation / development	MCA	40
New Idea generation	M.Sc.	10
Misuse of AI	B. Tech	19

Interpretation

From the above table it is evident that M.Tech Students have the highest figure as they rely heavily on the usage and application of AI. On the other hand. MCA students have the figure of 40 thereby indicating that content generation

and creation is widely carried out by means of AI.

Overall interpretation

The figures in the above tables, do not reflect the correct picture but nevertheless they provide the starting point for data analysis. This is due to the fact that evaluating areas are overlapping and that these parameters are not confined to any one particular stream of program. For example, M.Tech students not only deal with continuity of the process but that they also deal with content creation, new idea generation and also some aspect of misuse of AI. Hence while arriving at crucial decisions, one should look into other aspects also.

Limitations

The study in its present form provides a base work evaluation on the technical aspects of the AI application in technical programs. By including other aspects such as Arts, commerce and associated disciplines this limitation could have been removed and a more clear picture of the application of AI would have unfolded.

Conclusion

The AI is bound to stay for a considerable period of time. Hence, the need for evaluation is bound to occur and in fact evaluation should be made a compulsory activity and further, the evaluation parameters must be re-assessed and refined based on the market dynamics.

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74. Training and Development for Sustainable Skills and Leadership in Human Resource Management

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Abstract

Training and development have become essential pillars of Human Resource Management, especially as organizations require employees who not only possess technical competence but also emotional understanding and adaptive leadership abilities. This study explores how structured training initiatives contribute to the overall development of employees by strengthening sustainable skills, enhancing emotional intelligence, and preparing individuals for future leadership roles. (Noe ,2020)

Using a mixed-method approach that combines a short employee survey with a review of contemporary HRD models, the research highlights the importance of continuous learning in today's dynamic work environment.The findings indicate that employees who receive regular training show significant improvement in problem-solving, communication, emotional self-management, and teamwork skills that are crucial for sustainable professional growth. Development programs such as mentoring, soft-skills workshops, and leadership simulations further support emotional awareness and responsible decision-making. These capabilities collectively build leaders who can motivate teams, manage conflict, and respond effectively to organizational challenges.The study contributes to the existing literature by emphasizing the interconnected role of sustainable skill development and emotional intelligence in shaping modern leadership. The insights are valuable for HR managers, educators, and organizations aiming to design comprehensive development programs that create not only skilled employees, but emotionally aware and future-ready leaders. (Goleman, 2015)

Keywords: Human Resource Management Training and Development, Sustainable Skills, Leadership Development, Emotional Intelligence, Employee Growth

1. Introduction

Background: Training and development play a crucial role in Human Resource Management, especially as organizations face rapid technological changes, global competition, and evolving job demands. Modern workplaces require employees who possess not only technical capabilities but also sustainable skills such as adaptability, critical thinking, communication, and emotional understanding. Along with this, leadership qualities are becoming increasingly important as companies seek individuals who can guide teams, manage challenges, and maintain a positive working environment. As a result, training is no longer limited to basic task learning; it has expanded into a holistic approach that supports overall employee development…professionally, emotionally, and socially.

Problem Statement: Despite investing in training, many organizations still experience gaps in employee performance, leadership readiness, and emotional intelligence. Employees may know how to perform their tasks, but they may lack the sustainable skills and emotional understanding needed to collaborate effectively, manage stress, handle conflict, or take on leadership responsibilities. This gap indicates that traditional training programs are not fully addressing the developmental needs of the modern workforce. Therefore, there is a need to examine how structured training and development initiatives can contribute to sustainable skills and leadership, including the emotional and interpersonal aspects of employee growth. (Sharma, 2022)

Objectives:

The major objectives of this study are:1.

To analyze how training programs help develop sustainable skills among employees.

2. To examine how development initiatives enhance emotional intelligence and support leadership growth.

Hypotheses

Based on the objectives, the study proposes the following hypotheses:

- H1: Structured training programs significantly improve sustainable employee skills.
- H2: Development programs have a positive impact on emotional intelligence and leadership capabilities.

Significance of the study

This study is important because organizations today require employees who can adapt to change, work collaboratively, and lead teams responsibly. Emotional intelligence, empathy, communication, and interpersonal awareness have become essential leadership qualities. By understanding how training and development influence both sustainable skills and emotional understanding, HR managers can design more effective programs that benefit employees at all levels.The research also adds value to academic literature by connecting sustainable skill development with emotional intelligence an area that is often discussed separately. This integrated approach provides a deeper perspective on how comprehensive training contributes to long-term organizational success.

