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South Asian Journal of Management Research (SAJMR), is a scholarly journal that publishes scientific research on the theory and practice of management. All management, computer science, environmental science related issues relating to strategy, entrepreneurship, innovation, technology, and organizations are covered by the journal, along with all business-related functional areas like accounting, finance, information systems, marketing, and operations. The research presented in these articles contributes to our understanding of critical issues and offers valuable insights for policymakers, practitioners, and researchers. Authors are invited to publish novel, original, empirical, and high quality research work pertaining to the recent developments & practices in all areas and disciplines.

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Dr. Pooja M. Patil

Editor

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South Asian Journal of Management Research (SAJMR)

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The Challenges Faced By Coconut Processing Firms across Kerala an Analytical Study

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Abstract

Coconut processing firms play a vital role in strengthening the coconut industry, particularly in states like Kerala, where coconut cultivation is widespread. Despite their importance, these firms have been experiencing a decline in growth in recent years. The current study was undertaken to examine and evaluate the significant challenges that coconut processing firms in Kerala are currently facing. To carry out this investigation, five key variables were considered: Finance, Labour, Marketing, Competition, and Technology. Primary data for the study were gathered from 155 coconut processing firms located across various regions of Kerala. A structured questionnaire was developed using Google Forms to ensure consistency and accuracy in data collection. The responses collected were then analyzed using Microsoft Excel. Statistical tools such as percentage analysis, ranking methods, and the chi-square test were employed to interpret the data and derive meaningful conclusions.

The results of the study indicate that financial difficulties are the most significant challenge confronting coconut processing firms in the state. These economic constraints were ranked first, underscoring the critical role that access to adequate funding plays in the smooth operation and expansion of such firms. Labour-related issues were identified as the second major challenge. Many firms reported problems related to the availability, cost, and skill level of labour, which directly impact productivity and operational efficiency. Marketing emerged as the third-ranked challenge. Firms often face difficulties in effectively promoting and selling their products due to limited market access, lack of branding, and stiff competition from larger players. The competition itself was ranked fourth, suggesting that while it is a concern, it is not as pressing as financial or labour issues. Nonetheless, the influx of competitors—both from within and outside the state—has added pressure on local processors to innovate and improve efficiency. Finally, technological constraints were ranked the lowest among the five variables. This indicates that although a lack of advanced technology is a concern, it is not as immediate or severe as the other issues. However, in the long run, limited access to modern processing equipment and techniques may hinder the industry's ability to remain competitive in a rapidly evolving market. In conclusion, the study highlights that financial issues are the foremost obstacle for coconut processing firms in Kerala, followed by challenges related to labour, marketing, competition, and technology. Addressing these challenges through policy support, financial assistance, skill development, and technological upgrades could significantly aid in revitalizing the coconut processing sector in the region.

Keywords: Coconut Processing Firms, Annual Turnover, Technology, Value-Added Products, Financial Problems.

Introduction

Coconut is recognized as one of the most versatile and valuable natural resources globally, with its applications spanning a wide range of industries, including food and beverages, cosmetics, pharmaceuticals, and various industrial sectors. Due to its multifaceted utility, the coconut industry presents lucrative opportunities for entrepreneurs seeking to establish businesses based on coconut-based products. India holds a prominent position in global coconut production, ranking as one of the leading producers worldwide. The country cultivates coconuts over an extensive area of approximately 1.97 million hectares. Among the Indian states, Kerala stands out as the most significant contributor, accounting for over 90% of the nation's total coconut output. The favorable climatic conditions, fertile soil, and traditional expertise in coconut farming have positioned Kerala as the epicenter of the coconut industry in India. Coconut processing firms in the region play a pivotal role in transforming raw coconuts into a wide array of value-added products. These include but are not limited to, Virgin Coconut Oil (VCO), Desiccated Coconut Powder, Activated Carbon, Coconut Milk, Coconut Oil, and other derivative products. Such processed goods not only meet domestic demand but are also gaining popularity in international markets, driven by increasing consumer awareness of natural and organic products. The rising global demand for coconut-based products presents significant growth potential for coconut processing enterprises. Establishing a coconut processing business offers a promising avenue to capitalize on this expanding market trend. By leveraging innovative technologies and efficient supply chain systems, entrepreneurs can tap into both domestic and export

markets, contributing to rural development, employment generation, and economic growth, particularly in coconut-producing regions like Kerala.

Literature Review

Coconut farmers in Kerala have demonstrated varying levels of satisfaction with co-operative marketing systems, with studies revealing structural deficiencies and unmet expectations in several key areas of performance. Evaluations of farmer perceptions indicate that positive sentiment toward co-operative channels was lacking in a majority of the assessed variables, suggesting the need for institutional reform and improved functional efficiency (Ayyoob et al., 2012).

Despite substantial institutional support, Coconut Producer Societies (CPSs) have shown limited effectiveness in revitalising the sector, primarily due to inadequate infrastructure and limited availability of suitable coconut varieties. Many societies have struggled to participate actively in value addition, marketing, and the use of formal credit facilities, thereby weakening their impact on processing and marketing outcomes (Sebastian, 2013).

The formation of community-based producer groups has been shown to positively influence rural livelihoods, with collective action improving food security, social cohesion, and economic stability. These outcomes reinforce the value of group-based initiatives in empowering agricultural communities (Jnanadevan, 2018). A broader analytical examination of coconut product economics has also identified inefficiencies in value chain operations that impact profitability and sustainability in the sector (Elias, 2014). Furthermore, an early study underscored the crucial role of organised market federations in enhancing price realisation, minimising post-harvest losses, and reducing transaction costs across supply chains (Pillai, 1994).

Virgin coconut oil (VCO) has emerged as a prominent value-added product within the coconut industry. Several studies have affirmed its nutritional and therapeutic value, positioning it as a functional food with significant consumer appeal (Marina et al., 2009; Nevin & Rajamohan, 2004). Sensory evaluations have further validated its market potential based on taste and aroma preferences among consumers (Villarino et al., 2007). The increasing popularity of VCO in Kerala is supported by consumer-based research highlighting awareness levels, purchase patterns, and demographic differences in consumption behaviour (John & Ushadevi, 2018). Branding and market positioning efforts have also played a role in expanding the reach of niche VCO products (Salomy et al., 2019), with further research demonstrating its growing acceptance beyond Kerala, notably in urban centres like Bangalore (S.P. et al., 2023).

Challenges in coconut cultivation and primary production have been exacerbated by external shocks such as the COVID-19 pandemic, which disrupted supply chains and exposed systemic vulnerabilities related to labour availability and price instability (Mathuthra & Arumugaswamy, 2020). Similar constraints have been observed in other regions, where marketing inefficiencies and resource limitations have adversely affected producer margins (Shashikumar & Chandrashekar, 2014). Region-specific studies in Kerala have highlighted persistent agronomic and marketing barriers that continue to affect farmer motivation and long-term viability (Veerakumar, 2019).

Recent value chain analyses have emphasised the need for integrated approaches to strengthen the coconut sector. Improved coordination across production, processing, and marketing segments is seen as essential for enhancing competitiveness and ensuring equitable value distribution among stakeholders (Veerakumaran et al., 2023).

Statement of the Problem

The coconut processing industry is a vital segment of Kerala's agro-based economy, contributing significantly to rural employment, entrepreneurship, and value addition. With Kerala being one of the largest coconut-producing states in India, the region has witnessed the emergence of numerous small and medium-scale processing units focused on products such as virgin coconut oil, coconut milk, and desiccated coconut powder. Despite the sector's inherent potential and a favourable supply base, recent trends indicate a worrying decline in the operational performance and growth trajectory of many coconut processing enterprises in the state.

This decline is attributed to a range of interrelated challenges that adversely affect the competitiveness and sustainability of these firms. Reports from industry bodies and preliminary observations suggest that access to institutional finance remains limited, especially for micro and small entrepreneurs. Labour shortages, rising wage costs, and a dearth of skilled manpower have further intensified operational inefficiencies. In addition, marketing constraints, such as poor brand positioning, limited market reach, and weak distribution networks, have impeded firms' ability to scale and differentiate their products. Many units also rely on outdated processing technologies, which not only reduce production efficiency but also affect product quality. The growing presence of large-scale competitors, including multinational brands and organised players, has further heightened market pressures for local processors.

Although these issues are widely acknowledged, there is a lack of comprehensive empirical studies that systematically identify, rank, and analyse the specific challenges faced by coconut processing firms in Kerala.

Existing literature predominantly focuses on coconut cultivation or consumer trends, with limited attention to the supply-side constraints encountered by processing units. Hence, a data-driven investigation is necessary to capture the lived realities of entrepreneurs in this sector and to inform targeted policy and managerial interventions. This study seeks to bridge this gap by examining the major operational challenges experienced by coconut processing firms in Kerala and exploring their relationship with firm characteristics, thereby contributing to the discourse on rural industrial sustainability.

Scope of the Study

This research, titled "The Challenges Faced by Coconut Processing Firms," is focused on exploring and analyzing the core difficulties experienced by coconut processing enterprises within the state of Kerala. The primary objective is to investigate the key factors impeding the growth and development of these firms, irrespective of their operational scale or production capacity. The study encompasses a broad range of coconut processing units, including both small-scale and larger businesses involved in the production of value-added coconut products. A total of 155 firms were selected as the sample size for the research. Data collection was carried out through a structured and comprehensive questionnaire designed to gather relevant insights from the respondents. The findings aim to provide a clear understanding of the prevailing issues within the sector and offer meaningful recommendations for policymakers, industry stakeholders, and entrepreneurs.

Objectives of the study

- To examine the demographic characteristics of coconut processing firms in Kerala.
- To identify and rank the key challenges encountered by coconut processing firms in their operations.
- To analyse the association between firm-specific characteristics and the challenges they face in coconut processing.

Hypothesis of the Study

- H₀₁: There is no significant association between the experience of the firm in coconut processing and the challenges faced.
- H₀₂: There is no significant association between the type of ownership of the coconut processing firm and the challenges faced.
- H₀₃: There is no significant association between the level of technology used in coconut processing and the challenges faced.
- H₀₄: There is no significant association between the annual turnover of coconut processing firms and the challenges faced.

Research Methodology

The present study is exploratory, and it is based purely on primary data from three months. For data collection, the simple random sampling method was used, and the response was strictly restricted to coconut processing firms that produced coconut-based value-added products in the Kerala region. For this, a standard, well-structured Google survey questionnaire was developed and forwarded through email. Initially, 250 Google survey forms were forwarded, and ultimately, 155 responses were received and found appropriate for the study.

Tools and Techniques

The collected data were analyzed with the help of the Microsoft Excel Add-Inn (Analysis tool Pak) feature by using statistical tools, that is, percentage, rank, and chi-square test, to test the hypotheses and assess the relationship between demographic variables and The challenges faced by coconut processing firms.

Data Analysis and Result

Table No.1: Demographic profile of coconut processing firm

Demographic profile	Factors	Frequency	Percentage
Experience in coconut processing	Less than one year	53	34
	One to three years	38	25
	Three to six years	47	30
	Above six years	17	11
	Total	155	100
Type of coconut processing firms	Single owner	63	41
	Partnership	31	20
	Company	04	2
	Co-operative society	57	37
	Total	155	100
Technology used in coconut processing	No technology	33	22
	Semi mechanized	86	55
	Fully mechanized	36	23
	Total	155	100
Annual turnover	Less than one crore	74	48
	One to three crore	34	22
	Three to six crore	43	28
	Above six crore	04	2
	Total	155	100

The survey yielded 155 responses from various parts of Kerala state. Experience in coconut processing is an important factor in identifying the challenges faced by coconut processing firms. Table 1 shows that 53 %of the respondents had less than one year of experience in coconut processing and only 17 % of the respondents had more than six years of experience in coconut processing. The type of coconut processing firms is another important factor in identifying the challenges. The result shows that most of the (63 %) firms do their business in single ownership, followed by Co-operative society (57 %). According to technology Used in coconut processing,86 % of firms used semi-mechanized technology,36 % used Fully mechanized technology, and 33 % used No technology in coconut processing. Based on annual turnover, 74 % of the coconut processing firms have less than one crore annual turnover, and only 4% have above six crores annual turnover in the year.

Table No. 2 : The challenges faced by coconut processing firms

challenges	1 Rank	2 Rank	3 Rank	4 Rank	5 Rank	Total	Rank Assigned
Financial problems	55	32	28	63	28	206	1
Labour problems	43	61	47	26	27	204	2
Marketing problems	32	22	33	28	25	140	3
Competition	15	18	38	23	42	136	4
Lack of Technology	10	22	09	15	33	89	5

Over the past few years, coconut processing firms in Kerala have suffered huge losses for several reasons. Table 2 represents the various challenges faced by coconut processing firms. The above table shows that financial problems are the main challenges faced by coconut processing firms, with the first rank, the second rank assigned to labour problems, the third rank given to marketing problems, and the fourth rank given to competition. The fifth rank is assigned to lack of technology. Therefore, it can be summarized that financial problems are the main challenges faced by most coconut processing firms, followed by labour problems, marketing problems, competition, and lack of technology

Hypothesis testing

Table No. 2 : Demographic Variables and the Challenges Faced by Coconut Processing Firms

Demographic profile	factors	Chi-square value	Null Hypothesis
Experience in coconut processing	Less than one year	$\chi^2 = 17.926$ Df = 6 P = 0.382	Accepted
	One to three years		
	Three to six years		
	Above six years		
Type of coconut processing firms	Single owner	$\chi^2 = 12.307$ Df = 6 P = 0.055	Accepted
	Partnership		
	Company		
	Co-operative society		
Technology used in coconut processing	No technology	$\chi^2 = 38.958$ Df = 4 P = 0.000	Rejected
	Semi mechanized		
	Fully mechanized		
Annual turnover	Less than one crore	$\chi^2 = 16.956$ Df = 6 P = 0.021	Rejected
	One to three crore		
	Three to six crore		
	Above six crore		

Hypothesis 1. On the application of the chi-square test, the calculated value of the chi-square test is 17.926, and the p-value is 0.382..it is found that the p-value exceeds the significance level, i.e. 5%. Hence, the null hypothesis is accepted. It may be concluded that there is an insignificant association between Experience in coconut processing and the challenges faced by coconut processing firms.

Hypothesis 2. The calculated value of the chi-square test is 12.307, and the p-value is 0.055.It was found that the p-value exceeded the significance level by 5%. Hence, the null hypothesis is accepted. This means that the results of the statistical test are insignificant. It means the variables are independent, or there is no relationship between the type of coconut processing firms and the challenges faced by coconut processing firms.

Hypothesis 3. The chi-square value for the association between technology used in coconut processing and their challenges is 38.958 with 6 degrees of freedom, and a significance probability is less than 0.05 %, i.e., a significant result. Therefore, there is an association between the technology used in coconut processing and their challenges.

Hypothesis 4. There is an association between the Annual turnover of coconut processing firms and their challenges because the calculated value of the chi-square test is 16.956, and the p-value is 0.021. The p-value is found to be less than the 5 level of significance

Conclusion and Recommendations

Coconut processing firms play a vital role in the advancement of the coconut industry and contribute significantly to rural employment generation, particularly among the younger population in Kerala. However, in recent years, many of these firms have encountered numerous operational and structural challenges that have hindered their growth and sustainability. This study has revealed that financial difficulties are the most pressing issue faced by coconut processing firms in Kerala, followed by labour shortages, inadequate marketing strategies, and limited access to modern technology. To enhance the competitiveness and resilience of these firms, both the industry stakeholders and policymakers must address these challenges through strategic interventions. In particular, it is recommended that the government extend venture capital assistance and facilitate access to financial resources for emerging entrepreneurs. Moreover, capacity-building initiatives, including specialized training programs, should be organized to equip aspiring entrepreneurs with the knowledge and skills necessary for managing and expanding coconut processing ventures effectively. Strengthening infrastructure, improving access to markets, and encouraging technological adoption are also essential measures to revitalize this crucial rural industry. The findings of this study offer valuable insights into the core challenges faced by coconut processing firms in Kerala. For existing enterprises, the study serves as a practical guide for identifying critical operational areas that require attention and improvement. By focusing on these areas, firms can formulate more effective business strategies and enhance their overall performance. Additionally, the study provides a valuable framework for prospective entrepreneurs and investors who are considering entering the coconut processing sector. The insights gained from this research can inform strategic planning, investment decisions, and operational design to ensure long-term sustainability and profitability.

Limitations of the Study and Scope for Further Research

While this study contributes meaningfully to the understanding of the challenges in the coconut processing sector, it is subject to certain limitations:

- The research is geographically confined to the state of Kerala and may not fully represent challenges in other coconut-producing regions.
- The sample size of 155 firms, though adequate for preliminary insights, may not capture the complete diversity and scale of the industry across the state.
- The focus of the study was limited to coconut processing firms; future research could broaden the scope to include supply chain actors, such as raw coconut suppliers and distribution networks.
- Similar studies can be conducted in other states or regions to allow for comparative analysis and generalization of findings.

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Determinants of Students' Global Migration in Select Countries

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Abstract

The study examines global migration with a focus on International Students' Mobility (ISM) in both developed and developing countries. Utilizing data from UNESCO on international student inflow from 2011 to 2020, the research evaluates the influx of foreign students in selected countries through panel regression analysis. The study investigates the determinants of ISM by exploring the perspectives of global student migration and identifying key educational and economic factors within host countries that attract international students. The analysis reveals significant differences in how these factors affect student inflow between developed and developing nations. Findings highlight that developed countries often benefit from robust educational infrastructures and economic stability, making them more attractive to international students seeking high-quality education and better career opportunities. In contrast, developing countries may rely on competitive tuition fees and cultural ties to attract foreign students. The study underscores the complexity and heterogeneity of factors influencing ISM, emphasizing that policies promoting international education should be tailored to the specific characteristics and needs of each host country. This research contributes to the understanding of ISM by providing insights into the motivations behind international student migration and the varying impact of host country attributes. It offers valuable implications for policymakers and educational institutions aiming to enhance their attractiveness to foreign students, thus facilitating a more balanced and mutually beneficial global exchange in higher education. The study's comprehensive analysis of ISM dynamics supports informed decision-making in the development of strategies to optimize international student inflows and foster global academic collaboration.

Keywords: International Student Mobility (ISM), Global Migration, Higher Education Policy, Developed vs Developing Countries, Panel Data Analysis

Introduction

During the colonial era, the imperial government provided opportunities for exclusive nationals to pursue higher education in imperial capitals such as London and Paris for the purpose of adjudicating the colonial administrative cadres. This cross-border mobility for education was allowed with the assumption that graduates return home to serve the administration in their home country; this was the expectation before World War II. Due to post-war effects, developing nations experienced a lack of qualified knowledge community to meet their development needs. During this period, higher education investment and human resource development became essential. Foreign education provides assistance to developing nations around the world in developing their fundamental knowledge communities in their home universities. Foreign education was a determinant in post-colonial development periods due to factors such as a lack of facilities in domestic education (i.e., subject experts), the value of foreign education in encouraging people to pursue higher education, and the experience gained through multi-culturalism. During the colonial period, the colonial powers sponsored overseas education, and during the post-colonial period, funding for overseas education came from a variety of sources, including national governments, scholarships for study abroad offered by the United States, and the World Bank. In fact, there was a competition to attract graduates from developing nations during the cold-war period. The Soviet Union and the USA were in tough competition to attract more students to their higher education institutions.

The end of the Cold War era allowed the public universities to introduce fee collection from the students, which had previously been the case only in private universities. The affiliations with private universities were aided by foreign universities, which led to international pricing of the fees levied by them. With the emergence of the private sector, cross-border institutional linkages, and full pricing of educational services, the role of GATS in foreign education and rendered services takes shape. Further the discussion will be focused on the international student's mobility (ISM) to developed and developing nations across world.

The ISM is influenced by various socioeconomic and political factors in the students' home countries as a result of globalization. It is generally assumed that the flow of student mobility is from developing to developed economies. In the present study, the researcher assumed that the flow of cross-border education is caused by economic factors, educational factors, and migration factors, respectively. Consider a nation that speaks English

(globally speaking). Developed nations like Australia, Canada, New Zealand, and the United Kingdom are important suppliers of study abroad options for students from other countries. Neeraj Kaushal (2019); Khaled Qassem Hailat (2020). On the other hand, when choosing developing nations like India, Kazakhstan, Russia, and Ukraine, consideration is given to the increasing number of international students in these economies, which enhances their status as an education destination for higher education. Vakulenko, (2016); Botagoz Ibragimova, (2019); Tamara, (2020); and Kriti Dagar, (2021).

Further the paper is organized as following phases. Phase two begins with a literature review, followed by phase three where the conceptual framework and study hypotheses has framed. Phase four discusses the methodology of the paper with source of data and empirical estimations in sixth phase. In phase seven the results are discussed and followed by the conclusion in eighth phase. Suitable recommendations are suggested for policy makers in last phase eight.

Review of Literature

In the purview of globalization, international students' mobility (ISM) attracts more capital and generates revenue under GATS-WTO. The cross-border student flow in this sector attracts a large number of knowledge consumers and service providers in the global arena. In international student mobility (ISM), it indicates a dominant flow of students from developing countries into developed countries. The studies below argue the determinants of cross-border student mobility between developed and developing nations.

A study by N.V. Varghesse (2008) observed the distribution of student flow across the globe and identified the influencing factors of student flow in cross-border higher education, which include ideological affinity, language proficiency, foreign language and culture, employment opportunities, and easy visa formalities. According to Wei, Hao (2012), it is observed that the inflow of students in developing countries is more inclined due to economic factors, and in developed countries, it is due to educational factors. Caruso (2013) argue that students as a rational group prefer richer countries, regardless of the cost of living (an economic factor), where they are provided with adequately funded services and possibly fellowships for higher education. Andrew Abbott (2016) used gravity variables to determine international student migration and discovered that a 10% increase in the net flow of students among high-income countries across the globe raises the 8.6 percent of bilateral flow and the 26.5 percent marked by non-high-income countries.

The Rationale Behind The Selection of Country Groups Is Motivated By The Studies Reviewed Below.

Historically, the top destinations for international students have included Australia, Canada, New Zealand, the USA, and the UK. And existing literature has also identified new emerging economies with accelerating growth in international students in countries such as the central and south Asian parts of Asia as well as eastern Europe. Numerous studies have examined the determinants of international students' mobility across the globe using various concepts and theories such as push-pull factors, migration theory, neoliberalism, and economic perspectives, and have also identified various determinants and influential factors of international students' mobility. Existing literature has identified determinants of international student mobility and studied the effects of various higher education policies on students' inflow. See Martin Kahanec (2011) discussed the key factors such as multiculturalism, safety, weather, the friendliness of people, tuition fees and costs of study, language of instruction, the quality of education, and its reputation, and concluded that programs taught in English act as an important factor to attract international students from Australia, Canada, New Zealand, and the United Kingdom. The role of education agents in admitting students to international destinations connects knowledge consumers and service providers. In the study conducted by Francis Leo Collins (2012), the author investigated how new industry formations have connected with the processes of student mobility through the role of agents in student mobilities by focusing on the development of export education activities since the early 1990s in New Zealand. The quality of higher education is a key determinant of the inflow of tertiary students into countries, especially Europe and United Kingdom-like countries. Linda Van (2013). In contrast, Halyna Mishchuk et al. (2019) claimed that intellectual migration can have a significant negative impact on national competitiveness and intellectual capability in Ukraine. The developing economies are thriving to attract international students through the pull factor; however, the decision to study abroad is influenced by the push factor. Botagoz Ibragimova's (2019) study in Kazakhstan reveals that the decision to study in Kazakhstan is primarily influenced by pull factors. As for universities in Kazakhstan, the international students seem to be attracted not by the quality of education but rather the availability of seats at Kazakhstani universities and the cost of higher education. The antecedents to ISM in developed and developing nations are heterogeneous. Ping Zheng (2014) established an antecedent's heterogeneity among the two home country groups, emphasizing that economic, social, and political factors are all crucial to international students from developing countries. and for the students from developed countries, their home country's economic wealth, population, and trade links are more important than other factors affecting worldwide flows into the UK. In consistent with the above antecedent of the trade link, Byung S. Min (2017) investigated the factors affecting international student flows for higher education and their consequences for

bilateral market integration in Australia, and the results infer that university study is an important determinant of bilateral trade between Australia and the student's home country. The developed and developing nations, to attract the inflow of international students, adopt numerous strategies such as neoliberalism and the migration model, observe various socio-economic and political factors, and analyze the demographic characteristics of international students worldwide. In contrast, there is literature that rejects conventional approaches and invents comparative advantage in accordance with education policy, language, and multiculturalism. See Neeraj Kaushal (2019), who infers that student flow to English-speaking countries fails to validate the migration model, and Kriti Dagar (2021), whose determinants of cross-border mobility to India vary with respect to economic, social, political, and academic factors. In India, international students from South and South-East Asia are attracted, given the advancement of NEP 2020 (the New Education Policy-2020).

This section of the study demonstrates the choice of countries and the determining variables that draw student inflow to developed and developing countries in light of the aforementioned reviews, which establish the convincing and contradicting viewpoints on numerous theories, concepts, and socio-economic factors of ISM.

Objectives of the Study

- To examine international student inflow trends in developed and developing countries (2011–2020).
- To identify key educational and economic factors influencing international student mobility.
- To compare the impact of these factors between developed and developing host countries.

Research Question and Hypotheses of the Study

- What are the key educational and economic determinants influencing international student inflows to developed and developing countries?
- How do the effects of these determinants differ between developed and developing countries in shaping patterns of international student mobility?

Hypotheses

H1: The net flow of internationally mobile students has a positive effect on the total international student inflows in selected countries.

H2: Outbound student migration from middle-income countries positively influences international student inflows in host countries.

H3: Outbound student migration from lower-middle-income countries positively influences international student inflows in host countries.

H4: The gross enrolment ratio in tertiary education has a positive effect on international student inflows in selected countries.

H5: Government expenditure on education (as a percentage of total government expenditure) has a positive effect on international student inflows in selected countries.

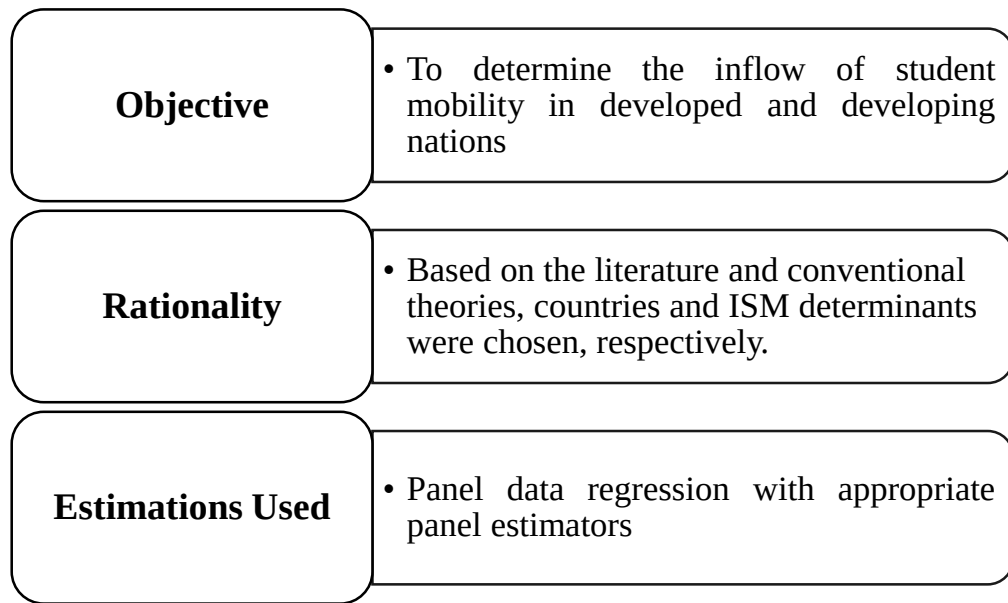
H6: GDP per capita (PPP) has a positive effect on international student inflows in selected countries.

H7: GDP per capita has a positive effect on international student inflows in selected countries.

Conceptual Framework and Hypotheses of the Study

The previous chapter's literature section includes theoretical underpinnings as well as several methodological constructs used in various investigations. As noted in the previous chapter, there aren't many modern statistical tools and methods that can be used for secondary data analysis. This session defines the approach to accomplishing the objectives, taking into account the research objectives and synthesising the literature. To answer the research questions, the conceptual framework described below is used before moving on to the main methodology:

Fig 1: Conceptual Framework



Source: Illustrated by authors

Table No.1: Selection of ISM variables and countries to assess the student's inflow in developed and developing countries.

Variables	Explanation	Hypothesis
Total Students inflows in selected countries <i>(Independent Variable)</i>	International students are those who received their prior education in another country and are not residents of their current country of study. This indicator shows the number of international tertiary students enrolled as a proportion of the total tertiary students enrolled in the destination (host) country.	
<i>Dependent Variable</i>		Expected
Net Flow of International Mobile students in selected countries	Number of inbound internationally mobile students minus the corresponding number of outbound internationally mobile students.	Positive effect
Income Group Countries (Outbound Students) Middle-Income countries	Middle-income countries are those with \$1,026 to \$12,475 in per capita GNI.	Positive effect
Lower-Middle-Income countries	Lower-Middle-income countries those with a GNI per capita between \$1,036 and \$4,045	Positive effect
Gross enrolment ratio in selected countries (Tertiary)	Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown.	Positive effect
Government expenditure on education, total (% of government expenditure)	General government expenditure on education (current, capital, and transfers) is expressed as a percentage of total general government expenditure on all sectors (including health, education, social services, etc.). It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments.	Positive effect
GDP per capita, PPP (current international \$)	This indicator provides per capita values for gross domestic product (GDP) expressed in current international dollars converted by purchasing power parity (PPP) conversion factor.	Positive effect
GDP Per Capita	GDP per capita is gross domestic product divided by midyear population.	Positive effect

Source: World Bank Development indicators, UNESCO Institute of Statistics

Note: All the data are mapped to the International Standard Classification of Education (ISCED) to ensure the comparability of education programs at the international level

It shall be noted that the selected variables are motivated through the existing theoretical linkages of ISM, and in the particular study, they were considered based on the migration factor, the inflow country's educational factor, and economic factors from an internationalisation perspective, respectively. The expected hypothesis assumes a positive effect of the determinant on students' inflow into selected developed and developing countries.

Table No.2: Countries selected in the study

Developed Nation	Developing Nations
Australia	India
Canada	Kazakhstan
New Zealand	Russia Federation
United Kingdom	Ukraine

Note: Based on the literature review

The countries selected were based on the important insight that international student mobility is widespread throughout all nations and that developing countries also receive a sizeable number of students who are internationally mobile and can be seen in the league.

Research Methodology

To analyse student mobility in selected countries, panel data regression has been adapted with a simple linear equation for developed and developing nations separately. Two empirical models have been synthesised with the pooled panel data sets: one is for international student inflow in developed countries, and the other is for international student inflow in developing countries. For the panel data set's dependent variable, data on international students who mobilised to selected developed and developing countries between the years of 2011 and 2020 (ten years) has been acquired from the UNESCO Institute for Statistics (UIS). Pooled OLS and a fixed or random effect model are the general approaches to panel data, and the same has been employed in the study to estimate the regression equation. The said estimations were performed using the Stata 15.1 statistical package.

Empirical Model

The model assumes that the international student inflow in the developed and developing countries is more determined by various factors such as the net flow of students internationally mobile across the world, the outflow of students from middle-income country groups (Lower middle-income country groups for developing countries), the inflow country's tertiary level gross student enrolments, government expenditure on education, purchase power parity, and GDP per capita.

The econometric form of the equation for Developed Country model:

$$\text{Total inflow}_{it} = \alpha_{it} + \beta_1 \text{Netflow}_{it} + \beta_2 \text{MIC}_{it} + \beta_3 \text{TerEnroll}_{it} + \beta_4 \text{GovtExp}_{it} + \beta_5 \text{GDPPPP}_{it} + \beta_5 \text{GDPPercap}_{it} + u_{it}$$

For Developing Country model:

$$\text{Total inflow}_{it} = \alpha_{it} + \beta_1 \text{Netflow}_{it} + \beta_2 \text{LMIC}_{it} + \beta_3 \text{TerEnroll}_{it} + \beta_4 \text{GovtExp}_{it} + \beta_5 \text{GDPPPP}_{it} + \beta_5 \text{GDPPercap}_{it} + u_{it}$$

Where, Total inflow is number of international students in selected inflow countries

Net flow is students internationally mobile across the world

MIC is outbound students from middle-income country groups

LMIC is outbound students from lower middle-income country groups

TerEnroll is inflow country's tertiary level gross student enrolments

GovtExp is government expenditure on education (% of Govt exp)

GDPPPP is purchase power parity

GDPPercap is GDP per capita is gross domestic product divided by midyear population

And α , β_1 , β_2 are the coefficients where, U is the Error term.

Pooled OLS				Random effect			Fixed effect			Pooled OLS Robust Model	
YINFLOW	Coef.	P> t	Std. Err.	Coef.	P> t	Std. Err.	Coef.	P> t	Std. Err.	Robust Std. Err.	P> t
NETFLOW	0.998	***	0.011 6938	0.998	***	0.0116 94	1.003	***	0.01 1	0.011	***
MIC	-0.043	***	0.006 464	-0.043	***	0.0064 64	0.0001	*	0.00 2	0.007	***
ENROLTER	-165.7	***	50.34 003	-165.7	***	50.340 03	-31.584	***	13.4 2	59.16	***
Govt Exp Edu	-631.9	**	297.2 012	-631.9	**	297.20 12	153.9	*	71.9 1	319.7	**
GDPPPP	5.983	***	1.005 394	5.983	***	1.0053 94	0.538	*	0.37 5	0.953	***
GDPPC	-2.394	***	0.385 2746	-2.394	***	0.3852 75	-0.203	*	0.13 1	0.283	***
_cons	18989. 27	0.354	2018 3.55	18989.	.0347	20183. 55	10167. 6	0.267	8980 .1	20765.1	0.367
Observations	40			40			40			40	
F-test/v	1894.46 ***			11366.78 ***			5855.57 ***			2343.54 ***	
within				0.9837			0.9991				
R2 between				0.9991			0.9879				
Overall	0.9971			0.9971			0.9894			0.9971	
BPLM										1.000	
Hausman Test				108.14***							
Autocorrelat ion	Breusch-Godfrey LM test for autocorrelation						accepted the null hypothesis				
Heterosceda sticity	Breusch-Pagan / Cook-Weis test for heteroskedasticity						accepted the null hypothesis				

Source: Estimated using Stata 15.1

Note: *, **, ***Statistical significance at 10, 5 and 1 per cent, respectively.

To test the above model the following empirical estimations were estimated: Pooled OLS regression model, (FEM) Fixed effect model and (REM) Random effect model on both equation of model separately (i.e., Developed country model and developing country model).

The determinants of international students' inflow in developed nations are tested using pooled OLS (POLS), FEM, and REM. From Table 3, it can be observed that all the explanatory variables are significant at 1 percent for all three models, while the coefficients are inversely significant to the student inflow in developed countries except net flow and GDP PPP in the POLS and REM, while the FEM shows a positive significance except gross tertiary enrolment and GDP per capita. The model indicates that 99% of the variation in students' inflow in developed countries such as Australia, Canada, New Zealand, and the United Kingdom is explained by the determinants (chosen independent variables) in the model (R squared =.9971).

However, the result of the Breusch-Pagan LM diagnostic test is consistent with the POLS as the final model. Also, recall when Hausman tests were performed. In other words, it implied that the panel data ignores the state-specific effects of determinants in the regression model for the inflow of students into developed nations. Considering the POLS as the appropriate model, robust standard error estimations are derived to further improve the model in the study.

Table 4. Estimations of Developing Countries Model

Source: Estimated using Stata 15.1

Note: *, **, ***Statistical significance at 10, 5 and 1 per cent, respectively

Table 4 depicts the POLS, REM, and FEM for the determinants of student inflow in developing countries. According to the above three model, all other factors are positively significant determinants of student inflow in developing countries such as India, Kazakhstan, Russia, and Ukraine, with the exception of purchase power parity, which is insignificant. The model indicates nearly 62% of the variation in students' inflow in developing countries is explained by the determinants (chosen independent variables) in the model ($R^2 = .629$).

The result of the BPLM test does not reject the null hypothesis, which indicates that pooled OLS is preferable to REM. Unlike the developed country model, the Hausman test accepts the null hypothesis and demonstrates that FEM is not suitable in this model. But, the Breusch-Pagan LM test does not reject the null hypothesis and indicates pooled OLS is appropriate. The test for heteroscedasticity (Breusch-Pagan / Cook-Weisberg test for heteroscedasticity) explains the heterogeneity in the model. As a result, the robust standard error estimations of POLS are finally considered for inferring student inflows into developing countries.

According to the findings of the two models mentioned above (see Tables 3 and 4), the combination of economic, educational, and migration factors impacts the flow of students into developed nations in an inverse manner. The beneficial benefits in developing countries, however, have been determined by the same determinant factors.

Summary of Findings

The migration factor for developed countries shows that the influx of students is inversely correlated to the outflow of students from middle-income country groups (MIC) due to the negative significance of MIC students though net flow has a positive significance. This reverse flow has been elicited by (de Haas, 2011) in the study of the determinants of international migration. The educational factor reveals the opposite effect of both the gross tertiary enrolment and government expenditure variables, and the large difference in coefficients explains that in developed countries' educational institutions, tertiary level enrolments will be considered as quality intakes, (Kahanec et al., 2011) and this result is inconsistent with the (Kritz, 2015). The negative sign of government expenditure will explain the growing number of private educational institutions in developed countries. Finally, the economic factor in developed countries' student inflow reveals a negative effect on per capita, which contradicts previous findings of (Zheng, 2014) implying that student migration to a developed country for higher education is less oriented toward earnings and more oriented toward knowledge gained in the selected developed country. While the effects of tuition costs, exchange rates, and living expenses are revealed by the host country's positive PPP rates, this effect is positively proportional to the inflow of students to developed countries unlike the findings of (Kaushal & Lanati, 2019).

In the case of developing countries, the migration factor, in addition to the net flow of ISM, includes students from lower-middle-income countries. The statistically significant positive coefficients show that in the case of developing countries, the migration factors are what most attract international students from the rest of the world. The education factor shows a positive coefficient for both variables, the gross tertiary enrolments and government expenditure on education, although, with the insignificance of government expenditure, this education factor reveals that the gross enrolments in educational institutions in developing countries attract international students. This finding is consistent with the case of Kazakhstan; see (Ibragimova, 2019). In economic factors the variable, GDP PPP rates of developing country reverse the student's inflow and GDP per capita attracts. This effect of the education factor is contradictory in nature because developing economies' per capita income is lower than that of developed economies, and PPP rates in developing economies should actually attract students' mobility rather than repel it. This case can be derived from the favourable impact of student immigration into developing countries from lower-middle-income-country groups.

Conclusion and Implication

In conclusion, this study explores the factors influencing international student mobility (ISM) across developed and developing countries. Interestingly, the findings reveal distinct trends for each category. Developed countries see a "reverse flow" phenomenon, where student influx is inversely related to outflow from middle-income countries. Educational quality, measured by gross tertiary enrolment, appears to be a key driver for developed nations, while economic factors show a surprising twist. Per capita income has a negative effect, whereas higher Purchasing Power Parity (PPP) rates correlate with increased student mobility. This suggests students might prioritize educational quality and affordability over post-graduation earnings. Conversely, developing countries experience a net student inflow from all regions, particularly lower-middle-income ones. Here, gross tertiary enrolment acts as a positive attractor, while government spending on education shows a less clear impact. Economically, GDP per capita positively influences student inflow, while higher PPP rates have a negative effect. This requires further investigation but could potentially reflect the appeal of developing economies with lower living costs.

These findings hold valuable implications for policymakers and educational institutions. Developed countries can focus on maintaining educational quality and affordability to attract international students. Developing countries can leverage their expanding educational opportunities and potentially lower living costs to attract students from

abroad, while ensuring sufficient funding for quality programs. Further research is needed to fully understand the seemingly contradictory economic factors, particularly the contrasting effects of per capita income and PPP rates on student mobility across development levels.

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Smart Analytics Platform for Generating Indirect Attainment Reports in Outcome-Based Education Using Automated Insight Engine

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Abstract

The current research proposes a comprehensive and automated web-based framework for streamlining the implementation of Outcome-Based Education (OBE) with a specific emphasis and focus on the indirect assessment of learning outcomes. Recognizing the limitations of manual feedback processing and fragmented evaluation practices, the proposed and developed system addresses these challenges by integrating key technological components for enabling efficient data collection, processing, visualization, and reporting. At the core of the system architecture is the automated acquisition of student feedback through Google Forms, which is employed to capture learners' perceptions regarding the attainment of Course Outcomes (COs) and their alignment with Program Outcomes (POs). The responses collected through Google Forms are further stored in Excel format which are parsed and analyzed within a structured backend powered by a MySQL database. The results of the indirect assessments are automatically processed which are exported into well-organized PDF reports thereby facilitating transparent and standardized documentation. Real-time data visualization is achieved through seamless integration with Microsoft Power BI, offering dynamic dashboards to enable faculty and administrators monitor course-wise and program-level attainment metrics effectively. The system is architected to support role-based access control, distinguishing between student and faculty functionalities. Students are provided with intuitive interfaces for submitting feedback and assessments, while faculty members are empowered with comprehensive administrative controls for managing academic entities such as programs, courses, COs, POs, and feedback links. Additional modules support the parsing of Excel sheets, data persistence, and the generation of analytic reports. A well-defined relational database schema underpinning the system is designed and implemented for ensuring consistency, scalability, and integrity of educational data. Further, for facilitating remote access and mobile compatibility, the system leverages ngrok, a secure tunneling solution exposing the local web application to the internet through publicly accessible URLs. This feature inevitably contributes to the significant enhancement of the flexibility and accessibility of the platform for stakeholders operating in distributed environments. The proposed framework aligns extremely well with contemporary educational quality assurance practices and accreditation requirements, offering a scalable, data-driven approach to OBE implementation. It further enables institutions to close the feedback loop through continuous quality improvement (CQI) by transforming raw feedback into actionable insights, ultimately contributing to the enhancement of curriculum design, instructional practices, and learner outcomes. The current research contributes significantly to the field of educational technology by presenting a replicable, extensible model for indirect attainment analysis in OBE, thereby supporting institutional efforts to deliver learner-centered, industry-relevant education.

Keywords: Course Outcome, Curriculum Mapping, Indirect Assessment, Outcome-Based Education, Programme Outcome, Power BI, Student Feedback

Introduction

Outcome-Based Education (OBE) is crucial in higher education as it shifts the focus from traditional teaching methods to what students are expected to achieve by the end of their learning experience. It emphasizes clear goals, measurable outcomes, and continuous improvement, ensuring that graduates possess the skills, knowledge, and attitudes required by industry and society. By aligning curriculum, teaching, and assessment with defined outcomes, OBE enhances accountability, fosters lifelong learning, and better prepares students for real-world challenges, making higher education more relevant, transparent, and impactful.

Flaws in Traditional Teaching Methods

Traditional education primarily focused on what the teacher taught rather than what the student learned. It was often lecture-driven, content-heavy, and time-based, with little emphasis on individual learning pace, skills application, or outcome measurement. Assessment mainly tested memory rather than understanding, critical

thinking, or practical skills. This led to a gap between academic learning and real-world requirements, leaving many graduates underprepared for professional challenges.

How OBE Overcomes These Flaws

Outcome-Based Education addresses these issues by centering the educational process around clearly defined learning outcomes. It emphasizes what students are able to do after instruction, promotes active and student-centered learning, and continuously measures performance against specific goals. OBE ensures that teaching, learning, and assessment are aligned to industry and societal needs, thus making education more meaningful, flexible, and relevant. The relative comparison between traditional education and outcome-based education is outlined in Fig 1.

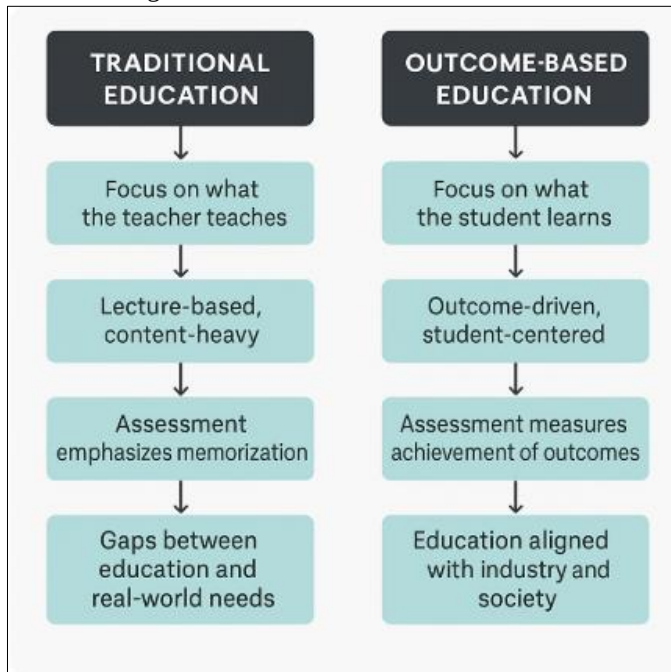
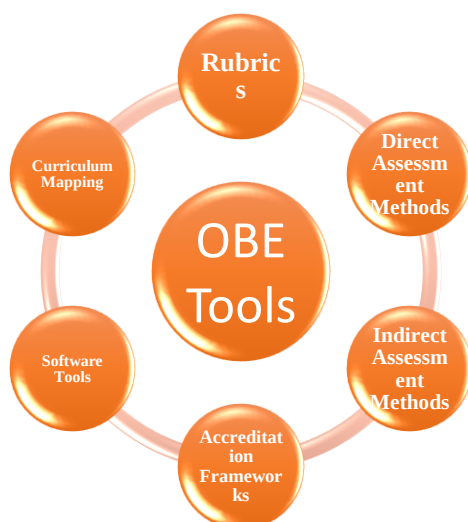


Fig. 1. Traditional Education Vs. Outcome-Based Education

Tools Used in OBE Implementation

A wide range of OBE tools have been reported, with a few prominent ones illustrated in Fig. 2.



Description of these tools is provided below:

Curriculum Mapping

Aligns course objectives with program outcomes.

Bloom's Taxonomy

Guides designing outcomes at appropriate cognitive levels (e.g., remembering, analyzing, creating).

Rubrics

Provides clear criteria for evaluating complex skills and competencies.

Direct Assessment Methods

Exams, projects, presentations, portfolios.

Indirect Assessment Methods

Surveys, feedback forms, alumni tracking.

Accreditation Frameworks

Frameworks

such as NBA (India), ABET (USA) that formalize OBE standards.

Software Tools

Outcome-based education management systems like OBEAM, Accredinator, or LMS-integrated tools (for example, Moodle with OBE plugins) help automate tracking and reporting of outcomes attainment.

Significance of Indirect Assessment Methods

Indirect assessment methods, such as feedback forms, are significant because they provide valuable insights into students' perceptions of their learning experience, teaching effectiveness, and curriculum relevance. While they do not directly measure learning outcomes, they help identify areas of improvement in instructional strategies, course design, and academic support services. Feedback forms capture subjective but essential information—like student satisfaction, engagement levels, and confidence in applying knowledge—which complements direct assessment methods and supports continuous quality enhancement in education.

The current research aims to develop an integrated web-based software solution that streamlines the process of computing indirect course attainment by automating the collection of student feedback through Google Forms, parsing and analyzing Excel responses, generating structured PDF reports, storing results in a MySQL database, and offering real-time visualizations through Power BI—ensuring a seamless and efficient mechanism for Outcome-Based Education (OBE) evaluation.

Review of Literature

The literature examined offers a detailed overview of Outcome-Based Education (OBE) within the realm of higher education, emphasizing diverse methodologies aimed at enhancing pedagogy, curriculum design, and quality assurance practices. Thakkar and Landge (2022) stress the necessity of accurately evaluating Course Outcomes (COs) and Program Outcomes (POs) through robust mapping techniques, underlining the critical role of alignment to ensure educational effectiveness. Complementing this, Okojie et al. (2022) introduce innovative strategies such as virtual learning modules, advocating for the inclusion of national curriculum standards to promote accessibility and maintain quality. Rajagopal Reddy et al. (2021) highlight the role of Continuous Quality Improvement (CQI) in fostering sustained enhancements to the teaching-learning process.

In another contribution, Jeyanthi R. (2019) emphasizes aligning educational objectives with the hierarchical structure of Bloom's Taxonomy to foster deeper cognitive engagement and knowledge application among learners. Rani (2020) proposes a balanced transition toward OBE, recommending the retention of effective elements from conventional systems while gradually integrating outcome-focused strategies across curriculum, assessments, and instructional methods. Rajak et al. (2019) provide a broader strategic perspective on achieving Program Educational Objectives and POs, supported by performance metrics and comparative analysis.

Marey et al. (2018) advocate for rubric-based evaluation frameworks to measure both course and program-level learning outcomes, offering data-driven insights to inform teaching practices. Similarly, Kavitha A. et al. (2018) focus on assessment methods that align with accreditation standards, aiming to optimize instructional delivery and student engagement. Lastly, Ahankari and Jadhav (2016) explore the effectiveness of e-rubrics in evaluating COs and POs, supporting both formative and summative assessments that guide curriculum refinement.

Collectively, these scholarly works deepen the understanding of OBE implementation, offering significant contributions in the areas of assessment methodology, curriculum alignment, instructional improvement, and academic quality assurance in higher education.

Conceptual Model Design

Conceptual Model Flow

The curriculum defines Course Outcomes (COs), which are mapped to Program Outcomes (POs). Student feedback enables indirect assessment, while assessment data analyzed via Power BI provides insights for continuous improvement of the curriculum and OBE implementation as outlined in Fig. 3.

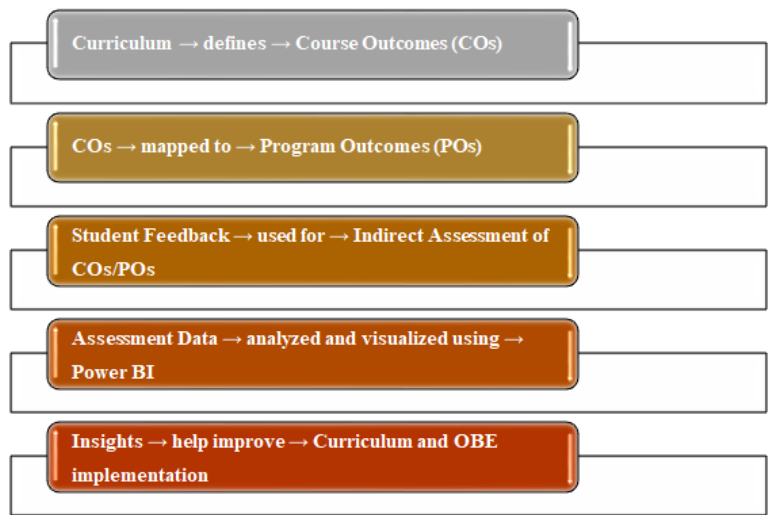


Fig.3. Conceptual Model Flow

Model Implementation

Module Dependency Diagram for Landing Page

The Module Dependency Diagram depicted in Fig. 4. for landing page illustrates the navigation flow and access control of a web-based Outcome-Based Education (OBE) system, beginning with index.php as the landing page. Users who are not logged in can access public modules like mcq.html for taking tests and home4.html for exit surveys. Upon login (session active), users gain access to administrative functionalities, including inserting links (insert_mcq_link.php, insert_link.php), managing academic entities (manage_programs.php, manage_courses.php, manage_po.php), viewing or deleting mappings (display_all_links.html, delete_all_links.php), and handling data files and indirect assessment (parse_excel_files.php, export_indirect1.php, indirect_database.php). The session can be terminated via logout.php. This diagram clearly separates user and admin functionalities, ensuring role-based access and structured navigation.

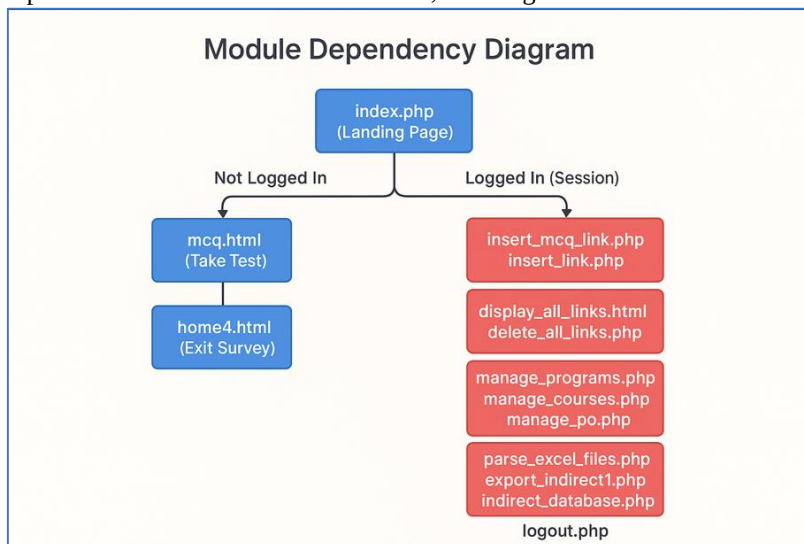


Fig. 4. Module Dependency Diagram for Landing Page

Module Dependency Diagram for Exit Survey and Generating Report

Fig.5 outlines the client-server interaction for home4.html, which serves as the front-end page handling exit survey logic using JavaScript. The JavaScript layer captures DOM events and uses Fetch APIs to request data from three backend scripts—fetch_programsp, fetch_courses1, and fetch_electives.php—which return program, course, and elective data respectively from the corresponding database tables. Once the user selects their inputs and clicks 'Proceed' the collected data is used to redirect the user to exitsurvey.php for further action, completing the data-driven survey flow. Fig 6. demonstrates the module dependency diagram for generating report.

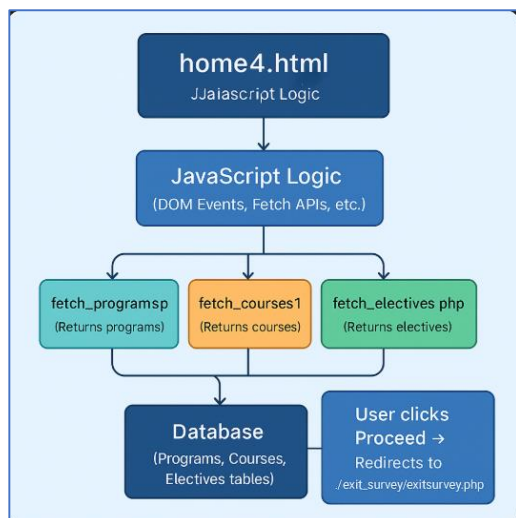


Fig. 5. Module Dependency Diagram for Exit Survey

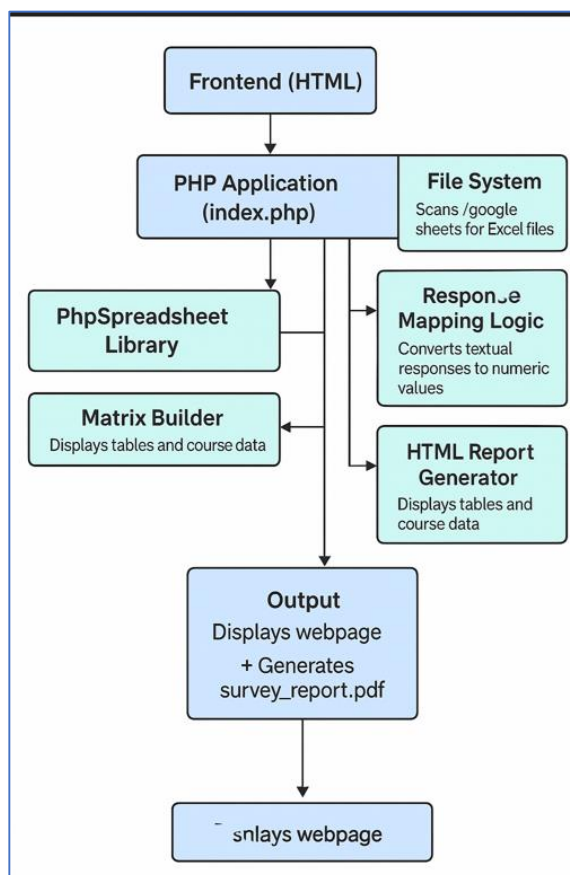


Fig. 6. Module Dependency Diagram for Generating Report

Structure of Database

The database 'exit_survey_mca' shown in Fig. 7. is structured with six tables that collectively support the mapping and assessment of course and program outcomes based on student feedback. The course_master and co_master tables likely store details about courses and their associated course outcomes (COs), while the po_master and program_master tables manage program-level outcomes (POs) and overall program details. The link_master table likely handles the mapping or relationship between COs and POs. The indirect_attainment table captures and stores indirect assessment data, such as student exit survey results, which are used to evaluate attainment levels based on perceptions rather than direct evidence. Together, this schema supports an Outcome-Based Education (OBE) framework with both direct and indirect assessment components.

Server: 127.0.0.1 » Database: exit_survey_mca

Structure SQL Search Query Export Import Operations Privileges Routines Events Triggers

Filters

Containing the word:

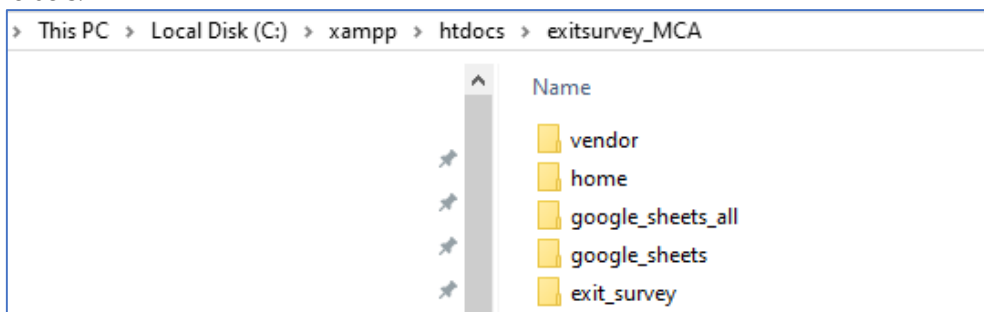
Table	Action	Rows	Type	Collation	Size	Overhead
☐ course_master		85	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐ co_master		266	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐ indirect_attainment		196	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐ link_master		6	InnoDB	utf8mb4_general_ci	32.0 KiB	-
☐ po_master		24	InnoDB	utf8mb4_general_ci	16.0 KiB	-
☐ program_master		3	InnoDB	utf8mb4_general_ci	16.0 KiB	-
6 tables	Sum	580	InnoDB	utf8mb4_general_ci	112.0 KiB	0 B

☐ Check all With selected:

Fig. 7. Structure of Database for Exit Survey

Software System Folder Structure

A Software System Folder Structure organizing the files and directories of a software to project in a systematic way, ensuring clarity, maintainability, and efficient collaboration among developers is depicted in Fig 8(a)-8(c). It typically separates source code, configuration files, documentation, and build artifacts into distinct, well-defined folders.



Content of 'home' Folder

This PC > Local Disk (C:) > xampp > htdocs > exit_survey_MCA > home

Name	Date modified	Type
assets	01-04-2025 10:49	File folder
vendor	01-04-2025 10:49	File folder
exitsurvey.php	15-04-2025 15:10	PHP Source File
index - Copy.html	24-03-2025 12:44	HTML Document
index.html	24-03-2025 12:44	HTML Document
index.php	15-04-2025 16:21	PHP Source File
login.html	26-03-2025 12:25	HTML Document
login.php	26-03-2025 12:41	PHP Source File
logout.php	26-03-2025 12:33	PHP Source File
meeting-details.html	12-10-2021 16:41	HTML Document
meetings.html	12-10-2021 16:41	HTML Document
process_login.php	26-03-2025 12:38	PHP Source File

Google_sheets Folder of Web Application

Contains google sheets containing exit survey data.

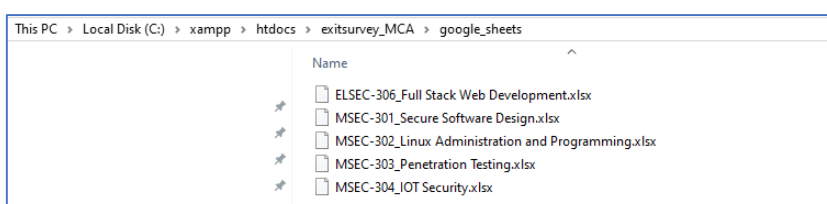


Fig 8(a)-8(c) Software System Folder Structure

Experimental Results

Setting up Execution Environment

Software Requirements for Client-Side Execution

- Operating System (Client Machine)
Windows 7/8/10/11 (64-bit preferred)
Admin rights to install and run services
- XAMPP Package Installation

Installation of the full XAMPP stack

- Apache (Web Server)
- MySQL/MariaDB (Database Server)
- PHP (Scripting Engine)
- phpMyAdmin (Database Management GUI)

System Roles and Permissions

The system distinguishes between two primary user roles, each with specific responsibilities and access privileges. The Student role is designed for learners who engage with the platform by providing valuable feedback through structured forms, such as exit surveys and course evaluations. This feedback contributes to indirect assessment and overall program improvement. On the other hand, the Faculty role encompasses administrative and analytical functions. Faculty members are authorized to manage academic entities such as courses, programs, and electives, configure and oversee surveys, and analyze direct and indirect attainment reports. They play a crucial role in monitoring outcome-based education metrics, ensuring that course outcomes (COs) and program outcomes (POs) are aligned and met effectively. The role-based access control ensures secure, purposeful interaction with the system tailored to each user's responsibilities.

System Access Permissions

Faculty Role – Full Administrative Access

Faculty users have extensive privileges to manage academic structures and analyze feedback data. The following menu options are available to them:

Manage Menu

- Programmes – Add, update, or delete academic programs
- Courses – Manage courses within each program
- Programme Outcomes (POs) – Define and edit outcome goals for programs
- Course Outcomes (COs) – Link course-level objectives to POs

Insert Google Form Links Menu

- MCQ Test – Upload links for direct assessment tests
- Exit Survey – Upload links to collect student feedback

Link Management Menu

- View All Links – View all currently inserted form links
- Clear All Links – Delete any outdated or unused links

Data Management and Reporting Menu

- Parse Excel Files – Read and extract data from survey sheets
- Persist Data – Save processed data into the database
- View Power BI Report – Access dynamic dashboards for attainment analysis

Student Role – Limited Functional Access

Student users have access only to essential feedback and assessment features. Their available menu items include:

- Home – Navigate to the main landing page
- MCQ Test – Participate in multiple-choice assessments
- Exit Survey – Submit feedback through the exit survey form
- Login – Authenticate and access student-specific features

Browser Access

Client accesses the application through browser employing the following URL:

http://localhost/exitsurvey_MCA/home

The home page of the web application is displayed as shown in Fig. 9.

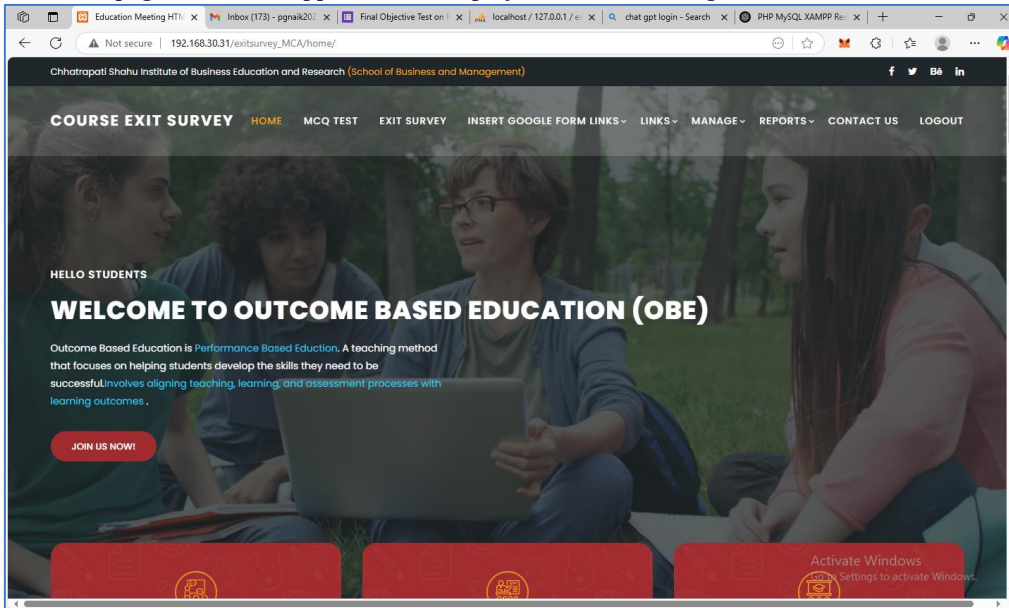


Fig. 9. Landing Page of Web Application for User in Faculty Role

Menu Structure for a User in Student Role

The home page of the system is displayed as shown in Fig. 10.

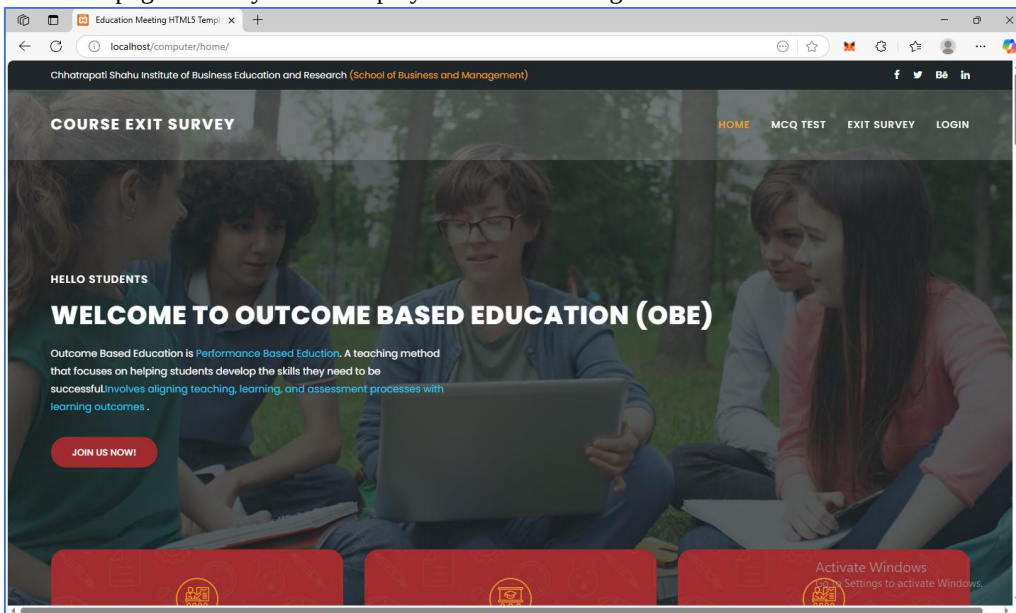


Fig. 10. Landing Page of Web Application for User in Student Role

For the student user, the following menu items are displayed:

- Home
- MCQ Test
- Exit Survey and
- Login

The student will only be able to provide the feedback using 'Exit Survey' menu option

The faculties will be able to authenticate with the system using the authentication information shared with them.

On selecting the 'Login' menu option the following authentication page is displayed as shown in Fig. 11.

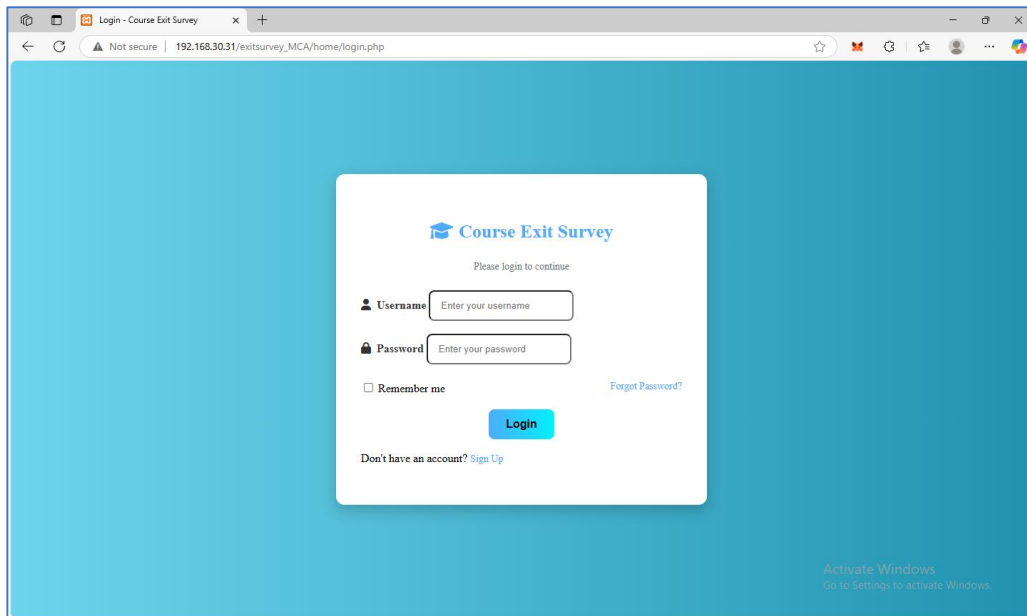


Fig. 11. Authentication Screen

On entering the valid login information, home screen for the user in Faculty role is displayed as outlined in Fig. 12.

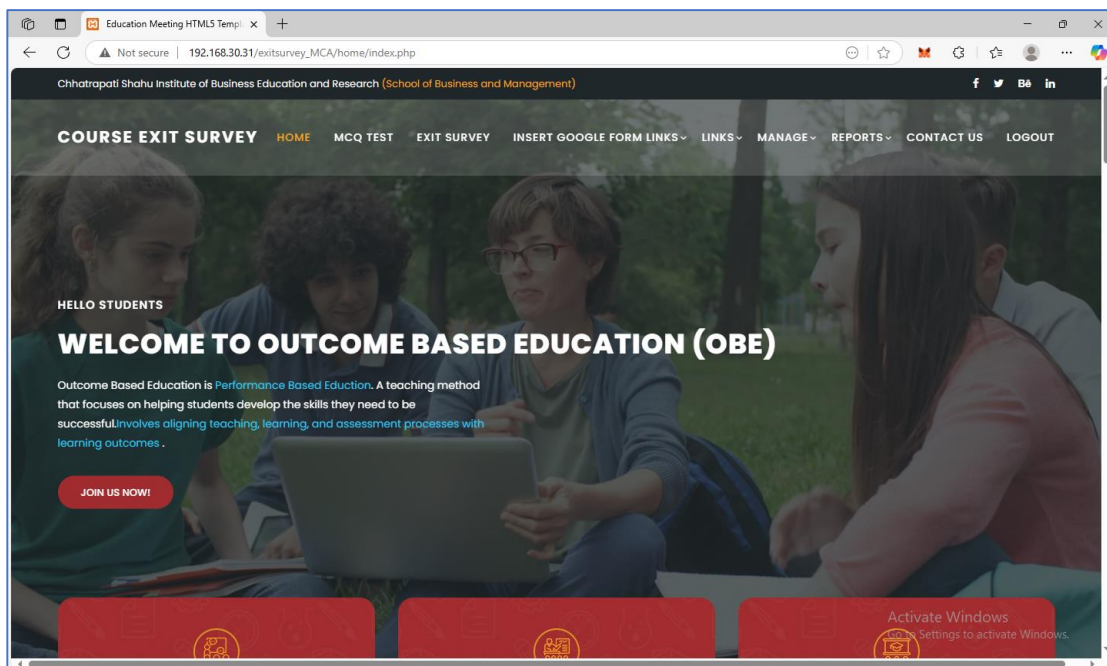


Fig. 12. Home Screen for the User in Faculty Role

Fig 13(a) – 13(c) outline the PO management, CO management and link management screens employed by the user in Faculty role.




Insert Program Outcome (PO)

Select Program
MCA

PO ID
Enter PO ID

PO Description
Enter PO description

Submit PO

Program Outcomes for Selected Program

PO ID	Program Name	PO Description	
PO1	MCA	1. Conceptual Knowledge: Nurturing a foundation of comprehensive understanding and analytical thinking.	Update Delete
PO2	MCA	Research and Innovation: Fostering a spirit of research and innovation among students for formulating novel solutions.	Update Delete
PO3	MCA	Collaborative Learning: Imbibing collaboration and leadership skills for individual growth and collective empowerment.	Update Delete

Activate Windows
Go to Settings to activate Windows.




Insert CO for Program and Course

Select Program
MCA

Select Semester
I

Select Course
-- Select Course --
Object Oriented Software Engineering
Web Design and Development
Programming with C
Design and Analysis of Algorithms
Statistical & Mathematical Application
Research Methodology

Search Course Outcomes
Type to search...

Existing Course Outcomes

Activate Windows
Go to Settings to activate Windows.

Add MCQ Link Master Record

Program Name
Select a Program

Semester
Select a Semester

Course Code
Select a Course

Google Form Link
Enter Google Form Link

Add Record

Link Master Records

Program Name	Semester	Course Code	Course Name	Google Form Link	Actions
MCA	IV	MCA-402(P)	Full Stack Web Development	View Form	
MCA	IV	MCA-401	Artificial Intelligence	View Form	

Fig. 13(a)-13(c). PO, CO and Link Management Screens

Conducting Exit Survey

Fig 14. Shows a screen to initiate conducting exit survey for the selected program and semester.

Program & Semester Selection

Select Program
MCA

Select Semester
III

Select Elective
Mobile Computing

Choose...

- Mobile Computing
- Spring Framework
- Computer Graphics

MCA-101 - Object Oriented Software Engineering

MCA-102(P) - Web Design and Development

MCA-103(P) - Programming with C

MCA-104 - Design and Analysis of Algorithms

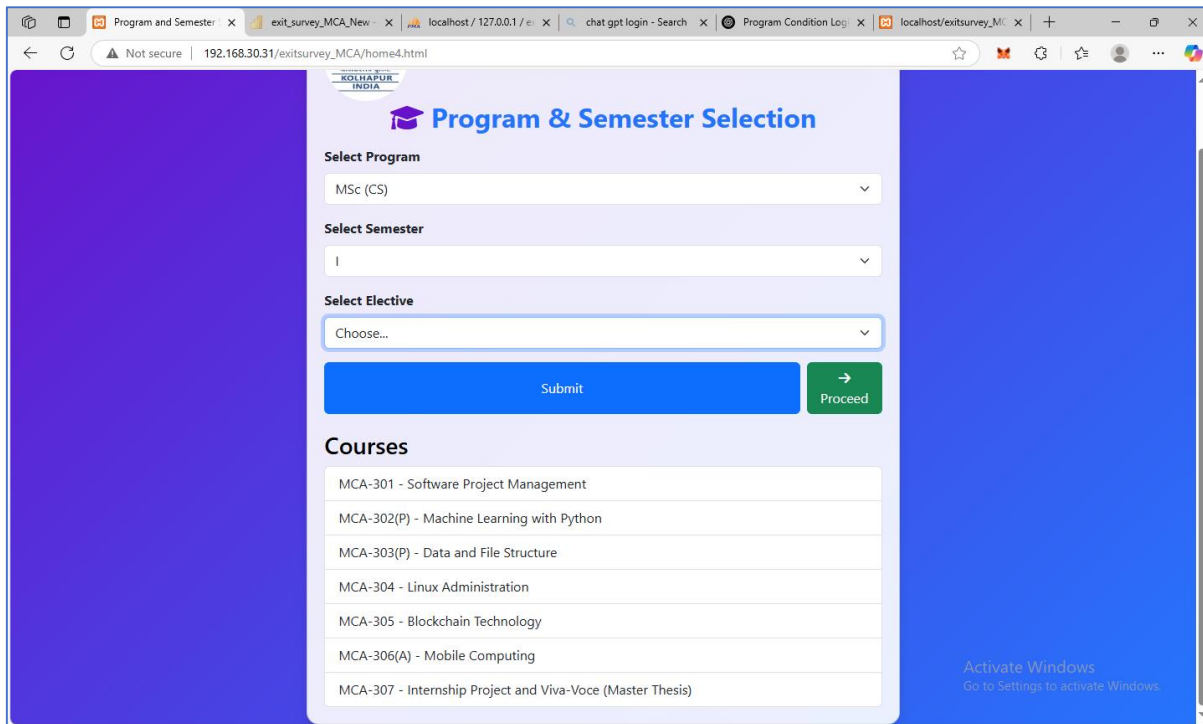
MCA-105 - Statistical & Mathematical Application

MCA-106 - Research Methodology

Submit

Fig. 14. Conducting Exit Survey

On clicking the 'Submit' button, all the courses of the selected program, semester and elective, if applicable are displayed as shown in Fig 15.



Click on 'Submit' button to view the courses.

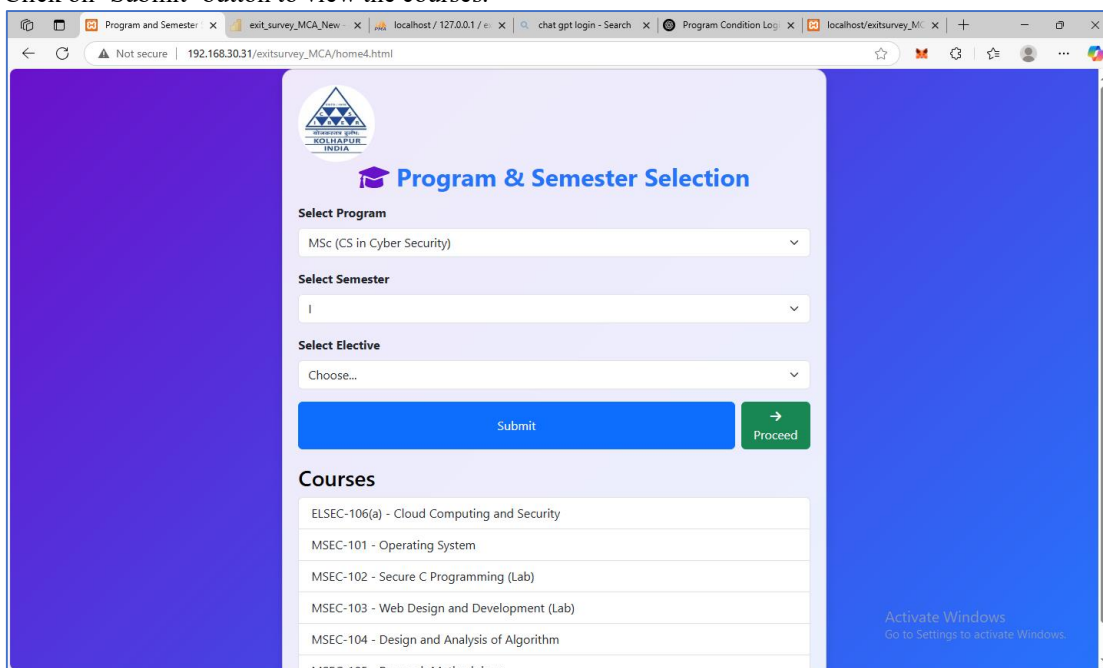


Fig 15. Course Selection Page

On clicking 'Proceed' button after confirming the courses the exit survey home page is displayed as depicted in Fig. 16. The main menu contains the course code links to the exit survey Google forms. The course names corresponding to different course codes are also displayed on the page for verification.

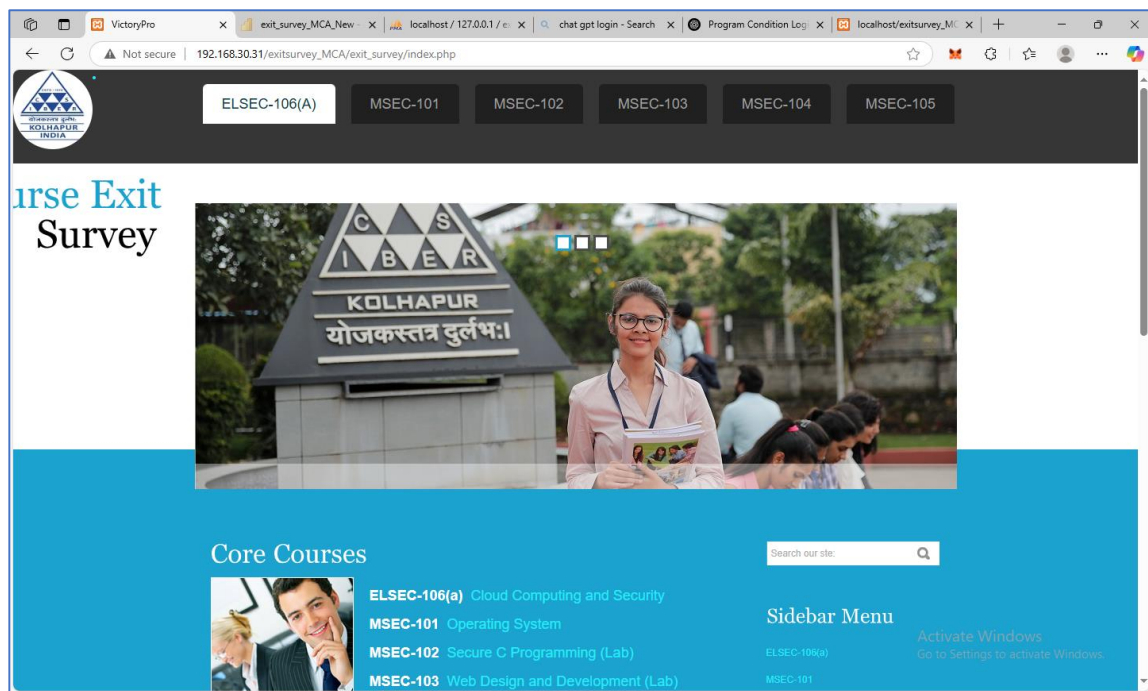


Fig 16. Exit Survey Home Page

Analyzing Exit Survey Data - Computing Indirect Attainment Parsing Excel Files

Inside web root folder a subfolder with the name 'google_sheets' exists as shown in Fig. 17.

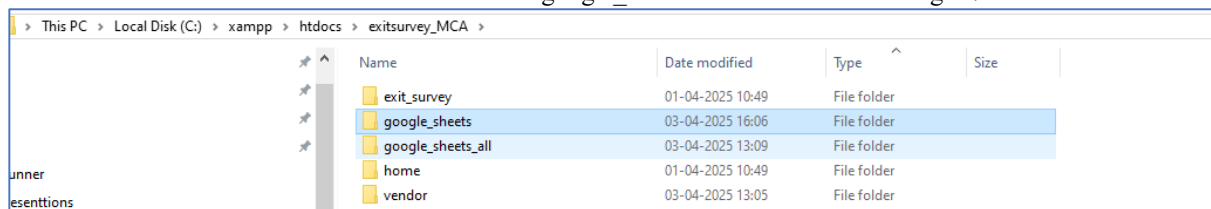


Fig. 17. Google Sheets Folder containing Exit Survey Data

The naming convention used for the Google Sheets is as shown in Fig. 18.

Course code_Course Name

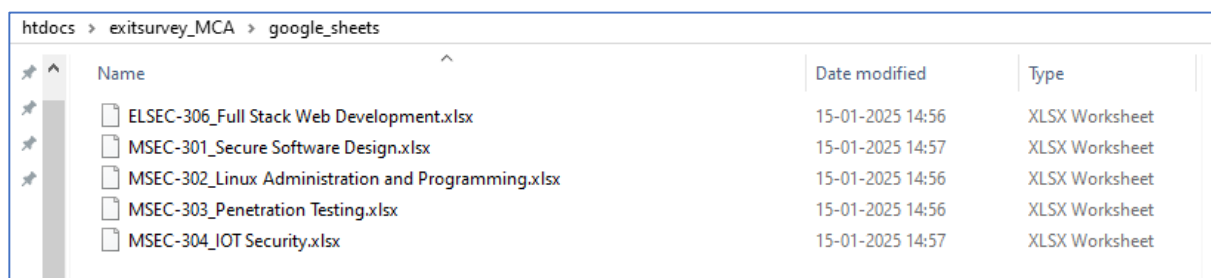


Fig. 18. Naming Convention Used for Google Sheets

Fig. 19. shows the report exported to PDF format.

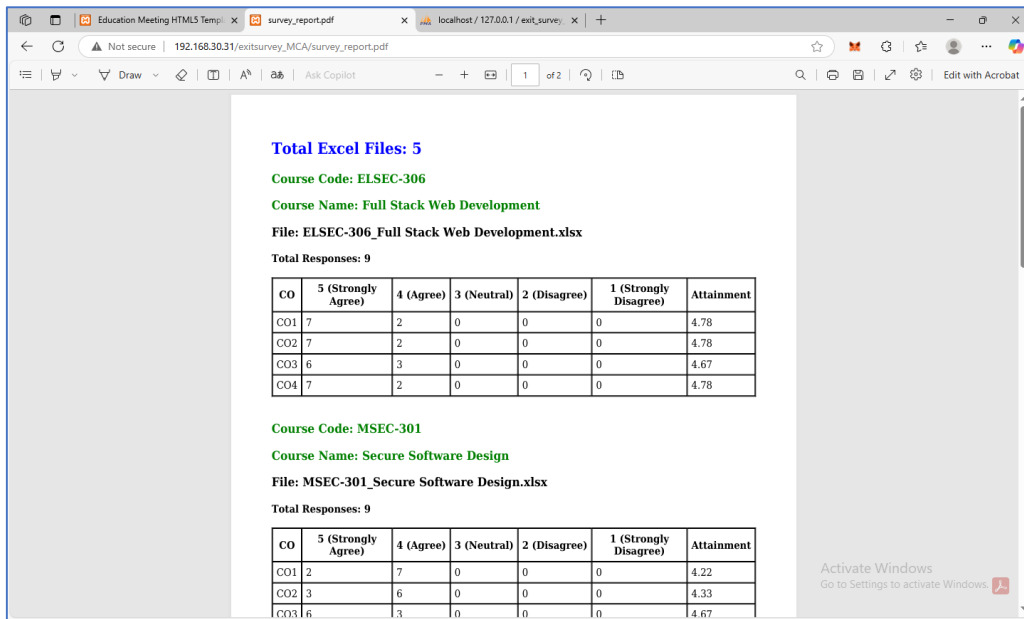
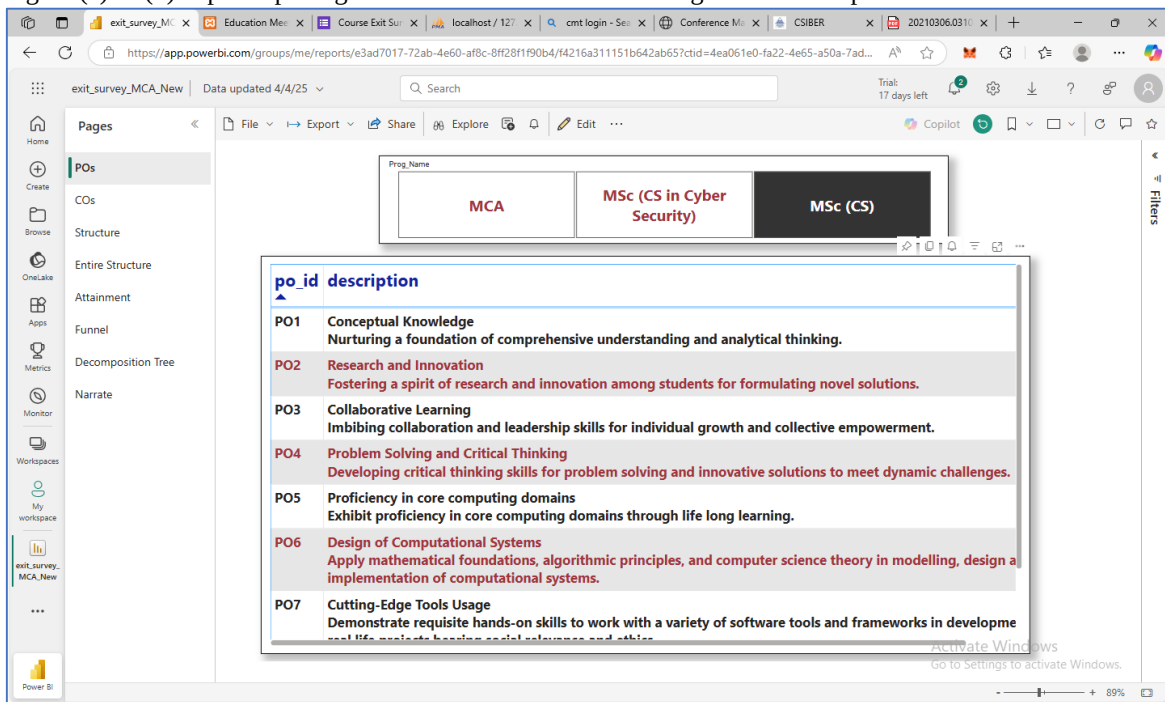


Fig. 19. Exit Survey Report in PDF Format

Viewing Power BI Reports

Fig. 20(a)-20(d) depict reports generated in Power BI for viewing attainment reports in different charts.