Literature Review

The concept of training and development has evolved significantly over the years, moving from simple skill-based learning to a more holistic and strategic approach within Human Resource Management (HRM). Earlier research in HR focused mainly on task efficiency and technical capabilities, but recent studies highlight the growing importance of sustainable skills, emotional intelligence, and leadership readiness (Noe, 2020). Organizations today operate in fast-changing environments, making continuous employee development essential for long-term success.Training is defined as a planned effort to enhance the knowledge, skills, and behaviors necessary for job performance. Development, on the other hand, focuses on long-term growth and prepares individuals for future roles and responsibilities. Scholars such as Armstrong (2021) explain that effective training must integrate both professional competence and personal development to create a well-rounded workforce.

Theoretical Frameworks

Several theoretical models guide training and development research. One of the most widely used models is Kirkpatrick's Four-Level Training Evaluation Model, which evaluates training based on reaction, learning, behavior, and results. This model highlights the need to measure not only what employees learn but also how they apply those skills in the workplace. According to this theory, organizations that invest in training are more likely to achieve innovation, higher performance, and competitive advantage.In the context of leadership development, Transformational Leadership Theory provides a useful framework. It emphasizes the role of inspiration, motivation, and personal influence in shaping effective leaders. (Armstrong, 2020)

Training and Sustainable Skills

Recent research highlights that training programs must focus on sustainable skills to remain relevant. Sustainable skills are those that help employees adapt to new situations, manage challenges, and continue performing effectively in changing work environments. These skills include creativity, communication, digital literacy, teamwork, problem-solving, and personal resilience.Studies indicate that employees who undergo structured training show improved cognitive flexibility, better decision-making, and a greater ability to work collaboratively. Additionally, problem-solving workshops and critical-thinking sessions help employees respond more effectively to workplace issues.

Training and Emotional Intelligence

Emotional intelligence (EI) has become an essential component of modern HR training. EI refers to the ability to understand, manage, and use emotions effectively both one's own and those of others.

Training interventions such as role-playing, mindfulness sessions, and conflict-resolution workshops have been found to improve

emotional awareness and self-regulation. Organizations that incorporate EI training report reduced interpersonal conflict, improved team cohesion, and higher employee engagement. (Salovey & Mayer, 2016; Goleman, 2015)

Research further shows that emotionally intelligent employees demonstrate stronger leadership potential, as they are better at decision-making, empathy, and motivating others.

Leadership Development through Training

Leadership development is a major focus within HRM, particularly because organizations require leaders who can adapt to complex and unpredictable environments. Development initiatives like mentoring, coaching, leadership simulations, and project assignments allow employees to gain practical leadership experience. Studies confirm that such programs enhance confidence, strategic thinking, communication, and emotional maturity. Leadership training also supports sustainable development by promoting ethical behavior, social responsibility, and long-term planning qualities essential for modern organizational leadership. Moreover, emotional intelligence training, when integrated into leadership development programs, helps leaders manage diverse teams more effectively and create a positive workplace culture

Significance of the Study

The methodology used in this study is valuable because it captures both the practical and emotional dimensions of employee development. By focusing on real-life experiences, the research provides insights into how training helps employees grow in terms of behavior, communication, confidence, and leadership.This chapter presents the responses collected through the questionnaire and explains what the data indicates about the impact of training and development on sustainable skills and emotional understanding.

Methodology

This chapter explains how the study was carried out and the steps followed to collect and analyze information. Since the topic deals with employee behavior, emotional understanding, and development through training, a systematic and people-centered research approach was adopted.

Research Design

The study uses a mixed descriptive approach, which combines both descriptive elements and simple measurement techniques. This design helps in understanding what employees feel about training and how it influences their skills and emotional growth. Instead of experimenting or controlling variables, the study focuses on observing real workplace perceptions. The descriptive design is suitable because the aim is to explore practical experiences rather than test complicated scientific models.

Area of the Study

The research was conducted among employees working in people-oriented environments, especially those involved in communication, service delivery, team coordination, and frontline responsibilities. These workplaces rely heavily on interpersonal behavior, patience, empathy, leadership readiness, and emotional balance. Therefore, they provide meaningful insights into how training shapes sustainable skills such as teamwork, adaptability, confidence, and emotional intelligence.

Sampling Method

The study follows a convenience sampling method with random selection.