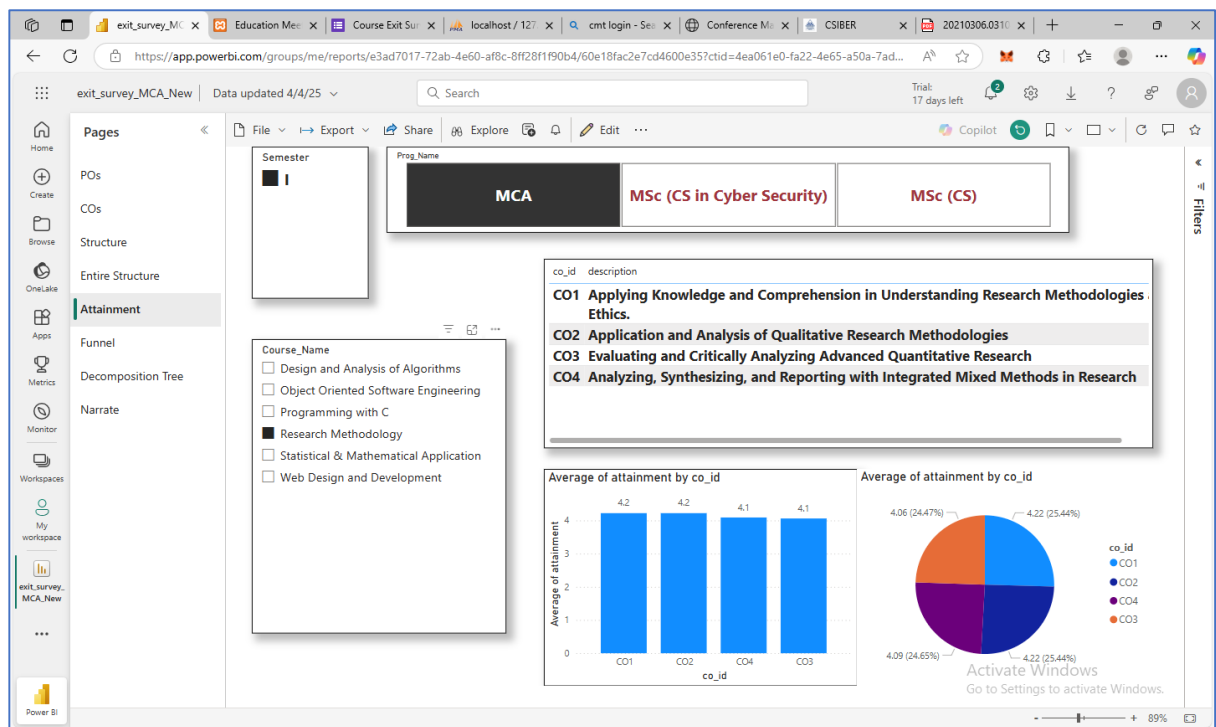


Fig. 20(a)-20(b) Power BI Reports for Viewing Course-wise Indirect Attainment

Viewing the Indirect Attainment in a Decomposition Tree

Decomposition tree page can be used to view the indirect attainment score in a hierarchical tree-like structure.

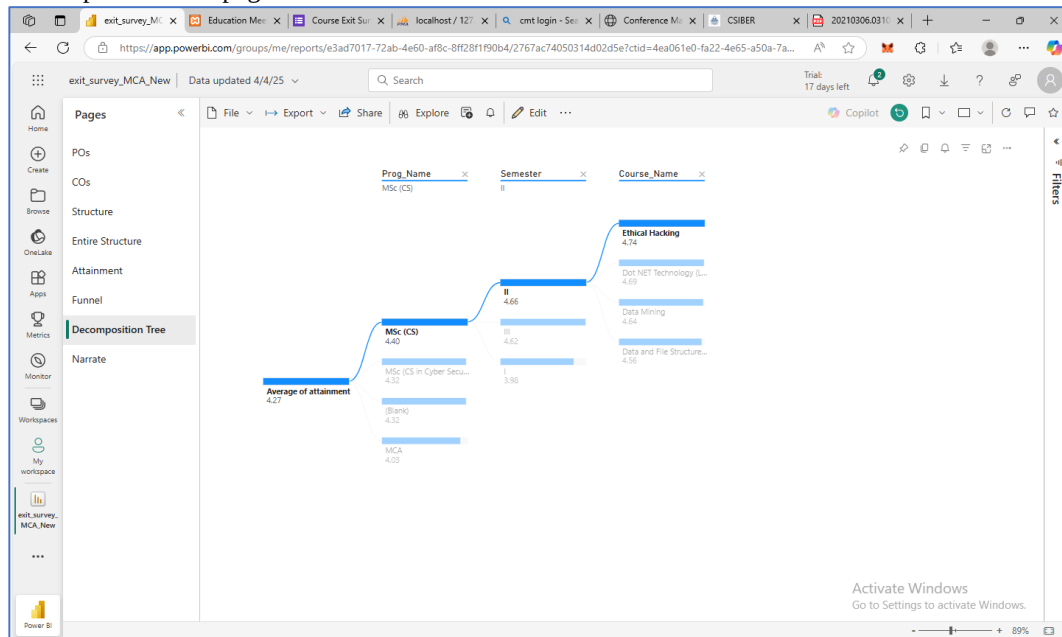


Fig. 20(c) Viewing the Indirect Attainment in a Decomposition Tree

Viewing a Summary Using Narrate

Narrate page provides the narration of the average indirect assessment of all the courses of the selected program and semester.

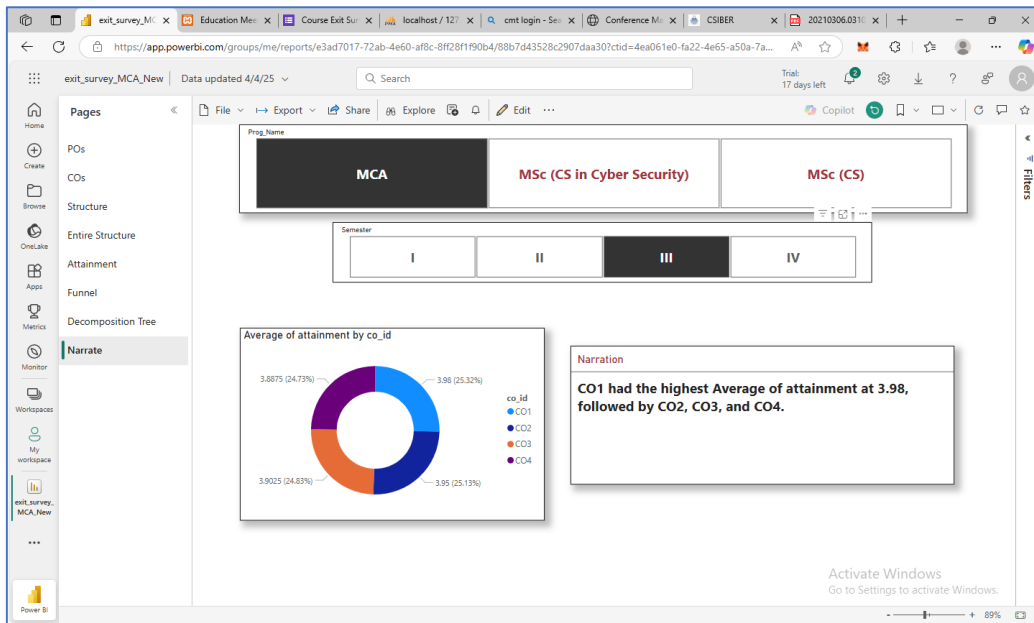


Fig. 20(d). Viewing a Summary Using Narrate

Accessing Application in Mobile App Using ngrok

Ngrok creates a secure tunnel from your local machine to the internet, allowing external access to a locally running server by exposing it through a public URL. It is commonly used for testing webhooks, demos, or accessing local apps remotely.

Setting Up the Authtoken

Following command is employed for setting up authtoken for authenticating local ngrok client with the ngrok account as outlined in Fig 21.

ngrok config add-authtoken 2jVW26vc2cqt3TKmv3cq0aPiQvE_2Xb8unPSpWjr7uqiiSQco

```
C:\Windows\System32\cmd.e
C:\ngrok-v3-stable-windows-amd64>ngrok config add-authtoken 2jVW26vc2cqt3TKmv3cq0aPiQvE_2Xb8unPSpWjr7uqiiSQco
Authtoken saved to configuration file: C:\Users\pgnai\AppData\Local\ngrok\ngrok.yml
C:\ngrok-v3-stable-windows-amd64>
```

Fig. 21. Setting Up Authtoken in Ngrok

The setup is verified by running ngrok using the following command as depicted in Fig. 22.

ngrok http 192.168.1.8

```
C:\Windows\System32\cmd.e
ngrok
(Ctrl+C to quit)
* Goodbye tunnels, hello Agent Endpoints: https://ngrok.com/r/aep
Session Status      online
Account             Dr. Poornima G. Maik (Plan: Free)
Update              update available (version 3.22.1, Ctrl-U to update)
Version             3.10.0
Region              India (in)
Web Interface        http://127.0.0.1:4040
Forwarding            https://0a32-106-76-70-176.ngrok-free.app -> http://192.168.1.8:80
Connections          ttl    opn    rt1    rt5    p50    p90
                   0      0      0.00   0.00   0.00   0.00
```

Fig 22. Using Ngrok for Secure Tunneling

Now, the application is served on the internet using the following URL.

<https://0a32-106-76-70-176.ngrok-free.app>

To test the following URL is accessed in the address bar of a browser. The web access page is displayed as shown in Fig. 23.

https://0a32-106-76-70-176.ngrok-free.app/exitsurvey_MSW/home/

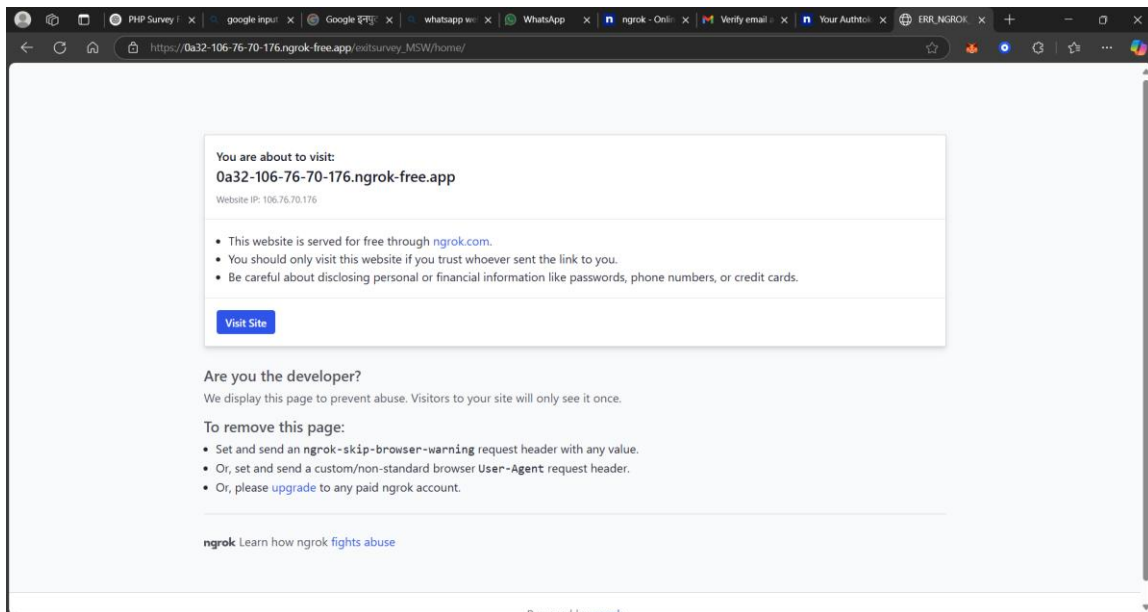


Fig. 23. Ngrok Web Access Page

On clicking the 'Visit Site' button the local webapp is served remotely by establishing a secure channel by ngrok.

Conclusion and Scope for Future Work

Conclusion

The integration of Outcome-Based Education (OBE) with automated systems for assessing and managing course and program outcomes provides a significant advancement in higher education. By leveraging tools like Google Forms for student feedback, MySQL for data storage, and Power BI for real-time visualizations, the system offers a comprehensive solution for both direct and indirect assessment. This approach ensures continuous improvement and alignment with industry needs, enhancing the relevance and effectiveness of educational programs. The automation of feedback collection, analysis, and reporting streamlines the entire OBE evaluation process, empowering educators and administrators to make informed decisions that drive curriculum improvements and better prepare students for professional challenges.

Scope for Future Work

Future work can expand the current system by integrating more advanced data analysis techniques, such as machine learning models, to predict student performance and outcomes based on historical data. Further, the system can be enhanced to support more interactive feedback mechanisms, such as peer reviews and real-time surveys during the course. The integration with more Learning Management Systems (LMS) and broader accreditation frameworks could further streamline OBE implementation. Expanding the system's capabilities to track long-term graduate success, such as employment outcomes and industry engagement, would also provide a more holistic view of program effectiveness.

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A Bibliometric Analysis of Sustainable Leadership

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Abstract

Nowadays, every leader is concerned about sustainability in their organization. They think about the negative impact of their decisions on the environment, society, and economy. After they plan accordingly, how can they reduce and minimize their negative impact? So, sustainable leadership is the long-term leadership approach in which to study how the leader's actions and decisions impact the organizations, societies, and economies; how to balance among environmental, social, and economic sustainability and minimize the negative impact of them. The purpose of this paper is to conduct a bibliometric analysis of sustainable leadership from 1998-2025. This research analyzed 366 articles extracted through the Scopus database using the keywords "sustainable leadership" OR "sustainability leadership". The science mapping approach and performance analysis were used as an analysis technique. The publication and citation-related metrics were employed as a performance analysis. In the science mapping approach, the analysis techniques have been used as a bibliographic coupling, co-occurrence, citation and co-citation analysis. VOSviewer, R-Studio and Biblioshiny were utilized as a software tool to perform both analyses. The most productive year was 2024. The most productive and impactful author is Qaisar Iqbal. The most productive and impactful organizations are the Human Development Network and the World Bank. The most productive and impactful country is United States. Similarly, the most productive and impactful source is Sustainability. Furthermore, the most impactful article is Sahlberg (2007) and the most referenced article is (2011). The three and five clusters were identified through co-citation and bibliographic coupling analysis respectively. This research also discusses the future trends, future research directions, limitations and implications at the end of the paper.

Keywords: Sustainable leadership, Sustainability leadership, Bibliometric Analysis

Introduction

The 'Center for Sustainability Leadership' has been established by the FICCI. The founding member of the center is Hindustan Unilever Limited. Decarbonization, green entrepreneurship, and nature-based solutions are the main aims of this center. (HUL, 2023) As per 'The Economics Times', the Centre for Sustainable Development (CSD) hosted a Sustainable Leadership Summit in Bengaluru, marking the 20th anniversary of the organisation. The summit also adopted the 'Bengaluru declaration on Acceleration of Sustainable development goals (SDG).' (The Economics Times, 2023)

We often hear about the words 'sustainable' and 'sustainability'. These words look similar but are different in terms of identity and meaning. First of all, we try to know these words one by one. What is the exact meaning of these words? Firstly, we need to understand the word 'sustainable'. The word 'sustainable' is an adjective that is comprise of two words, i.e., sustain + able. Here, the former word is 'sustain' which is the 'verb' that means "to maintain or continue something for a long period" and the later word is 'able' which is the 'adjective' that means "to have the ability to do something" so we can say that sustainable literally means that 'which has the ability to sustain for a long time or generation to generation without harming environment, economic and society'. When we hear the word 'sustainable' then another pair of words come into our mind such as sustainable business, sustainable product, sustainable consumption, sustainable growth etc. The second word is 'sustainability' which is a noun that consists of two words, i.e., sustain + ability. The former word is 'sustain' which is the 'verb' that means "to make something continue for a long period" and the subsequent word is 'ability' which is the 'noun' that means "the quality or state of being able". The word 'sustainability' is a concept or practice which means "maintaining balance, particularly in environmental, economic and social contexts". When we talk about sustainability then we discuss about environmental sustainability, business sustainability, economic sustainability, social sustainability etc.

Usually, we hear, speak and see the word 'development'. Is it true development? We compromise our natural resources and human wellbeing in exchange of development. We face many challenges like environmental (global warming, pollution, climate change, deforestation, biodiversity loss etc.), social (health issues i.e., rare diseases, stress, depression, corruption etc.) and economic (inflation, poverty, unemployment, income inequality etc.)

challenges. So, we need sustainable development in which we take care of all these three aspects. Sustainable development is a path for people to use resources without the resources running out for future generations.

Now we are hearing the new word 'sustainable leadership' or 'sustainability leadership'. It is not a new word. As per the Scopus database, the first time appeared in the year 1998, in an article Lynham (1998). Now we understand the word 'Sustainable leadership' or 'sustainability leadership'. Many scholars use both terms interchangeably. Sustainable leadership is defined as an action in which the leaders think, act and lead in a sustainable manner and analyze how much positive and negative impact of their actions or decisions have on the environment, economy and society as a whole.

To know about sustainable leadership, what is the current status and past development of sustainable leadership and their future prospects so we will explore this domain through bibliometric analysis using performance analysis and a science mapping approach. As per Scopus database, three bibliometric review articles are found relevant to this research area. The first review article Hallinger & Suriyankietkaew (2018) covers the years from 1990 - 2018 with mix of bibliometric analysis and conceptual model. This review paper added the other keywords with core keywords. So, it does not give true picture of development of this domain. The second review article Aung & Hallinger (2022) covers the years from 1998–2021 with bibliometric analysis and different search strategy employed. Again, it does not provide real development of this domain. It is also limited to one specific area i.e., higher education. The third review article Jusoh et al. (2024) covers the year from 1991–2023 with bibliometric analysis. This review paper added the additional keywords with core keywords. It is limited to only one specific area business and management. Our study covers the year from 1998–2025 with bibliometric analysis and employed various analysis techniques. Our study included those articles which are related to only core keywords. So that the true picture comes out. It covers all areas which are related to social science domain. So like this, this research is distinct in many aspects from the previous studies.

This research study covers following research questions: -

What are the trends in the sustainable leadership research?

What are the most impactful and productive authors, organizations and countries in the sustainable leadership research?

What are the most impactful and productive journals in the sustainable leadership research?

What are the most impactful and referenced articles in the sustainable leadership research?

What are the intellectual structures and thematic clusters of sustainable leadership research?

What are the future trends and future research avenues of sustainable leadership research?

To get the answers of these research questions, a bibliometric analysis of the documents in sustainable leadership will be executed. The scope of the study highlights various analysis of the research area. The first research question is about the trends in which we describe the current status, growth and development of the sustainable leadership research domain. The second research question presents the most impactful and productive organizations, authors and countries in the sustainable leadership research where the total citations show the most impactful authors, organizations and countries whereas the total publications show the most productive authors, organization and counties. The third research question depicts the most impactful and the productive journals in the sustainable leadership research where the total citations show the most impactful journals whereas the total publications show the most productive journals. The fourth research question presents the most impactful and referenced articles in the sustainable leadership research where the global citations (GC) show the most impactful journals whereas the local citations (LC) show the most referenced journals. All these five units of analysis like authors, organizations, countries, documents and journals cover under the citation analysis. The fifth research question presents the intellection structures and thematic clusters of sustainable leadership research where the intellectual structures show through the co-citation analysis whereas thematic clusters show through the bibliographic coupling. The sixth research question presents the future trends and future research directions where both show through co-occurrence analysis. The fifth and sixth research question also present network analysis through visualization.

This research study is divided into seven sections. This first section presents introduction in which we covered significance of study, meaning and definition of the research area, research objectives, literature review, research gap, research questions and the scope of study. The next section shows research methodology. The third section contains findings in which we covered trends, citation, co-citations, bibliographic coupling and co-occurrence analysis. The next section offers the future research avenues. The fifth section shows the conclusion. The sixth section has the limitations. The last section shows the implications of the study.

Research Methodology

Deciding the Search Strategy and Selecting the Appropriate Keywords

The selection of keywords plays an important role in bibliometric analysis. Which documents will appear depends on the search method. Here, the core keyword is "sustainable leadership" in this study. It consists of two words

i.e., sustainable and leadership. The keyword sustainable leadership is put in the inverted comma like “sustainable leadership” because the database will search only those documents in which both words appear together. If it doesn’t use inverted comma then the database will also show the two types of results in which both words appear together and both words appear separately also.

The second one will show similar results when both words are searched separately with and without inverted commas, along with the ‘and’ operator. When reviewed the documents, some scholars are also using the keyword “sustainability leadership” Both keywords look similar, but the only difference is available in the first word of both keywords with respect to spelling. The maximum documents are covered by the core keyword, but more than one third of articles were found by the secondary keywords. So, it is finally decided that both keywords will put for documents extraction with “or” operator. The database will show the documents either “sustainable leadership” or “sustainability leadership”. Another important thing is that no additional keywords or supplementary keywords have been added because the true picture will not come out of this domain. In this study So, both keywords were used for this bibliometric analysis and are shown in stage 5 of Table 1.

Table No1: Documents Inclusion and Exclusion Criteria

Stage	Filtering Criteria	Excluded	Included
1	Search Database: Scopus	-	-
2	Search Date: 25 January 2025	-	-
3	Publication Period: 1998-2025	-	-
4	Search Fields: Title, Abstract and Keywords	-	-
5	Search Term: Sustainable Leadership OR Sustainability Leadership	-	693
6	Subject Area: - Social Sciences, Psychology, Business, Econometrics and Finance, Management and Accounting, Multidisciplinary, Economics, Arts and Humanities	87	606
7	Document Types: Article and Review Article	200	406
8	Publication Stage: - Final	27	379
9	Source Type: - Journal	5	374
10	Language: “English”	4	370
11	Erroneous Records Screening: Documents which have only correct author information	2	368
12	Content Screening: Articles in which titles, abstracts and keywords showing relevancy of the study	2	366

Steps for Data Collection

This research is extracted articles from Scopus database which provide wide coverage than any other database. The articles were extracted on 25 January 2025 and cover the year from 1998 to 2025. The search fields were title, abstract and keywords in which our keywords were found in those articles. The search term was sustainable leadership and sustainability leadership. The areas of subjects were covered social sciences, management and accounting, econometrics and finance, multidisciplinary, business, psychology, arts and humanities, economics. The types of documents were included articles and review articles. When the documents extracted then the publication stage was final, the source type was journal and the article language was English. In erroneous records screening, this study was included those documents which have with valid author information only. In content screening, this study was covered those articles in which titles, abstracts and keywords showing relevancy of the study. Finally, this study was selected 366 articles for the various analysis techniques.

Selection of Data Analysis Technique

Based on the research questions which were covered in this bibliometric analysis, the three types of analysis techniques were employed including performance analysis, science mapping approach and network analysis. In performance analysis, citation-and-publication-related metrics were used in this study. In science mapping approach, bibliographic coupling, co-occurrence, co-citation and citation were used as an analysis technique in this study. In network analysis, visualization technique was used in this study. Microsoft excel, VOSviewer, R-studio and Biblioshiny have been used in this study. Microsoft Excel was used as an analysis to draw results for publication trends. VOSviewer was used in the science mapping approach. R-studio and Biblioshiny were used to draw results for top-referenced articles based on the local citations (LC).

Findings

This section shows the findings of the various analysis techniques used in the bibliometric analysis.

Performance Analysis

In the figure 1, the total document(s) has been presented on the vertical-axis and the year of publication has been presented on the horizontal-axis. The publication trends were shown on sustainable leadership research as per the Scopus database from 1998 to 2025 (till 25 January). The total documents are three hundred and sixty-six after inclusion and exclusion criteria during the periods in which three hundred and thirty-nine are the articles and twenty-seven are review articles.

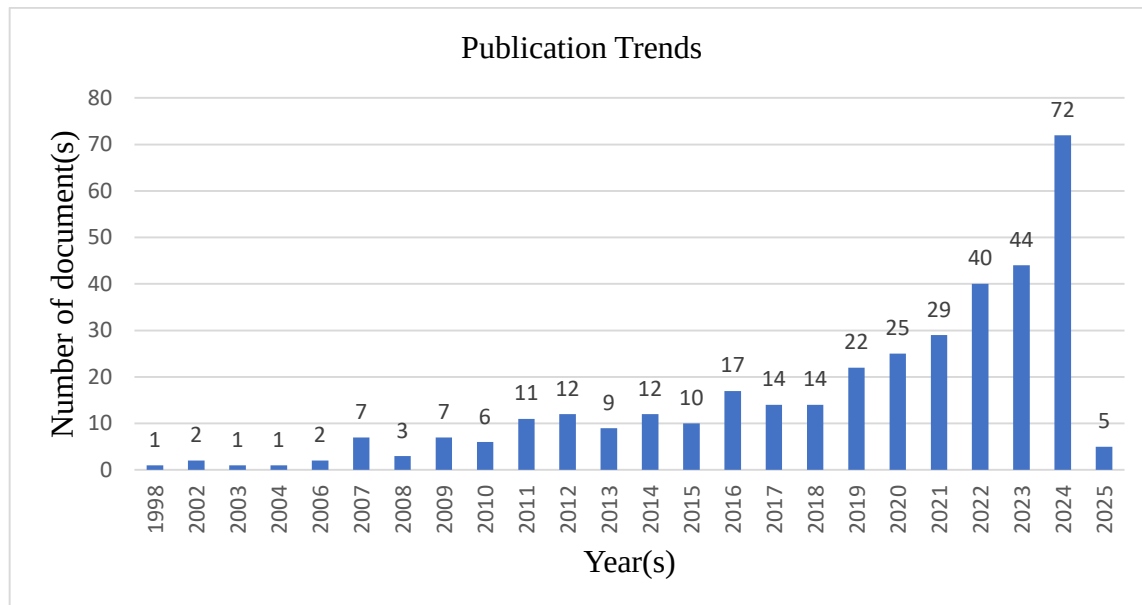


Figure 1: Publication trend of Sustainable Leadership research

Sustainable leadership is not a new topic in the field of social science. As per the Scopus database, it was published for the first time in the year 1998. This was the year when Amartya Sen, an Indian professor won the Nobel Prize in Economics for his contribution to welfare economics. The most productive year is 2024 in which seventy-four articles were published which is the highest in number.

The documents were only fourteen in the first decade (1998-2007). Sustainable leadership is scored a century in which the documents increased from fourteen to one hundred and one in the next decade (2008-2017). Sustainable leadership has achieved growth in the next five years (2018-2022) from one hundred and one to one hundred and thirty. Sustainable leadership got a century in only two years (2023-2024) in which published one hundred and sixteen articles.

Such evidence suggests that most intellectual debates on sustainable leadership occurred following the COVID-19 pandemic. Overall, looking at the trends in recent years, the study in this area will increase in the coming years.

The most impactful and productive authors, organizations and countries in sustainable leadership research

Table 1 presents the most impactful organizations, authors and countries through the highest citations which is shown by total citations (TC). It also presents the most productive organization, authors and countries through the highest publications which is shown by total publications (TP). As per the Scopus database, 835 authors from 688 organizations and 74 countries were published 366 documents on sustainable leadership research.

The minimum documents of an author and citations were taken 1 and 281 respectively, to get the top 10 authors out of 835, based on the Authors–Citation Analysis. Qaisar Iqbal, Noor Hazlina Ahmad and Suparak Suriyankietkaew are the most impactful authors with 924, 606 and 415 citations respectively. Qaisar Iqbal, Sooksan Kantabutra and Suparak Suriyankietkaew are the most productive authors with 20, 18 and 9 documents respectively.

The minimum articles of an organization and citations were taken 1 and 243 respectively, to get the top 10 organizations out of 688, based on the Organizations - Citation Analysis. Human Development Network & World Bank (Washington), Federation Institute of Education Science & Technology & University of Caxias Do Sul (Brazil) and Universiti Sains Malaysia are the most impactful organizations with 332, 311 and 307 citations respectively. The Universiti Sains Malaysia, Macquarie Graduation School of Management, Sydney and Human Development Network & World Bank (Washington) are the most productive organizations with 3, 2 and 1 documents respectively.

Table No. 2: The top ten most impactful and productive authors, organizations and countries in sustainable leadership research

TP	Author	TC	TP	Organization	TC	TP	Country	TC
20	Qaisar Iqbal	924	1	Human Dev Net, Washington	332	68	United States	2274
8	Noor Hazlina Ahmad	606	1	World Bank Washington	332	39	Australia	1005
9	Suparak Suriyankietkaew	415	1	Fed Ins of Edu, Sci &Tech Brazil	311	35	Thailand	901
5	Gayle C. Avery	382	1	University of Caxias Do Sul Brazil	311	18	Canada	883
18	Sooksan Kantabutra	333	3	Universiti Sains Malaysia	307	27	Malaysia	851
1	Pasi Sahlberg	332	2	Mac Grad Sch of Mgmt, Sydney	281	24	China	590
1	Denise Genari	311	1	N270 Eli Michigan State University	273	36	United Kingdom	520
2	Janaina Macke	311	1	N370 Business, Michigan State University	273	10	Brazil	512
2	Andy Hargreaves	303	1	N370 Eli Michigan State University	273	19	Spain	494
2	Harald Bergsteiner	281	1	Institute for Sustainable Leadership, Sydney	243	15	Poland	437

Note: TP = Total Production and TC = Total Citation

The minimum documents of a country and citations and were taken 1 and 437 respectively, to get the top 10 countries out of 74, based on the Countries - Citation Analysis. The United States, Australia and Thailand are the most impactful countries with 2274, 1005 and 901 citations respectively. The United States, Australia and United Kingdom are the most productive countries with 68, 39 and 36 documents respectively.

The most impactful and productive journals in sustainable leadership research

Table 3 shows the most impactful journals through the highest citations. It also shows the most productive journals through the highest publications. As per the Scopus database, 188 journals published 366 documents on sustainable leadership research.

The minimum documents of a journal and citations were taken 1 and 185, respectively, to get the top 10 journals out of 188, based on the Sources (Journals)-Citation Analysis. 'Sustainability (Switzerland)' is the most impactful journal with 1177 citations followed by 'Journal of Cleaner Production' along with 'Journal of Business Ethics' have 726 and 579 citations respectively. 'Sustainability (Switzerland)' is the most productive journal with 58 publications followed by 'International Journal of Sustainability in Higher Education' along with 'Journal of Cleaner Production' which have 15 and 12 publications.

'Journal of the Academy of Marketing Science' is placed in the A* category. 'Journal of Cleaner Production' & 'Journal of Business Ethics' were ranked in the A category in the ABDC 2022 Journal Quality List. The eight out of the ten journals are placed Q1 in the journal ranking of SCOPUS. 'Journal of the Academy of Marketing Science' is got 7.19 SJR (Scimago Journal Rank) scores which is the highest in the top 10 journals after that 'Journal of Business Ethics' along with 'Journal of Cleaner Production' with 2.62 and 2.06 SJR scores respectively.

Table No. 3: The top ten most impactful and productive journals on sustainable leadership research

Source	TP	TC	Quartile	ABDC 2022	SJR 2023	H-Index	Number of Paper(s)	
							1998-2011	2012-2025
Sustainability (Switzerland)	58	1177	Q1	-	0.67	169	-	58
Journal of Cleaner Production	12	726	Q1	A	2.06	309	1	11
Journal of Business Ethics	7	579	Q1	A	2.62	253	1	6
Journal of Education Policy	1	332	Q1	-	1.63	90	1	-
Journal of the Academy of Marketing Science	1	273	Q1	A*	7.19	207	1	-
International Journal of Sustainability in Higher Education	15	268	Q1	-	0.83	77	1	14
Strategy & Leadership	1	243	Q3	C	0.24	54	1	-
Educational Leadership	1	205	-	-	0	71	1	-
PLoS ONE	1	186	Q1	-	0.84	435	-	1
Journal of Change Management	1	185	Q1	C	1.02	53	1	-

Note: Total Production (TP), Total Citation (TC), Australian Business Deans Council (ABDC) and SCImago Journal Rank (SJR)

PLoS ONE', 'Journal of Cleaner Production' & 'Journal of Business Ethics' are the top 3 journals which is the highest H-Index values with 435, 309 and 253 respectively. The 2012-2025 period is the most productive compared to the 1998-2011 period which have 8 documents but the previous one has 90 documents in the top 10 journals. 'Sustainability' is the most productive journal with 58 documents published in the period 2015-24 after that 'International Journal of Sustainability in Higher Education' & 'Journal of Cleaner Production' with 14, 11 documents respectively.

The most impactful articles in sustainable leadership research

Table 4 presents the most impactful articles through the highest citations. This analysis is based on global citations (GC). Global citation refers to the documents which are available in the database (Scopus) without filtration.

Based on the Documents-Citation Analysis, the minimum citation of a document is 157 to get the top 10 articles out of 366. Sahlberg (2007), Macke & Genari (2019) and Closs et al. (2011) are the most impactful articles with 332, 311 and 273 citations respectively.

Table 4: The top ten most impactful articles on sustainable leadership research

Rank	Author(s)	TC
1	Sahlberg (2007)	332
2	Macke & Genari (2019)	311
3	Closs et al. (2011)	273
4	Avery & Bergsteiner (2011)	243
5	Hargreaves & Fink (2004)	205
6	Osterblom et al. (2015)	186
7	Ferdig (2007)	185
8	Robinson et al. (2011)	176
9	Iqbal et al. (2020a)	164
10	Lourenço et al. (2014)	157

Note: TC = Total Citation

The most referenced articles in sustainable leadership research

Table 5 presents the top referenced articles based on local and global citations. These results get through the R-Studio and biblioshiny. The local citation (LC) refers to getting citations from the articles available in our dataset (366 documents) to get the articles after all filtrations. We have already discussed about global citations (GC) in the previous section (d).

Table No. 5: The top ten most referenced articles in sustainable leadership research

Rank	Author(s)	LC	GC
1	Avery & Bergsteiner (2011)	59	243
2	Iqbal et al. (2021)	48	40
3	Iqbal et al. (2020a)	35	164
4	Iqbal et al. (2020b)	35	80
5	Burawat (2019)	32	125
6	Gerard et al. (2017)	30	62
7	Ferdig (2007)	28	185
8	Iqbal & Piwowar-Sulej (2022)	22	21
9	Kantabutra & Avery (2011)	21	43
10	McCann & Sweet (2014)	21	51

Note: GC = Global Citation, LC = Local Citation

Previously, Table 4 described the most impactful articles based on the documents-citation analysis, which is the same as the global citation because all articles are included and cited each other in the database. Here, the analysis is shown based on local citations. Avery & Bergsteiner (2011), Iqbal et al. (2021) and Iqbal et al. (2020a) are the most referenced article with 59, 48 and 35 local citations respectively.

The intellectual structure of sustainable leadership through co-citation technique

Figure 2 shows the development of the foundational themes in sustainable leadership research through the co-citation. A co-citation is when two articles are cited together in the reference list of another article. Co-citation was introduced by Henri Small and Irina Marshakova in 1973. A co-citation analysis shows intellectual structure, seminal publication and knowledge foundations. In this co-citation map, out of 20743 cited references, each has at least 10 citations, and 24 cited references fulfill this criterion.

Table 6 exhibits three foundational themes of sustainable leadership research through cited references co-citation analysis. Sustainable Performance (Red Cluster), Sustainable Education (Green Cluster), and Sustainable Business (Blue Cluster) are the names of foundational themes (clusters) for past development of sustainable leadership research.

The size of the node indicates that a node has how many connections. The links between nodes denote two or more publications that are cited together in other publications. TLS is the total of the link strengths of one node on other nodes.

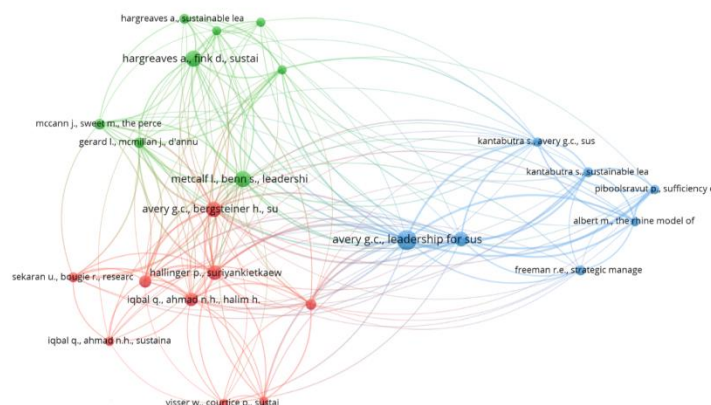


Figure 2: Network of Cited References - Co-Citation Analysis

The first theme (Red Cluster) consists of 9 sustainable performance articles cited 153 times. Avery & Bergsteiner (2011), Hallinger & Suriyankietkaew (2018) and Iqbal et al. (2020b) are the top three cited documents in this cluster with 29, 27, and 21 citations respectively. The second theme (Green Cluster) consists of 8 sustainable education articles cited 135 times. Hargreaves & Fink (2005), Metcalf & Benn (2013) and Gerard et al. (2017)

are the top three cited documents in this cluster with 32, 30 and 15 citations respectively. The third theme (Blue Cluster) consists of 7 sustainable business articles cited 129 times. Avery (2005), Avery & Bergsteiner (2010) and Kantabutra (2011) are the top three cited documents in this cluster with 46, 26 and 12 citations, respectively.

Table No. 6: Clusters of sustainable leadership research through co-citation analysis

Cluster	Author(s)	TC	TLS
Sustainable Performance (Red Cluster)	Avery & Bergsteiner (2011)	29	96
	Hallinger & Suriyankietkaew (2018)	27	83
	Iqbal et al. (2020b)	21	52
Sustainable Education (Green Cluster)	Hargreaves & Fink (2005)	32	55
	Metcalf & Benn (2013)	30	85
	Gerard et al. (2017)	15	53
Sustainable Business (Blue Cluster)	Avery (2005)	46	137
	Avery & Bergsteiner (2010)	26	97
	Kantabutra (2011)	12	47

Note: Total Citation = TC and Total Link Strength = TLS

The thematic cluster of sustainable leadership research through bibliographic coupling

Figure 3 presents the current or latest development of sustainable leadership research through the documents – bibliographic coupling analysis. Bibliographic coupling means that two articles cite another article in their reference list. The bibliographic coupling also shows the recent and niche publications, the latest developments, and the present development of the research. In this bibliographic coupling map, out of 366 documents, each has at least 50 citations, and 36 documents fulfill this criterion.

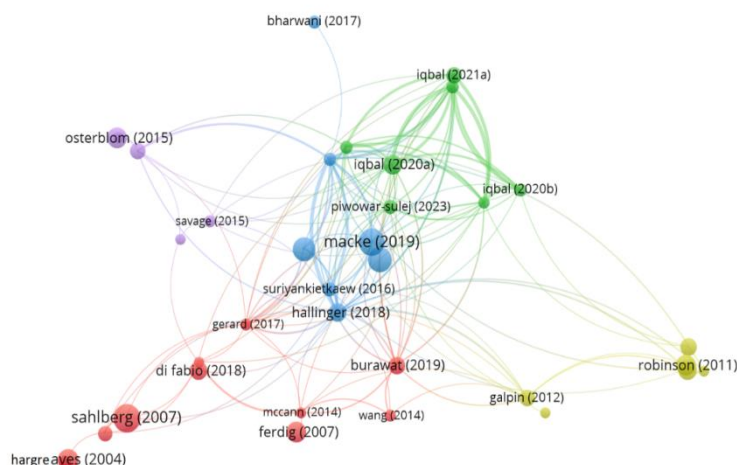


Figure 3: Network of Documents - Bibliographic Coupling

Table 7 presents the five thematic clusters of sustainable leadership research through the documents - bibliographic coupling analysis. Sustainable leadership (Red Cluster), Leadership for Sustainable Performance (Green Cluster), Leadership for Business Sustainability (Blue Cluster), Corporate Social Responsibility (Orange Cluster) and Education for Sustainable Leadership (Purple Cluster) are the names of themes for the present development of sustainable leadership research. The size of the node presents the citations of the document. The links between nodes indicate the number of references shared. TLS is the sum of the link strength of two documents that cite one document.

Table No 7: Thematic clusters of sustainable leadership research

2024) are the most recent keywords used in this sustainable leadership research followed by sustainable performance, responsible leadership, culture, human capital sustainability leadership, authentic leadership, social sustainability, project management and climate change (Avg. pub. year between 2022-2023). As a result, future researchers can use these keywords in their future studies. Most importantly, it determines that employee well-being, resilience, circular economy, sustainable entrepreneurship, green innovation and sustainable are the most recent research topics investigated.

Table 7 presents the author's keywords, representing sustainable leadership research's most frequently used words. The term sustainable leadership holds first rank with 123 frequencies followed by leadership, sustainability, sustainable development, sustainability leadership, corporate sustainability, leadership development and transformational leadership with 76, 71, 40, 31, 17, 14 and 12 occurrences respectively. It shows that most previous studies on the author's keywords which are sustainable leadership, leadership, sustainability, sustainable development, sustainability leadership, corporate sustainability, leadership development and transformational leadership. These have been mentioned in sustainable leadership research.

Table 7 also presents the link strength between keywords, indicating that sustainable leadership is placed the first rank with 212 TLS (Total Link Strength) which is the highest followed by leadership, sustainability, sustainable development, corporate sustainability and sustainability leadership have strong network links with 153, 146, 83, 64 and 60 TLS respectively. This implies that these six keywords had been regularly used in research over the last 25 years.

Table 8: List of author's keywords in sustainable leadership research through co-occurrence analysis

Keyword	Occurrences	Total Link Strength (TLS)
Sustainable Leadership	123	212
Leadership	76	153
Sustainability	71	146
Sustainable Development	40	83
Sustainability Leadership	31	60
Corporate Sustainability	17	64
Higher Education	16	33
Leadership Development	14	16
Transformational Leadership	12	23
Thailand	10	46
Education	9	20
Education for Sustainable Development	9	15
Organizational Culture	8	20
Innovation	8	17
Ethics	7	13
Sustainability Education	7	11
Rhineland Principles	6	32
Sufficiency Economy	6	27
Asia	6	23
Smes	6	16
Knowledge Management	6	14
Environmental Sustainability	6	10
Sustainable Performance	6	7

Future research avenues

Evaluating sustainable leadership research in social science from a past context is significant for deciding present and future results. By investigating related papers, this research may establish a baseline for the fast-developing domain of sustainable leadership research in social science, allowing future researchers to investigate the usage and benefits of sustainable leadership in the social science area.

A future study could see how the most sustainable leadership practices to perform better in the organizations. Between 1998 and 2011, the total number of articles are 41 in which the studies focused on leadership, sustainable leadership, sustainable development, sustainability, ethics and sustainability leadership. The studies from 2012 to 2025, 325 articles are found in which the study concentrated on leadership, sustainability, sustainable leadership, sustainable development, sustainability leadership and corporate sustainability. Sustainability is noteworthy as a sustainable leadership research for sustainable development and leadership.