Respondents were chosen based on accessibility and willingness to participate, but random selection was applied within the available group to maintain fairness. This method was practical because employees were located in different units and worked in shifts. The sample size is moderate but sufficient for identifying meaningful opinions and trends.

Sources of Data.

Primary Data

Primary information was gathered directly from employees using a simple questionnaire. The questions focused on:

- the type of training they received,
- their comfort and confidence at work,
- communication and interpersonal skills,
- emotional awareness and handling of workplace situations,
- and whether training helped them develop leadership qualities.

Secondary Data

Secondary information was collected from published sources, including books on HRM, research articles, training manuals, organizational case studies, and online academic material. These sources helped build the theoretical foundation for the study and supported the interpretation of the primary data.

Tools for Data Collection

A structured questionnaire was the main tool used. It contained:

- closed-ended questions,
- rating scales,
- and a few short opinion-based items.

The structure ensured that responses were uniform and easy to analyze.

Tools for Data Analysis

The responses were analyzed using percentage analysis and simple interpretation techniques. The data was organized into tables to show how many employees agreed, disagreed, or felt neutral about different aspects of training. This basic statistical approach helped highlight patterns without making the analysis too technical Overall Participation

A total of 50 employees participated in the study. The group included both male and female employees, working in different roles such as administration, service support, customer handling, and field operations. The diversity of job roles helped in understanding training needs from different angles.

Training Experience of Employees

Table 1:

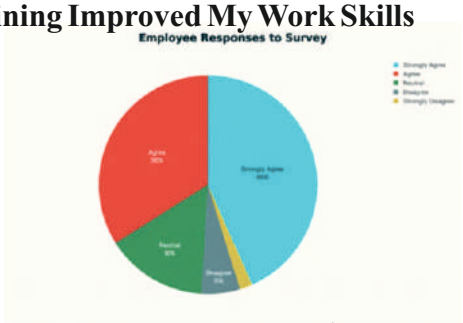
Whether Employees Received Formal Training



Interpretation: Respondents reported that they had received some form of training in their organization. This shows that training is becoming a routine practice in workplaces. However, the small percentage of employees who reported not receiving any training highlights that certain units still need improvement.

Usefulness of Training Table 2:

Training Improved My Work Skills



Interpretation: 46% employees strongly agreed that training helped them perform better at work. This suggests that even basic training has a visible impact on productivity and work confidence. Only a few employees felt neutral, which may indicate that either the training content was not relevant to their job role or they needed more practical sessions.

Development of Sustainable Skills Table 3:

Training Helped Me Develop Communication & Teamwork Skills



Interpretation: The results clearly show that communication and teamwork skills improved for most employees. These two areas are essential for long-term performance and are usually the foundation of sustainable skills.

Emotional Understanding & Workplace Behavior Table 4:

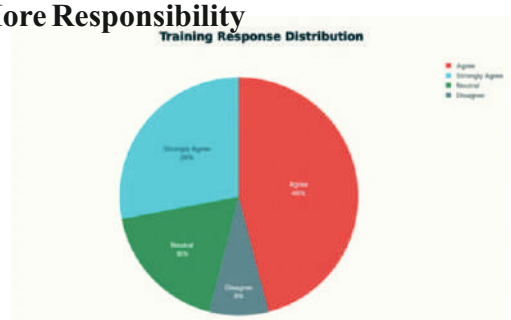
Training Increased My Emotional Understanding (Empathy, Patience, Handling Pressure)



Interpretation:A significant portion of employees felt that training helped them handle workplace situations more calmly. Many of them mentioned that after training, they became more aware of how to talk to colleagues or customers, how to stay composed during busy hours, and how to avoid conflicts. This shows that emotional intelligence can genuinely be improved through training.

Leadership Development

Table 5: Training Encouraged Me to Take More Responsibility



Interpretation: Most employees agreed that training motivated them to take initiative and accept more responsibility. This is an encouraging sign because leadership does not only mean holding a higher position, it also includes being dependable, guiding co-workers, and managing small tasks independently.

General Opinion on Training Quality

Table 6: Overall Satisfaction with Training Programs



Interpretation: Most employees were either satisfied or highly satisfied. This indicates that training is not just a routine formality but is genuinely helping employees improve. A small number of neutral or unsatisfied responses may be due to factors such as outdated methods or lack of practical exposure.

Summary

Based on the analysis, the following patterns were observed:

- Employees clearly benefit from structured training.
- Sustainable skills like teamwork, communication, patience, and adaptability improved significantly.
- Emotional understanding also showed noticeable improvement.
- Training encourages employees to take responsibility, indirectly improving leadership qualities.
- Most respondents are satisfied with the training they received.