The practice of sustainability in sustainable leadership research is a demanding topic in current studies. Sustainability works in several forms, such as, economic sustainability, social sustainability, corporate sustainability, business sustainability, environmental sustainability and sustainability education. Future studies on sustainability and leadership themes shall work towards leadership for sustainability. Furthermore, future studies shall be on leadership development for sustainability etc. Furthermore, future research directions for sustainability leadership and education for sustainable development should also use sustainability. The studies on sustainable development are numerous. However, the studies focused on sustainable leadership are very less attention. So, research on this area in the future will change the destiny of the organizations and permit them to enforce sustainable leadership to encourage their business. Further, future studies on the corporate sustainability theme shall be given attention to the process of corporate social responsibility activities in business. Specifically, social responsibility, responsibility towards the environment, sustainable business, social welfare, and employment for the community apply to business. Further, future studies could be on the utilization and benefits of corporate sustainability for consumer co-creation and community involvement. Future studies on the execution of corporate sustainability for customer's response and reactions and the application of sustainability promote the products and services provided by businesses. Future study could be conducted on the applications of social welfare, employee welfare, ethics, and sustainable business in terms of corporate sustainability. Future study could be organized on business culture and the competitive advantage of corporate sustainability for business. Besides, future studies for innovation and sustainable development could focus on sustainable innovation, challenges of frugal innovation adoption, and organizational innovation climate to understand consumers' needs and behavior for social innovation exercises. Additionally, future studies could focus on the environmental innovation strategy, resource constraint innovation, and disruptive innovation aspects of organizations in adopting and implementing sustainable leadership in their businesses. Further, future studies on responsible leadership themes could be conducted, concentrating on environmental sustainability, environmental leadership, social environmental system, environmental identity, and environmental psychological ownership. The future study can also be explored through another database like web of science or others because previous studies were only focused on the Scopus database. Further we can also combine two databases because earlier studies were based on the only single database. The future research could be purely based on the keywords only related to the domain such as sustainable leadership or sustainability leadership and also included both of them because previous studies are mixed with other keywords also like leadership and sustainable development. From this, it does not come the true picture of the domain. Further, the future study may use proper search strategy that is extracted only those articles which is related to only domain because previous studies are far from the domain. Other analysis techniques can be also used for the future study such as co-authorship analysis, page rank etc. Last but not least, the future study could use another analysis software like Gephi, Biblioshiny, CiteSpace, Bibexcel etc.

Conclusion

This research highlights a bibliometric analysis of research trends, most impactful and productive authors, organizations, countries and the journals; the most impactful articles based on the global and local citations; intellectual structure, thematic clusters, future trends and future research avenues in the domain of sustainable leadership research.

This study revealed five major thematic research clusters with significant focus on sustainable leadership, leadership for sustainable performance, leadership for business sustainability, corporate social responsibility and education for sustainable leadership. The findings also highlight increasing attention towards employee well-being, resilience, circular economy, sustainable entrepreneurship, green innovation and sustainable, particularly after 2023. Qaisar Iqbal, Noor Hazlina Ahmad and Suparak Suriyankietkaew are the most impactful authors along with Qaisar Iqbal, Sooksan Kantabutra and Suparak Suriyankietkaew are the most productive authors. 'Sustainability (Switzerland)' and 'Journal of Cleaner Production' are the most impactful as well as the most productive journals. Overall, this study provides a valuable roadmap for researchers and practitioners, facilitating a deeper engagement with the evolving landscape of sustainable leadership.

Limitations

This research work also has limitations, just like any other research work. First, this study only looked at the bibliographies of articles published in the Scopus database. Second, the different analysis techniques will be used in future studies such as co-authorship analysis and page rank etc. Third, this study employed VOSviewer software for data analysis, in future study, it can be used other statistical tools like Gephi, BibExcel, etc.

Implications

These insights provide to a better understanding of the knowledge structure in the sustainable leadership, guiding future scholars towards emerging areas and underexplored topics. This research has a variety of implications for scholars, academicians, policy-makers, practitioners, managers, entrepreneurs and marketers. Further, it could also help them to see the gap in the current literature and future directions, which will help them to conduct future studies. They should be aware of the existing research in this domain. By getting the impactful and vital contributors of the research and the cause for becoming prominent contributors, they can use these documents to answer the existing educational and industrial problems.

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Tourism, Airline Industry, and Economic Growth In India

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Abstract

This study explores the evolving interconnections between tourism, the airline industry, and economic growth in India, using a panel dataset spanning selected states and union territories from 2010 to 2020. By employing panel data regression analysis, this study aims to provide a comprehensive understanding of how these sectors interact and mutually influence one another. The least squares regression analysis is adopted to examine the impact of tourism and the airline industry on economic growth in India. In addition, the Granger causality test is employed to determine the nature of causality between the selected variables. The findings indicate that both tourism and the airline industry exert a significant and positive influence on economic growth, as demonstrated through least squares regression analysis. These results highlight the critical role that service-based sectors, particularly tourism and aviation, play in accelerating economic development. The causality analysis yields further insights: a bidirectional causality is observed between the airline industry and economic growth, suggesting a mutually reinforcing relationship. As economic activity expands, demand for air travel rises, while a robust aviation sector further increases economic growth. In the case of tourism and economic growth, a unidirectional causality is identified, where economic growth drives an increase in tourism. Finally, a unidirectional causality is observed between the airline industry and tourism, wherein changes in the airline industry lead to changes in tourism. These findings carry important implications for policymakers, planners, and investors. To maximize the economic potential of tourism and air transport, a coordinated approach is required—one that integrates infrastructure development, marketing strategies, and supportive policy frameworks. As India continues to assert itself as a leading global economy and travel destination, focused investment in these interlinked sectors can serve as a catalyst for sustained economic growth. Strategic investment in aviation and tourism can generate long-term benefits with respect to regional connectivity, thereby promoting economic growth.

Keywords: Tourism, Airline Industry, Economic Growth, Least Squares Regression, Granger Causality Test.

Introduction

India's vast cultural heritage, breathtaking landscapes, and historical sites draw a significant number of tourists. Tourism is recognized as a vital catalyst for economic development, directly influencing income generation, investment opportunities, and infrastructure growth. The World Travel & Tourism Council highlights that the travel and tourism sector accounted for 9.1% of global Gross Domestic Product (GDP) in 2023 (WTTC, 2024). In the Indian context, tourism plays an essential role in providing livelihoods for local communities and driving overall economic progress (Saluja et al., 2022). Moreover, plenty of evidence indicates that increased tourism can help diminish income inequality and enhance investments in airline infrastructure. Consequently, the rise in tourism has provoked a heightened demand for air travel, leading to increased passenger movement (Alcalá-Ordóñez & Segarra, 2023; Almeida & Pinto Machado, 2021; Nguyen, 2021).

Air transport is well-regarded for its ability to stimulate economic activity, due to higher employment levels within the service sector by creating job opportunities in airports, hotels, and travel agencies. These jobs not only elevate individual incomes but also benefit the economy in general through increased consumer spending. Furthermore, air transport enhances route connectivity, thereby generating positive externalities, especially in developing nations where tourism is often a critical sector (Seetanah, 2011).

Tourism and air travel are intricately linked; the large influx of tourism, both business and leisure travel, has created an elevated demand for air travel. Air travel is often viewed as a derived demand, driven by tourism-related needs. As more individuals seek to explore new destinations or travel for business, the requirement for air transport naturally escalates (InterVISTAS, 2009; Iyer & Arabhi, 2012; Rodrigue, 2024). On the other hand, developments in the airline sector through improved services and better connectivity tend to encourage tourism in the country (Ansari, 2024; Papatheodorou, 2021).

The relationship among tourism, the airline industry, and economic growth is complex, while existing research suggests a strong link exists (Pulina, 2014). Causal relations vary depending on the country examined and the economic context during which existing studies were conducted. Certain studies indicate that economic growth

fuels the expansion of tourism and the airline industry, while others propose that the development of these sectors leads to economic growth (Balaguer & Cantavella-Jordá, 2002). Hence, the direction of causal relationships between these areas remains an area of active research. Understanding the dynamics of these interrelationships is crucial for policymakers aiming to enhance the tourism and aviation sectors for economic advancement.

India has experienced a strong growth rate in recent years, with a real Gross Value Added (GVA) of 7.2% in the Financial Year (FY) 2023-24 (MOSPI, 2025). The service sector is currently the dominant driver of this expansion, contributing 54.72% to India's GVA in FY 2023-24 (MOSPI, 2024). Within the services domain, tourism and aviation are increasingly recognized as critical engines of development.

While extensive literature explores the interactions among tourism, the airline industry, and economic growth, a notable gap persists regarding these dynamics in India. Many studies focus on broader regions or other countries, often overlooking the unique socio-economic and cultural factors that significantly shape these interactions in India. Furthermore, previous research often examines the relationships between tourism, the airline industry, and economic growth in isolation, failing to account for their interconnected nature. This can hinder a holistic understanding of how changes in one sector impact the others.

This study addresses this research gap by investigating the interrelationships among tourism, the airline industry, and economic growth, utilising data from specific states and union territories (UTs) in India. By employing least squares regression and Granger causality tests on panel data from 2010 to 2020, this research yields significant insights by examining the direction and strength of these linkages. Moreover, this study incorporates recent data, enhancing its relevance to current economic conditions. The objectives of the study are: (i) to assess the impact of tourism and the airline industry on economic growth in India, and (ii) to investigate the causal relationships among tourism, the airline industry, and economic growth.

Review of Literature

The relationship between tourism, the airline industry, and economic growth has attracted considerable interest in the realm of economic literature in recent years. Due to globalisation, the movement of people across borders has significantly increased, resulting in a surge in international travel and tourism. Scholars and researchers have utilized a diverse array of methodologies to delve into the intricate linkages that are present among these three sectors. Many studies highlight tourism as a crucial driver of Gross Domestic Product (GDP) growth, emphasising its role in generating income and creating jobs, while also recognizing the airline industry's significant contribution to enhancing economic activity by increasing connectivity and accessibility. These interactions are not uniform; they can differ significantly across different countries due to differences in economic structures, cultural contexts, and infrastructure development. This variability provides a solid foundation for a more comprehensive examination of how these sectors interact with one another. In order to capture the interconnectedness between the airline industry, tourism, and economic growth, the papers are reviewed under three broad categories, namely, (i) Tourism and economic growth, (ii) Airline industry and economic growth, and (iii) Airline industry and tourism.

A recent study conducted by Singh & Alam (2024) applied Johansen's cointegration and error correction model to study the tourism-economic growth nexus in India. The study concluded that investment in tourism and Gross Domestic Product (GDP) had a bidirectional causal relationship, whereas the remaining variables, such as central government expenditure on tourism, foreign tourist arrivals, and foreign tourist visits, depicted a unidirectional causal relationship on GDP. Ohlan (2017), in his study, highlighted the impact of tourism on Indian economic growth from 1960 to 2014 using the Bayer and Hanck combined test. The results depicted the presence of cointegration among tourism, economic growth, and financial development. Furthermore, a unidirectional causal relation running from tourism to economic growth was also found. Chulaphan & Barahona (2018) examined the tourism-led economic growth hypothesis in Thailand using cointegration analysis and the Granger causality method. They used international tourist arrivals from four continents and the industrial production index to represent economic growth. The findings revealed that South Asian tourist arrivals led to economic growth; additionally, Thailand's economic growth led to a rise in tourists from Oceania. Abbes et al. (2015) also employed the co-integration analysis and Granger causality test to explore the relationship between tourism spending and economic growth in 49 countries. A cointegration relationship and a bidirectional causal relationship were identified between economic growth and tourism. Chou (2013) studied the causality between tourism expenditure and economic growth across 10 transition countries from 1988 to 2011, using the bootstrap panel Granger causality technique. The findings differed among the countries, with some countries experiencing causality running from tourism spending to economic growth, other countries witnessing an absence of causality between the variables, and a few other countries having an inverse relationship. Dogan & Zhang (2023) employed a Common Correlated Effects (CCE) estimation technique to assess the relationship between tourist arrivals and economic growth from 1995 to 2019 in the Schengen area. Their findings confirmed a positive and significant relationship between tourism and economic growth from 1995 to 2003. However, during the global financial crisis (2007 to 2008) and the recession in Europe (2012 to 2013), the relationship was found to be negative. Atan &

Arslanturk (2012) evaluated the tourism and economic growth nexus using input-output analysis in Turkey. It was concluded that the tourism sector supports the output of other related sectors, along with improving economic growth.

An expanding body of literature focuses on the interrelation between the airline industry and economic growth. Profillidis & Botzoris (2015) used correlation analysis to study the link between air passenger movement and economic activity, and confirmed that the variables depicted a strong correlation. Carbo & Graham (2020) used a causal analysis to assess the effects of air transport on the economy in the Chinese provinces. The authors discovered that the rise in air passengers and air cargo positively impacts the economy. Hu et al. (2015) adopted the Granger causality analysis to study the relationship between domestic air passenger movement and China's economic growth. The authors identified a short-term unidirectional causality, wherein domestic air passenger movement influences economic growth, along with a bidirectional causal relationship in the long term between the two variables. Marazzo et al. (2010) also used the Granger Causality technique to evaluate the connection between air transportation demand and Brazil's economic growth, and concluded that passenger movement and GDP are co-integrated. Kiracı & Bakır (2019) studied the causal interactions involving air transportation and economic growth among selected countries from 1990 to 2016 using the bootstrap panel Granger causality analysis, and the panel causality test used for heterogeneous mixed models. The results were mixed depending on the country's income level; however, a considerable number of countries reported a bidirectional causal relation between air transportation and economic growth. Kumar & Patel (2023) estimated the impact of international air arrivals on Fiji's economic growth from 1975 to 2017 using the Nonlinear Autoregressive Distributed Lag (NARDL) technique. The findings indicated that a decline in air arrivals creates a stronger impact on economic growth as compared to an increase in air arrivals. Raihan et al. (2024) examined the interrelation between Malaysian air transport and economic growth from 1970 to 2020, using the Autoregressive Distributed Lag (ARDL) technique, and concluded that air travel improves Gross Domestic Product (GDP) in the short term and long term. Hanson et al. (2022) also used the ARDL method and explored the causal relationship between the real GDP and air travel demand in the United States of America (USA) from 1972 to 2018. The authors concluded that the variables depicted a bidirectional causality between each other.

There are studies that have analysed the relationship between the airline industry and tourism. Eric et al. (2020) studied the impact of air connectivity on tourism development and welfare in Kenya. The authors used a gravity model and found a strong connection between air connectivity and passengers, thereby leading to tourism expansion. Tang et al. (2023) used a dynamic panel model to highlight the impact of the number of air routes on international tourist arrivals in China. Air routes have a positive influence on tourist arrivals. Küçükönel & Sedefoğlu (2017) applied the panel Granger causality analysis to determine the causality between air travel, Gross Domestic Product (GDP), tourism, and employment, in the Organisation for Economic Cooperation and Development (OECD) countries from 2000 to 2013. The findings reveal a unidirectional causal relation from economic growth, tourism, and employment towards air travel in the short run.

The literature highlights a strong and dynamic relationship among tourism, the airline industry, and economic growth, though the nature of this relationship varies across countries. Tourism is widely recognised as a key driver of GDP, with studies showing both unidirectional and bidirectional causality. Similarly, air transport significantly contributes to economic growth, although this connection may differ by country and income level. Finally, evidence suggests that tourism demand can stimulate growth in the airline sector. Despite these insights, region-specific studies, especially in the Indian context, remain limited, indicating the need for further focused research.

This study is original and adds to the body of research as it focuses on the joint impact of tourism and the airline industry on India's economic growth. Considering that studies in tourism and economic growth in the Indian context have mixed results (Singh & Alam, 2024), this study will offer important insights into their relationship. The study also examines the causality among the three variables: Total Tourist Visits (TTV), Indian National Departures (IND), and Gross State Domestic Product (GSDP), which are used to represent tourism, the airline industry, and economic growth, respectively. The study uses more recent data, and the variables chosen are more representative. The study is unique in the Indian context, which will add to the existing body of knowledge.

Research Methodology

This section presents the description of the panel data used in the study, along with the source. It also outlines the least squares regression model used for analysis. Finally, it states the hypotheses for the Levin-Lin-Chu unit root test, which is a prerequisite for the Granger causality test.

Data Description

The study explores the relationship between three variables: Total Tourist Visits (TTV), Indian National Departures (IND), and Gross State Domestic Product (GSDP). The panel dataset consists of 66 observations with six states/union territories (UTs) in India spanning from 2010 to 2020. The following states/UTs were selected

based on the highest percentage of airport-wise IND in 2021: New Delhi, Maharashtra, Kerala, Tamil Nadu, Karnataka, and West Bengal. It may be noted that Hyderabad airport, currently in Telangana, was excluded from the study despite having a high percentage share of IND, as it belonged to Andhra Pradesh before the bifurcation in 2014. By excluding Hyderabad, the study eliminates potential discrepancies caused by the formation of a new state, such as changes in governance, resource allocation, infrastructure development, or any other effects of state bifurcation specific to Telangana post-2014. The selected airports represent a wide geographic coverage in India, ensuring the analysis captures national trends. Even without Hyderabad, the selected airports cover key regions across North, South, East, and West India, providing a balanced representation of the Indian aviation trends. According to the Ministry of Tourism, the joint percentage share of IND in the selected airports amounts to 78.8% (Ministry of Tourism, 2022).

Table No.1: describes the variables used in the study, the sectors they represent (tourism, airline industry, and economy), and their respective sources of data.

Table 1: Description of Variables

Variable	Measurement	Description	Source
Tourism	Total Tourist Visits (TTV)	TTV refers to the total number of tourist visits (both international and domestic) to the respective states/UTs.	Ministry of Tourism, 'India Tourism Statistics'
Airline industry	Indian National Departures (IND)	IND refers to the departures of Indian nationals from the select states/UTs.	Ministry of Tourism, 'India Tourism Statistics'
Economy	Gross State Domestic Product (GSDP)	The GSDP at current prices was used with the base year 2011-12. The amount is represented in ₹ Lakh.	RBI, 'Handbook of Statistics on Indian States, Publications'

Source: Compiled by authors.

Least Squares Regression Model

The Least Squares regression model is applied to the panel dataset to assess the impact of tourism and the airline industry on economic growth. The general functional form of the model is developed as follows:

$$[GSDP]_{it} = \beta_0 + \beta_1 ([TTV]_{it-1}) + \beta_2 ([IND]_{it-1}) + u_{it} \quad (1)$$

All variables are transformed to natural logarithmic form (ln), so the coefficients are in the form of elasticities. The independent variables are lagged in order to reflect the time taken for their changes to reflect on the dependent variable. The log-log model is presented as follows:

$$\ln([GSDP]_{it}) = \beta_0 + \beta_1 \ln([TTV]_{it-1}) + \beta_2 \ln([IND]_{it-1}) + u_{it} \quad (2)$$

where:

- $\ln(GSDP_{it})$ = log of Gross State Domestic Product for state i at time t.
- $\ln(TTV_{it-1})$ = lagged log of Total Tourist Visits.
- $\ln(IND_{it-1})$ = lagged log of Indian National Departures.
- u_{it} = error term.

Levin-Lin-Chu unit root test

Before conducting the Granger causality test, it is essential to confirm the stationarity of the panel data series. The three variables, $\ln(GSDP)$, $\ln(TTV)$, and $\ln(IND)$, are examined for stationarity using the Levin-Lin-Chu unit root test. The hypothesis is described as follows:

H_0 = The series is non-stationary, i.e., panel data contains a unit root

H_A = The series is stationary, i.e., panel data does not contain a unit root

This step ensures the validity of further analysis.

Granger Causality Test

After establishing the order of integration of the variables under study, the Granger causality test is employed to determine whether a causal relationship exists between the specified variables. The Granger causality test yields significant insights into the directionality of the relationships among the variables.

RESULTS

The summary statistics, results of the least squares regression analysis, the unit root test results, and the findings of the Granger causality analysis are depicted in Tables 2, 3, 4, and 5, respectively.

Summary Statistics

Table 2 depicts the summary statistics for the variables in the study: $\ln(\text{GSDP})$, $\ln(\text{TTV})$, and $\ln(\text{IND})$. The Jarque-Bera test was utilized to test the normality of the variables. Upon analysing all three variables, it was determined that the null hypothesis of normality could not be rejected at a 5% level of significance, indicating no significant deviation from normality. Consequently, the three variables under consideration exhibit a normal distribution; the assumption of normality is crucial for the statistical analyses employed in this study.

Table 2: Summary Statistics

Statistic	$\ln(\text{GSDP})$	$\ln(\text{TTV})$	$\ln(\text{IND})$
Mean	18.31261	17.85094	14.44943
Median	18.22285	18.08614	14.52766
Maximum	19.42665	20.03358	15.60139
Minimum	17.22554	15.48881	12.24126
Std. Dev.	0.556474	1.115475	0.822210
Skewness	0.103982	-0.022544	-0.536563
Kurtosis	2.275163	2.035452	2.337205
Jarque-Bera	1.563754	2.564063	4.374969
Probability	0.457546	0.277473	0.112199
Sum	1208.632	1178.162	953.6624
Sum Sq. Dev.	20.12814	80.87852	43.94192
Observations	66	66	66

Source: Authors' calculation.

Least Squares Regression Analysis

The results of the least squares regression analysis are presented in Table 3. The impact of $\ln(\text{TTV}_{it-1})$ and $\ln(\text{IND}_{it-1})$ on $\ln(\text{GSDP}_{it})$ is examined. Both the independent variables are lagged by one year to reflect the delayed impact of tourism and airline activity on economic growth.

The estimated coefficients are both statistically significant at the 1% level. A 1% increase in $\ln(\text{TTV}_{it-1})$ leads to a 0.41% increase in $\ln(\text{GSDP}_{it})$, while a 1% increase in $\ln(\text{IND}_{it-1})$ leads to a 0.21% increase in $\ln(\text{GSDP}_{it})$, in the short run.

The model's adjusted R-squared is 0.6909, indicating that 69.09% of the variation in the dependent variable, $\ln(\text{GSDP}_{it})$, is explained by the model. The F-statistic value of 66.951 and its corresponding p-value of 0.000 indicate that the regression model is statistically significant overall.

Table 3: Least Squares Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant (C)	7.999	1.074	7.446	0.000 ***
$\ln(\text{TTV}_{it-1})$	0.409	0.035	11.537	0.000 ***
$\ln(\text{IND}_{it-1})$	0.209	0.015	4.069	0.000 ***
Adjusted R-Squared	0.6909			
F-statistic	66.951			
p-value	0.000 ***			

Note: *** indicates statistical significance at the 1% level.

Source: Authors' calculation.

Stationarity Check: Levin-Lin-Chu Unit Root Test

Before conducting a Granger causality test, it is crucial to verify that the panel data series are stationary. This step ensures the validity of the subsequent analyses. The findings of the Levin-Lin-Chu unit root test, presented in Table 4, show the stationarity properties of the variables.

At the level form, all three variables are non-stationary, as the null hypothesis of a unit root is not rejected. However, upon taking the first difference of each variable, the variables become stationary with p-values well below the 0.05 threshold. The null hypothesis was rejected, confirming that the differenced variables exhibit stationarity. This confirms that all variables are integrated of order one, denoted as $I(1)$, and are therefore suitable for use in the Granger causality test.

Table 4: Levin-Lin-Chu Unit Root Test

Form of variable	Variable	LCC Test statistic	p-value	Inference
Log form (Level)	$\ln(GSDP)$	-0.22987	0.4091	Non-stationary
	$\ln(TTV)$	-0.37434	0.3541	Non-stationary
	$\ln(IND)$	-0.97342	0.1652	Non-stationary
1 st difference of log	$d_ln(GSDP)$	-4.86811	0.0000 ***	Stationary
	$d_ln(TTV)$	-3.44002	0.0003 ***	Stationary
	$d_ln(IND)$	-2.75718	0.0029 ***	Stationary

Note: *** indicates statistical significance at the 1% level.

Source: Authors' calculation.

Granger Causality Test

Table 5 depicts the results of the Granger causality test among the three pairs of variables. At a 5% level of significance, the Granger causality test suggests the following;

Causality between $d_ln(TTV)$ and $d_ln(GSDP)$: The null hypothesis that $d_ln(TTV)$ does not Granger-cause $d_ln(GSDP)$ is not rejected ($p = 0.2387$), while the null that $d_ln(GSDP)$ does not Granger-cause $d_ln(TTV)$ is rejected ($p = 0.00001$). This indicates a unidirectional causality from $d_ln(GSDP)$ to $d_ln(TTV)$.

Causality between $d_ln(IND)$ and $d_ln(GSDP)$: Both null hypotheses are rejected ($p = 0.0037$ and $p = 0.0003$), indicating a bidirectional causality between $d_ln(IND)$ and $d_ln(GSDP)$.

Causality between $d_ln(TTV)$ and $d_ln(IND)$: The null that $d_ln(TTV)$ does not Granger-cause $d_ln(IND)$ is not rejected ($p = 0.9467$), but the reverse is rejected ($p = 0.0118$), indicating a unidirectional causality from $d_ln(IND)$ to $d_ln(TTV)$.

Table No. 5: Granger Causality Test

Null hypothesis	F-statistic	Probability	Inference
$d_ln(TTV)$ does not Granger-cause $d_ln(GSDP)$	1.421	0.2387	Not rejected null hypothesis
$d_ln(GSDP)$ does not Granger-cause $d_ln(TTV)$	24.152	0.00001 ***	Rejected null hypothesis
$d_ln(IND)$ does not Granger-cause $d_ln(GSDP)$	9.256	0.0037 ***	Rejected null hypothesis
$d_ln(GSDP)$ does not Granger-cause $d_ln(IND)$	14.999	0.0003 ***	Rejected null hypothesis
$d_ln(TTV)$ does not Granger-cause $d_ln(IND)$	0.004	0.9467	Not rejected null hypothesis
$d_ln(IND)$ does not Granger-cause $d_ln(TTV)$	6.818	0.0118 **	Rejected null hypothesis

Note: *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

Source: Authors' calculation

DISCUSSION

Least Squares Regression Analysis

The regression results indicate that both tourism and the airline industry exert a significant and positive influence on economic growth in India. The elasticity coefficient of 0.41 for Total Tourist Visits (TTV) confirms that tourism is crucial in stimulating regional economic activity. This finding supports previous research by Atan & Arslanturk (2012) and Ohlan (2017), which also observed a growth-enhancing effect of tourism.

Similarly, the coefficient of 0.21 for Indian National Departures (IND) highlights the contribution of the aviation sector to economic growth. These findings are consistent with existing studies (Carbo & Graham, 2020; Dimitrios et al., 2017; Inan, 2021; Raihan et al., 2024).

The lag structure used in the model reflects the reality that economic growth responses to tourism and air transport activities are not immediate, but change over time. The strength and statistical significance of the model validate the importance of both sectors in India's economic development.

Interpretation of Unit Root Results

The results of the Levin–Lin–Chu unit root test confirm that the natural log forms of the variables $\ln(\text{GSDP})$, $\ln(\text{TTV})$, and $\ln(\text{IND})$ are non-stationary at the level form but become stationary after first differencing. This finding implies that the series exhibits unit roots.

The confirmation of integration at order one, $I(1)$, satisfies the prerequisite for applying the Granger causality test, as causality testing requires stationary data to avoid spurious results. These results validate the assumptions of the causality analysis.

Interpretation of Granger Causality

The Granger causality analysis provides important insights into the relationships among tourism, the airline industry, and economic growth in India.

First, the unidirectional causality from $d_ln(\text{GSDP})$ to $d_ln(\text{TTV})$ suggests that economic growth acts as a driver of tourism activity. This aligns with similar findings from Chulaphan & Barahona (2018) in Thailand.

Second, the bidirectional causality between $d_ln(\text{IND})$ and $d_ln(\text{GSDP})$ implies a mutually reinforcing relationship between the airline industry and economic growth. This finding is consistent with Hu et al. (2015) wherein a similar interdependency was observed in China. It suggests that a strong air transport sector leads to economic expansion and vice versa.

Lastly, the unidirectional causality from $d_ln(\text{IND})$ to $d_ln(\text{TTV})$ reveals that improvements in air travel—such as increased departures or better air connectivity—stimulate tourism, while tourism itself does not appear to drive changes in airline departures. This emphasizes the airline industry's role as a facilitator of tourism rather than the reverse.

Overall, the findings highlight that economic growth appears to drive changes in tourist movements, while air travel also appears to influence tourist visits. However, tourist visits do not significantly predict either economic growth or air travel. Additionally, a bidirectional relationship between air travel and economic growth indicates a strong interdependent relationship between the two variables.

Conclusion

The study analysed data from 2010 to 2020 and explored the relationship between tourism, the airline industry, and economic growth. It may be concluded from the study that the tourist visits and air travel by Indians play an important role in the expansion of India's Gross State Domestic Product (GSDP), promoting economic growth. Furthermore, the study led us to conclude that there is an interdependence between tourist visits, air travel, and economic growth. The Granger causality test unravelled a bidirectional causality between air travel and economic growth, a unidirectional causality between economic growth and tourism, and a unidirectional causality between the airline industry and tourism, supporting the interdependence.

These findings emphasise the interconnectedness of the tourism and aviation sectors with the overall economy, illustrating their critical roles in fostering economic development. This connection presents significant implications for policymakers focused on promoting economic growth. By strategically enhancing tourism and increasing investments in the airline industry, the country can experience notable economic advancement. Policymakers should prioritize improvement in route connectivity and the enhancement of airport infrastructure, ensuring that facilities can accommodate growing passenger volumes. This will create a dual benefit of stimulating tourism along with enhancing economic growth. Economic growth, in turn, will enable investments in the airline industry, as well as support tourism and its related industries.

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Demographic Influences on Organisational Citizenship Behaviour: Exploring the Interplay with Universal Human Values

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Abstract

Organisational Citizenship Behaviour (OCB) is of profound importance in fostering organisational harmony and efficiency. This discretionary behaviour involving acts of helping colleagues, refraining from complaining acts, working in the holistic interest are significantly associated with positive organisational behaviour and favourable work outcomes. The present study examines the influence of demographic variables such as age, gender, educational qualification, work experience, and organisational tenure on Organisational Citizenship Behaviour among industrial employees of Goa. OCB's have been looked at generally from behavioural and psychological perspective, but this study draws its connection with Universal Human Values (UHV), thereby exploring OCB's as manifestation of Universal Human Values in the organisational context. UHV's, known for facilitating co-operativeness and healthy social bonds go beyond culture and societies and provide a equally strong ethical and moral foundation for eliciting OCB's in an organisational context. Study highlights how dimensions of OCB particularly altruism, civic virtue and conscientiousness exhibit the inherent principles of UHV's. On the basis of data collected from a sample of 419 employees from varied industrial setups across Goa using Organisational Citizenship Behaviour Scale by Dr. Arti Bakshi and Dr. Kuldeep Kumar; study aims to identify mean differences, significant demographic patterns and interaction effects. Findings reveal prominent age, gender, education wise differences in expression of OCB. Results thus underscore the essence of individual characteristics in shaping value driven behaviour in the workplace. By recognising these demographic disparities, organizations can focus on promoting UHV's within an organization to foster discretionary and extra-role behaviours.

Keywords: Demographics, Organisational Citizenship Behaviour, Universal Human Values, Workplace Behaviour

Introduction

In the contemporary work settings, Organisational Citizenship Behaviours are considered to be predominantly important in nurturing organisational harmony and promoting organisational effectiveness. In the highly competitive and politicised work environment evident of late; every organization is in search to onboard the best employees who exhibit positive value driven work behaviour and function within the ethical framework of the organization. According to Organ & Ryan (1995), Organisational Citizenship Behaviour is one such discretionary behaviour that extends beyond formal job requirements and contributes to the overall functioning and well-being of the organization. OCB's encompasses certain behaviours that go beyond job descriptions but play a vital role in creating a collaborative work environment, reducing conflicts and building organization as a cohesive unit. It involves acts of being supportive and collaborative towards colleagues; being respectful, humble and polite in one's interactions; demonstrating a ethically governed behaviour; being optimistic and resilient when faced with burdensome challenges; adding vibrancy to the organisational environment by active involvement in several activities.

According to Organ (1988) five dimensions of OCB comprises of conscientiousness, sportsmanship, civic virtue, courtesy, and altruism. These five dimensions cover such organisational behaviours as helping co-workers, following company rules, not complaining, and actively participating in organisational affairs.

Altruism: Altruism has been defined by Smith & Organ (1983) as voluntary behaviours where an employee provides assistance to an individual with a particular problem to complete his or her task under unusual circumstances.

Conscientiousness: According to Podsakoff & MacKenzie (1997), it is a prototype of going well beyond minimally required levels of attendance, punctuality, and housekeeping, penchant towards conserving re-sources, and overall giving an impression of being a responsible citizen of the organization. If the employee is highly conscientious it implies that he is highly responsible and needs less supervision.

Sportsmanship: As defined by Organ (1990), sportsmanship is a willingness to tolerate the inevitable inconveniences and impositions of work without complaining.

Courtesy: As mentioned by Organ (1990) courtesy refers to the gestures that help others to prevent interpersonal problems from occurring, such as giving prior notice of the work schedule to someone who is in need, consulting others before taking any actions that would affect them.

Civic virtue: As noted by Podsakoff, MacKenzie et al. (1990), civic virtue is behaviour on the part of an individual that indicates that employee dutifully participates in, is actively involved in, and is concerned about the life of the company

All these 5 dimensions of OCB constitute prosocial behaviours which significantly contributes to the growth of both individual as well the organization.

Traditionally, OCB's have been explored from the perspective of behavioural outcomes thereby highlighting its linkage with several instrumental benefits like organisational effectiveness, work outcomes, employee engagement etc. Numerous studies have also explored connection between several dispositional and organisational antecedent factors like personality, organisational climate, leadership and OCB's. However, relatively lesser amount of research is dedicated towards understanding ethical and moral groundwork underlying OCB's. In this context, it is intriguing to explore OCB as a behavioural manifestation of Universal Human Values in the workplace. These UHV's in the form of Trust, Compassion, Peace, Responsibility, Respect extend across cultures, societies and are considered to be of paramount importance in facilitating positive humanly interactions and strengthening the social fabric of our society. By examining OCB's from UHV lens this study postulates that OCB's reflect practical applicability of UHV's in the organisational context.

Secondly, existing literature highlights disparities in citizenship behaviour based on demographics. However, barely any studies have been conducted in the Goan region despite rampant industrial growth witnessed in this region. To develop a deeper understanding of how individual characteristics shape citizenship behaviours, this study explores the influence of gender, age, tenure, work experience, education on OCB's. Study also examines whether employees working at varied levels, in different industries and sectors differ in exhibiting OCB's.

Theoretical Framework - Exploring the Convergence Of Ocb And Uhv

Theoretical evidence asserting that OCB's are one form of Universal Human Values can be drawn from several existing theories establishing the connection between values and discretionary work behaviours. Based on these theories, OCB's can be perceived as manifestation of UHV's in the organisational setting.

According to Cameron et al. (2004), organizational virtuousness is characterized by traits like compassion, integrity, forgiveness and trust. This theory is based on theory of virtue developed by Aristotle which postulates that virtuous individuals significantly contribute in building virtuousness within an organization.

In subsequent revisions of his theory, Cameron (2014) emphasised that sense of virtuousness does play an instrumental role in bringing positive outcomes and positively contributes to employee's well being and sense of involvement.

Moral Foundation theory proposed by Haidt (2001) postulates that ethical decision making and behaviours are driven by universal moral values namely care, loyalty, fairness, authority and sanctity. These values being deep-rooted in human behaviour can be associated with OCB's. Altruism dimension of OCB focusing on helping acts on the part of employees is related to Care whereas conscientiousness dimension is highly similar to fairness.

In his Expanded theory of Basic Human Values Schwartz (2012) asserts that our attitudes, behaviours and decision making particularly employee attitudes and discretionary behaviours is guided by set of 19 universal values related to openness to change, self enhancement, conservation and self transcendence.

Universal Human Values are ethical principles that serve as a foundation to guide our behaviour. These values are universal across cultures and societies. OCB and its dimensions align with key universal values such as truth, compassion, peace, respect and responsibility. Compassion is a foundational human value that is similar to altruism dimension of OCB. Altruism involves voluntary acts of helping colleagues, being supportive, understanding and expressing concern towards well being of the co-workers. These qualities are related to compassion which involves being caring, co-operative and helpful towards others. Responsibility, second key facet of universal values involves commitment towards one's duties and obligations, being accountable and reliable in executing duties. This value draws similarities with conscientiousness dimension of OCB which incorporates meticulously performing work, accepting additional duties, being accountable and professional in performing one's duties and diligently completely the work assigned. Third dimension of OCB that is Courtesy involves being

polite and considerate while interacting and being respectful towards other people's opinions so that effective communication and congenial environment is maintained. This dimension resonates with universal value of respect which involves treating others in a fair and dignified manner. Sportsmanship dimension of OCB encompasses maintaining optimistic attitude in the face of adversities, avoiding complaining behaviour, prioritising collective harmony over personal grievances so as to minimise conflicts and facilitate collective harmony. This reflects strong resonance with universal value of Peace which also stresses upon reducing conflicts and promoting harmony. The fifth key universal value of Truth emphasises principles of honesty, openness and transparency. Civic Virtue dimension of OCB aligning with this value also entails upholding of ethical standards, reporting wrong doings, working with integrity, honesty and a deep sense of commitment towards organisational governance through involvement in decision making process and other organisational activities.

From this it can be inferred that OCB's are deeply grounded in fundamental human values and exploring it from this perspective can provide a more holistic view of human behaviour. This also underlines a need to integrate ethical principles in organisational fabric to positively guide human interactions and behaviours.

Review of Literature

Several researchers have attempted to investigate the influence of demographics on OCB's however fewer studies have been carried out in Indian context, particularly Goa. Also not much research has centred around industry, job level, sector wise comparison of OCB; hence this study attempts to address this gap. Majority of the existing literature perceives OCB as a outcome variable bringing out definite benefits whereas this study explores it as ethically and morally driven value based behaviour.

Bhatti, O. K., Waris, S., & Zaheer, A. (2023) in their study exploring relationship between personality traits and organisational citizenship behaviour discovered significant influence of demographic factors especially age and education on dimensions of OCB. This study highlights how intrinsic values connected with cultural norms interact with demographics in shaping citizenship behaviours like altruism and conscientiousness. Farid, T., Iqbal, S., & Maqsood, A. (2021) in their study of banking sector employees of Pakistan examined influence of gender on OCB and Job Satisfaction. Study underlined the gender differences thereby further emphasising that females are more likely to indulge into interpersonal-focused OCB whereas males are more prone to exhibit organization-focused citizenship behaviours.

Gupta, V., & Singh, S. (2020) in their study found a strong positive connect between tenure, work experience and civic virtue, conscientiousness dimension of OCB. A study by Kim, Y. J., & Park, C. (2019) divulged significant age differences in OCB's with older employees found exhibiting higher levels of citizenship behaviours compared to their counterparts. Podsakoff, N. P., MacKenzie, S. B., & Podsakoff, P. M. (2018) in his comprehensive review examining the influence of education, found augmented levels of civic virtue and courtesy in those who had acquired higher levels of education. Zaman, T., & Parveen, H. (2022) in his study examining demographic predictors of OCB in emerging markets concluded that education and tenure have a statistically significant impact on OCB. Rahman, M., & Ahsan, M. (2021) in their study discovered moderating role of gender and age on the relationship between job satisfaction and OCB. This study suggests significance of intrinsic values and life experiences in shaping the expression of citizenship behaviours.

Li, Y., & Huang, X. (2023) in their study of industry specific factors shaping citizenship behaviours found OCB's to be more pronounced in service based industries as nature of job role is customer facing which fosters interpersonal citizenship behaviours. Gupta, S., & Sharma, K. (2022) in their study comparing OCB's in IT and healthcare sector asserted that focus on innovation in IT and empathy in healthcare influences OCB dimensions such as altruism and courtesy. Rahman, M., & Khan, S. (2021) in their comparative analysis of public and private sector employees concluded that public sector employees exhibit higher levels of organization based whereas private sector employees are more inclined towards interpersonal based citizenship behaviours. Researchers attributed this to variations in motivational system and job security across these sectors.

Though there exists research supporting influence of demographic variables, research that has been carried out in the field of OCB over past several years has primarily focused on exploring its antecedent and predictor variables. Role of several dispositional, contextual and situational factors such as personality, psychological capital, leadership, organizational climate, culture is being widely explored presently. OCB as a construct is of great significance presently in the organizations considering its effectiveness in enhancing organisational performance. Universal Human Values are the foundational moral principles guiding our behaviour and hence gaining pronounced importance on all frontiers. Recent studies have highlighted its role in promoting peace, social harmony, global citizenship. Organizational Citizenship Behaviour can be considered as manifestation of UHV's in the organizational context and recent studies do emphasise its role in creating value driven and human centric work environment.

Research Methodology

Research Design

Quantitative research design has been adopted for this study wherein data has been collected from 419 employees of organisations from the state of Goa. As study employs cross-sectional survey; data collected reflects only current behavioural perceptions of employees.

Objectives of the Study

- To establish a theoretical connection between Universal Human Values and Organisational Citizenship Behaviours.
- To examine the influence of age, gender, education, work experience and organisational tenure on Organisational Citizenship Behaviour among employees of Goa region.

Sample: This study is based on a sample of 419 selected employees of medium sized industrial establishments from the state of Goa. Random Sampling method has been employed for sample selection. Sample comprised of 241 Males and 178 Female respondents.

Tools for Data Collection: 30 items Organisational Citizenship Behaviour Scale developed by Dr. Arti Bakshi and Kuldeep Kumar consisting of five dimensions namely Conscientiousness, Courtesy, Sportsmanship, Helping Co-worker and Civic Virtue with well established reliability and validity have been utilised for data collection purpose. Reliability of the scale was found to be above 0.80

Tools for Statistical Analysis: Data gathered using standardised tools and personal data sheet has been analysed using t-test, One Way Anova, Factorial Anova, Post Hoc and MANOVA and Multiple Regression.

Result and Discussion

Data gathered from the respondents has been statistically analyzed to identify mean difference between varied demographic groups. Further regression analysis was also executed to explore effect of significant demographic factors on OCB. Factorial Anova, MANOVA and Post Hoc analysis has also been performed to identify the interaction effect and group differences.

Ha1: There is a significant gender difference in organisational citizenship behaviour.

To investigate whether males and females differ on organisational citizenship behaviour and its five dimensions t-test analysis was performed. From the Table 1 it can be inferred that t value of -4.124 ($p = <.001$) is significant at 0.01 level of significance thereby indicating that males and female distinctly differ in exhibiting OCB. Further from the results of MANOVA (Table 2) it is apparent that Gender exerts a significant influence on almost all dimensions of OCB except for Courtesy and Helping CoWorker (Conscientiousness: $F = 6.04$, $P = 0.014^*$; Civic Virtue: $F = 5.98$, $P = 0.01488^*$; Sportsmanship: $F = 44.88$, $P = 7.08e-11^{***}$). Highly prominent gender based differences have been evident on particularly sportsmanship dimension.

Table 1: Results of t-test showing Gender differences in OCB		
Dimensions of OCB	T Value	P Value (Sig.)
Conscientiousness	-2.457	.014*
Courtesy	0.133	0.894
Sportsmanship	-6.537	<.001**
Helping Co-Worker	-1.131	0.259
Civic Virtue	-2.460	.014*
Overall OCB	-4.124	<.001**

*Significant at 0.05 Level of Significance

**Significant at 0.01 Level of Significance

Table 2: Results of Multivariate MANOVA (Pillai's Trace)			
Variable	Pillai	Approx F	Pr(>F)
Gender	0.117	10.535	1.63e-09 ***
Age	0.066	1.812	0.0285 *
Educational_Qualification	0.07	1.914	0.0185 *
Years_of_Experience	0.086	1.420	0.0810
Organizational_Tenure	0.021	0.422	0.9882

***Significant at 0.001 Level of Significance

*Significant at 0.05 Level of Significance

Further, results of descriptive analysis supported by results of Post Hoc (Table 3) reveal that males score lower on Organizational Citizenship Behaviour compared to their female counterparts by 5.95 points. Also on the other three dimensions of OCB wherein significant gender differences are noticeable, female employees have been discovered to be more involved in conscientious, sportsmanship and civic virtue based behaviours.