Overall, the data strongly supports both hypotheses of the study.

DISCUSSION

The purpose of this study was to understand how training and development influence sustainable employee skills, emotional understanding, and leadership readiness. After analyzing the responses from 50 employees, several clear patterns emerged. This chapter discusses what the results mean and how they connect with ideas from HRM theories and previous studies.

Training Participation and Its Implications

The first observation is that 84% of the respondents had received some form of formal training, which indicates that organizations today are taking employee learning seriously. Even though 16% had not received training, the overall participation is still high. This supports the modern view in HRM that training is not just an administrative requirement, it is a long-term investment.

Skill Development and Workplace Performance

One of the strongest findings was that 76% of employees agreed or strongly agreed that training improved their work skills. This is important because many organizations face gaps between employee capability and job requirements. The data shows that even simple, structured training sessions help employees perform tasks more effectively and with greater confidence.The results also show that communication and teamwork skills improved for 80% of respondents, with very few expressing disagreement. This confirms the idea that skill-based training, especially when it includes activities like group work, scenario-based learning, and role-playing, can significantly enhance interpersonal abilities.

These skills form the foundation of "sustainable skills" competencies that help employees remain adaptable and useful over a long period.

Emotional Understanding and Behavioral Changes

A unique part of this study was its focus on emotional understanding. Many traditional research papers focus only on technical or job-related skills. However, in modern workplaces, emotional balance is just as important as technical competence. From the responses, 72% agreed or strongly agreed that training improved their emotional understanding.The improvement reported by respondents suggests that organizations are beginning to include behavioral topics such as conflict handling, empathy, customer dealing, and stress management in their training modules. This is a positive sign because emotional intelligence contributes not just to personal development but also to a healthier workplace environment.

Leadership Development Through Training

Another major point revealed by the study is the impact of training on leadership readiness. 74% of respondents said training encouraged them to take more responsibility. This indicates that employees who receive training feel more confident in making decisions and guiding others when needed.

Leadership is not only about holding a higher designation. It includes qualities like initiative, clarity in communication, problem-solving, and motivating others. Training programs that include mentoring, team activities, or scenario-based discussions naturally help employees develop these traits. These findings support the idea that leadership can be developed gradually and does not depend solely on experience structured learning plays an important role.

General Satisfaction With Training

The overall satisfaction results were also very positive. 72% of respondents were either satisfied or highly satisfied with the training programs. This shows that employees see training as something useful rather than a compulsory routine. When employees are satisfied, they are more likely to participate actively and apply what they learn.The small percentage (8%) of employees who were not satisfied suggests that some training sessions may need updates or more practical content. Organizations can use this feedback to improve the relevance and quality of future programs.

Overall Interpretation

Taking all the results together, the study clearly supports both hypotheses:

- Training improves sustainable employee skills, especially communication, teamwork, and job performance.
- Development initiatives increase emotional understanding and leadership qualities.

The discussion shows that training has both technical benefits and human-centred benefits. It helps employees work better, behave more maturely, and take responsibility three key elements of sustainable growth.

Conclusion

Training and development play a central role in shaping a capable, confident, and emotionally aware workforce. This study highlighted how structured training programs not only improve technical skills but also support personal growth, communication abilities, and emotional understanding among employees. The analysis showed that organizations investing in holistic training covering behavioral, interpersonal, and emotional intelligence skills experience higher employee motivation, improved teamwork, and better job performance. At the same time, employees reported feeling more valued, supported, and connected to their workplace. Overall, the research supports the idea that training and development are not just HR activities but long-term investments that strengthen productivity, workplace culture, and organizational sustainability. As workplaces evolve, the most successful organizations will be those that recognize learning as an ongoing journey and promote both skill enhancement and emotional growth among their people.

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Winners of 11th National Level Student Research Competition 2024-25



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Participants with the Dignitaries and Organising team of 11th National Level Student Research Competition 2024-25



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Student Participants presenting their research at the 11th National Level Student Research Competition (2024-25)



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Publication Ceremony of 'Young Researcher Journal 2024-25.' > Seen here (L to R): Prof. Dr. Asha Khilare, Prof. Dr. M.G. Mulla, Principal Dr. Kishor Desarda, Prof. Dr. Y. M. Mithare, Dr. Vinayak Pawar, and Dr. Sharmila Kavediya.