Table 3: Results of TurkeyHSDPost-Hoc Test - Gender Based Comparison				
Comparison	Difference	Lower CI	Upper CI	p-adjusted
Male - Female	-5.95	-8.74	-3.16	3.44e-05

Gender differences on overall organisational citizenship behaviours can be attributed to parental conditioning and gender based socialisation wherein females are nurtured from the initial ages to be more compassionate, empathetic, considerate which prompts them to indulge in such discretionary behaviours. Findings of this study are in concurrence with that of Eagly, A. H., & Crowley, M. (1986) who in their study also suggests women are conditioned and socialised to adopt nurturing roles which predisposes them to participate in OCB. Higher sportsmanship behaviour among females implies that women employees are likely to be optimistic and resilient when confronted with challenging work scenarios. This could be ascribed to the societal nurturing wherein females are encouraged to be accommodating which results in development of positive values like patience, adaptability and resilience in them. Goleman (1995) also highlights higher levels of empathy and self regulation among females. So all these traits collectively possibly contributes to positive attitude among women employees when faced with adversities in work settings. Findings of this study are consistent with Podsakoff, MacKenzie et al. (2000) who also suggests that sportsmanship aligns with feminine traits of patience and adaptability. With regards to conscientiousness dimension of OCB which relates to fulfilment of duties, responsibilities, sense of accountability and organised approach in accomplishing tasks; enhanced scores of females may step from their ability to manage multiple tasks simultaneously in a structured, methodical and meticulous way. On the aspect of Civic Virtue, females are socially predisposed to value harmony and collective well-being which to an extent justifies their higher involvement in organisational activities and decision making processes (Eagly & Johannesen-Schmidt, 2001). Chattopadhyay et al. (2004) also found that involvement of women in company based initiatives is likely to be on higher side due to their focus on cooperative and value driven goals.

The absence of any underlining difference on courtesy and helping co-worker insinuates that these behaviours are likely to be influenced by factors such as organisational climate, leadership culture rather than gender. With courtesy being a universal dimension and less gender specific in expression (Ilies et al., 2007). The above findings reinforce the idea that certain intrinsic values linked with Universal Human Values such as compassion and responsibility do play a prominent role in guiding citizenship behaviour of women employees in organisational settings.

Ha2: There is a significant difference in organisational citizenship behaviour across different age groups.

To explore differences in organisational citizenship behaviour and its dimensions across different age groups (20-29 Years, 30-39 Years, 40-49 Years, 50 Years and Above) one way anova was performed. As depicted in the Table 4, F value of 2.815 has been found significant at 0.05 level of significance ($p = .039$). Findings signify that

age factor does play a pivotal role in facilitating OCB. As evident from table 2, findings of MANOVA highlight significant age differences on dimensions of OCB. Age is found to be influencing sportsmanship dimension of OCB ($F = 5.68$, $P = 0.00081^{***}$).

Table 4: Results of One Way Anova showing differences in OCB based on Age		
Dimensions of OCB	F Value	P Value (Sig.)
Conscientiousness	1.630	0.182
Courtesy	1.010	0.388
Sportsmanship	3.244	.022*
Helping Co-Worker	1.373	0.250
Civic Virtue	0.324	0.808
Overall OCB	2.815	.039*

*Significant at 0.05 Level of Significance

Results of descriptive analysis substantiates that as employees age, they are more likely to be tolerant to hardships, sail through problematic situations smoothly and generally exhibit discretionary behaviours. From the table 5 depicting results of Post Hoc Test it can be inferred that employees in the age range of 40-49 exhibit higher OCB's compared to those in the age group of 20-29. Marginal difference is also noticeable among those aged between 50-59 and 20-29. This could be attributed to the fact that younger employees are not thoroughly accustomed to work environment, prioritise their career goals and professional advancement and hence are less likely to demonstrate discretionary behaviours. However, older employees with age end up being more matured and better at self regulation which may result in they refraining from complaining behaviour and adopting a positive attitude. Also, as older employees through their experience have a better understanding of organisational dynamics they might exhibit sportsmanship behaviour.

Table 5: Results of TurkeyHSDPost-Hoc Test - Age Based Comparison				
Comparison	Difference	Lower CI	Upper CI	p-adjusted
40-49 - 20-29	6.47	0.27	12.66	0.036*
50-60 - 20-29	7.85	-0.09	15.78	0.054

These findings are in accordance with previous research conducted by Organ and Ryan (1995) which also found age to be positively correlated to sportsmanship and conscientiousness. Researchers attributed this difference to variations in the organisational investment of varied age groups. Podsakoff et.al. (2000) in his study ascribed age differences to emotional stability and tolerance. These findings too affirm the idea that values such as peace and tolerance which develop over the years are particularly vital in shaping sportsmanship behaviour in the work setting.

Ha3: There is a significant difference in organisational citizenship behaviour based on education.

Results of one way anova analysis executed to assess whether OCB varies as per educational level of employees are presented in the Table 6. As evident from the table, F value of 3.466 ($p = .008$) has been found significant at 0.01 level of significance which insinuates that level of citizenships behaviour exhibited by employees varies significantly as a result of their acquired education.

Table 6: Results of One Way Anova showing differences in OCB based on Education		
Dimensions of OCB	F Value	P Value (Sig.)
Conscientiousness	1.471	0.210
Courtesy	2.305	0.058
Sportsmanship	2.883	0.022*
Helping Co-Worker	0.743	0.563
Civic Virtue	1.911	0.108
Overall OCB	3.466	0.008**

*Significant at 0.05 Level of Significance

**Significant at 0.01 Level of Significance

As evident from Table 2, MANOVA results also assert multivariate effect of Education Level on OCB. Significant difference has been specifically evident through Univariate MANOVA on Courtesy (F = 3.62, P = 0.013*) and Sportsmanship (F = 2.88, P = 0.0355*) dimensions.

Results of descriptive analysis underscores that citizenship behaviour enhances with education. Also, as evident from Table 7, findings of Post Hoc Test reveals that OCB score is significantly higher among post graduates compared to those with secondary education. Marginal differences are also evident among secondary-graduation and post graduation-higher secondary groups thereby implying that OCB's increase with higher levels of qualification. This is likely because, as an employee acquires higher levels of education like graduation or post graduation; their chances of exhibiting OCB are increased in comparison to those with secondary or higher secondary education. As education fosters cognitive abilities, interpersonal skills, moral reasoning and aims to lay sound ethical foundation by internalising values in students, findings of this study highlighting its positive correlation with OCB are well justified. Also with achievement of higher levels of education, an individual's awareness of self and surrounding is heightened which may also contribute to higher levels of OCB. Higher levels of sportsmanship behaviour with higher levels of education can be explained with existing traces of evidence positing that emotional intelligence, resilience enhances with higher levels of educational attainment.

Table 7: Results of TurkeyHSDPost-Hoc Test - Education Based Comparison				
Comparison	Difference	Lower CI	Upper CI	p-adjusted
Secondary - Post Graduation	-9.90	-19.24	-0.56	0.033*
Secondary- Graduation	-8.28	-17.39	0.82	0.089
Post Graduation - Higher Secondary	5.54	-0.17	11.26	0.061

Findings of the study are in accordance with that of Podsakoff et al. (2000) who also reported education as a significant factor influencing OCB. He attributed this to increased ability to understand and abide by organisational norms with higher education. Goleman (1995) asserted that employees with higher education levels showcase better coping mechanism which is a result of increased emotional regulation and empathy. These two traits are considered inherent to sportsmanship. Kohlberg's (1981) theory of moral development propounds that advanced stages of moral reasoning gets facilitated with education, which empowers individuals to act in a manner consistent with Universal Human Values.

Ha4: There is a significant difference in organisational citizenship behaviour based on level of work experience.

Contrary to the hypothesis formulated, as can be seen from Table 8, results of one way anova did not unveil any significant difference in OCB across groups with varying levels of work experience. This implies that individual's willingness to behave responsibly and engage in helping, courteous, organization focussed behaviour is not affected by work experience. This implies that regardless of years of experience, intrinsic values and motivations

that guide discretionary behaviour remains the same. Also there exists a possibility of other contextual or job related factors being influential in determining OCB. No multivariate effects of experience has been noticed on OCB through MANOVA analysis as evident from Table 2.

Table 8: Results of One Way Anova showing differences in OCB based on Work Experience		
Dimensions of OCB	F Value	P Value (Sig.)
Conscientiousness	1.124	0.347
Courtesy	0.805	0.547
Sportsmanship	3.750	.002**
Helping Co-Worker	0.498	0.778
Civic Virtue	0.655	0.658
Overall OCB	1.817	0.108

**Significant at 0.01 Level of Significance

However dimension wise analysis discovered significant difference on sportsmanship dimension of OCB. As previously reported, experienced employees with their mastery over self regulation and coping mechanisms are likely to deal with problematic and conflicting scenarios positively compared to the less experienced group. Hence difference in sportsmanship could be attributed to this aspect. Study findings are consistent with that of Goleman (1995) who posited that emotional intelligence, which improves with experience, is closely tied to sportsmanship behaviours like patience and tolerance. Turnipseed and Rassuli (2005) in their study found that while work experience correlates with certain organisational attitudes, it does not uniformly predict OCB.

Ha5: There is a significant difference in organisational citizenship behaviour based on organisational tenure.

Table 9: Results of One Way Anova showing differences in OCB based on Organisational Tenure		
Dimensions of OCB	F Value	P Value (Sig.)
Conscientiousness	1.072	0.370
Courtesy	0.505	0.732
Sportsmanship	1.177	0.321
Helping Co-Worker	0.556	0.695
Civic Virtue	0.287	0.887
Overall OCB	1.277	0.278

Considering the theoretical base that employees with longer tenure develop a familiarity with organisational norms, get accustomed to the company environment and are more prone to act in a socially integrated way, this hypothesis assessed differences in OCB based on organisational tenure. Morrison (1994) asserted that longer tenure results into deeper sense of belonging which in turn fosters engagement in citizenship behaviours. Van Dyne et al. (1994) also underlined that attachments both social and psychological that individual develops through long tenure do play a significant role in driving OCB. Contrary to the existing body of literature lack of significant difference in this study suggests the role of other individual traits, contextual and organization based factors in fostering OCB rather than just length of service. Findings of MANOVA did not underline any note-worthy multivariate effects of Tenure as can be seen in the Table 2. Absence of effect of tenure also underscores possible role of intrinsic values, inherent personality traits, emotional intelligence in influencing OCB over external factor such as time spent in the organization.

Interaction Effect and Regression Analysis

As discussed above, ANOVA findings prominently highlight individual effects of gender, age and educational qualification on OCB. However results of factorial ANOVA depict non significant 3 way interaction between Gender x Age x Qualification. However F Values as depicted in the Table 10, support marginally significant two way interaction between Gender x Age and Gender x Educational Qualification. This implies that the way gender influences citizenship behaviour is likely to marginally vary across varied age groups and educational levels. However, despite these three variables having individual effects, study does not depict any noteworthy combined effect of these three variables on OCB.

Table 10: Anova Table With Interaction Terms		
Source	F value	Pr(>F)
Gender:Age	2.242	0.08292 .
Gender: Educational_Qualification	2.445	0.06365 .
Age: Educational_Qualification	0.658	0.74697

Table 11: Results of Multiple Regression			
F Value	P Value	R Square	Adjusted R Square
2.861	0.0002	0.1022	0.0665
Predictors: Gender, Age, Educational Qualification, Years of Experience, Tenure.			

From Table 11 depicting results of multiple regression it is evident that F Value of 2.861 is significant hence it can be asserted that this overall model is significant. This implies that age, gender, education, experience and tenure do play a significant role in predicting OCB. Further R square value of 0.1022 indicates that approximately 10.2% variance in OCB is explained by predictor variables of this model. Gender, Age and Educational Qualification proved to be significant predictor thereby supporting findings obtained through Analysis of Variance techniques.

Future Scope

Considering the findings, industry professionals can develop HR interventions targeting younger employees and those with lesser qualifications as OCB's have been found lower among these groups. Also specific strategies could be developed to boost OCB levels among male employees. Companies can increase their investment in employee education which can bring them positive results in the form of heightened OCB's. Further research can empirically test the connection between UHV's and OCB and simultaneously assess the moderating role of contextual and situational behaviours including cultural norms across sectors and industries to develop a comprehensive understanding of the organisational dynamics. Intervention based studies can also be considered while doing future research.

Conclusion

This research sought to accomplish dual objectives of exploring theoretical connection between OCB and UHV and also empirically analysing the influence of demographic variables in shaping citizenship behaviours. Theoretical review provides compelling evidence of linkage between conscientiousness, courtesy, helping co-worker, civic virtue, sportsmanship aspect of OCB and universal human values like empathy, peace, respect and responsibility. Study highlights how viewing OCB's from ethical and moral lens can significantly help in fostering these discretionary behaviours in the organisational settings.

Demographic analysis highlights prominent role of gender, age and education in shaping OCB. On the gender front, female employees were found to exhibit higher levels of OCB particularly on conscientiousness, sportsmanship and civic virtue, thereby concurring with existing literature body suggesting female preferences for empathy, collaboration and adaptability. Older employees as well as those with higher levels of educational attainment exhibited greater levels of OCB, therefore emphasising transformational role of education in reinforcing discretionary behaviours through development of moral reasoning. Work experience and organisational tenure exhibited little influence thereby underling the role of intrinsic values, motivations in driving OCB rather than just number of years associated with an organisation or experience.

Research findings underscore the interplay between values and demographics in shaping OCB's. Organizations aiming to foster OCB's can promote universal human values by creating nurturing environment characterized by value-based training programs, value-driven ethical leaderships, reinforcement initiatives recognising OCB. Study highlights how UHV's can be looked at from a strategic perspective for cultivating citizenship behaviours in the forthcoming years so as to promote interpersonal harmony and organisational success.

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Age-Wise Analysis of Financial Capability among Cashew Workers in Kerala: A Socioeconomic Perspective

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Abstract

The paper seeks to examine the financial capability of cashew workers and whether financial literacy, financial behaviour, and financial attitude contribute to workers to make appropriate financial judgments. In our turbulent financial world where people go through the vista of various different financial products and services it is important to improve financial capability as a means of having well-being in the economic life of the individual. The study also points at the need to provide cashew workers with the required skills in finances so that they can overcome financial risk, make wise decisions, and provide their financial safety in the long run. The primary data was gathered through questionnaire that was administered to a sample size of working cashew workers. The dimensions that were used to measure financial knowledge, behavior, and attitude in the survey were through Likert-type scale. The sampling technique applied here was stratified random sampling as it was to be represented in terms of income levels and occupation. The relationships between the independent variables and financial decision-making were analysed using the statistical tools which included descriptive analysis, correlation and multiple regression analysis using SPSS software. The results indicated that although there has been an expansion of the access to financial instruments, most of the cashew workers who have command of such instruments are not competent to deliver their usefulness. Those people who had good financial behavior patterns and positive attitude approached their financial decisions more wisely. The findings explain why specific financial literacy interventions should not be limited to education on the subject but have to encompass exercises on behavior and attitude formation. The article supports the vision of viewing financial education as a multifaceted concept that should combine psychological and contextual dimensions, thus increasing financial empowerment among the grassroots population.

Keywords: Financial Capability; Financial Literacy; Financial Behaviour, Financial Attitude, Cashew Worker.

Introduction

Financially capable people are able to identify and protect themselves from financial risks. Individuals can be encouraged to adopt attitudes and behaviours consistent with their own best financial interests by equipping them with the necessary knowledge, skills, timely and reliable sources of information, and the appropriate instruments at the right time. Many of the employees rely on multiple sources to obtain funds when they are in need. For the economic and social development of labourers, appropriate legislation must be formulated and enacted. A Study conducted among the working women's in Bardoli found that respondents having the knowledge about savings account but having only low knowledge regarding chit fund, investment in commodity markets etc. Need more awareness programs to be created for making awareness about investment avenues. Monthly income of them are not in tact with their spending behavior (Desai, 2020). Reduced repayment capacity could induce higher loan defaults (Rakhe P. Balachandran, 2019). Financial literacy enables the individuals to minimize the chance to be misled. Lack of personal financial education make poor levels of financial capability. Financial capability can affect the person's economic prosperity and development. Economic growth of country will not be meaningful without the presence of financial capability (D, Sritharan R, 2020). Educated women especially in the organized sectors are rationally informed players in the economy. Yet some of the women remain in the backyard. Benefits of women empowerment programmes should be reaped by all women (Shah, 2019).

Financial capability is the ability to act in one's best financial interest, in the given socioeconomic environment. Financial capability is a combination of the financial understanding, abilities, mindsets, and conduct that leads to favourable financial behaviours and appropriate money management decisions. It refers to more than just the knowledge necessary to make sensible financial decisions. Financial capability in another way is an individual's understanding and awareness of money and financial ideas, products and services, and their own personal financial status. Hard and soft skills in the area of finance enable a person to manage financial opportunities and risks by using pertinent knowledge. General abilities like literacy, numeracy, problem-solving, communication, and critical thinking help financial skills.

Financial Capability and Cashew Worker

Cashew industry places a dominant position for creating more employment opportunities and rural development in Kerala especially in Kollam district. In Kerala, the Cashew Industry is primarily concentrated in the Kollam District. The government of India recognises Kollam as the "Centre of Cashew Industry." The industry is extremely labor-intensive and employs more than 2 lakh employees, with more than 90 percent of them being women. Thus, the industry provides a significant source of income for low-income families. Financial capacity gives cashew workers the internal motivation to make decisions that are in their best financial interests, which can be crucial in improving their socio-economic and financial circumstances. This will make it easier for cashew workers to budget any money they receive. They can keep track of current spending and potential savings thanks to it. They always look for methods to enhance their financial conditions and may handle unexpected debt with good financial planning.

Review of Literature

Ansong (2016) defines financial capability "Financial capability is an individual and structural idea that combines people's ability to act with their opportunity. From this perspective, financial capability does not reside within the individual, but rather in the relationship between the individual and social institutions" Salazar et al. (2021) in their article titled "Building financial capability in youth transitioning from foster care to adulthood" narrates emerging adults need to build their financial capacity as they move from being dependent on caretakers to being in charge of making their own life decisions and taking care of their own needs. Financial independence is especially important for adolescents ageing out of foster care because of the lack of access to conventional services. Beyond the documenting of teenage employment, lower wages, and increased usage of public assistance, however, very little study has been done to better understand the financial realities, obstacles, and abilities of youth. Mokhtar et al. (2020) made study titled "Financial Capability and Differences in Age and Ethnicity" observed Planning ahead, handling money, making decisions about things, and staying informed are all significantly impacted by age. However, ethnicity was shown to have no impact on financial aptitude other than in the area of forward planning. It is advised that greater emphasis is being given to academic study and professional development in order to increase respondents' financial competence. Government and non-government groups should also adopt a comprehensive strategy to improve households' financial capabilities and living standards, especially those that are financially vulnerable.

Anthony & Fazil Sabri (2019) research article titled "The Impact of a Financial Capability Program on the Financial Well-being of Medical Practitioners" narrated that developments in the information communications technologies created more convenient access to the financial services products but it require technical proficiency. For handling the financial products like credit cards, insurance, mortgages etc require skill and efficient understanding of the way to handle them. Here they suggest that financial training can advance the financial capability and thereby increase financial satisfaction. Caplan et al. (2018) their findings of the paper "Financial capability as social investment" revealed financial capability consists of interrelated concepts of financial learning and financial inclusion. It is a social investment strategy which means promote investment of resources for the social and individual wellbeing. Zottel et al. (2016) article entitled "Enhancing Financial Capability and Inclusion in Senegal" opinioned programmes like mobile phone application, media channels ,messages etc. can be used to enhance the financial knowledge ,attitude, and behaviour. Adequate complaint mechanisms should be ensured to handle complains .Financial Ombudsman's should be formed. Ansari et al. (2022) their findings in the paper titled " A Study of Financial Literacy of Investors—A Bibliometric Analysis" found to analyse the literature on financial literacy, Utilizing bibliometric methods such as citation analysis of networks, co-citation evaluation, analysis of content, publication patterns, and keyword analysis, the study aimed to determine the relationships between scholarly works. That both society and institutions promote financial literacy to strengthen citizens' investment strategy development responsibilities .Financial literacy is interdisciplinary and intertwined with numerous academic fields. Utkarsh et al. (2020) in their research paper entitled "Catch them young: Impact of financial socialization, financial literacy and attitude towards money on financial well-being of young adults" observed future financial well-being can be positively impacted by financial practices including spending and saving. This study also emphasised the importance of parental financial integration during childhood as a determinant of improving financial capability. This study also proved a positive correlation between money attitude and financial capability. By showing that financial socialisation and attitudes towards money are crucial preconditions for financial welfare, this study adds to the existing indices of financial strength.

Lusardi (2019) article on "Financial literacy and the need for financial education: evidence and implications" pointed out that due to the swift changes and improvements in the economy, it is essential to comprehend how they make daily financial decisions efficiently and effectively. Financial literacy is a worldwide passport that enables individuals to make financially sound choices and take advantage of the abundance of financial products available on the market. Financial literacy is an absolute and universal requirement. Matemane (2018) in his study

on “Saving for Tomorrow: Does the Level of Financial Literacy in the South African Working Class Matter?” discovers that qualification and work experience have a progressive influence on their level of financial literacy. Because the theory suggests a high relationship between financial learning and financial capability, low levels of literacy result in low levels of financial literacy. Holzmann (2012) article on “Bringing Financial Literacy and Education to Low and Middle Income Countries” narrated that during the last decade most of the countries shows huge interest in financial education strategies and programmes. Therefore there was a transformation of knowledge based financial concepts to behaviour based financial capability.

Objectives

- To assess the level of financial capability among cashew workers in Kollam district, Kerala.
- To examine the differences in financial capability across various age groups of cashew workers.
- To evaluate the association between age and financial behavior indicators.
- To provide recommendations for enhancing financial capability among vulnerable age segments.

Methodology

This study is an empirical research. Here what the researcher sees and measures directly. Data was collected between January 2023 to July 2023. Empirical research based on survey method confined to State of Kerala. Kollam district has been purposively chosen for the study since most of the cashew factories of Kerala are located in this district. The cashew laborers of Kerala are considered as the population for this study. For the purpose of study, Kollam district was categorized into nine zone and currently working factories were selected for identifying the sample respondents. Probability sampling method was used to select the sample factories and sample employees. Cochran’s sampling calculation method was used to decide the desired sample size of factories and employees according to the listed population from nine zones of Kollam district. Hence, it was decided to choose 384 sample respondents from selected factories. Again, the 384-sample size was proportionally distributed among the employees of each zone. Then systematic sampling method was used to select the sample respondents, Sample intervals were calculated on the basis of zone population and concerned desired sample size. Cronbach’s alpha was used to check the reliability of the questionnaire the reliability coefficient is 0.802. MANOVA test with BOX’M plot, and Mean significant difference among different age were used for the study.

Results and Discussion

This section presents the empirical findings derived from the primary data collected from 384 cashew workers in Kollam district, Kerala. The analysis focuses on assessing the differences in financial capability across various age groups. Financial capability was measured using indicators such as perceived financial stress and saving behavior. The responses were subjected to statistical techniques including descriptive analysis, Box’s M test for homogeneity of covariance matrices, and Multivariate Analysis of Variance (MANOVA), to examine the significance of age-wise differences in financial capability. The following tables and interpretations provide insights into how cashew workers from different age brackets perceive and manage their financial situations. These results serve as the foundation for subsequent discussion and policy recommendations

Table I

Different age group respondent’s opinion regarding financial capability

Age	Financial issues don’t cause stress and strain in the life			Before spending save some for tomorrow		
	Mean	SD	N	Mean	SD	N
20-25	3.08	1.165	12	2.75	.866	12
26-30	2	1.604	8	2.75	.886	8
31-35	3.65	1.387	20	3.00	.649	20
36-40	2.62	1.544	69	3.30	1.033	69
41-45	3.12	1.683	73	3.27	.854	73
46-50	3.27	1.547	95	3.20	1.088	95
51-55	3.18	1.586	61	2.92	1.069	61
56-60	3	1.476	46	3.48	.836	46
Total	3.07	1.570	384	3.19	.986	384

Source : primary data

Table 1. indicates that, the mean scores represent the level of agreement with the statement. Higher means suggest lower financial stress. Across the age groups, 31–35 years have the highest mean (3.65), indicating that this group experiences the least stress due to financial issues. Conversely, the 26–30 years group has the lowest mean (2.00), suggesting they experience the most stress. The standard deviations (SDs) show variability within each group. The highest SD is in the 41–45 years group (1.683), implying greater variation in financial stress perceptions within this group. The lowest SD is in the 20–25 years group (1.165), suggesting more consistent responses

within this younger group. The mean scores represent the level of agreement with the habit of saving before spending. Higher means indicate stronger agreement with saving behavior. The 56–60 years group has the highest mean (3.48), indicating this group is the most likely to save before spending. The 20–25 years and 26–30 years groups have the lowest mean (2.75), suggesting these younger age groups are the least likely to prioritize saving. The SDs are relatively small across groups, indicating less variability in saving habits compared to financial stress perceptions. The highest SD is in the 46–50 years group (1.088), showing some variability in responses, while the lowest SD is in the 31–35 years group (0.649), indicating more uniform saving behavior in this group. The overall mean for financial stress is 3.07, suggesting that the general perception across all age groups leans slightly toward less financial stress. The overall mean for saving behavior is 3.19, indicating a moderate tendency to save before spending.

Table 2
Box'S test of equality of covariance matrices

Box's M	262.642
F	1.557
df1	147
df2	7771.985
Sig.	.000

Source: Primary data

Table 2 illustrate the result of homogeneity of covariance matrices of the dependent variables across the groups. The test has produced a significant result i.e., Box's M test p-value is lesser at 5 per cent significant level (p-value=.000<0.05). Hence it can be inferred that there is no homogeneity of covariance matrices of the dependent variables across the age groups. Based on this result, it was decided to interpret the multivariate effect across the group by using Pillai's Trace instead of Wilks' Lambda test value.

Table 3
Mean significant difference among different age group regarding financial capability

	Value	F	Hypothesis df	Error df	Sig.
Pillai's Trace	.170	1.564	42.000	2256.000	.012
Wilks' Lambda	.840	1.572	42.000	1743.596	.012
Hotelling's Trace	.179	1.574	42.000	2216.000	.011
Roy's Largest Root	.078	4.184 ^c	7.000	376.000	.000

Source : Primary data

Table 3 result indicates that p-value of MANOVA is significantly lower than the p-value i.e., Pillai's Trace=.170, F (42,2256) =1.564, p-value=.012<0.05. Hence it can be inferred that, cashew workers financial capability s significantly different across different age groups.

Discussion

Result indicates that 31-35, 41-45, 46-50, and 51-55 age groups believe that financial issues doesn't cause stress and strain in their life. Regarding saving money for tomorrow, 36-40, 41-45, 46-50, and 56-60 age groups know that saving money for tomorrow is better to meet future expenses. Hence, multiple comparison tests were further used to identify which of the groups were significantly different from each other. It can be observed that 46-50 age respondents' opinion is significantly different from 31-35 age groups respondents' opinion. Age group 31 - 35 opinioned that financial issues don't cause stress and strain in the life (3.07±1.570), which means that they haven't any clear opinion about the financial issues which are causing stress and strain in their life. Meantime majority of the respondents were agreeing they know that saving some for tomorrow is very important and hence they keep money for tomorrow before spending (3.19±.986). Majority of the different age group respondents were disagreeing with the statement related to financial capability. Cashew Workers are strongly urged to develop a budget for themselves that takes into consideration the expenditures associated with providing for their family. Employees are advised to begin planning for their retirement as soon as they start working. They can only plan their investment and savings strategies, which will ensure their secure old age, and provide them a working knowledge of fundamental financial concepts.

Suggestions and Recommendations

Financial capability differs greatly according to age, which is indicated by the study. Organisations should therefore carry out financial literacy activities that fulfill the needs of individual age groups. Younger employees (especially aged 20-30 years) with a higher level of financial stress and low rate of saving behavior could need basic financial education on budgeting, saving habits, and debt management. Middle-aged and older employees

should get training on retirement planning, investment options, and financial resilience. The government agencies should work with cashew factory management to conduct a well-structured financial capability workshop in office place, which should be carried out once every quarter and should have modules on basic banks, insurance. A large part of the workforce, in particular older women, might be unfamiliar with digital platforms. Design mobile apps or helplines in vernacular language to clarify simple financial concepts, and expense-tracking information. Use peer financial mentoring, where the workers in higher capability cohorts informally guide younger workers. Cultivate a culture of worker saving by encouraging the worker to open recurring deposits or small savings schemes (such as PPF, Sukanya Samriddhi Yojana) through employer-employee collaboration, or by giving a small matching contribution or bonus. Promote salary-linked savings programmes, where a percentage of wages is low. The unions and cooperatives of the cashew workers must prepare modules on financial empowerment during their regular meetings and welfare programmes. Financial counselors or resource persons may be nominated at each zone to serve as local agencies on financial wellness. The workers must be sensitized to save towards their retirement benefits at a young stage of employment. The education can be based on compounding and long-term financial planning. Workshops should emphasize the presence of the emergency funds cash that will make people less dependent on costly borrowing in case of the financial crisis.

Conclusion

The study examines the inter-relationships of the age with, Financial issues and saving. The current study analysed the role of age in financial capability of cashew workers. A dynamic, life-stage-oriented approach to financial education and support is crucial, as evidenced by the correlation between age and financial capability. Policymakers, educators, and financial institutions may enable people to create educated assessments to improve their financial security, and contribute to better economic firmness by attending to the particular demands of each age group. Up until middle adulthood, income typically rises with age before declining. While older persons rely more on their collected riches, younger people frequently confront financial restraints. While financial capability increases with age and experience, cognitive ageing may cause it to stall or even diminish in later life. These differences can be addressed by customised educational programs. All ages are affected by cognitive biases that affect financial decisions, such as present bias or overconfidence. While older persons may get too risk apprehensive, younger adults may misjudge future demands. Financial capability is shaped by the state of the economy in early life. People who have gone through economic downturns, for instance, might start using more cautious financial methods. So there is an unavoidable relation between age and financial capability.

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Herding behaviour in the Indian stock market through Static and Dynamic Approaches: Evidence from the NSE-100

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Abstract

This study investigates herding behaviour in the Indian stock market. The study has collected 2,475 daily, 521 weekly, and 119 monthly closing prices for the Nifty 100 index and its constituent stocks. The data were collected from the Prowess IQ database, managed by the Centre for Monitoring the Indian Economy (CIME), covering the period from 2013 to 2023. This study used the CSAD model developed by Chang et al. (2000), which investigates herding behaviour based on the static and dynamic approaches of the Indian stock market. The static model used Ordinary Least Squares (OLS) regression for analysis. In contrast, the dynamic models utilised Markov regime-switching models, as introduced by Hamilton in 1989. These methodologies were applied to gain insights into the presence and nature of herding behaviour in the Indian stock market during the different regimes. Relying on the static approach, the investor's anti-herding behaviour was evident daily, weekly, and monthly. Moreover, the herding behaviour was found in the dynamic model in the daily dataset, but anti-herding behaviour was apparent in the weekly and monthly datasets. Comparing the results of the static and dynamic approaches, herding prevails during the regime change. From the practitioner's perspective, this study provides valuable insights for investors in the Indian Stock Market and policymakers regarding asset pricing, portfolio diversification, trading strategies and market stability. Many studies explore herding in the Indian stock market, but not specifically through both approaches. This study fills this literature gap by comprehensively examining the herding in the Indian Stock market through Static and Dynamic approaches.

Keywords: Stock Market, Herding Behaviour, CSAD, Markov-Regime Switching Model.

Introduction

Financial market participants have historically believed that investment selections are rational and sensible. It was assumed that reasonable investors would select a portfolio that offered the optimal combination of return and risk. Furthermore, it was believed that financial markets were efficient and could only provide participants with the expected profits. Academic research focused on these idealised assumptions until the global financial crisis, questioning these traditional theoretical principles. As a result, behavioural finance—a field emphasising the importance of behaviour, emotions, personality, and cognition in everyday decision-making—has dramatically changed economic analysis. Today's Researchers claim that there is no single, universal problem-solving approach. Therefore, an academic study must incorporate modern psychological principles to understand investment decision-making's dynamic and ever-evolving process (Suresh, 2024; Sattar et al., 2020). Several biases that taint investment decisions have been exposed by behavioural finance. These presumptions serve as general guidelines for resolving any difficult decision. Shiller (2000) even links these anomalies to the never-ending cycle of economic frictions. Biases include overconfidence, self-attribution, herding, anchoring, representativeness, and mental accounting, which are all captured in the literature on finance. Of all the preferences mentioned earlier, herd activity has been proven to be most disastrous for the stability and functioning of the financial markets (Javaira and Hassan, 2015; Bogdan et al., 2023; Choi & Yoon, 2020). Herd behaviour is frequently blamed for producing deceptive bubbles and inviting noise traders into the stock market to exploit mispricing and push assets from their true intrinsic worth (Kallinterakis et al., 2010; Costa et al., 2024; Mishra & Mishra, 2023; Bouri, 2021).

Numerous authors and researchers have employed the models to detect herding behaviour in various market conditions, including up and down markets, high or low volatility periods, and even during financial crises. Most research articles exploring the CSAD measure of herding have adopted constant coefficient models and utilised the Ordinary Least Squares (OLS) method. Babalos et al. (2015) argued that the parameter is constant in static models, and the conclusion can be misleading. The herding behaviour of the investor is not a continual phenomenon but rather a time-varying one. The study's primary purpose is to address the methodological gap in the Indian context while investigating herding behaviour. Most Indian studies have considered the OLS and the Quantile regression. In this study, the Markov regime-switching regression model was developed by Hamilton

(1989) and is used to capture the herding behaviour of investors in the Indian stock market. The Markov Switching or regime-switching model is instrumental when the underlying data exhibit structural changes over time, where the relationships between variables may vary across different states or regimes. In the Markov regime-switching regression model, the time series data is assumed to be governed by a hidden Markov process, where the system switches between different regimes according to a Markov chain. Each regime is associated with a different set of regression parameters, capturing the distinct relationships between the variables in that regime. The model allows for estimating probabilities associated with each regime, indicating the likelihood of the system being in a particular state at any given time. This will enable researchers to identify periods of stability and instability within the data and to understand how the relationships between variables change during different economic or market conditions.

Furthermore, the Indian stock market, an emerging market, has witnessed volatility in recent years due to global shocks (Vidya et al., 2022), domestic macroeconomic fluctuations, and policy reforms (Kashif et al., 2020), with increasing participation from retail investors and the growing influence of foreign institutional investors. Empirical studies on the Indian context have predicted that herding tendencies during bullish and bearish phases, where investors mimic the actions of others (Choi & Sias, 2009), lead to temporary asset mispricing and deviation from fundamentals (Alamsyah et al., 2023). Events such as the COVID-19 pandemic (Hu et al., 2022; Jabeen et al., 2022) and the Russia-Ukraine conflict (Singh & Debnath, 2024) have further intensified herding behaviour, as investors collectively shifted their positions to minimise perceived risks during market turbulence (Kyriazis, 2020). However, the above studies have been done based on the static approach. Here, the main question arises: Do the changes in regime or state lead to the herding behaviour of the investors in the stock market? To answer this question, the study's primary purpose is to investigate the herding behaviour based on the static and dynamic approaches.

The remainder of the study is organised as follows. The next section provides the literature review based on the previous studies. Section 3 describes the data and methodology. Section 4 analyses the results and discussions, and Section 5 summarises the findings of the study's conclusion.

Review of Literature

It poses a challenge to define herding behaviour in the financial world. It is hard to describe spurious actions and intentional herding in normal market behaviour (Devenow & Welch, 1996; Bogdan et al., 2022; Aharon, 2021). Spurious herding occurs when investors imitate others' decisions without necessarily sharing the same information. In contrast, intentional herding involves investors irrationally copying peers' decisions and disregarding their information. Two primary forms of herding behaviour are identified—rational and irrational. From an illogical point of view, Ahmad (2022), Bogdan et al. (2022), Christie and Huang (1995) characterise herding as individuals suppressing their beliefs and making investment decisions solely based on collective market actions, even if they disagree with the expected outcomes. Chang et al. (2000) describe herding as irrational market behaviour where investors abandon their prior beliefs to follow others unthinkingly. On the rational side, herding occurs when less experienced managers intentionally mimic senior investors, ignoring their private information because they believe others' decisions are more informed. This strategic herding allows them to uphold their reputation in the market (Gurung et al., 2024; Khan et al., 2024; Devenow & Welch, 1996). Herding, deeply rooted in behavioural finance, has been extensively explored in literature, with its origins attributed to Banerjee's seminal work in 1992. Banerjee's experiment revealed a pattern wherein successive decision-makers relied heavily on the information possessed by their predecessors (Arnott & Gao, 2021). This resulted in a cascading of information, leading individuals to follow the prevailing trend and neglect their signals. This behaviour resulted from widespread conformity driven by observational learning, effectively minimising tangible and financial costs (Welch, 1992). However, the detrimental cycle of information spillover is interrupted when there is a reduction in information asymmetry, and the cost of acquiring new strategic data becomes more favourable compared to the associated benefits. This phenomenon is technically termed the fragility of cascades (Bikhchandani et al., 1998).

While detecting herding behaviour, two approaches came forward from the extensive literature review. In the first approach, Lakonishok et al. (1992) conducted pioneering research on herding, investigating the impact of herding and positive feedback trading on stock price destabilisation. The study defined herding as the tendency to imitate the investment actions of fellow fund managers simultaneously, while positive feedback trading involves buying winning stocks and selling losing ones. The study also developed a model to assess herding by analysing a subset of market participants over time. Surprisingly, the study found no significant evidence of herding or positive feedback trading among pension fund managers, except for small stocks. In a related study, Scharfstein and Stein (1990) explored factors contributing to herd behaviour in money managers' investment decisions (Ahmad & Wu, 2022; Quaicoe & Eleke-Aboagye, 2021). The study created a model that distinguishes between competent managers who receive informative signals about investment value and biased (dumb)

managers who receive noise signals. The study has identified reputational concerns and the 'sharing-the-blame' effect as factors that could drive managers to herding behaviour.

The second approach, "Market-wide herding", focuses on the behaviour of all participants toward the market as a whole. Christie and Huang (1995) introduced the Cross-Sectional Standard Deviation (CSSD) as a tool to examine the US market. For their study, they analysed the daily closing prices of both the market and individual stocks. The CSSD measures the variation between each stock's return rate and the overall market return. Significantly, the effectiveness of the CSSD is limited to situations where investors exhibit identical behavioural trends. Chang et al. (2000) introduced the Cross-Sectional Absolute Deviation (CSAD) to study herding behaviour in South Korea, Taiwan, Japan, the US, and Hong Kong markets. The study revealed herding in South Korea and Taiwan, with partial indications of herding in Japan, while finding no support for herding behaviour in the US and Hong Kong markets. The study utilised the daily, weekly, and monthly market closing prices and individual stocks to conduct the analysis. The CSAD proved to be particularly effective in detecting even slight changes in the market and exhibited greater sensitivity in identifying instances of herding behaviour. Gębka and Wohar (2013) argue that when investors overemphasise their view or focus on views dominant among a subset of actors (who may herd jointly moving in and out of positions) excessively ignoring market information, it results in increased dispersion in returns across assets leading to adverse herding as the possible explanation of negative herding. Gębka and Wohar (2013) identify localised herding, excessive "flight to quality" during market stress (Favero and Giavazzi 2002; Kaminsky et al. 2004; Baur and Lucey 2009; Berger and Turtle 2011; Davis and Madura 2012), and overconfidence (Goodfellow et al. 2009). When a subset of investors synchronously moves into (moves out of) a subset of assets, the resulting increase (decrease) in prices leads to excessive dispersion in return across assets, creating localised herding. Second, during highly volatile or turbulent times, investors may shift their capital from risky positions to more secure ones due to irrational fears, leading to very high CSAD values above rational levels. Third, high return dispersion might result from investors' overconfidence during high market returns due to their perceived ability to pick stocks or timing skills rather than market conditions.

In the Indian stock market, Kumar et al. (2016) conducted a study to examine herding behaviour in the stock market using the CSAD model from 2008 to 2015. The study also involved analysing the daily closing prices of Nifty, which serves as the benchmark index of NSE, along with the thirty-six companies that form part of it. Despite investigating various levels of herding in the Indian stock market, the study yielded no evidence of herding behaviour, even during extreme market conditions. These findings suggest that participants in the Indian stock market tend to make independent investment decisions and do not engage in herd behaviour by imitating the investment actions of their fellow investors. Ganesh et al. (2016) used the CSAD model to analyse whether industry herding behaviour existed in the Nifty 50 index from 2005 to 2015, and the analysis revealed that industry herding behaviour has no overall impact on the Indian stock market. Ansari and Ansari (2020) examined herd behaviour among lottery stocks in the Indian stock market from 2000 to 2018, and herding behaviour was not evident despite the use of CSSD and CSAD.

Furthermore, it demonstrates adverse herding. Bharti and Kumar (2020) analysed the herd behaviour of FMCG sector stocks from January 2008 to December 2018 using CSAD and Quantile regression. The study found a lack of herd behaviour during market asymmetries, severe swings, the global financial crisis, and afterwards. Papade et al. (2021) investigate market-wide herding employing observations of the Nifty 50 and Nifty 100 from 2019 to 2022 in the Indian stock market. The study examines the herding behaviour in normal and extreme market conditions across five sectors. The analysis finds no evidence of herding in the five sectors. Madaan and Shrivastava (2022) explored herding behaviour at the sector level in the stock market. Following the global financial crisis, the CSSD and CSAD models were employed to detect herding in the equity market. The CSSD model showed no evidence of herding, whereas the CSAD model showed evidence of herding in select areas of the Indian stock market. Furthermore, herding was observed in the cement and service sectors regardless of market state, trade volume, or conditional volatility.

Using the dynamic model, Bohl et al. (2016) investigated the US stock Market using the Markov Regime Switching Model from 2001 to 2010 to detect herding behaviour. The study has proved that herding behaviour is a time-varying phenomenon and rejected the previous assumption that herding is a constant over time that does not change with the state of the economy. The study found evidence of herding behaviour in the US stock market. Akinsomi et al. (2018) researched real estate investment trusts (REITs) listed in the UK. The study used static and dynamic models to analyse data from June 2004 to April 2016. Surprisingly, while the regime-switching model provided strong evidence of herding behaviour within the low-volatility regime, the static herding model did not detect any herding in the REIT markets. The study's most significant finding was that the FTSE 100 Volatility Index (UK VIX) played a crucial role in the transition from anti-herding behaviour in the high-volatility regime to herding behaviour in the low-volatility regime. This indicates that market volatility, as

measured by the UK VIX, significantly impacted the prevalence of herding among investors in the UK-listed REITs during different market conditions.

Cakan et al. (2019) conducted a study focusing on the South African housing industry from 2004 to 2016 to explore the connection between economic policy uncertainty and herding behaviour in financial markets. Their research utilised both static and dynamic approaches to investigate this relationship. Interestingly, the static approach did not identify herding behaviour in the South African housing market. However, employing a two-regime Markov switching specification, the dynamic approach revealed evidence of herding only during the high volatility regime. This finding suggests that herd behaviour is primarily driven by increased market uncertainty. The study extended its analysis using quantile regressions to examine the link between policy uncertainty and herding behaviour. The results showed that higher quantiles of policy uncertainty were associated with a higher likelihood of being in the herding regime. This indicates a clear relationship between policy uncertainty and the occurrence of herding behaviour in the South African housing market. Fu and Lu (2020) examined the A-Chinese market using the CSSD and CSAD models from 1999 to 2016.

The herding was evident in volatile regimes as the Markov Regime Switching Model was employed in the study. Coskun et al. (2020) used the CSAD model and found that herding was not evident in cryptocurrency. The Ordinary Least Squares Regression, Generalised Autoregressive Conditional Heteroscedasticity (GARCH) and Time-Varying Markov-Switching were also used to analyse herding behaviour from 2013 to 2018. The anti-herding was evident during the study. Mand and Sifat (2021) investigated herding behaviour in Bursa Malaysia from 1995 to 2016 using CSSD and CSAD models. The result was inconsistent because herding was only detected in one of the models. In contrast, the two-state Markov Regime Switching model has shown that herding prevailed in the market. Furthermore, a deeper investigation was done through sector analysis and herding behaviour was found in the financial sector and large and mid-cap segments.

The literature review shows that herding behaviour may be detected through static and dynamic models. However, the results through dynamic models seem more robust as they allow for the detection of herding behaviour in different economic states. Furthermore, no previous studies have employed the dynamic model in the Indian market. The investigation will endeavour to address this methodological gap.

Research Question:

Based on the above literature review, the study found that herding behaviour in the Indian stock market has been measured through the static approach; however, recent studies pointed out that static and dynamic approaches can be employed to investigate the herding behaviour. Hence, a significant question arises: Does the state or regime change lead to herding behaviour in the Indian stock market?

Research Objectives:

To address the above research question, the study has formulated the research objective as:

To investigate the herding behaviour in the stock market using static and dynamic approaches.

Data and Materials

Data

The selection of the Nifty 100 for this study was based on its market capitalisation, which accounts for approximately 69% of the free-float market capitalisation of NSE-listed stocks. The Nifty 100 Index is the top 100 companies by market capitalisation from the Nifty 500. The dataset comprised 2,475 daily, 521 weekly, and 119 monthly closing prices for the Nifty 100 index and its constituent stocks. The data were collected from the Prowess IQ database, managed by the Centre for Monitoring the Indian Economy (CIME), covering the period from 2013 to 2023. The analysis, conducted using Stata 17 software, delved into market trends, stock performance, and various financial metrics over the specified timeframe. Although initially involving 100 companies, the dataset was refined to 81 companies after removing data with missing values, as indicated in the Appendix.

Econometric Models Estimation

Static Model

The study employed the cross-sectional absolute deviation (CSAD) model introduced by Chang et al. (2000), which centres on the relationship between CSAD and market return. Mathematically, the CSAD is expressed in the following manner:

$$CSAD_t = \frac{1}{N} \sum_{i=1}^N |R_{i,t} - R_{m,t}|$$

In this context, $R_{i,t}$ represents the unique return of stock 'i' at the time 't,' and $R_{m,t}$ represents the overall market return for the period 't.' The quantification of the individual stock return $R_{i,t}$ is delineated as follows:

$$R_{i,t} = \ln \left(\frac{P_{i,t}}{P_{i,t-1}} \right)$$

Here, $P_{i,t}$ denotes the closing price of stock 'i' at time 't,' while $P_{i,t-1}$ indicates the closing price of the same stock 'i' on the previous trading day. The determination of the market return is computed as follows:

$$R_{m,t} = \frac{\sum_{i=1}^N R_{i,t}}{N}$$

N represent the number of firms.

The rational asset pricing model proposes a linear connection between the Cross-Sectional Absolute Deviation (CSAD), which represents the dispersion of stock returns, and the market return. This association is grounded in the distinct responses exhibited by individual stocks in response to market fluctuations, reflecting diverse investor perspectives influenced by private information. However, during periods of market instability, a non-linear and inversely correlated pattern emerges when investors consistently adhere to specific patterns. This pattern either constrains the extent of variation among stock returns or amplifies it at a decreasing rate.

Expanding on Black's conditional Capital Asset Pricing Model (CAPM) framework introduced in 1972, Chang et al. (2000) developed a subsequent model to identify instances of herding behaviour within the market. This model goes beyond the traditional linear relationships and incorporates considerations of investor behaviour during market turbulence, providing insights into how herding tendencies may impact asset pricing dynamics.

$$CSAD_t = \alpha + \alpha_1 |R_{m,t}| + \alpha_2 R_{m,t}^2 + \varepsilon_t \dots \dots \dots \text{eqn (1)}$$

In the context provided, the variable $R_{m,t}$ denotes the prevailing market return, whereas $R_{m,t}^2$ pertains to the square of the market return. As expounded within the framework, herding tendencies manifest when the coefficient denoted as γ_2 assumes a negative value and concurrently demonstrates statistical significance. Conversely, an augmented market return aligns with an intensified dispersion among stock returns in scenarios where the absence of herding phenomena prevails.

Dynamic Model

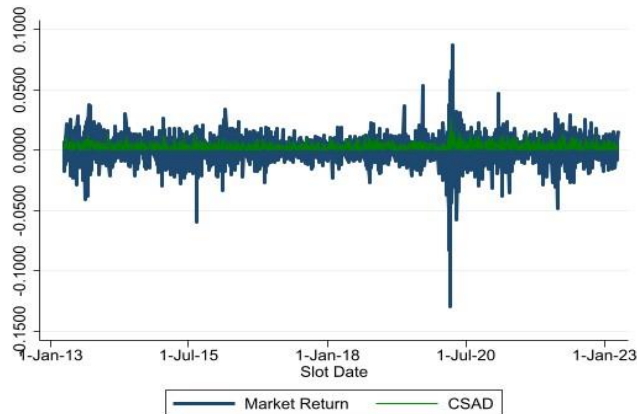
The assertion suggests that the static model presented in equation (1) may result in an inaccurate comprehension of herd behaviour, primarily because it assumes constant parameters over time, as highlighted by Balcilar et al. (2013) and Ngene et al. (2017). To address the above limitation, the study has adopted the Markov-switching model to investigate potential variations in herding behaviour across different market phases. This model is employed to estimate cross-sectional return dispersions within two states. The superiority of Markov-switching models over linear models stems from their ability to capture patterns beyond traditional stylised facts, which only non-linear models, as indicated by Babalos et al. (2015), can generate.

$$CSAD_t = \alpha_{0,St} + \alpha_{1,St} |R_{m,t}| + \alpha_{2,St} R_{m,t}^2 + \varepsilon_t \dots \dots \dots \text{eqn(2)}$$

Where $\varepsilon_t \sim \text{iid}(0, \sigma_{\varepsilon_t}^2)$ and St is a discrete regime variable taking values of $\{0,1,2\}$ and following a 3-State Markov process. Thus, the random variable St is defined as a 3-state first-order Markov chain. The specification is fulfilled by defining the transition probabilities of the Markov chain as $p_{ij} = P(St = i | St = j)$. Thus, p_{ij} is the probability of being in regime i at time $t+1$ given that the market was in regime j at time t , where i and j take values in $\{0,1\}$. The transition probabilities satisfy $\sum_{i=1}^3 p_{ij} = 1$.

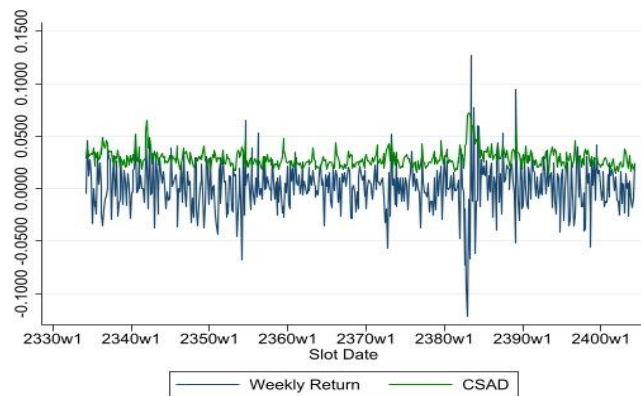
Results and Discussions

Two-way line plots between CSADs and Market Returns



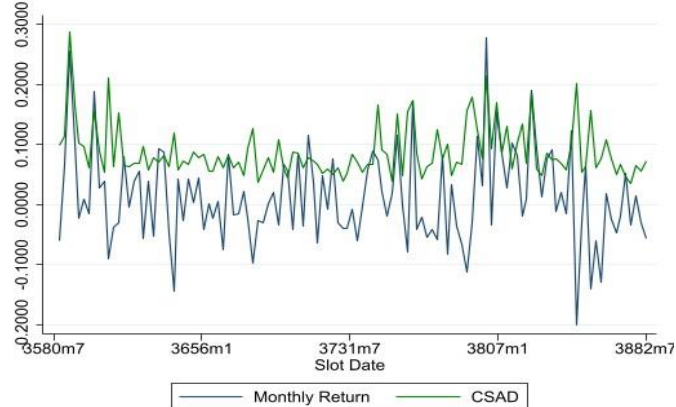
Source: Estimated by the Authors

Figure 1. The two-line plot of CSADd vs Daily Market Return.



Source: Estimated by the Authors

Figure 2. The two-line plot of CSADw vs Weekly Market Return.



Source: Estimated by the Authors

Figure 3. The two-line plot of CSADm vs Monthly Return.

Figures 1,2, and 3 represent the two-way line plot of the different CSADs and Market returns for the period. High CSAD values indicate significant deviations, signalling potential market turbulence, while low values suggest greater consistency and a more synchronised market environment. Interpreting these lines together helps assess market volatility and investor behaviour, with high CSAD values, downward market trends indicating increased divergence (possibility of the herding behaviour during time), and low CSAD values coupled with upward trends suggesting market stability (in this case, the possibility of the anti-herding behaviour).

Descriptive statistics

Table No.1: Descriptive Statistics

	CSAD _d	Daily Return	CSAD _w	Weekly Return	CSAD _m	Monthly Return
Observation	2,475	2,475	521	521	119	119
Mean	.003092	0.005087	.028671	.002451	.0876283	.0114781
Std. dev.	.0025644	.0108197	.0081694	.0228444	.0437075	.0763913
Min	8.00e-07	-.1298046	.0140595	-.1215194	.0356509	-.1995527
Max	0.267848	.0876321	.0722565	.1271803	.288022	.2790804
Skewness	-.9456106	1.736321	1.827535	-.165794	1.803196	.0058356
Kurtosis	18.12756	9.385839	8.777991	7.114037	6.629216	.6219643
Jarque-Bera test	5449***	2.4e+04***	1015***	369.8***	129.8***	16.82***

Source: Estimated by the Authors

Note: CSAD_d, CSAD_w and CSAD_m represent the Cross-Sectional Absolute deviation of the daily, weekly and monthly, respectively. *** <1 %, ** <5 % and * < 10 %.

Initially, the study analysed descriptive statistics for all variables under consideration. Table 1 presents a comprehensive overview of these statistics. The findings indicated positive mean values for all variables. Additionally, the study found that all variables exhibited leptokurtic characteristics except for monthly return, which displayed a platykurtic nature. Noteworthy patterns included positive skewness across all variables, with daily and monthly returns being the exceptions, showing negative skewness. The Jarque-Bera test was applied to evaluate the normality of the variables. The null hypothesis, suggesting normal distribution when the p-value is above 0.05, was not supported, as the p-values for all variables were statistically significant at the 1% level. Although the non-normality of variables could pose challenges for the ordinary least squares (OLS) method, the central limit theorem suggests that test statistics tend to conform to appropriate distributions even in the absence of normality (Yao et al., 2014; Ansari and Ansari, 2020). Moreover, the Central Limit Theorem (CLT) asserts that sample sizes equal to or exceeding 30 are adequate, ensuring that the sample distribution approximates normality. Given the ample sample size in this study, OLS is deemed suitable for analysis.

Table No.2: The outcome of the ADF test and the Perron test for stationarity and unit roots.

	ADF Test	Philips Perron Test	
	Z(t)	Z(t)	Z(rho)
CSAD _d	-42.362***	-42.372***	-1856.905***
Daily Return	-47.904***	-47.974***	-1872.914***
CSAD _w	-12.176***	-12.649***	-257.489***
Weekly Return	-22.063***	-22.066***	-506.385***
CSAD _m	-9.634***	-9.818***	-119.087***
Monthly Return	-10.417***	-10.535***	-129.207***

Source: Estimated by the Authors

Note: *** <1 %, ** <5 % and * < 10 %

The ADF and Philips-Perron tests determine and detect stationarity. Stationarity is a crucial concept in time series analysis, as it implies that the statistical properties of a time series, such as mean and variance, remain constant over time. In the context of the ADF test, the null hypothesis assumes the presence of a unit root in the time series data, indicating non-stationarity. Conversely, rejecting the null hypothesis suggests the absence of a unit root, indicating stationarity. The Philips-Perron test serves a similar purpose by examining unit roots in the time series data. It also helps identify the presence of a deterministic trend, which can affect the stationarity of the series. The outcomes of these tests are critical in time series analysis, as they guide researchers in determining whether differencing the data is necessary to achieve stationarity. Stationary time series data are essential for accurate modelling and forecasting in various fields, including economics, finance, and environmental science. Therefore, the ADF and Philips-Perron test results provide valuable insights into the characteristics of the analysed time series data. The Augmented Dickey-Fuller and Philips Perron tests were employed to check whether all variables are stationary and have a unit root. The assumptions of the Augmented Dickey-Fuller test state that if the p-value is significant at 1 %, then the null hypothesis is accepted or rejected. In Table 2, all variables are significant at 1 %. Philips Perron's test supported the results of the Augmented Dickey-Fuller test.

Static Results

Table No. 3: The outcome of the OLS regression is based on Equation 1.

Daily	Parameter	Co-efficient	Standard Error	t-Statistics	p-value
	α	.0024751(.0024751)	.0000804(.0000929)	30.80(26.65)	0.000(0.000)
	α_1	.0876984(.0876984)	.0103666(.0159343)	8.46(5.50)	0.000(0.000)
	α_2	-.3055468(-.30554)	.1692299(.3860583)	-1.81(-0.79)	0.071(0.429)
	Adjusted R-Square = 0.0506		Prob > F = 0.0000		
Weekly	Parameter	Co-efficient	Standard Error	t-Statistics	p-value
	α	.0252198(.0252198)	.0005731(.0005395)	44.00(46.75)	0.000(0.000)
	α_1	.1505029(.1505029)	.0408982(.0380048)	3.44(3.96)	0.001(0.000)
	α_2	1.687973(1.687973)	.4899922(.4062437)	3.68(4.16)	0.000(0.000)
	Adjusted R-Square = 0.2808		Prob > F = 0.0000		
Monthly	Parameter	Co-efficient	Standard Error	t-Statistics	p-value
	α	.0658588(.0658588)	.0059332(.0055542)	11.10(11.86)	0.000(0.000)
	α_1	.1600786(.1600786)	.14802(.1779946)	1.08(0.90)	0.282(0.370)
	α_2	2.10232(2.10232)	.6570289(.9462186)	3.20(2.22)	0.002(0.028)
	Adjusted R-Square = 0.5118		Prob > F = 0.0000		

Source: Author's Calculation

Note: The figures within the parentheses represent the regression results with Newey-West standard errors.

The rational asset pricing theories (CAPM) state that a linear relationship exists between the CSAD and the market return since individual securities react differently to the market return to replicate investors' beliefs based on their private information. However, Chang et al. (2000) stated that the herd behaviour of the investors reduces the dispersion among the stock returns or increases it at a decreasing rate. Hence, a negative and non-linear relationship exists between the CSAD and market return in the case of herd behaviour among the investors. Table 3 depicts the outcome regression results based on Equation 1. The study found the issue of heteroskedasticity and autocorrelation daily, weekly, and monthly. A robust test has been run to rectify the above problem, and the results are depicted within the table's parentheses. The coefficient of Rmt2 was positive but insignificant for the daily data series.

In contrast, the weekly and monthly data series were positively significant at 1 %. The study found adverse or anti-herding patterns in the weekly and monthly datasets. Gębka and Wohar (2013) argue that when investors overemphasise their views or focus on ideas dominant among the subset of actors (who may herd jointly moving in and out of positions), excessively ignoring market information, it results in increased dispersion in returns across assets, leading to adverse herding. When a subset of investors synchronously moves into (moves out of) a subset of assets, the resulting increase (decrease) in prices leads to excessive dispersion in return across assets, creating localised herding. The study aligns with the findings of Satish and Padmashree (2018), Kanojia et al. (2020), and Garg & Gulati (2013). However, it differs from the conclusions drawn by Banerjee and Padhan (2017), Shrotryia & Kalra (2020), and Kumar et al. (2016). According to Kanojia et al. (2020), the prevalence of herding behaviour in the Indian market can be attributed to the significant influence of institutional investors and the comparatively low involvement of individual investors in the market. Garg & Gulati (2013) argued that due to the regulatory reforms implemented in the Indian equity market and the substantial involvement of foreign institutional investors, there is a perception that investors' behaviour has become more rational, and rational pricing models have been followed in Indian stock markets. It may also highlight the weakness of the static model, which fails to capture the potentially dynamic nature of the herding behaviour, thus providing further support for a model that allows testing of herding under different market regimes in which herding behaviour

May or may not exist.

Dynamic Result

Table No.4: The outcome of the Markov-Regime Switching Model based on Equation 2.

Daily	Parameter	Co-efficient	Standard Error	t-Statistics	p-value
State1	α	.0021587***	.000075	28.80	0.000
	α_1	.0512831***	.0092755	5.53	0.000
	α_2	-.2900586**	.1338724	-2.17	0.030
State 2	α	.0067807***	.0002829	23.97	0.000
	α_1	.1368838***	.031106	4.40	0.000
	α_2	.2590481	.5465748	0.47	0.636
AIC	HQIC	SBIC	sigma	P11	P21
-9.3207	-9.3130	-9.2996	.0018147	.9035874	.8091579
Weekly	Parameter	Co-efficient	Standard Error	t-Statistics	p-value
State1	α	.0249436***	.0005157	48.37	0.000
	α_1	.1206369**	.0420127	20.87	0.004
	α_2	1.721285**	.6486998	2.65	0.008
State 2	α	.0473239***	.0026441	17.90	0.000
	α_1	.0521099	.1309988	0.40	0.691
	α_2	.8847416	1.056116	0.84	0.402
AIC	HQIC	SBIC	sigma	P11	P21
-7.3270	-7.2982	-7.2535	.0057783	.9917019	.1889679
Monthly	Parameter	Co-efficient	Standard Error	t-Statistics	p-value
State1	α	.0641418***	.0045906	13.97	0.000
	α_1	.0241097***	.1283106	0.19	0.000
	α_2	2.357183	.5248997	4.49	0.851
State 2	α	.1517173***	.0211379	7.18	0.000
	α_1	-.1936934	.4264409	-0.45	0.650
	α_2	2.682086***	1.439701	1.86	0.000
AIC	HQIC	SBIC	sigma	P11	P21
-4.2585	-4.1732	-4.0483	.02005	.8971198	.80553358

Source: Author's Calculation

Note: * <1 %, ** <5 % and * <10 %**

In the context of the static model, herding behaviour was not evident; instead, there was a prevalence of anti-herding or adverse herding during the study period. Building upon the study by Mand & Sifat (2021) and Cakan et al. (2019), the study employed a two-state Markov Regime Switching model. Table 4 reveals that the coefficient was negatively significant at the 1% level in state 2 for the daily dataset. It suggests that investors tend to imitate the actions of other investors, and such behaviour varies depending on the state or regime. Contrary to the prior assumption of herding as a constant phenomenon that does not change with the state of the economy, Bohl et al. (2016) argued that herding behaviour is a time-varying phenomenon.

Similarly, in the studies by Mand & Sifat (2021) and Cakan et al. (2019), herding was observed with changes in state or regime, contradicting the analyses of Kanojia et al. (2020) and Garg & Gulati (2013). Arjoon and Bharatnagar (2017) suggested that a time-varying analysis reveals the evolving nature of herding, indicating that an approach based on constant coefficients can only provide partial information about such behaviour. Given the dynamic and unpredictable nature of investors' behaviours, these expected results are influenced by changing sentiments, preferences, biases, and economic fundamentals. In this context, according to (Economou et al., 2011; Holmes et al., 2013; Guney et al., 2016; and Youssef & Mokni, 2018), the presence of herding behaviour can manifest itself according to the market volatility state. Indeed, during low volatility periods, investors herd based on the assumption that it is easy for an investor to mimic their peers during these periods.

In the weekly dataset, the coefficient is positively significant at the 10% level in state 1, indicating the presence of anti-herding behaviour. Furthermore, anti-herding was evident in the monthly dataset as the coefficient was positively significant at 1% and 10 % in States 1 and 2, respectively. Tan et al. (2008) suggested that herding behaviour is more prevalent in the high-frequency datasets. The study is in line with Tan et al. (2008), Youssef & Mokni (2018), and Ansari and Ansari (2020). The transitional probabilities from State 1 to State 2 suggest that the low-volatility regime (i.e. regime 1) follows the low-volatility regime, and the high-volatility regime (i.e.

regime 2) follows the high-volatility regime. In other words, the market is likelier to follow this risky and high-volatility regime during extreme market returns and large price movements. On the other hand, in high volatility regimes, anti-herding behaviour occurs in the market.

Conclusions

Understanding the behavioural aspects of investor decision-making can help market participants, financial advisors, and policymakers develop strategies to mitigate the impact of cognitive biases and improve overall financial decision outcomes. Regulators may be grappling with integrating behavioural finance insights into regulations. The rise of robo-advisors and algorithmic trading raises ethical questions about how these technologies account for and respond to behavioural biases. The primary objective of this study was to examine herding behaviour within the Indian stock market, spanning the period from 2013 to 2023. The study gathered data on the daily, weekly, and monthly closing prices of the Nifty 100 index and its component stocks. The dataset was sourced from the Prowess IQ database, managed by the Centre for Monitoring the Indian Economy (CMIE). The study utilised the Cross-Sectional Absolute Deviation (CSAD) model, developed by Chang et al. (2000), to identify herding behaviour. Two distinct approaches were employed to explore herding behaviour: static and dynamic models. The static model used Ordinary Least Squares (OLS) regression for analysis. In contrast, the dynamic models utilised Markov regime-switching models, as introduced by Hamilton in 1989. These methodologies were applied to gain insights into the presence and nature of herding behaviour in the Indian stock market during the different regimes.

The study's significant findings reveal that the herding pattern does not prevail in the static model, whereas the anti-herding pattern was exhibited. The herding and anti-herding patterns are typically related to behaviours in financial markets or decision-making processes where individuals tend to follow the crowd (herding) or intentionally go against the crowd (anti-herding). In a herding pattern, individuals tend to mimic the actions or decisions of others, leading to collective behaviour that follows a trend. This behaviour may be driven by a desire for conformity, fear of missing out (FOMO), or a belief that others possess valuable information. On the other hand, an anti-herding pattern involves individuals intentionally making decisions that go against the prevailing trend. This behaviour may be motivated by contrarian strategies, where individuals believe the crowd is wrong and purposely choose to do the opposite. Psychological factors, such as risk aversion or a desire for independence, could contribute to an anti-herding pattern in the static model. The dynamic model approach yields results contradicting the static model. The dynamic model results suggested that herding was evident in daily data, whereas the anti-herding pattern was evident in weekly and monthly data.

Policymakers may be considering strategies to manage the impact of herding on market stability and investor outcomes. Policymakers might explore ways to improve communication and disclosure practices to account for behavioural biases. This includes designing disclosures more likely to be understood and acted upon by investors. Policymakers and regulators may be examining how to balance the need for short-term economic stability with encouraging long-term decision-making by investors. Behavioural biases often lead to a focus on short-term gains or losses. Unforeseen global events, such as financial crises or pandemics, can significantly influence investor behaviour. Policymakers may need to adapt their strategies to address the specific behavioural challenges such events pose.

Limitations and future scope

In this study, investor behaviour regarding the extreme market conditions has not been measured, whereas previous studies have measured it. Moreover, the study has not considered bullish or bearish market conditions. The study only considered the NSE-100 rather than the whole NSE or BSE market. The study did not consider the factors that might influence investors to herd. For future studies, various economic variables can be considered as to how such variables lead investors to herd. Furthermore, the intensity of the herding can be measured using the study of Hwang and Solomon (2004), as the herding behaviour prevailed during the study.

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Evaluating Women's Economic Empowerment through Entrepreneurship Schemes in Goa: A Beneficiary Perspective

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Abstract

Increased attention is being given to women's empowerment in the policy discourse, especially through the entrepreneurship-focused initiatives of the government. In Goa, schemes such as Chief Minister's Rojgar Yojana and the Prime Minister's Employment Generation Programme have been launched for the encouragement and upliftment of women through the establishment of their own ventures. These programmes aim at promoting self-reliance, income generation and overall empowerment of women. The study aims to evaluate the impact of entrepreneurship schemes on the economic empowerment of women beneficiaries and subsequently examine the effect of economic empowerment on overall empowerment of women. The research adopted an empirical approach, collecting primary data through a structured questionnaire for a sample size of 300 women beneficiaries. The data was analysed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Findings revealed that there exists a significant relationship between economic empowerment and overall empowerment of women, confirming that improvements in financial independence, control over resources and the ability to make economic decisions directly enhance women's empowerment. However, results also implied that although the aim of these schemes was to encourage the beneficiaries, there could be possible obstacles in accessing these schemes, such as improper implementation, restricted access to vital resources or unfulfilled expectations. The study highlights the importance of support mechanisms, the addressing of structural changes within these initiatives and suggests a robust ecosystem, including follow-up support, easier access to credit was essential to fully achieve the potential of entrepreneurship as a tool for the empowerment of women in Goa.

Keywords: Economic Empowerment, Entrepreneurship Schemes, Family Expenses, Financial Independence, Investments, Women Empowerment

Introduction

Economic empowerment of women plays a crucial role while trying to achieve the overall empowerment of women. Holistic women empowerment provides the means to become financially independent, improvement in social status and also promotes active participation in the decision-making process in the family and in the society (Purnamawati & Utama, 2019; Duflo, 2012).

Economic empowerment is pivotal for achieving holistic women empowerment, as it helps to provide the means for being financially independent, improving the social status and security and also in actively participating in the decision-making processes in their individual families and in the society (Hill, 2003; Malhotra & Schuler, 2005). A transformation is experienced by the women in their economic position and also an increase in their confidence, self-worth and ability to influence the environment (Kabeer, 1999). Economic empowerment not only implies a financial upliftment but also a source of achieving broader gender equality and social justice (Simanjorang et.al, 2023; Bradshaw, et. al., 2017).

Empowerment of women, especially economic empowerment, has been in attention in policies of the government, and it has been observed that one of the major sources or strategies to achieve this is through entrepreneurship. Women can generate their own income, become independent, set themselves free from the traditional dependencies and also contribute towards economic development (Sulaiman, et. al., 2019). Government support through their policies and programmes can help augment this empowerment. The government has, time and again, introduced several entrepreneurship schemes targeted at women, which would make setting up their own ventures a less challenging task through the provision of capital, training programmes and offering support in the market (Minniti & Naude, 2010).

There have been several schemes designed and implemented for the promotion of entrepreneurship among women by the Economic Development Corporation, Goa and the State Khadi and Village Industries Board, Goa, such as the Chief Minister's Rojgar Yojana and the Prime Minister's Employment Generation Programme, which play a pivotal role in the fostering of entrepreneurship among women. The main goal of such schemes is to

reduce the gender gap and create equality by providing the means to set up ventures through financial support, skill enhancement and institutional support to aspiring women entrepreneurs. It is evident that such well-targeted involvements significantly augment women's financial freedom, contribute to household income and reassure investments in productive activities, thereby achieving enhanced empowerment (Cheston & Kuhn, 2002).

A strong foundation laid by the combination of economic resources and the supportive policies of the government empower women beyond the economic domain, thus allowing them gain voice, agency and autonomy in all areas of life. Considering the importance of entrepreneurship schemes in the economic empowerment of women in Goa, the study aims to explore by assessing the way in which the government initiatives allow the women beneficiaries to become financially independent, create a surge in their savings, create their investments, and contribute to their family expenses.

Literature Review and Hypotheses Formulation

Literature Review

The association between economic empowerment and overall empowerment of women is multifaceted, with substantial implications for the development of society. Economic empowerment of women boosts their individual capabilities along with their contribution to larger economic growth and social equity. Kaur (2012) discussed the interrelation between women empowerment and economic development and emphasized that investment in gender equality leads to faster economic growth, brings down poverty levels and improves social outcomes. Ramya & Deepak (2024) also stated that economic empowerment of women was desirable for gender parity and progress. Abdurrohim (2023) highlights the importance of participation of women in MSME's for economic development. It was found that empowerment contributes to economic growth and human capital development. Policies must include support for entrepreneurship, education facilities and proper gender laws in order to create an environment conducive to entrepreneurship (Bobek, et. al. 2023). Obasi & Uduji (2024) suggested that rural women would participate in traditional industries and build livelihoods and raise their economic status if they were provided access to resources and opportunities on par with their urban counterparts. Islam & Ghosh (2024) asserted that women's empowerment was vital for global development and economic growth. Khushwah et. al (2021) in their study examined the role of entrepreneurship funding in women empowerment in India and found that there is a noteworthy alteration in the empowerment levels of women beneficiaries of entrepreneurship schemes. However, they also pointed out that women faced numerous challenges on the personal and professional front and that economic empowerment would not always directly lead to women empowerment. Ali, et. al. (2024) also stated the positive outcomes of greater decision-making power, increased control over finances, boosted self-confidence, expanded networks and overall societal empowerment through women-led tourism enterprises. While highlighting the internal and external constraints faced by women entrepreneurs, the study also emphasised the need for immediate policy interventions to support women entrepreneurship in the region for their empowerment. Entrepreneurs are important catalysts of economic growth and productivity (Ahmad & Hoffman, 2007; Murniati et. al., 2021), especially in developing countries (Lowrance et al., 2019; Chamlou, 2008).

From the literature review, it is understood that economic empowerment leads to the empowerment of women, and it is vital for the overall economic growth and development. One of the key ways of accomplishing this is through entrepreneurship. Mamo et. al. (2021) in their study have stressed the need for capacity-building programmes for women entrepreneurs and their socio-economic benefits. Besides promoting economic development, women entrepreneurship would also be a driver for institutional and societal change (Alkhaled & Berglund, 2018). It has also been emphasized that women can be freed from poverty and their standard of living can be improved through the provision of finance (Morduch, 1999; Khandker, 2005; Li, et. al., 2011) and also through the promotion of entrepreneurial activities (Bruton et al., 2013). Earning through entrepreneurial activities or self-employment have gained popularity as a source of livelihood for women in developing countries (Rahman & Khandker, 1994; Adom & Anambane, 2019).

However, dearth of affordable credit, less capital, unavailability of small loans and collateral requirements, prevents the growth of small enterprises (Mehra, 1997; Singh & Kaur, 2021). The government schemes for entrepreneurship help to reduce poverty among women by providing them with the necessary finance for starting their own ventures and promoting women empowerment through entrepreneurship (Najeeb et al., 2020, Datta & Sahu, 2022).

Despite this fact, there were limited studies or no studies found on the implementation and impact of government-backed schemes for entrepreneurship especially in the State of Goa. Identifying this as a research gap, the main research questions (RQs) arrived at were:

RQ1: Do the entrepreneurship schemes implemented in the State of Goa help the women beneficiaries to become economically empowered?

RQ2: Does economic empowerment lead to women empowerment in Goa?

To address the research questions, the objectives of the study were framed as follows:

To assess the impact of schemes for entrepreneurship on the economic empowerment of women beneficiaries.

To assess the impact of economic empowerment on women empowerment.

Hypotheses Formulation

On the basis of this background the hypotheses have been formulated as under:

Schemes for Entrepreneurship -> Economic Empowerment

Economic empowerment of women is a transformative process that helps women to make and act on decisions, allowing them to achieve meaningful results from economic activities and effectively utilize resources (Bill & Gates, 2009). Entrepreneurship helps to generate employment, develop economic independence, personal and social capabilities among women (Sharma, et.al., 2012; Bruton et al., 2013).

The hypothesis proposed is as under:

H1: There exists an impact of schemes for entrepreneurship on economic empowerment of women beneficiaries.

Economic Empowerment->Women Empowerment:

Developmental policies and programmes lead to enhanced economic status of women thereby leading to their growth. Economic empowerment of women has been fundamental to the process of achieving overall women empowerment (Mehra,1997). However, it is a need to establish whether the schemes of the government play a role in fostering economic independence among the beneficiaries, such that they become empowered. Hence, the proposed hypothesis is as under:

H2: There exists an impact of economic empowerment on women empowerment.

Dimensions of Economic Empowerment

Economic empowerment of the women beneficiaries in the study is measured with the help of financial independence (FD), family expenses (FE) and investments (INV).

Financial Independence:

The concept of women's financial independence revolves around women having the power to manage their own financial resources and make decisions without depending on others. Expanding access to finance to low-income individuals can have a sizeable positive effect on economic activity (Bruhn & Love, 2014; Gupta & Chauhan, 2024).

Family Expenses:

Family expenses for women encompass the costs incurred in managing daily life, pursuing education, sustaining a career, bearing one's own marriage expenses and supporting families. A greater access to financial resources contributes to I mproves economic outcomes for women (Adera & Abdisa, 2023; Swamy, 2014).

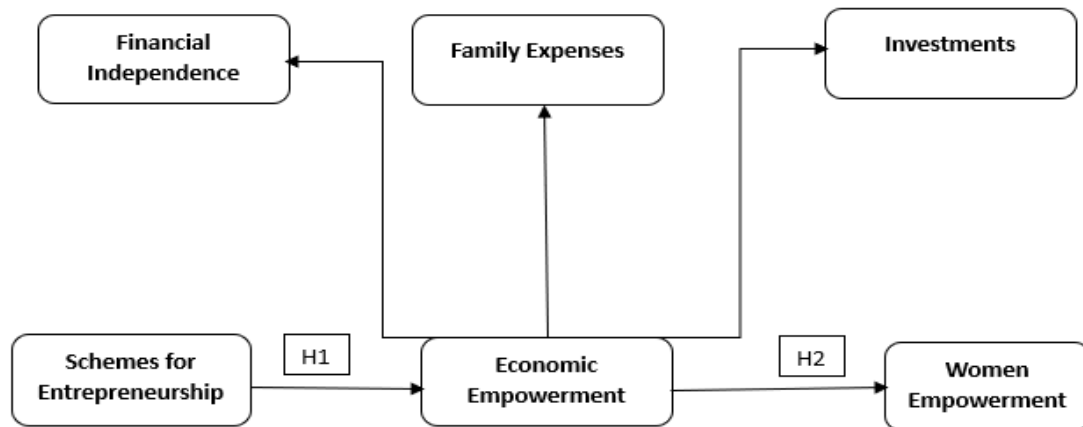
Investments:

The access to individual private savings accounts empowers women to make financial decisions, purchase durable goods and also reinforce their negotiating power within their household (Dupas & Robinson, 2013; Gupta & Roy 2023).

Conceptual Model

Figure 1 depicts the conceptual model for the study, which includes the constructs of schemes for entrepreneurship, economic empowerment, financial independence, family expenses, investments and women empowerment. Economic Empowerment is a second-order construct measured with the help of three independent constructs, namely, financial independence, family expenses and investments. Women empowerment is a dependent construct on economic empowerment. Schemes for entrepreneurship is an independent construct in the model.

Figure 1: Conceptual Model



Source: Author's Compilation
. Research Methodology

Sample Design

The current study has adopted an empirical data collection approach and has employed a positivist and logical method. The study has adopted the survey method for the collection of data. The sample is taken from the target population of women beneficiaries of schemes selected for the purpose of the study namely; Chief Minister's Rojgar Yojana and the Prime Minister's Employment Generation Programme across the two districts in Goa. The data was obtained from official records maintained by the implementing agencies, which included lists of approved and active beneficiaries.

Sample Size

A sample size of 300 women beneficiaries was taken into consideration as a representative of the population of women beneficiaries of the two schemes; Chief Minister's Rojgar Yojana and the Prime Minister's Employment Generation Programme.

Sampling Method

The sample was collected using probability and non-probability sampling methods namely, stratified sampling, purposive and snowball sampling methods.

Sampling Procedure

The women beneficiaries were first identified and contacted through the panchayats and self-help groups from North and South Goa. The beneficiaries were identified using a random sampling method from the database provided by the implementing government departments. A structured questionnaire was personally administered to the identified women beneficiaries. Their detailed responses were noted. A further list of sample women beneficiaries was drawn using snowball sampling method through the contacts of beneficiaries identified.

Questionnaire Design

The data was collected through a questionnaire. The questionnaire consisted of four constructs with 17 items. The measurement scales for the constructs were adapted from previously validated scales and tailored for this study. A 5-point Likert scale was adopted to analyse the respondents' perceptions regarding each factor, with 1 indicating 'strongly disagree' and 5 indicating 'strongly agree'. 350 questionnaires were administered however, only 300 insightful responses were obtained, arriving at a response rate of 85.71 percent. The study deals with measuring economic empowerment (dependent construct) through the independent constructs; financial independence, family expenses and investments.

Statistical Technique Used

The analysis was conducted using partial least squares structural equation modeling using Smart PLS 4.0 software.

Analysis and Results

Table 1 provides comprehensive information about the demographic characteristics of the respondents. It was observed that 51.67 percent of the beneficiaries were from North Goa, and 48.33 percent of them were from the South District. The majority of women beneficiaries belonged to the age group of 18-40 years (40.00 per cent),

and 60 per cent of them were married. 51.67 per cent of them lived in areas under the jurisdiction of the Panchayat.

Table No.1: Demographic Characteristics of Women Beneficiaries (n=300)

Variable	Classification	Frequency	Percentage
District	North	155	51.67
	South	145	48.33
Age Group	18 to 40 years	120	40.00
	41 to 60 years	95	31.67
	61 years and above	85	28.33
Marital Status	Unmarried	120	40.00
	Married	180	60.00
Residential Area	Municipality	145	48.33
	Panchayat	155	51.67

Source: Primary Data

Measurement Model

The Partial Least Squares structural equation modelling (PLS-SEM) and Smart PLS 4 techniques were made use of for the analysis of the data collected for the study. PLS-SEM is largely employed in management research due to its ability to generate reliable results. The discriminant and convergent validity of the outer model were first tested followed by evaluation of the hypotheses using the inner model.

Table No. 2: Outer Validity Measurement and Multicollinearity Detection

Constructs	Variable Code	Factor Loading	Variation Inflation Factor (VIF)	Cronbach's Alpha (CA)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Economic Empowerment	EE			0.940	0.941	0.509
Family Expenses	FE1	0.781	2.077	0.905	0.906	0.726
	FE2	0.885	3.376			
	FE3	0.875	3.413			
	FE4	0.876	3.596			
	FE5	0.838	2.647			
Financial Independence	FD1	0.828	2.968	0.922	0.922	0.682
	FD2	0.801	2.836			
	FD3	0.819	2.897			
	FD4	0.840	3.046			
	FD5	0.822	2.913			
	FD6	0.835	2.961			
	FD7	0.834	2.755			
Investments	INV1	0.851	2.759	0.876	0.883	0.670
	INV2	0.844	2.654			
	INV3	0.852	2.597			
	INV4	0.826	2.434			
	INV5	0.711	1.757			
Women Empowerment	WE1	0.773	1.627	0.889	0.891	0.753
	WE2	0.906	3.133			
	WE3	0.888	3.016			
	WE4	0.898	3.408			

Source: Primary Data

Table 2 depicts the outer model of SEM PLS which assesses the reliability and validity of the measurement indicators that represent the latent constructs. It ensures that the observed variables precisely reflect the theoretical concepts before analysing relationships in the structural model. The key aspects that were evaluated in the outer model measurements were; internal consistency reliability, discriminant validity and convergent validity.

The internal consistency reliability comprising of the CA, CR, and AVE all showed high internal consistency and reliability with CA and CR values surpassing the recommended threshold of 0.70. Specifically, the sub-dimensions of economic empowerment, namely family expenses, financial independence and investments, showed CA values of 0.905, 0.922, and 0.876, respectively, while their CR values ranged from 0.883 to 0.922. The AVE values for these sub-constructs were also above the suitable benchmark of 0.50, confirming satisfactory convergent validity (Hair et. al., 2016). The second-order construct, economic empowerment, had a CA of 0.940, CR of 0.941, and an AVE of 0.509. While the AVE is marginally above the threshold, it remains acceptable, indicating that the construct covers a satisfactory proportion of variance from its indicators. Women empowerment, measured as a separate construct, also confirmed both reliability and validity.

VIF values were examined to assess multicollinearity. All indicators reported VIF values well below the commonly accepted threshold of 5, ranging between 1.757 and 3.596, indicating the absence of significant multicollinearity among indicators. The measurement model thus exhibited satisfactory levels of reliability, convergent validity, and absence of multicollinearity, thereby confirming the suitability of the constructs for subsequent structural model analysis.

Table No. 3: Fornell-Larcker Criterion (Discriminant Validity)

	Economic Empowerment	Family Expenses	Financial Independence	Investments	Women Empowerment
Economic Empowerment	0.869				
Family Expenses	0.753	0.852			
Financial Independence	0.837	0.533	0.826		
Investments	0.867	0.638	0.647	0.818	
Women Empowerment	0.813	0.686	0.515	0.604	0.868

Source: Primary Data

Table 3 shows the discriminant validity of the constructs. According to Fornell-Larcker, a construct should share a higher variance with its own indicators than with those of other constructs. This is confirmed when the square root of the AVE for each construct (shown on the diagonal) is greater than the corresponding inter-construct correlations (off-diagonal values) in the same row and column (Fornell & Larcker, 1981). The results presented in the matrix support acceptable discriminant validity for most constructs. The diagonal value of each construct is greater than its correlations with other constructs, signifying that the constructs are more strongly related to their own measures than to those of other constructs.

Table No. 4: Heterotrait-Monotrait Ratio Matrix (HTMT)

	Economic Empowerment	Family Expenses	Financial Independence	Investments	Women Empowerment
Economic Empowerment					
Family Expenses	0.847				
Financial Independence	0.647	0.582			
Investments	0.756	0.709	0.719		
Women Empowerment	0.769	1.101	0.568	0.679	

Source: Primary Data

As per Table 4, the discriminant validity of the constructs was assessed using the HTMT ratio of correlations, which is considered to be a more stringent and reliable measure compared to traditional criteria such as the Fornell-Larcker criterion. According to Henseler et al. (2015), HTMT values below the threshold of 0.90 (or 0.85 for a stricter criterion) show that the constructs are empirically different from each other, thereby confirming discriminant validity. The HTMT values among all the construct pairs are well below the threshold, indicating acceptable discriminant validity.

Table No.5: Cross Loadings/Outer Loadings

Indicators	Economic Empowerment	Family Expenses	Financial Independence	Investments	Women Empowerment
FD1	0.744	0.477	0.828	0.567	0.469
FD2	0.705	0.430	0.801	0.538	0.420
FD3	0.727	0.453	0.819	0.555	0.446
FD4	0.696	0.406	0.840	0.493	0.382
FD5	0.705	0.443	0.822	0.501	0.428
FD6	0.719	0.444	0.835	0.525	0.427
FD7	0.721	0.424	0.834	0.557	0.402
FE1	0.684	0.781	0.471	0.516	0.773
FE2	0.741	0.885	0.476	0.558	0.906
FE3	0.703	0.875	0.427	0.521	0.888
FE4	0.690	0.876	0.411	0.499	0.898
FE5	0.742	0.838	0.481	0.617	0.736
INV1	0.767	0.572	0.590	0.851	0.540
INV2	0.743	0.583	0.533	0.844	0.544
INV3	0.731	0.594	0.489	0.852	0.570
INV4	0.705	0.467	0.563	0.826	0.440
INV5	0.587	0.368	0.469	0.711	0.356
WE1	0.684	0.781	0.471	0.516	0.773
WE2	0.741	0.885	0.476	0.558	0.906
WE3	0.703	0.875	0.427	0.521	0.888
WE4	0.690	0.876	0.411	0.499	0.898

Source: Primary Data

The factor loadings shown in table 5, across constructs show a strong convergent validity, as each indicator loads highest on its intended construct compared to others. High internal consistency is demonstrated by the constructs of financial independence, family expenses and investments with loadings mostly above 0.7 on their respective constructs. Overall, the measurement model was found to be statistically sound indicating reliable and valid indicators for the assessment of economic and women empowerment.

Structural Model and Hypotheses Testing

Table No. 6: Hypotheses Testing

Hypotheses	Path Coefficient (β)	t-value	p-value	Result
Schemes for Entrepreneurship -> Economic Empowerment	-1.534	7.101	0.000	Supported
Economic Empowerment -> Women Empowerment	0.813	36.483	0.000	Supported

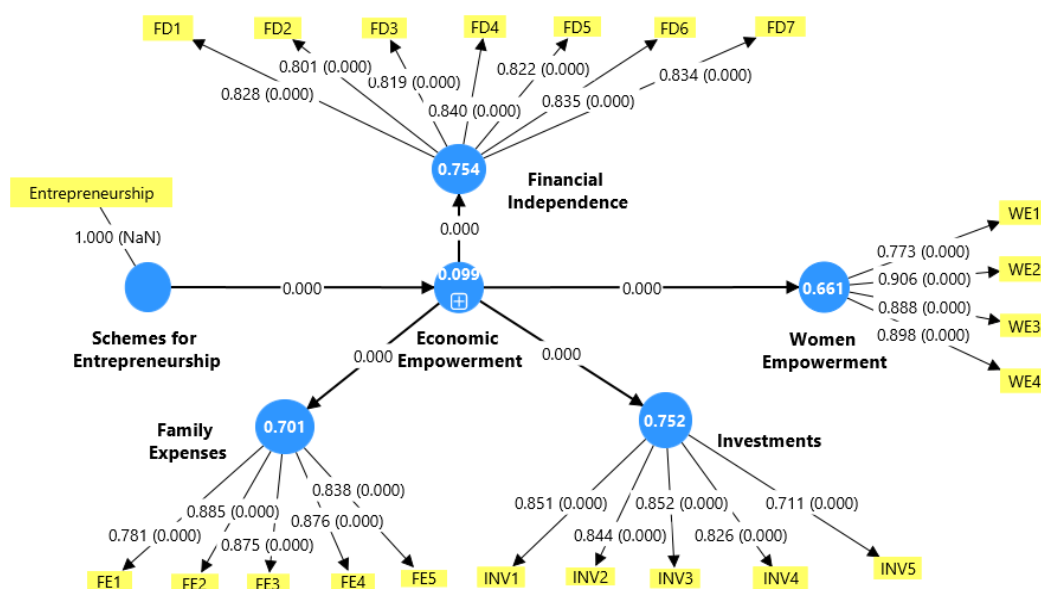
Source: Primary Data

Measurement of the structural model through path coefficients (β), t-values and p-values to test the hypotheses is shown in table 6. A hypothesis was reported as supported if the path coefficient was statistically significant with a p-value of less than 0.05 and the t-value was greater than 1.96 (Hair et.al., 2016).

The hypothesis that schemes for entrepreneurship have a significant impact on economic empowerment was accepted; however, there was a negative but statistically significant relationship ($\beta = -1.534$, $t = 7.101$, $p < 0.001$). This pointed out that women beneficiaries of entrepreneurship schemes reported a lower sense of economic empowerment. This could have been the result of implementation difficulties, limited access to the benefits of the schemes or their unfulfilled expectations, potentially ignoring the intended impact of the schemes. The inverse relationship between entrepreneurship schemes and economic empowerment highlights the need for reviewing policies and suggests the need for programme improvement to ensure that these schemes provide effective support towards the economic advancement of women beneficiaries.

The hypothesis that economic empowerment has a significant impact on women empowerment was supported. The direct path from economic empowerment to women empowerment is positive and also significant ($\beta = 0.813$, $t = 36.483$, $p < 0.001$), which is a sign of improvements in economic factors such as income, expenses, and investments that significantly contribute to the empowerment of women at a broader level.

Figure 2: PLS-SEM Analysis



Source: Primary Data

Conclusion

The study emphasises the economic empowerment of women beneficiaries of the entrepreneurship schemes implemented in the State of Goa, and thereafter, the impact of economic empowerment on the overall empowerment of women. The study concludes that while the entrepreneurship schemes have the intent of empowering the women beneficiaries economically, their actual impact reveals a multifaceted relationship. It is observed that economic empowerment positively influences overall women empowerment. Economic empowerment was measured with the help of constructs of financial independence, family expenses and investments, which showed a positive transformation.

However, the direct effect of entrepreneurship schemes on economic empowerment was found to be unexpectedly negative, indicating some challenges in availing these schemes. It could be interpreted that the beneficiaries may face challenges such as difficulty in accessing the schemes, gaps in implementation or unfulfilled expectations.

The findings emphasize the pivotal role of economic factors in promoting women empowerment while also highlighting the need for a more effective and supportive ecosystem surrounding the entrepreneurship initiatives. There is a greater need for a more supportive policy environment, improved execution of the schemes and higher awareness about these schemes among the target population in order to ensure tangible empowerment outcomes for women beneficiaries.

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Branding Beyond Boundaries: The Effectiveness of Online Advertising in Shaping FMCG Preferences in Kerala

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Abstract

The development of cheap, high-speed internet has transformed the digital marketing arena in India, and it has contributed significantly to the boost in online advertisement reach and effectiveness. Online tools have become essential vehicles for brand interaction, particularly in the Fast-Moving Consumer Goods (FMCG) industry. This research examines the contribution of online advertising towards influencing consumer perception and brand-related factors such as attractiveness, motivation, image, fondness, and product knowledge.

The study adopts a descriptive research design and uses primary data gathered from a structured questionnaire among 151 respondents in Kerala. Kerala has been chosen because it boasts high digital literacy and extensive penetration of the internet, making it an ideal representative sample to study digital engagement. The research hopes to identify consumer sentiments regarding online advertisements as well as their performance in creating brand equity in FMCG products.

In order to extract better conclusions from the data, Principal Component Analysis (PCA) was utilized to determine the central factors affecting consumer beliefs. In addition, statistical methods such as t-tests, ANOVA, and factor analysis were employed to investigate differences in ad performance among socio-economic classes. The results indicate that online ads play a major role in improving perception of brand characteristics, including trust, awareness, and emotional attachment. Yet the findings also underscore significant differences in the effect of these ads on different demographic categories of income, education, and regional origin.

Notably, the research reveals that, although urban and affluent segments are more affected by creative and influencer-based advertisements, rural and lower-income buyers resonate more effectively to value-based or price-based advertisements. This highlights the importance of tailoring advertisement strategies according to targeted segments rather than applying the same strategy to all segments.

The research concludes that online advertising in the FMCG segment depends on various factors such as content approach, distribution platform, and demographic profile of the viewership. It delivers actionable recommendations for marketers and brand managers on how to maximize digital ad performance, use influencer marketing, and create long-term consumer connections in a competitive digital landscape. Through the discovery of how various consumer segments perceive and react to internet advertising, this study adds to the growing body of knowledge on digital marketing in the emerging markets and provides real-world implications for enhancing advertising return on investment in the FMCG sector.

Keywords: Online Advertising, Brand Attractiveness, Brand Image, Brand Motivation, Brand Fondness, Brand Knowledge.

Introduction

India is seeing the fastest Internet relinquishment rate due to several direct and indirect enterprises. As per Mid-Year Estimates from the UN, encyclopaedically internet druggies are estimated to be 8 billion people on the earth or 5.25 billion internet druggies worldwide which accounts for 65 of the world population. The “Jio Effect” readdressed Indian digital marketing with Reliance Jio’s affordable high-speed Internet, increasing online exertion and driving marketers to acclimate styles to the rising digital followership, roughly 49 of India’s population, or around 700 million people, are expected to be online as of FY 2025. India has added over 42 million new druggies, counting for roughly 40 of the worldwide aggregate. In India, diurnal media consumption parses 6 to 7 hours, strongly emphasizing conditioning similar to social media participation, entertainment, online browsing, shopping, gaming, and much more. (Source: UN estimates).

To those doubting that the current pattern will benefit everyone, the answer is simple: it increases everyone’s capacity to increase the value of their relationships, which is why the whole spectacle is fascinating. More effective campaigns will be able to be launched by brands. Map 14 Influencers, consistent with their professional standing, will be treated with courtesy. Consumers will get the very best prices on the products they need.

Nevertheless, being capable of generating relevant content and building authentic relationships with consumers, influencers are one of the dominant marketing tools in India. They influence product research and consumer decisions in a very big way. This is some among many important industries that have embraced influencer marketing personal care vertical. Other important industries such as the food industry, fashion industry, jewellery industry, mobile industry, electronics industry and several other industries have also accepted influencers in creating messages to their target market.

The Internet penetration rate, smartphone operation, and the snappily expanding e-commerce terrain in India have all contributed to the rapid-fire rise of the digital marketing geography, which was estimated to be worth INR 31,500 crore in FY 23, a 30 increase from the former time. 36 of the nation's total advertising budget is allocated to this request. The primary protrusions indicate that this trend will continue, and in FY 24, the digital expenditure will surpass TV announcement spending to reach roughly INR 41,000 crore or roughly 39 of the entire advertising budgets. (Source: Ipsos estimates).

In India, nine major diligences regard the maturity of digital advertising spending with FMCG and e-commerce accounting for further than 60 of the aggregate. With an absolute share of 34.9 in FY 23, The FMCG assiduity remained in the lead, nearly followed by e-commerce at 25.6. The three primary media platforms that marketers have employed in their digital marketing approach are still social media, online vids, and paid hunts. With a donation of 30.5 in FY 23, social media surfaced as the most popular platform. Online videotape, which grew at the topmost rate (35 rises) at 29, came in alternate. The chance of a paid hunt is 21.5, while the chance of display banners is about 15. (Source: brand equity- Economic Times).

Research Problem

Due to rising internet penetration and the accessibility of inexpensive high-speed connectivity, India's digital landscape is rapidly growing, which is having a significant impact on marketing tactics and customer behaviour. Relatively speaking, not much is known about how online advertising affects consumers' attitudes and purchasing decisions regarding fast-moving consumer items, even though the channel is starting to become more sophisticated and used. Considering that influencers are able to frame brand interaction and drive consumer engagement, this becomes quite relevant to get into detail on how various aspects of online advertising—for instance, brand attractiveness, motivation, image, fondness, and knowledge—affect FMCG product perceptions. The literature on this lacuna is what the study will try to fill, looking into assessing the effectiveness of online advertising about improving brand attributes and consumer engagement, and identifying the influencing elements across different socio-economic groups.

Research Questions

- How do online advertisements influence brand attractiveness among FMCG consumers?
- To what extent do online advertisements impact brand motivation among FMCG consumers?
- What is the relationship between online advertisements and brand image among FMCG consumers?
- How do online advertisements affect brand fondness among FMCG consumers?
- Can online advertisements increase brand knowledge among FMCG consumers?
- What are the key factors that influence the effectiveness of online advertisements across different socio-economic groups of FMCG consumers?
- How do demographic factors influence the effectiveness of online advertisements among FMCG consumers?

Rationale of the Research

The internet is gradually turning into a one-stop shop for customers to fulfil most of their needs due to the quick evolution of technology. Because of this, a lot of customers are attached to their computers and frequently use the internet. The problem is that many customers rely on the internet for personal purposes every day, but how many of them give due importance to the banners, ads, and alternative types of advertising? Online advertisements are an essential tool for arousing consumer thought by reminding or educating them about things, but they also need to entice people to purchase those goods.

The study aims to determine how innovative and successful digital media is in helping businesses establish sustainable brands. It also aims to determine how useful and successful digital media is from the viewpoints of experts, customers, and marketers. The outcome of the study assists both present and prospective online shoppers in selecting the media to use for their purchase decisions. In addition, the study helps manufacturers and service sector marketers in creating online media communication strategies that will draw in several customers to their goods and services. The study allows marketers to assess the potency of interactive digital communication tools and integrate digital media communication.

Literature Review

Online advertising has received significant acceptance concerning FMCG product perceptions by consumers. This paper attempts to review findings on the effectiveness of online advertising in building brand attractiveness, brand motivation, brand image, brand fondness and brand knowledge.

Online Advertising and Brand attractiveness

Brand attractiveness generated by online advertising mainly works on engaging and affecting consumer perception. Studies suggest that beautiful ads with strong aesthetic and emotional appeals grab consumer attention and generate positive evaluations of the brand. Azimi et al. (2012) observe that beautiful online ads increase user engagement and brand attractiveness. Additionally, digital ads foster interactivity, which allows consumers to craft personal experiences, thereby increasing brand attractiveness (Kim & Ko, 2012). Influencers can increase brand attractiveness. Wiedmann and Mettenheim (2020) and Munnukka et al. (2016) argued for influencer attractiveness, trustworthiness, and expertise. Lou et al. (2019) and Kapitan and Silvera (2016) considered credibility versus perceived trustworthiness. Therefore, further investigation should be conducted into how the various characteristics of influencers affect the perceived attractiveness of FMCG product brands.

Online Advertising and Brand Motivation

Brand motivation is the internal stimulation that encourages consumers to interact with a brand. Brand values, benefits, and unique selling propositions can be emphasized by online advertising to trigger this motivation. Interactive functions, like quizzes or recommendations, can encourage consumers further, increasing their motivation to browse and buy (Pourkabirian et al., 2021). Brand motivation can be triggered by influencer marketing. As stated by Lou, Munnukka, Chen, Yuan, and Uusitalo, credibility and worth of content that influencer posts affect consumer trust to a large extent. Toivonen and Munnukka, Uusitalo noted that a peer endorser requires credibility. Munnukka, Uusitalo, and Toivonen also observed that social media activities enhance the effectiveness of search engine advertising. Farzin and Fattahi, 2018; Li and Lo, 2015 confirmed video ads and eWOM drive brand motivation. It is also critical to find out the consumer motivations for employing the various social media vehicles, as suggested by Buzeta, Pelsmacker, and Dens, 2020. A proposed area of future study must be the whole online advertisement strategy and influencer marketing effectiveness.

Online Advertising and Brand Image

Brand image refers to the impression that consumers hold towards a brand, influenced by marketing communications and personal experiences. Strategic and consistent online advertising can foster strong brand image through messaging and values that are communicated clearly. Social media platforms, especially, provide brands with the opportunity to express their personality and interact with consumers, contributing to favourable brand image (Kim & Ko, 2012). eWOM takes an inevitable role in the formation of brand image. Lien et al. (2015) and Yang et al. (2016) demonstrated that eWOM relates to purchase intentions and brand image among Generation Y and Z. Farzin and Fattahi showed in 2018 the impact of social network sites on brand image. Cheung, Pires, and Rosenberger also referred to the requirement for social media engagement in 2020. Therefore, more studies need to conduct on which eWOM relates to brand image, including demographics and culture.

Online Advertising and Brand Fondness

Brand fondness is the emotional connection consumers build with a brand. Emotive content and relatable stories used in online ads can build such connections. The mere-exposure effect suggests that repeated exposure to a brand through online ads could breed familiarity and liking, thereby enhancing brand fondness (Zajonc, 1968). Consumer engagement with online advertisements and brand fondness go hand in hand. While Lou et al. (2019) have concentrated on source and disclosure in advertisements, Li and Lo (2015) focused their attention on video advertising. Chun et al. (2014) proved that there can be an influence on consumer behaviour by exposure to some contextual advertising. Ting et al. (2020) revealed that social interactivity mediates brand loyalty. Semantic scholar, 2020 theorizes that "display advertising creates brand search behaviour". The study must take into account cross-cultural variations and an ever-changing online environment.

Online Advertising and Brand Knowledge

Brand knowledge involves brand awareness and the associations with a brand by consumers' minds. Informative online advertisements help construct brand knowledge by informing consumers about product features, advantages, and usage. Proper use of SEO and content marketing ensures that the target audience is reached with relevant information, developing a better understanding and memory of the brand (Keller, 2003). Past studies indicate that social media marketing plays significant roles towards enhancing brand knowledge. Cheung, Pires, and Rosenberger, through their study in 2020, developed a conclusion that interaction, EWOM, and trendiness all contribute significantly towards brand knowledge. Similarly, Nepomuceno, Laroche, and Richard (2014) pointed out the fact that familiarity with brands lowers perceived risk and maximises trust. Advertisements through influencer-promoted content strategies (Lou, Tan, and Chen, 2019) and in-stream video ads (Li and Lo, 2015) are

effective in creating brand awareness. Thus, in the future, studies should investigate particular content strategies and the role of social media in generating brand knowledge.

Conceptual Model

Based on the literature review, a conceptual model can be developed to illustrate the relationship between online advertising (independent variable), brand preferences (dependent variable), and key variables (moderating variables like brand attraction, brand image, brand motivation, brand fondness, and brand knowledge).



Objectives

- To study the influence of online advertisements on FMCG products in generating brand attractiveness, brand motivation, brand image, brand fondness and brand knowledge.
- To identify the factors influencing the effectiveness of online advertisements among different socio-economic status of FMCG consumers.

Methodology

The study adopts a descriptive research design and uses primary data gathered from the central zone of Kerala. Kerala has been chosen because it boasts high digital literacy and extensive penetration of the internet, making it an ideal representative sample to study digital engagement. A structured questionnaire was used to gather data. Cluster Sampling method was used for this study. Ernakulam, Thrissur, and Palakkad were selected based on its geographical representation, economic significance, population density, and consumer behaviour. Within each cluster, different taluks were identified and primary data collected through a survey by using Google Forms. An average cluster size of 50 -60 samples per each district was collected. The sample size is determined at 151 samples with a reasonable level of precision. The study's total sample is deemed adequate since it surpasses the required minimum sample size of 30 individuals, as indicated by Cresswell (1998) and Sekaran (2000), allowing the study's hypotheses to be evaluated. Additionally, various published reports and journals have been used to collect data. There are two sections to the questionnaire. Gathering the respondents' personal information is the goal of Section A. Gender, age, occupation, internet use, social media use, and reason for utilizing social media are the items in this part. A brand's recent impressions based on online advertisements among respondents are examined in Section B. Likert scales (strongly disagree to strongly agree), were used to rate each item. Eighteen statements were included in the questionnaire, which dealt with the brand information generated by online advertisements among the respondents.

Principal component analysis has been used along with Varimax with Kaiser Normalization. Depending on the result, eighteen statements were converted into five factors of the study. Brand attractiveness, brand motivation, brand image, brand fondness, and brand knowledge are the elements identified for the study. SPSS was used to perform a quantitative analysis. One-sample t-test, independent t test, Anova and factor analysis were employed to diagnose the data. The research hopes to identify consumer sentiments regarding online advertisements as well as their performance in creating brand equity in FMCG products.

Data Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.786
Bartlett's Test of Sphericity	Approx. Chi-Square	663.676
	df	171
	Sig.	.000

Kaiser-Meyer-Olkin Measure of Sampling Adequacy register 0.786, which is more than 0.6. This register signals that the sample is adequate for factor analysis. It is also indicated by its p-value, which is less than 0.0001.

Total Variance Explained

Component	Initial Eigenvalues	Extraction Sums of Squared Loadings
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1	4.700	24.739	24.739	4.700	24.739	24.739
2	1.663	8.753	33.492	1.663	8.753	33.492
3	1.409	7.417	40.909	1.409	7.417	40.909
4	1.348	7.093	48.002	1.348	7.093	48.002
5	1.238	6.518	54.521	1.238	6.518	54.521
6	1.031	5.425	59.946	1.031	5.425	59.946
7	.910	4.787	64.733			
8	.869	4.572	69.305			
9	.750	3.949	73.254			
10	.708	3.724	76.978			
11	.625	3.289	80.267			
12	.622	3.273	83.539			
13	.546	2.873	86.413			
14	.501	2.639	89.052			
15	.493	2.593	91.645			
16	.470	2.474	94.119			
17	.458	2.411	96.530			
18	.371	1.953	98.483			
19	.288	1.517	100.000			

Extraction Method: Principal Component Analysis.

Based on the Eigen value, which is registered as more than 1, 18 statements shall be divided into 6 factors.

Rotated Component Matrixa

Statements	No.	Component					
		1	2	3	4	5	6
When I look up information about a product online or get marketing messages via mobile SMS or email, the influence of interactive digital media is beneficial.	Item 1					.646	
While I acquire information about the goods through emails advertisements, email marketing has a huge impact.	Item 2					.756	
When I learn about a product through SMS or mobile app promotions, the impact of mobile marketing is more noticeable.	Item 3					.577	
When I seek for information about a product on an Internet advertisement, search engine influences and company websites have a big influence.	Item 4			.693			
When I look for information on a product online, social network influences have influence on the advertisements I see.	Item 5			.753			
When I look for information about a product on the Internet, influence of advertising is the main consideration.	Item 6						

Depending on whether I'm a man or a woman, certain advertisements and online content are more appealing to me, and I use the Internet to research products.	Item 7		.722				
When I review the advertisement or online, the effects of my family and friends are crucial, therefore I search for information about the goods online in accordance.	Item 8		.768				
Every time I review the advertisement or online and look up information about the product on the Internet, my personal and family ideals serve as an inspiration.	Item 9		.575				
I'm fascinated by the advertisement's general characteristics, so I look up information about the goods online.	Item10	.661					
I'm attracted to the online or offline advertisement's design while I look up product details on the web.	Item11	.696					
I find the duration of the online advertising appealing and look up more about the goods online.	Item12	.772					
While going for online product information, the quality of the commercial or online content motivates me.	Item13				.561		
When I read the commercial or seek online for information about the things that satisfy me, my attitude directs me.	Item14						
When I review the commercial or online and look up information about such products on the Internet, brand loyalty is the most important aspect.	Item15				.737		
When I look for information about the product online or in an advertisement, my prior purchasing history speaks heavily.	Item16						.761
I search online for the suggested product and the advertisement, and word-of-mouth is unquestionably a significant factor.	Item17				.638		
I am inspired by advertisements and online shopping because of advancements in information technology.	Item18						

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 10 iterations.

	Name of the factors	Items
Factor 1	Brand Attractiveness	Items 10,11,12
Factor 2	Brand Motivation	Items 7,8,9
Factor 3	Brand Image	Items 4, 5
Factor 4	Brand Fondness	Items 13,15, 17
Factor 5	Brand Knowledge	Items 1,2,3
Factor 6	Brand Reinforcement	Items 16

Factor 3 and 6 can be clubbed or avoided.

One Sample T Test

to prove the existence of Variables like Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge

Hypothesis

H01: There is no significant difference between sample mean and population mean relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by Online advertisement

Table 1

One-Sample Statistics					
Construct	N	Mean	Std. Deviation	t value	P value

Brand Attractiveness	151	3.5673	.62277	11.194	<0.0001**
Brand Motivation	151	3.7241	.57059	15.593	<0.0001**
Brand Image	151	3.9360	.50437	22.804	<0.0001**
Brand Fondness	151	3.7152	.53527	16.420	<0.0001**
Brand Knowledge	151	3.5916	.57500	12.643	<0.0001**

Source: Primary data *significance @ 5% level

The mean value for Brand Attractiveness is 3.5673, and the standard deviation is 0.62277. The t-value of 11.194 and the p-value less than 0.0001 show that the sample mean for Brand Attractiveness is different to a hypothesized or expected value. In other words, based on this sample of 151 respondents, the brand is very attractive, and this relationship did not occur by chance. Brand Motivation has a mean of 3.7241 with a standard deviation of 0.57059. With the t-value as 15.593, and a p-value less than 0.0001, the mean Brand Motivation score is statistically significantly different from any hypothesized or expected value. This would therefore imply that, to this sample of 151 respondents, this brand is highly motivating; and such a finding is unlikely to be coincidental. Brand Image has a mean value of 3.9360 and a standard deviation of 0.50437. At a t-value of 22.804 with a p-value less than 0.0001, this indicates a statistically significant difference in the Mean Brand Image from that hypothesized or expected. This means that the brand image is very favourable within the 151-respondent sample, and a finding such as this is unlikely to occur by chance. Brand Fondness has a mean value of 3.7152, with a standard deviation of 0.53527. With a t-value of 16.420 and a p-value less than 0.0001, this means the mean Brand Fondness score is statistically significantly different from the hypothesized/expected value. It implies that the sample consisting of 151 respondents was very fond of the brand, and that this finding is unlikely to have occurred by chance alone. The mean for Brand Knowledge is 3.5916 with a standard deviation of 0.57500. The t-value of 12.643 and p-value less than 0.0001 set the mean Brand Knowledge score statistically significantly different from any hypothesized or expected value. This implies that the sample of the 151 respondents has a high level of knowledge about the brand and findings unlikely to occur by chance. These results mean that the brand is evaluated very positively on various brand-related constructs for the sample of 151 respondents, with statistical significance. In other words, it proves that the brand is doing well according to the target audience.

Independent T Test

to test the significant difference between Male and Female relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

H02: There is no significant difference between male mean and female relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement

Table 2

Independent t test						
Construct	Gender	N	Mean	Std. Deviation	t value	P value
Brand Attractiveness	Female	106	3.6101	.59889	1.238	0.220
	Male	45	3.4667	.67195		
Brand Motivation	Female	106	3.7736	.51956	1.646	0.102
	Male	45	3.6074	.66776		
Brand Image	Female	106	3.9371	.46030	.038	0.970
	Male	45	3.9333	.60135		
Brand Fondness	Female	106	3.7201	.51463	.163	0.871
	Male	45	3.7037	.58699		
Brand Knowledge	Female	106	3.6164	.57051	.801	0.426
	Male	45	3.5333	.58775		

Source: Primary data *significance @ 5% level

The average score of Brand Attractiveness among females is 3.6101, which is a bit higher than the corresponding average for males at 3.4667. Since this difference in the average Brand Attractiveness scores has a t-value of 1.238 and a p-value of 0.220, this cannot be said to be statistically significant. It can thus be concluded that the brand is as much attractive to female as to male respondents. The mean score of Brand Motivation among females is 3.7736, which is higher than their male counterpart with a mean score of 3.6074. Having obtained a t-value of 1.646 with a p-value of 0.102, it cannot be established that there exists a statistical difference in the difference of the mean Brand Motivation scores between females and males. The brand is hence perceived to be equally motivating to both female and male respondents. The mean Brand Image score for females is slightly higher, 3.9371, compared to males with a score of 3.9333. The t-value is 0.038 with a p-value of 0.970, so it shows that

the difference in the mean Brand Image score between females and males is not statistically significant. Basically, it means that there is no perception of brand image that is peculiar or unique to female or male respondents alone. The average Brand Fondness score for females was 3.7201, slightly higher than that of males, which was 3.7037. Using a t-value of .163 and a p-value of .871, the findings show that brand fondness mean scores are not significantly different between females and males. The fondness toward the brand, therefore, is similar in female and male respondents. The average score of Brand Knowledge in females is 3.6164, which is above that of their male counterparts, with an average score of 3.5333. The calculated t-value of 0.801 with a p-value of 0.426 implies that this difference in the mean Brand Knowledge scores for females and males is statistically nonsignificant. This means that the level of brand knowledge among female respondents was at a level similar to that seen in male respondents. In other words, the results of the independent t-test indicated that there were no statistically significant differences in mean values of the brand-related constructs across female and male respondents. The finding thus implies that the brand is perceived similarly by both genders on several dimensions.

One Way Anova

To test significant difference among different occupation of the respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

H03: There is no significant difference among different occupation relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement

Table 3

One way ANOVA						
Construct	Occupation	N	Mean	Std. Deviation	F Ratio	P Value
Brand Attractiveness	Students	69	3.6039	.57813	1.017	.401
	Employees	51	3.6078	.63493		
	Professionals	15	3.4444	.69769		
	Self employed	6	3.6667	.81650		
	Other	10	3.2333	.62952		
	Total	151	3.5673	.62277		
Brand Motivation	Students	69	3.7585	.55095	.206	.935
	Employees	51	3.7059	.61336		
	Professionals	15	3.7333	.55205		
	Self employed	6	3.6667	.84327		
	Other	10	3.6000	.37843		
	Total	151	3.7241	.57059		
Brand Image	Students	69	3.8599	.45878	.788	.534
	Employees	51	4.0196	.55542		
	Professionals	15	3.9778	.46234		
	Self employed	6	4.0000	.76012		
	Other	10	3.9333	.43885		
	Total	151	3.9360	.50437		
Brand Fondness	Students	69	3.6184	.57530	1.877	.117
	Employees	51	3.8693	.44261		
	Professionals	15	3.7111	.39574		
	Self employed	6	3.7778	.91084		
	Other	10	3.5667	.49814		
	Total	151	3.7152	.53527		
Brand Knowledge	Students	69	3.5652	.51862	.147	.964
	Employees	51	3.6209	.61831		
	Professionals	15	3.6000	.59362		
	Self employed	6	3.5000	1.04881		
	Other	10	3.6667	.41574		
	Total	151	3.5916	.57500		

Source: Primary data *significance @ 5% level

In case of Brand Attractiveness, the F-ratio is 1.017, p-value 0.401. The p-value indicates that the mean Brand Attractiveness scores among different occupations are not significantly different. The mean Brand Attractiveness score of students (3.6039) is slightly lower than the overall mean score (3.5673), whereas the mean scores of employees (3.6078) and self-employed (3.6667) are a bit higher. This implies that the brand is relatively attractive

in all occupations at large. In case of Brand Motivation, the F-ratio comes out at 0.206 and the associated p-value as 0.935 used in testing the null hypothesis, hence it is concluded that the difference in the mean scores of Brand Motivation across the different occupations is not statistically significant. The mean scores in Brand Motivation of all occupations are very close to the overall mean, which is 3.7241. This means that the perception based on motivation about how the brand is, does not vary between the other jobs. Brand Image shows the F-ratio is 0.788. P-Value is 0.534, it implies that there is no statistical significance of the difference between the borderline mean scores of Brand Image for the other jobs. The mean Brand Image scores for employees and self-employers are slightly above the overall mean, whereas the mean for students is slightly below. This indicates that the brand image is perceived almost the same among the different occupations, but with very little mean differences, meaning that they are close together. In case of Brand Fondness, the value for F-ratio is 1.877 with a p-value of 0.117 (<.05), which indicates a significant difference in Brand Fondness scores means across different occupations. The average Brand Fondness score for Students (3.6184) is less than the general average, while the same for Employees (3.8693) is greater than the general average. This means that the brand is perceived differently in terms of likability for different occupations. Students are least likely to like, and employees are most likely to like the brand. While analysing Brand Knowledge, the F-ratio is 0.147, and the value of p is 0.964, thus, there is no statistically significant difference in the average Brand Knowledge numbers across the varying occupations. The average of Brand Knowledge scores of all the occupations is very close to the average of the total of 3.5916. This indicates that level of brand knowledge is independent of the diversity of the respective occupation. Descriptive statistics reflect that the demographic makeup of respondents, while one-way ANOVA revealed that there are no statistically significant differences in the mean values of Brand Attractiveness, Brand Motivation, and Brand Image among different occupations. Statistically, thus, the difference in mean value of Brand Fondness between the two populations, students being less fond and workers fonder, is significant. Brand knowledge is not significantly different between the two occupations.

ONE WAY ANONA

to prove the significant difference among different Income level of the respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

H04: There is no significant difference among different Income level of the respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement

Table 4

One way ANOVA						
Construct	Income	N	Mean	Std. Deviation	F Ratio	P Value
Brand Attractiveness	Below 2.5 lakh	85	3.5647	.60863	.389	.761
	2.5 lakh - 5 lakh	42	3.6190	.60964		
	5- 10 lakh	18	3.5370	.54997		
	Above 10 lakh	6	3.3333	1.11555		
	Total	151	3.5673	.62277		
Brand Motivation	Below 2.5 lakh	85	3.7608	.56487	.888	.449
	2.5 lakh - 5 lakh	42	3.6190	.54882		
	5- 10 lakh	18	3.7222	.57451		
	Above 10 lakh	6	3.9444	.80046		
	Total	151	3.7241	.57059		
Brand Image	Below 2.5 lakh	85	3.8824	.49789	.847	.470
	2.5 lakh - 5 lakh	42	3.9841	.47113		
	5- 10 lakh	18	4.0185	.62069		
	Above 10 lakh	6	4.1111	.45542		
	Total	151	3.9360	.50437		
Brand Fondness	Below 2.5 lakh	85	3.6745	.57958	.490	.690
	2.5 lakh - 5 lakh	42	3.7619	.44954		
	5- 10 lakh	18	3.7407	.57798		
	Above 10 lakh	6	3.8889	.27217		
	Total	151	3.7152	.53527		
Brand Knowledge	Below 2.5 lakh	85	3.6000	.54627	.706	550
	2.5 lakh - 5 lakh	42	3.6508	.60688		
	5- 10 lakh	18	3.5000	.57451		
	Above 10 lakh	6	3.3333	.78881		

	Total	151	3.5916	.57500		
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Source: Primary data

*significance @ 5% level

The brand attractiveness score is highest for the 2.5 lakh - 5 lakh income group with a mean of 3.6190 and lowest for the above 10 lakh income group with a mean of 3.3333. The F-ratio is 0.389, and with a p-value of 0.761, this tells that changes in the Brand Attractiveness scores for different income groups are not statistically significant. The highest mean score on Brand Motivation for the above 10 lakh income group is 3.9444, and the lowest for the 2.5 lakh-5 lakh income group is 3.6190. The F-ratio is 0.888, and the p-value is 0.449, which falls outside the statistically significant threshold of 0.05. Differences in Brand Motivation scores across groups for different income classes are, therefore, not statistically significant. The highest mean of Brand Image corresponds to the above 10 lakh income group, and the lowest corresponds to the below 2.5 lakh income group. Here, F-ratio equals 0.847, and the p-value is 0.470; it is greater than 0.05, so the differences in the Brand Image scores of different income groups are not statistically significant. The mean of Brand Fondness in the above 10 lakh income group is maximum, while that for the below 2.5 lakh income group it is minimum, at 3.8889 and 3.6745, respectively. The F-ratio comes to be 0.490 with a p-value of 0.690; hence, it is greater than 0.05. Therefore, the differences in the Brand Fondness scores for these different income groups are not statistically significant. It ranges as high as 3.6508 for the 2.5 lakh - 5 lakh income group and as low as 3.3333 for the above 10 lakh income group. The F-ratio stands at 0.706 and the p-value 0.550; hence, it falls above 0.05. This proves that there is no statistically significant difference in the Brand Knowledge scores among the respondents across different income groups. In other words, based on the one-way ANOVA results, there are no statistically significant differences in the brand equity constructs across different income groups. The brand is able to maintain constant brand equity perceptions that seem unrelated to the consumer's income level.

One Way Anova

To prove the significant difference among different Education level of the respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

H05: There is no significant difference among different Education level of the respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement

Table 5

One way ANOVA						
Construct	Education	N	Mean	Std. Deviation	F Ratio	P Value
Brand Attractiveness	Higher Secondary	15	3.7778	.70897	1.421	.239
	Degree	65	3.4923	.58662		
	PG	66	3.6162	.61670		
	Other	5	3.2667	.82999		
	Total	151	3.5673	.62277		
Brand Motivation	Higher Secondary	15	3.5111	.76497	1.258	.291
	Degree	65	3.7795	.56604		
	PG	66	3.7374	.52791		
	Other	5	3.4667	.44721		
	Total	151	3.7241	.57059		
Brand Image	Higher Secondary	15	3.7778	.58644	1.062	.367
	Degree	65	3.9949	.46582		
	PG	66	3.9293	.52466		
	Other	5	3.7333	.43461		
	Total	151	3.9360	.50437		
Brand Fondness	Higher Secondary	15	3.7556	.68390	.891	.448
	Degree	65	3.7231	.47715		
	PG	66	3.7273	.56055		
	Other	5	3.3333	.40825		
	Total	151	3.7152	.53527		

Brand Knowledge	Higher Secondary	15	3.6222	.43400	.610	.610
	Degree	65	3.5795	.55988		
	PG	66	3.6212	.59308		

	Other	5	3.2667	.92496		
	Total	151	3.5916	.57500		

Source: Primary data *significance @ 5% level

The Brand Attractiveness has the highest average score of 3.7778 in case of the Higher Secondary education group, while the 'Other' education group has the lowest with an average score of 3.2667. The system gives an F-ratio of 1.421 with a p-value of 0.239: hence, it is greater than the significance level of 0.05. That means the differences in Brand Attractiveness scores across education groups are not statistically significant. Note that the highest Brand Motivation mean corresponds to the Degree education group with the value of 3.7795, while for the 'Other' education group, it is lowest at 3.4667. The F-ratio value is 1.258, with a p-value of 0.291. Since this is >0.05, differences in Brand Motivation scores across education groups cannot be asserted to be statistically significant. It is highest in the case of the Degree education group, with a score of 3.9949, and lowest for the 'Other' education group, with a score of 3.7333. The F-ratio is 1.062, while the p-value is 0.367, which is greater than 0.05—thus not significant. Across the different education groups, the highest mean Brand Fondness score was 3.7556 for the Higher Secondary group, while the lowest was 3.3333 for the 'Other' education group. The F-ratio here is 0.891, along with a p-value of 0.448, which is greater than 0.05. Thus, differences in Brand Fondness scores among education groups are not statistically significant. It can be seen that the mean for Brand Knowledge is highest in the group of PG education with a value of 3.6212 and the lowest in the 'Other' education group, with a value of 3.2667. The F-ratio is 0.61, and the p-value is 0.610. Since this is greater than 0.05, there is no statistically significant difference in the Brand Knowledge scores among these educational groups. The results of the one-way ANOVA clearly indicate that there are no statistically significant differences in the brand equity constructs across the different education groups. In other words, it is perhaps proper to say that a brand often tends to hold consistent brand equity perceptions, irrespective of their educational backgrounds.

One Way Anova

To prove the significant difference among different Region of the respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

H06: There is no significant difference among different Region relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement

Table 6

One Way ANOVA						
Construct	Region	N	Mean	Std. Deviation	F Ratio	P Value
Brand Attractiveness	Rural	64	3.5677	.62764	.190	.827
	Urban	38	3.6140	.57226		
	Semi Urban	49	3.5306	.66290		
	Total	151	3.5673	.62277		
Brand Motivation	Rural	64	3.7240	.58961	.047	.954
	Urban	38	3.7456	.58732		
	Semi Urban	49	3.7075	.54277		
	Total	151	3.7241	.57059		
Brand Image	Rural	64	3.8646	.50297	1.256	.288
	Urban	38	3.9561	.48504		
	Semi Urban	49	4.0136	.51801		
	Total	151	3.9360	.50437		
Brand Fondness	Rural	64	3.6979	.46279	.500	.607
	Urban	38	3.7895	.53927		
	Semi Urban	49	3.6803	.61973		
	Total	151	3.7152	.53527		
Brand Knowledge	Rural	64	3.5625	.53080	.656	.520
	Urban	38	3.6842	.55857		
	Semi Urban	49	3.5578	.64330		
	Total	151	3.5916	.57500		

Source: Primary data *significance @ 5% level

The largest mean Brand Attractiveness score is that for an urban region—3.6140, while the lowest is that for Semi Urban, at 3.5306. The F-ratio here is 0.190, and the p-value is 0.827, which is greater than the significance level of 0.05. There are no statistically significant differences in Mean Brand Attractiveness scores between the various regions. The Urban region had the highest mean of Brand Motivation at 3.7456, while Semi Urban posted the lowest at 3.7075. The F-ratio is 0.047, and the corresponding p-value is 0.954, which is greater than 0.05; hence,

differences in the scores on Brand Motivation among users across regions are statistically insignificant. For Brand Image, the Semi Urban category contributed a maximum average score of 4.0136, and the minimum was provided by the Rural at 3.8646. The F-value is 1.256 and the p-value is 0.288, that is greater than 0.05. Thus, there are no statistically significant differences in Brand Image scores across regions. Descriptive statistics The highest mean score of Brand Fondness was 3.7895 in case of Urban region and lowest was 3.6803 for Semi Urban region. The F-ratio is 0.500 and the p-value is 0.607, that is greater than 0.05. Hence, the mean scores for Brand Fondness do not vary significantly across regions. For Brand Knowledge, the highest mean is in the Urban region, 3.6842, followed by the lowest in Semi Urban, 3.5578. The F-ratio is 0.656, whose corresponding p-value is 0.520, which is greater than 0.05; hence, there is no significant difference in Brand Knowledge scores across regions. The results of the one-way ANOVA imply that there are no significant differences in brand equity constructs across regions, which means that the brand can maintain the perception of brand equity consistently regardless of geographical location.

One Way Anova

To prove the significant difference among different Districts of the respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement. H07: There is no significant difference among different Districts relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement

Table 7

One Way ANOVA						
Construct	District	N	Mean	Std. Deviation	F Ratio	P Value
Brand Attractiveness	Palakkad	113	3.5634	.62691	.134	.940
	Thrissur	33	3.5556	.63282		
	Ernakulam	3	3.7778	.69389		
	Alappuzha	2	3.6667	.47140		
	Total	151	3.5673	.62277		
Brand Motivation	Palakkad	113	3.7345	.58615	.114	.952
	Thrissur	33	3.7071	.53201		
	Ernakulam	3	3.5556	.69389		
	Alappuzha	2	3.6667	.47140		
	Total	151	3.7241	.57059		
Brand Image	Palakkad	113	3.9292	.50680	.522	.668
	Thrissur	33	3.9495	.50773		
	Ernakulam	3	3.7778	.50918		
	Alappuzha	2	4.3333	.47140		
	Total	151	3.9360	.50437		
Brand Fondness	Palakkad	113	3.6873	.54968	1.747	.160
	Thrissur	33	3.8384	.45736		
	Ernakulam	3	3.2222	.69389		
	Alappuzha	2	4.0000	.00000		
	Total	151	3.7152	.53527		
Brand Knowledge	Palakkad	113	3.5664	.56849	.575	.632
	Thrissur	33	3.6970	.63116		
	Ernakulam	3	3.5556	.19245		
	Alappuzha	2	3.3333	.00000		
	Total	151	3.5916	.57500		

Source: Primary data *significance @ 5% level

The highest mean score for Brand Attractiveness is contributed by the district of Ernakulam with 3.7778, and the lowest by Thrissur with 3.5556. The F-ratio is 0.134, and the p-value is 0.940; since this is higher than the significance level of 0.05, it states that the differences in the Brand Attractiveness scores of the respondents from different districts are not significant. The mean score in Brand Motivation is highest in the case of the Palakkad district, and the minimum for Ernakulam district, with a value of 3.5556. The F-ratio is 0.114, and a p-value of 0.952; since this is more than 0.05, the difference in the Brand Motivation scores of the different districts is not significant. Among the mean Brand Image scores, the maximum is noted in Alappuzha district with a value of 4.3333, and the minimum is in Ernakulam district. The F-ratio is 0.522, and with a p-value of 0.668, which is greater than 0.05, the interpretation is that there is no statistically significant difference in the Brand Image scores across districts. For Brand Fondness scores, the highest district mean is contributed by Alappuzha district with

4.0000, while the lowest mean contributed is by Ernakulam district with 3.2222. Again, the F-ratio is 1.747, and with a p-value of 0.160, which is greater than 0.05, it shows there is no statistically significant difference in the items of Brand Fondness scores across districts. It means that the Brand Fondness scores across districts are not significantly different. Next, the highest mean of Brand Knowledge is possessed by the Thrissur district, and the lowest by the Alappuzha district: 3.6970 and 3.3333, respectively. Here, the F-ratio comes to 0.575, and the p-value is 0.632, which is above 0.05—hence, not significant. In other words, the results obtained from the one-way ANOVA indicate there are no statistically significant differences in brand equity constructs across different districts. This implies that the brand can maintain its brand equity perception equivalently, regardless of the geographical location of the consumer in the state.

One Way Anova

To prove the significant difference among different type of the advertisements relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement. H08: There is no significant difference among different type of advertisement relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

Table 8

One Way ANOVA						
Construct	Advertisement Type	N	Mean	Std. Deviation	F Ratio	P Value
Brand Attractiveness	Search engine ads	9	3.4444	.79931	.239	.869
	Social media ads	131	3.5725	.60521		
	Display ads	2	3.8333	.23570		
	Mobile ads	9	3.5556	.79931		
	Total	151	3.5673	.62277		
Brand Motivation	Search engine ads	9	3.7778	.64550	.981	.404
	Social media ads	131	3.6972	.56304		
	Display ads	2	4.0000	.47140		
	Mobile ads	9	4.0000	.62361		
	Total	151	3.7241	.57059		
Brand Image	Search engine ads	9	3.7407	.36430	.926	.430
	Social media ads	131	3.9618	.49379		
	Display ads	2	3.6667	.00000		
	Mobile ads	9	3.8148	.76578		
	Total	151	3.9360	.50437		
Brand Fondness	Search engine ads	9	3.7407	.46481	1.704	.169
	Social media ads	131	3.7379	.49615		
	Display ads	2	3.0000	.94281		
	Mobile ads	9	3.5185	.92962		
	Total	151	3.7152	.53527		
Brand Knowledge	Search engine ads	9	3.3704	.91961	1.016	.387
	Social media ads	131	3.5878	.54354		
	Display ads	2	3.8333	.23570		
	Mobile ads	9	3.8148	.64788		
	Total	151	3.5916	.57500		

Source: Primary data

*significance @ 5% level

The mean score of Brand Attractiveness is highest in Display ads, 3.8333, and the lowest in Search engine ads, 3.4444. The analysis has presented a value of F-ratio of 0.239 with a p-value of 0.869, which is greater than the significance level of 0.05. Therefore, there are no statistically significant differences in Brand Attractiveness scores across ad types. The highest average Brand Motivation score is for Display Ads and Mobile Ads, 4.0000, while the lowest one is for Social Media Ads, 3.6972. The F-ratio is 0.981, with a p-value of 0.404; hence, this value is greater than 0.05. This shows that the motivation scores on the brand against various ad types are not statistically significant. It is the case that the mean of Brand Image was highest for a social media ad at 3.9618 and the lowest for Display at 3.6667. The F-ratio in this regard is 0.926, while the p-value is 0.430, hence higher than 0.05 and therefore indicating no statistically significant difference in brand image scores across the ad types.

It is highest for Search engine ads at a rating of 3.7407, and Display ads come at the end with a rating of 3.0000. The F-ratio is 1.704, and the p-value is 0.169, hence greater than 0.05. This interprets that differences in the Brand Fondness scores between the various ads somewhere are not important. It is highest in the case of Display ads with a mean of 3.8333, and minimum in the case of Search engine ads with the mean of 3.3704. The F-ratio is 1.016, with a p-value of 0.387, which is greater than the alpha level of 0.05, indicating no statistically significant differences in Brand Knowledge scores across advertisement type variations. In other words, the outcome of one-way ANOVA reveals that there are no statistically significant differences in the constructs of brand equity across different types of advertisements. The brand seems to hold the capacity to sustain perceived brand equity, irrespective of the channel used for advertising.

Independent T Test

To prove the significant difference between Married and Unmarried respondents relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

H09: There is no significant difference between married and unmarried relating to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness and Brand Knowledge engendered by online advertisement.

Table 9

Independent t test						
Construct	Marital status	N	Mean	Std. Deviation	t value	P value
Brand Attractiveness	Married	41	3.5122	.65446	-.643	.522
	Unmarried	110	3.5879	.61236		
Brand Motivation	Married	41	3.7561	.57264	.420	.675
	Unmarried	110	3.7121	.57199		
Brand Image	Married	41	3.9268	.48598	-.139	.890
	Unmarried	110	3.9394	.51319		
Brand Fondness	Married	41	3.8049	.41483	1.453	.149
	Unmarried	110	3.6818	.57183		
Brand Knowledge	Married	41	3.6585	.58446	.864	.391
	Unmarried	110	3.5667	.57212		

Source: Primary data *significance @ 5% level

The mean Brand Attractiveness score of married respondents is 3.5122, which is a bit lower than that for the unmarried with 3.5879. Here, the t-value is -0.643, and the p-value is 0.522, which is greater than the significance level of 0.05. This shows there is no statistically significant difference in the Brand Attractiveness score between married and unmarried respondents. The average Brand Motivation score among the married is 3.7561, which is a bit higher than that among unmarried ones, with 3.7121. Here, the t-value is 0.420, and with a p-value of 0.675, which is greater than 0.05, this means that the difference in Brand Motivation scores between married and unmarried is statistically insignificant. The average Brand Image score of 3.9268 for the married is insignificantly small as compared to that for the unmarried, with an average score of 3.9394. The t-value is -0.139, and the p-value of 0.890 is greater than 0.05. This suggests that the difference in the Brand Image scores of the married and unmarried is not significant. The mean of Brand Fondness for married respondents is 3.8049, which is higher as compared to the unmarried ones with a mean of 3.6818. The t-value is 1.453 with a p-value of 0.149, which is greater than 0.05. This means that there are no statistically significant differences of Brand Fondness scores as responses for the married and unmarried respondents. It means that the mean score in the brand knowledge for married respondents is 3.6585 while the mean for unmarried respondents is 3.5667. The t-value is 0.864 with a p-value of 0.391, also greater than 0.05. This means that the change in the Brand Knowledge scores for married and unmarried respondents is not significant. In other words, no statistically significant differences on brand equity constructs have been found between married and unmarried respondents. Marital status does not moderate consumer perception of the brand.

Findings

The study has several key findings about the effect of online advertisements on brand-related constructs among consumers. Here are the main conclusions drawn from the analysis:

Existence of Brand Constructs: Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness, and Brand Knowledge constructs exist in the population. Online advertisement provides effective viewership, motivation to purchase, brand image building, fondness for brands, and enhancement of knowledge about the brands, which together affect the purchase intentions of customers.

Gender Analysis: The analysis just reveals that the genders are not significantly different in their responses to Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness, and Brand Knowledge. This might mean that strategies for a specific gender are irrelevant, or the effectiveness of online ads is equally effective across all genders.

Occupational Distribution: The brand-related constructs are uniform across different occupations, hence a hint that the effectiveness of online ads is the same regardless of any occupational background. It could then imply that brand perception is more driven by individual tastes or lifestyle factors rather than occupation.

Income Levels: Based on socioeconomic levels, there were no noticeable variations in brand constructions in this particular situation. The lack of significant differences across income levels on brand-related constructs might be an indication that the effect of online advertisements is pervasive and cuts across all socio-economic classes. This is probably an effect of the ease of access to online ads and, in general, the democratization of information, which may make brand knowledge and perceptions universal.

Education Level: The large variance in brand constructs across education levels may be an indication that more educated people are more critical or more analytical towards web advertising. They simply attach different meanings to brand messages, hence the variance. This would therefore indicate that education has an impact on the level at which one can process and subsequently respond to a marketing message.

Regional Analysis: No regional differences in brand constructs were found to exist, indicative of the fact that online advertisements have a uniform impact across different regions, whether urban, rural, or semi-rural. This may be due to the extensive reach and standardization of online ad campaigns.

District Analysis: This district-wise analysis is also similar in trend to the regional analysis. It therefore indicates that factors local to the districts are not strong enough to influence brand perceptions from online advertisements.

Advertisements Types: The effect of various types of online advertisements, for example, display advertisements, mobile advertisements, and social media advertisements, was checked; it was discovered that all are the same about Brand Attractiveness, Brand Motivation, Brand Image, Brand Fondness, and Brand Knowledge. This means that what is more important is the content rather than the format or platform of the advertisement.

Marital Status: It was found that marital status does not considerably impact brand-related constructs resulting from online advertisements.

Implications of the Study

Effectiveness of Online Ads

The study confirms that online advertisements have a significant relationship with consumer buying behavior and are effective in changing consumer perceptions. The online ads have the power to draw viewers, prompt purchases, build images of brands, develop affection for brands, and enhance brand knowledge, which is an antecedent of the purchase intention.

Role of Brand Knowledge

Brand knowledge plays a very significant moderating role in the relationship between online advertising and customer satisfaction. Customer satisfaction is greater for people with a positive brand knowledge. Online ads are more considered as an information source rather than as a means to generate sales directly.

Demographic Factors

Regarding the demographic variables like gender, occupation, income, area, district, ad type, and marital status, the study did not find any significant variations in the brand-related constructs. Nonetheless, attitudes against online advertisements varied considerably according to the level of education.

Importance of Interactivity

As an interactive medium, the internet provides a better route to two-way interactivity with the consumer than traditional media. Such factors as perceived interaction, relevance, and entertainment value would go on to create an attitude towards online ads.

Conclusion

Internet pervasiveness can cause a levelling effect across demographics in brand perceptions, as people are exposed to homogeneous content irrespective of background. Many brands have standardized global marketing strategies that foster homogeneous brand constructs across diverse populations. Most online advertising has

universal appeal, tending to focus on broad themes such as quality, trust, and value, which cut across demographic segments. The ease with which information is accessible online puts people from diverse backgrounds on par in terms of information about brands. Factors like differences in income, occupation, or region do not easily affect brand perception.

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Trends in Non-Performing Assets (NPAs), And Effectiveness of Recovery Mechanisms in the Indian Banking Sector

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Abstract

Purpose: This study aims to outline trends related to non-performing assets (NPAs) and their recovery. It then assesses the effectiveness of recovery mechanisms in India and investigates the impact of NPA recovery on gross and net NPAs.

Methodology: Annual data was sourced from the Reserve Bank of India (RBI) website covering the period from 2003-04 to 2020-21. The data analysis involved applying time trend regression with Gretl, the Kruskal-Wallis test and Dunn-Bonferroni post hoc test using SPSS, and simple regression in E-Views. Additionally, the robustness of the regression results was assessed through the Breusch-Godfrey Serial Correlation LM test and the ARCH Heteroskedasticity test.

Finding: The findings highlight increasing trends in gross and net NPAs of banks operating in India. While NPA recoveries show an increasing trend, the recovery percentage is found to be declining, raising concerns for the banks in India. The study also found that the SARFAESI Act is more effective for NPA recovery than Lok Adalats and Debt Recovery Tribunals (DRTs), emphasising its efficiency as a debt recovery mechanism in recovering NPAs from the Indian banking sector. Research also revealed that increased NPA recovery is linked to a decline in the growth of gross and net NPAs in India's banking sector.

Managerial Implications: The study's findings emphasise the importance of the SARFAESI Act and advocate for improved efficiency in recovery mechanisms. Prioritising legislation like the SARFAESI Act is vital for increasing NPA recovery and strengthening the banking sector. The findings will benefit banks, policymakers, investors, and scholars in understanding NPA trends, recovery effectiveness, and the impact of the existing recovery mechanisms on NPAs within the Indian banking sector.

Originality: This research presents a distinctive approach by employing the index growth rate to evaluate the various NPA recovery channels on a comparable basis. Unlike other studies in the field, this analysis emphasises the differing operational levels of these channels, which have often been overlooked in existing literature.

Keywords: Debt Recovery Tribunals (DRTs); Gross NPA; Lok Adalats; Net NPA; NPA Recovery Mechanism; SARFAESI Act 2002.

Introduction

Non-performing assets (NPAs) pose significant challenges to the banking sector, impacting financial stability and economic growth (Das & Uppal, 2021; Dhananjaya, 2021). The alarming increase in NPAs in the banking sector has shattered worldwide economies (Dan, 2023). In 2021, the global average NPA stood at 5.92%, while India recorded an average NPA of 6.54%, placing it in the 34th position with the highest NPA among 122 countries (The World Bank, 2021). NPAs pose significant threats in India, affecting profitability, liquidity, and asset quality (Das, 2023). They ultimately jeopardise banks' survival and raise concerns about the overall financial health of the banking industry (Mani et al., 2023; Naili & Lahrichi, 2022). The rise of NPAs in India from Rs. 51556.66 crores in 2003-04 to Rs. 835051.42 crores in 2020-21 (Reserve Bank of India, 2021) can primarily be attributed to corporate distress, aggressive lending, poor management, and high debt at risk, particularly in Public Sector Banks (PSBs), which leads to deteriorating asset quality and profitability (Pramahender, 2022; Swami et al., 2022). The accumulation of NPAs can lead to reduced lending capacity, increased operational costs, and decreased bank profitability (Bajaj et al., 2024; Mani et al., 2023). NPAs also contribute to macroeconomic instability, hindering sustainable development efforts (Dan et al., 2024). In 2022, the gross NPAs of Indian banks reached ₹10.03 lakh crores, with PSBs accounting for 88.74% of the total (Kanimozhi & Ganesh, 2024). Effective management and recovery strategies are essential to mitigate the adverse effects of NPAs on banks' profitability and the broader economy (Dan et al., 2024). Recovery of NPAs involves prudent board policies, thorough pre-sanction borrower appraisals, and post-sanction forensic audits of large borrower disbursements. These measures can significantly help banks manage and reduce the impact of bad loans on their financial performance.

The recovery of NPAs in India presents a significant challenge for commercial banks (Kumar et al., 2017). Miglionico (2019) argues that enhancing private arrangements for resolving distressed debts is essential—serving as an alternative to public support mechanisms like asset management companies and securitisation strategies. Such enhancements could facilitate a more effective reduction of NPA on banks' balance sheets. However, the average recovery percentage during the study period was not provided, and the effectiveness of amendments made post-2016 was not assessed (Sharma & Vagrecha, 2022). Furthermore, Pramahender (2022) highlights that despite various initiatives aimed at addressing this issue, including the recapitalisation of PSBs, the establishment of ARCs, the creation of DRTs for expedited recovery of bad loans, and the implementation of the IBC, there remains a substantial amount of work to be done. The research is limited to the period from 2008 to 2014, which may not adequately reflect the long-term impacts of the SARFAESI Act on NPA recovery, as both economic conditions and banking regulations can evolve significantly over time (Shaardha & Jain, 2016).

A contrasting finding by Alamelumangai and Sudha (2019), Sharma and Vagrecha (2022), Chaki et al. (2019), Shaardha and Jain (2016), Kumar et al. (2017a), Kumar et al. (2017), Kumar and Muralidhar (2020), Dey (2018), and Kumar et al. (2017b) regarding the status of NPA recovery and the efficiency of NPA recovery channels provides scope for further study to extend the period and compare the parameters of NPA recovery across different NPA recovery channels on similar grounds which earlier researcher fail to addressed. Hence, to address this research gap, the present study first examines the trends in NPA and its recovery in absolute and percentage. Second, to test the efficiency of NPA recovery channels, the study compares the recovery of NPAs by various NPA recovery channels. Then, the study examines the impact of NPA recovery on gross and net NPA. The Uniqueness of this research is that it uses a distinctive approach by employing the index growth rate to evaluate the various NPA recovery channels on a comparable basis. Unlike other studies in the field, this analysis emphasises the differing operational levels of these channels, which have often been overlooked in existing literature. The study has employed the research methods explained in section 3 of the article to achieve the above-stated objectives.

Literature Reviews

Understanding the status and issues surrounding NPAs and their recovery in Indian banks is vital, as it directly influences the financial stability of the banking sector. Therefore, this section offers a comprehensive review of significant existing studies on the trends and status of NPAs and their recovery, the effectiveness of NPA recovery mechanisms, and the implications of NPA recovery, demonstrating the thoroughness of the research in this field.

Trends in NPAs

Kankipati and Murty (2019) state that the NPA of selected banks is on an upward trend and requires management through suitable NPA recovery mechanisms. Sharma et al. (2019) emphasised the causes of NPAs, their statuses, and the sectors experiencing elevated NPAs. Their study finding revealed that loan siphoning and inadequate recovery and management skills contributed to the high NPAs in agriculture and allied sectors. Pandey and Trivedi (2020) found that the gross NPA ratio is rising across all scheduled commercial and private sector banks, following a discernible trend. They also noted that public sector banks have significant NPAs. A study by Fatima and Ashraf (2020) found that there has been a significant increase in NPA ratios from 2007 to 2018 for the scheduled commercial banks in India. Further study by Mishra et al. (2021) shows that the gross NPAs for Indian banks have nearly quadrupled from approximately USD 35 billion in March 2014 to over USD 150 billion in March 2018. Existing studies by Kankipati and Murty (2019), Sharma et al. (2019), Pandey and Trivedi (2020), Fatima and Ashraf (2020), and Mishra et al. (2021) highlighted the increasing trend in NPAs over their study period. Alienating with the previous researcher, the present study proposes the following hypotheses **H₁** to **H₄** to measure the trend in gross and net NPAs in amount and percentage to understand better their respective magnitude, which other researchers fail to address as they have only focused on either gross or net NPAs and most of them have considered only NPA ratio.

H₁: There is a significant increasing trend in the amount of gross NPA.

H₂: There is a significant increasing trend in the gross NPA ratio.

H₃: There is a significant increasing trend in the amount of net NPA.

H₄: There is a significant increasing trend in the net NPA ratio.

Trends and status of NPA recovery

A study by Alamelumangai and Sudha (2019) highlights a decline in the recovery of NPAs within Indian banks, revealing that the annual recovery rate fell to a low of 20.8% in the 2016-17 fiscal year. They also stated that the existing channels for recovery, such as the DRT, Lok Adalat, and the SARFAESI Act, have exhibited diminishing effectiveness throughout the study period. This finding is supported by Sahoo and Majhi (2020) and Kumar and Muralidhar (2020), who also found that the overall NPA recovery mechanism in the Indian banking industry was unsatisfactory during their study period. Chaki et al. (2019) highlighted a contradictory finding: the Lok Adalat, SARFEASI Act, and DRTs facilitated recoveries when the banking sector in India experienced very high NPAs.

Their study also revealed that the SARFEASI Act accounted for as much as 70% of recoveries, while DRTs managed only 26% in 2014. Additionally, research by Kumar et al. (2017a) and Kumar et al. (2017b) provided evidence that implementing the SARFAESI Act, used in conjunction with Lok Adalats and DRTs, has positively influenced the recovery of NPAs in India. Existing studies by Alamelumangai and Sudha (2019), Sahoo and Majhi (2020), and Kumar and Muralidhar (2020) highlighted a declining trend in NPA recovery, while studies by Chaki et al. (2019) Kumar et al. (2017a) and Kumar et al. (2017b) highlighted the margin improvements NPA recovery rate during their study period. Hence, to address this contradictory finding, the researcher proposes the neutral hypotheses **H₅** and **H₆** for measuring the trend in NPA recovery in amount and percentage.

H₅: There is a significant trend in the amount of NPA recovered.

H₆: There is a significant trend in the NPA recovery rate.

Effectiveness of NPA Recovery Mechanisms

A study by Thakkar et al. (2023), Fatima and Ashraf (2020), Kumar et al. (2017), Hazarika (2019), Sahoo and Majhi (2020), Kumar et al. (2017a), Shaardha and Jain (2016) and Chaki et al., (2019) have identified the most important NPA recovery channels for Indian banks includes: Lok Adalats, DRTs, and SARFAESI Act. Hence, this section discusses the efficiency of these three NPA recovery channels. To begin with, a study by Sharma and Vagrecha (2022) reported that the average recovery percentage of NPAs through DRTs during their study period was just 7.4%, highlighting significant inefficacy in the recovery process, with only 9.1% of cases resolved within the desired timeframe. Shaardha and Jain (2016) conducted a study involving five public sector banks to compare the effectiveness of various methods for recovering NPAs, specifically Lok Adalats, DRTs, and the SARFAESI Act. Their findings revealed that the SARFAESI Act was significantly more effective in recovering NPAs than both Lok Adalats and DRTs from 2008 to 2014. Kumar et al. (2017) identified several factors contributing to NPAs, including deficiencies in bank credit appraisal processes and inefficiencies in the legal system. They noted a decline in recovery rates from Lok Adalats and DRTs over the years while asserting that the SARFAESI Act continues to play a vital role in the recovery of NPAs. Additionally, another study by Kumar et al. (2017a) and Kumar et al. (2017b) highlighted a statistically significant difference in the effectiveness of various recovery methods, such as Lok Adalats, DRTs, and the SARFAESI Act. This research provided evidence that implementing the SARFAESI Act, alongside the use of Lok Adalats and DRTs, has positively influenced the recovery of NPAs. Similar findings by Kumar (2017) state that DRTs, Lok Adalats, and the SARFAESI Act effectively recovered NPAs from Indian banks between 2006 and 2015. While Sahoo and Majhi (2020) found a significant difference in NPA recovery by Lok Adalats, DRTs and the SARFAESI Act, they further stated that India's overall NPA recovery mechanism is poor. Kumar and Muralidhar (2020) conducted extensive research to explore recovery management, revealing that Lok Adalats manage a significant volume of cases, which may indicate inefficiencies in the current recovery channels. Dey (2018) analysed the NPA recovery mechanism in India using three important recovery channels: Lok Adalats, DRTs and the SARFAESI Act from 2003-04 to 2016-17, and found that DRTs are better than others.

Researchers such as Shaardha and Jain (2016), Kumar (2017), Kumar et al. (2017), Kumar et al. (2017a), Kumar et al. (2017b), Dey (2018), Kumar and Muralidhar (2020), and Sahoo and Majhi (2020) identified the significant difference in NPA recovery by Lok Adalats, DRTs and SARFAESI Act NPA recovery channels. Further, Shaardha and Jain (2016), Kumar et al. (2017), Kumar et al. (2017), Kumar et al. (2017a), and Kumar et al. (2017b) supported that SARFAESI Act is better than the DRTs and Lok adalats in recovering NPAs for Indian banks during their study period. Dey (2018) argues that DRTs are better than Lok Adalats and the SARFAESI Act. Kumar and Muralidhar (2020) further argue that Lok Adalats is better than the SARFAESI Act and DRTs. To address this contradictory finding, the researcher proposes the following neutral hypotheses **H₇** to **H₁₀** to compare the efficiency of three NPA recovery channels.

H₇: There is a significant difference in the index growth rate in the number of NPA cases referred by the SARFAESI Act, DRTs, and Lok Adalats.

H₈: There is a significant difference in the index growth rate in the amount involved in NPA cases referred by the SARFAESI Act, DRTs, and Lok Adalats.

H₉: There is a significant difference in the index growth rate in NPA amount recovered by the SARFAESI Act, DRTs, and Lok Adalats.

H₁₀: There is a significant difference in the NPA recovery rate of the SARFAESI Act, DRTs, and Lok Adalats.

Understanding the Impact of NPA Recovery

Bajaj et al. (2024) examined the determinants of NPAs and compared recovery rates and asset quality between public and private sector banks. Their research concluded an inverse relationship between collateral and recovery, particularly noting that illiquid collateral tends to yield low recovery rates. Additionally, they found that private-sector banks outperform public ones regarding recovery. Pramahender (2022) identified several key factors contributing to the increase in bad loans in Indian banks, including inadequate recovery measures, insufficient credit and risk management systems at the bank level, wilful defaults by borrowers, a lack of stringent regulation,

poor corporate governance, and the misuse of funds by borrowers. Bajaj et al. (2024) explored the interplay of idiosyncratic and systematic factors affecting the recovery rates of NPAs in India's private sector banks, adding to the comparative framework for understanding their asset recovery performance. A study by Dan et al. (2024) stated that recovery of NPAs is vital as it enhances lenders' operating cash flow, stabilises financial health, and helps mitigate macroeconomic instability. Pandey (2019) examined the high bids and low recovery rates associated with NPA auctions in India in a related investigation. Through the development of a Vector Autoregressive (VAR) model and simulations, the study concluded that the bids proposed by ARCs do not accurately reflect the recoverable value of these assets. Pandey (2019) further expressed concerns about using auction bids as indicators of fair value on banks' financial statements. The study also provides targeted recommendations to address the challenges posed by flawed auction designs. Notably, it finds that ARCs in India frequently overbid for NPA, resulting in the misrepresentation and inflation of asset values in nearly 70% of cases.

Rajput et al. (2011) underscored the necessity of managing NPAs in PSBs by stringent asset classification standards. The study posits that robust management and recovery frameworks are crucial for Indian banks to recover NPAs effectively. A study by Kaur and Saddy (2013) examines the management of NPAs in PSBs in India, evaluating the effects of asset classification norms and recovery procedures. Malepati (2013) underscores the importance of managing NPAs in PSBs by addressing asset classification norms, identifying NPAs, and provisioning against advances. Ranjini (2013) explored the NPA management strategies utilised by public and private banks, focusing on their respective recovery mechanisms. This investigation uncovered that public banks typically employed more aggressive recovery strategies, while private banks leaned towards more conservative approaches in Bangalore City.

Hazarika (2019) highlights that, despite various initiatives from the Government of India (GOI) and the RBI aimed at reducing and recovering NPAs, the results have been inadequate, reflecting ongoing challenges within the banking sector. Researchers such as Alamelumangai and Sudha (2019), along with Kumar and Muralidhar (2020), investigated the recovery of NPAs through various channels. Their findings revealed a decline in annual recoveries, highlighting the urgent need for timely and effective measures to improve recovery efforts. Meher et al. (2020) identified essential strategies for the proactive management of NPAs, emphasising the importance of raising awareness about preventive measures, pinpointing root causes, recognising early warning signals, addressing implementation challenges, advocating for policy support, and evaluating the effectiveness of preventive strategies and government intervention. Thakkar et al. (2020) proposed the establishment of an exchange market as a viable solution to manage NPAs effectively. The study concluded that developing an exchange market could significantly mitigate NPAs in India, thereby enhancing the efficiency of debt recovery legislation. Additionally, Saini (2020) explored the role of the RBI in managing NPAs, emphasising the RBI's guidelines and initiatives pertinent to this issue.

Researchers such as Rajput et al. (2011), Dan et al. (2024), Ranjini (2013), and Kaur and Saddy (2013) stated that effective NPA recovery management would assist banks in reducing the level of NPAs. Meanwhile, researchers such as Hazarika (2019), Alamelumangai and Sudha (2019), and Kumar and Muralidhar (2020) highlighted that current NPA recovery rates fail to address the level of NPAs. However, neither of these studies has practically examined the impact of NPA recovery on the level of NPAs in banks. Therefore, this research seeks to investigate the impact of NPA recovery on gross and net NPAs within the Indian banking sector. Given that many previous studies support the notion that effective NPA recovery management is likely to lower the NPA level, the current study proposes the following hypotheses, H_{11} and H_{12} , to assess the impact of NPA recovery on gross and net NPAs.

H_{11} : NPA recovery is likely to reduce the level of gross NPAs.

H_{12} : NPA recovery is likely to reduce the level of net NPAs.

Research Methods

The study analyses data from all scheduled commercial banks in India, using annual figures collected from the RBI from April 1, 2003, to March 31, 2021. The SARFAESI Act 2002 was implemented in July 2002. Hence, the researchers chose the study period from 2003-04 to 2020-21, considering the data's uniformity compared to the other NPA recovery channels operating in India during this period. The researcher has used the same study period across all objectives to ensure uniformity in the present study.

Moreover, the researcher offered a compelling and detailed overview of the methodology specifically crafted to address each objective, setting the stage for the following discussion.

Firstly, the study examines gross and net NPA and NPA recovery trends. Gross NPAs denote the total value of loans and advances that a bank categorises as non-performing (Mani et al., 2023; Das, 2023; Das & Uppal, 2021). Net NPAs represent the actual burden of NPAs on a bank after accounting for provisions (Das, 2023; Das & Uppal, 2021; Gupta & Sharma, 2023; Swami et al., 2022). As per RBI guidelines, NPA recovery reduces NPAs during the year. The trend in NPAs and their recovery has been analysed using time trend analysis, employing

the Ordinary Least Squares (OLS) technique. In this analysis, the time trend is an independent (dummy) variable representing the study period, while NPAs and NPA recovery are dependent variables. The study utilises absolute and percentage values of NPAs and their recovery to better understand these trends' magnitude. The absolute values of Gross NPAs, net NPAs, and NPA recovered are Rs. in crores, while ratios of gross NPAs, net NPAs, and NPA recovery rate are in percentage form calculated using Eq. (1) to Eq. (3).

$$\text{Eq. (1)} \quad \text{Gross NPA Ratio} = \frac{\text{Gross NPAs}}{\text{Total Advance}} * 100$$

$$\text{Eq. (2)} \quad \text{Net NPA Ratio} = \frac{\text{Net NPAs}}{\text{Net Advance}} * 100$$

$$\text{Eq. (3)} \quad \text{NPA Recovery Rate} = \frac{\text{Amount of NPA recovered}}{\text{Gross NPAs}} * 100$$

Eq. (4) to Eq. (9) explain the regression equation used for examining the time trends analysis for the OLS regression models 1 to 6, as shown in Table 2.

$$\text{Eq. (4)} \quad \text{Gross NPA (Rs. in crores)} = \beta_0 + \beta_1. \text{ Time trend} + U_i$$

$$\text{Eq. (5)} \quad \text{Gross NPA ratio} = \beta_0 + \beta_1. \text{ Time trend} + U_i$$

$$\text{Eq. (6)} \quad \text{Net NPA (Rs. in crores)} = \beta_0 + \beta_1. \text{ Time trend} + U_i$$

$$\text{Eq. (7)} \quad \text{Net NPA ratio} = \beta_0 + \beta_1. \text{ Time trend} + U_i$$

$$\text{Eq. (8)} \quad \text{NPA Recovered (Rs. in crores)} = \beta_0 + \beta_1. \text{ Time trend} + U_i$$

$$\text{Eq. (9)} \quad \text{NPA Recovery rate} = \beta_0 + \beta_1. \text{ Time trend} + U_i$$

In the equations (Eq. (4) to Eq. (9)) *Gross NPA*, *Net NPA*, and *NPA recovery* are dependent variables in absolute and percentage form. β_0 is the constant value of dependent variables irrespective of independent variables. β_1 is a coefficient of slope representing the change in time trend (independent variable) leading to a change in dependent variables. U_i is the error term representing the unexplained variation in the dependent variable.

The above time trend regression equations (Eq. (4) to Eq. (9)) have been tested using the hypotheses (**H₁** to **H₆**) in Table 2.

Secondly, this study compares NPA recovery across different NPA recovery channels. The section below shows the presence of NPA recovery channels in India.

Indian NPA Recovery Mechanism consists of:

- **The Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act, 2002.**: This Act helps banks and other financial institutions to improve asset quality in multiple ways (Parakkott, 2024; Thakkar et al., 2023; Pramahender, 2022; Fatima & Ashraf, 2020; Chaki Sunita et al., 2019a; Shaardha & Jain, 2016). The Act provides three methods for the recovery of NPAs:
 - ✓ **Firstly**, the securitisation of assets means converting less liquid financial assets into marketable securities (Goswami, 2022; Shaardha & Jain, 2016; Oyetade et al., 2020; Yamuna & Subramanian, 2019; Chaki Sunita et al., 2019a; Abdelsalam et al., 2022).
 - ✓ **Secondly**, the reconstruction of financial assets means converting a bad or non-performing asset into a performing asset by selling it to the asset's reconstruction companies (Goswami, 2022; Yamuna & Subramanian, 2019; Chaki Sunita et al., 2019a).
 - ✓ **Thirdly**, giving the power to enforce security interests to the secured creditors (banks and financial institutions) to recover the bad loans by exercising powers to take possession or sell the secured asset without the court's intervention (Parakkott, 2024; Thakkar et al., 2023; Pramahender, 2022; Shaardha & Jain, 2016; Chaki Sunita et al., 2019a).
- **One-Time Settlement (OTS)**: This scheme is a compromise settlement executed by banks or financial institutions to recover NPAs. In the OTS scheme, the borrower who defaulted proposes to settle all outstanding balances in one go, and the banks or financial institutions agree to accept a lesser amount than the original amount due (Shaardha & Jain, 2016; Kumar et al., 2017).
- **Lok Adalats**: These are the dispute redressal mechanisms, where disputes/cases pending in the court of law or at the pre-litigation stage are settled or compromised cordially. Lok Adalats help banks settle loans by compromising between bankers and defaulters of bad loans (Goswami, 2022; Thakkar et al., 2023; Fatima & Ashraf, 2020; Chaki Sunita et al., 2019a; Hazarika, 2019; Chepuri et al., 2017; Shaardha & Jain, 2016; Baxi & Upendra, 2011; Nagaraj, 2010; Galanter & Krishan, 2004).
- **Debt Recovery Tribunal (DRTs) and Debts Recovery Appellate Tribunals (DRAT)**: These were constituted under the provisions of the DRT Act to establish tribunals for speedy settlement and recovery of debts due to banks and financial institutions and related matters. DRT has also been given the authority to judge the

applications filed by the borrower/mortgagor against the action of the secured creditor initiated under the Securitization and SARFAESI Act 2002 (Goswami, 2022; Visaria, 2009; Kumar et al., 2020; Fatima & Ashraf, 2020; Chaki Sunita et al., 2019a; Hazarika, 2019; Katara & Shastri, 2014; Shaardha & Jain, 2016; Thakkar et al., 2023).

- **Assets Reconstruction Companies (ARC):** ARCs purchase NPAs from banks and take action to pursue repayment from the debtors (Goswami, 2022; Kaur & Khanna, 2022; Bhagwati et al., 2017; Shaardha & Jain, 2016).
- **Corporate Debt Restructuring (CDR):** The mechanism covers only multiple banking accounts and syndication/conglomerate accounts, where all banks and institutions have an outstanding collective exposure of Rs. 10 lakhs and above. The cases of restructuring of standard and a sub-standard class of assets are covered in Category-I, whereas cases of doubtful assets are included under Category-II (Goswami, 2022; Shaardha & Jain, 2016; Okoye et al., 2020).
- **Credit Information Bureau (CIB):** Established in 2000 under the Credit Information Bureau of India Limited (CIBIL), this organisation specialises in disseminating credit information, particularly corporate credit. By analysing the consumer's information from CIBIL, banks and financial institutions can check the consumer's past behaviour and anticipate credit while making lending decisions (Shaardha & Jain, 2016; Jayadeva & Padma, 2020).
- **The Insolvency and Bankruptcy Code (IBC):** This is the bankruptcy law of India that seeks to consolidate the existing framework by creating a single law for insolvency and bankruptcy. The objective of the above code is the re-organisation and insolvency resolution of corporate, partnership, and individual persons for maximisation of the worth of assets of such persons and to promote entrepreneurship, accessibility of credit, and to balance the interests of all stakeholders (Chaki Sunita et al., 2019a; Goswami, 2022; Vidit & Ali, 2022; Baxi, 2023; Pramahender, 2022; Arora & Saurabh, 2022; Mukhopadhyaya, 2020; Bose et al., 2021).

Among the various NPA recovery channels, this study selected the SARFAESI Act, DRTs, and Lok Adalat due to their significant role in recovering NPAs within the Indian banking sector. This is further supported by researchers such as Fatima and Ashraf (2020), Kumar et al. (2017), Hazarika (2019), Sahoo & Majhi (2020), Kumar et al. (2017a), Shaardha & Jain (2016), and Chaki et al. (2019). Another reason for selecting only these three NPA recovery channels is the availability of authentic data from regulators, such as the RBI. The efficiency of recovering NPAs across three channels was assessed using the nonparametric Kruskal-Wallis test due to the non-normal distribution of certain variables (see Table 3). Significant results were further analysed with the Dunn-Bonferroni post hoc test, as shown in Tables 4, 5, and 6. Both tests were conducted using SPSS, focusing on four parameters: the number of NPA cases referred, the amount of NPA involved, the amount of NPA recovered, and the NPA recovery rate by each channel. To ensure uniformity in comparability, three absolute variables were transformed into index growth rates using a base value of 100 for 2003-04. The index growth rate for 2004-05 to 2020-21 has been calculated using equations Eq. (10) to Eq. (12) for three variables: the number of NPA cases referred, the amount of NPA involved, and the amount of NPA recovered. The NPA recovery rate is the ratio of the amount of NPA recovery to the amount involved in NPA cases.

$$\text{Eq. (10) Index growth rate in Number of NPA cases referred} = \frac{\text{Current year value}}{\text{Base year value for 2003-04}} * 100$$

$$\text{Eq. (11) Index growth rate in amount involved in NPA cases} = \frac{\text{Current year value}}{\text{Base year value for 2003-04}} * 100$$

$$\text{Eq. (12) Index growth rate in amount of NPA recovered} = \frac{\text{Current year value}}{\text{Base year value for 2003-04}} * 100$$

$$\text{Eq. (13) NPA recovery rate} = \frac{\text{Amount of NPA recovered}}{\text{Amount involved in NPA cases}} * 100$$

Thirdly, the study examined the impact of NPA recovery on gross and net NPAs using equations Eq. (11) and Eq. (12) for testing hypotheses H_{11} and H_{12} .

$$\text{Eq. (11) Gross NPA ratio} = \beta_0 + \beta_1 \cdot \text{NPA recovery} + U_i$$

$$\text{Eq. (12) Net NPA ratio} = \beta_0 + \beta_1 \cdot \text{NPA recovery} + U_i$$

In equations (Eq. (11) and Eq. (12)), the Gross NPA ratio and the Net NPA ratio are dependent variables. β_0 represents the constant value of the dependent variables' Gross and Net NPA ratios, irrespective of NPA recovery, which is the independent variable. β_1 is a slope coefficient that indicates the change in NPA recovery (the independent variable) leading to alterations in the dependent variables: Gross and Net NPA ratios. U_i denotes the error term, which reflects the unexplained variation in the dependent variables.

The H_{11} and H_{12} for Eq. (11) and Eq. (12) are tested using OLS regression models, employing E-Views software, as shown in Table 9.

Data Analysis and Results

Examination of trend in NPAs and their recovery

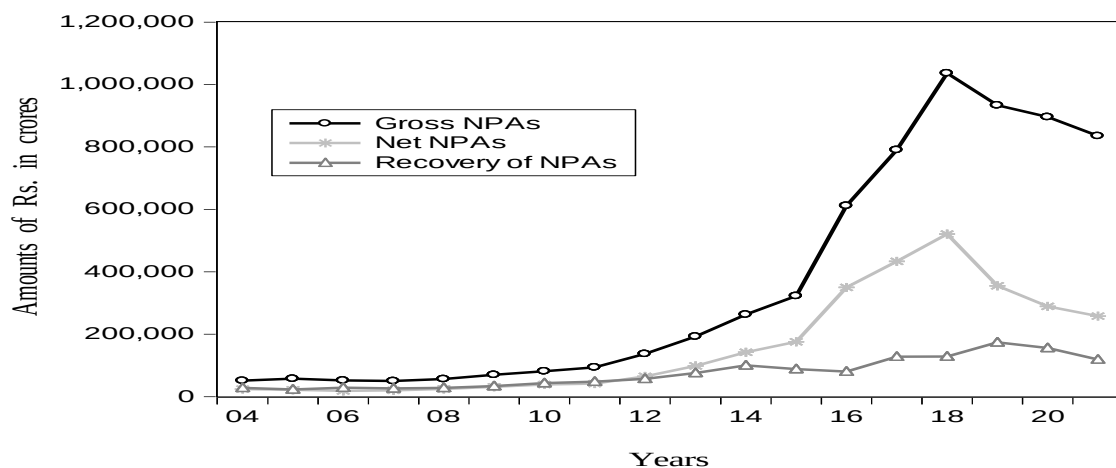
Table No. 1: Summary statistics and Normality Test for NPA and their recovery

Variables	Mean	Skewness	Kurtosis	Jarque-Bera Prob.
GNPA (Rs. in crores)	362887.30	0.72	1.80	0.2668
GNPA (%)	5.24	0.58	1.93	0.3908
NNPA (Rs. in crores)	161678.40	0.85	2.37	0.2892
NNPA (%)	2.39	1.07	3.07	0.1749
NPA Recovery (Rs. in crores)	75845.61	0.58	2.08	0.4392
NPA Recovery (%)	35.64	-0.28	1.44	0.3578

Source: Authors compilation

From 2003-04 to 2020-21, the average gross NPA, net NPA, and NPA recovery are Rs. 3,62,887.30 crores, Rs. 1,61,678.40 crores, and Rs. 75,845.61 crores, respectively, as per Table 1. The average gross NPA ratio is 5.24%, the net NPA ratio is 2.39%, and the NPA recovery rate is 35.64%. Positive skewness is observed for GNPA and NNPA (amount and percentage) and NPA recovery (amount), while the NPA recovery rate is negatively skewed. GNPA and NPA recovery (amount and percentage) and NNPA (amounts) have a kurtosis beta of less than 3 (platykurtic), while the NNPA ratio is mesokurtic with a beta of 3.07. Jarque-Bera probability values exceed 0.05, confirming normal distribution for all variables.

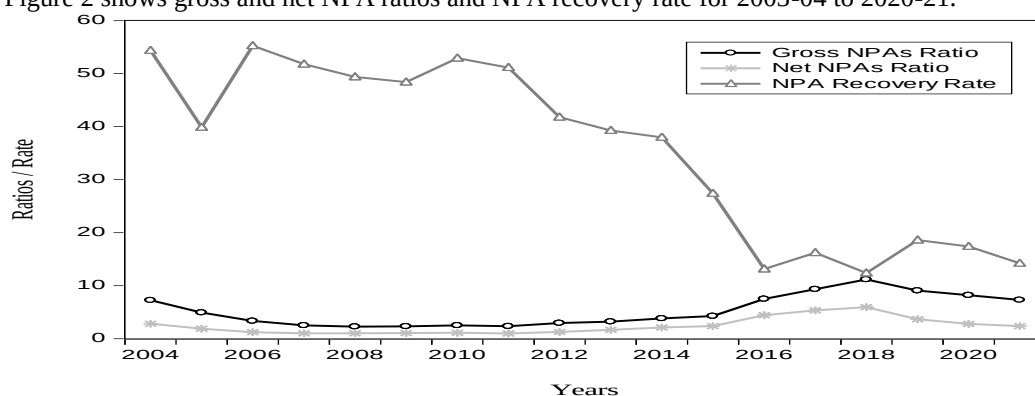
Figure 1 shows gross NPA, net NPA and NPA recovery in Rs. in crores from 2003-04 to 2020-21.



Source: Authors compilation

Figure 1 shows that gross NPA increases faster than net NPA while the recovery of NPA in amount grows slower. Gross and net NPAs have risen at a higher rate from 2014-15 to 2017-18 while NPA recovery was moderate; this can be due to various reasons such as an increase in wilful defaulters, aggressive lending practices by banks, poor recovery management practices, etc. From the financial year 2018-19 onwards, gross and net NPAs have started declining due to the combined efforts of RBI and the governments of India, which helped banks in India to write off the accumulated NPAs (Hazarika (2019)).

Figure 2 shows gross and net NPA ratios and NPA recovery rate for 2003-04 to 2020-21.



Source: Author compilation

As shown in Figure 2, the NPA recovery rate was initially higher than the gross NPA and net NPA ratios due to the introduction of a new NPA recovery mechanism, the SARFAESI Act 2002, which has helped the banks boost the NPA recovery. However, the NPA recovery rate declined while the gross and net NPA ratios increased. This can be attributed to the other NPA recovery channels' inefficiency in managing NPAs and banks' aggressive lending behaviour. This trend poses a significant concern for banks in India.

Table No. 2: Trend in NPAs and their recovery

Model	Hypothesis	Variables	Coefficient values	Adjusted R ²	P-value	Inferences
1	H ₁	GNPA (Rs. in Crores)	62300.90	0.7921	<0.0001	Supported
2	H ₂	GNPA (%)	0.3442	0.3565	0.0053	Supported
3	H ₃	NNPA (Rs. in Crores)	25584.60	0.6716	<0.0001	Supported
4	H ₄	NNPA (%)	0.1705	0.3096	0.0097	Supported
5	H ₅	NPA Recovery (Rs. in Crores)	8434.97	0.8509	<0.0001	Supported
6	H ₆	NPA Recovery Rate (%)	-2.7291	0.7827	<0.0001	Supported

Source: Authors compilation

Table 2 shows the p-values for GNPA, NNPA, and NPA recovery (amount and percentage) are significant: **H₁** <0.0001, **H₂** 0.0053, **H₃** <0.0001, **H₄** 0.0097, **H₅** <0.0001, **H₆** <0.0001. All are below the 0.05 threshold, indicating a significant trend. Adjusted R² values show that time trends account for 79.21% and 35.65% of variation in GNPA in amount and percentage, 67.16% and 30.96% of variation in NNPA in amount and percentage and 85.09% and 78.27% of variations in NPA recovery in amount and rate, respectively. Positive coefficients for GNPA, NNPA, and NPA recovery in amount indicate increases of Rs. 62,300.90, Rs. 25,584.60, and Rs. 8,434.97 crores per annum, respectively. GNPA and NNPA ratios are rising by 0.3442% and 0.1705% per annum, whereas NPA recovery rates are declining by 2.7291% per annum, raising concerns for Indian scheduled commercial banks.

Effectiveness of NPA recovery channels

Table No. 3: Summary statistics and normality test for recovery of NPAs through selected NPA recovery channels.

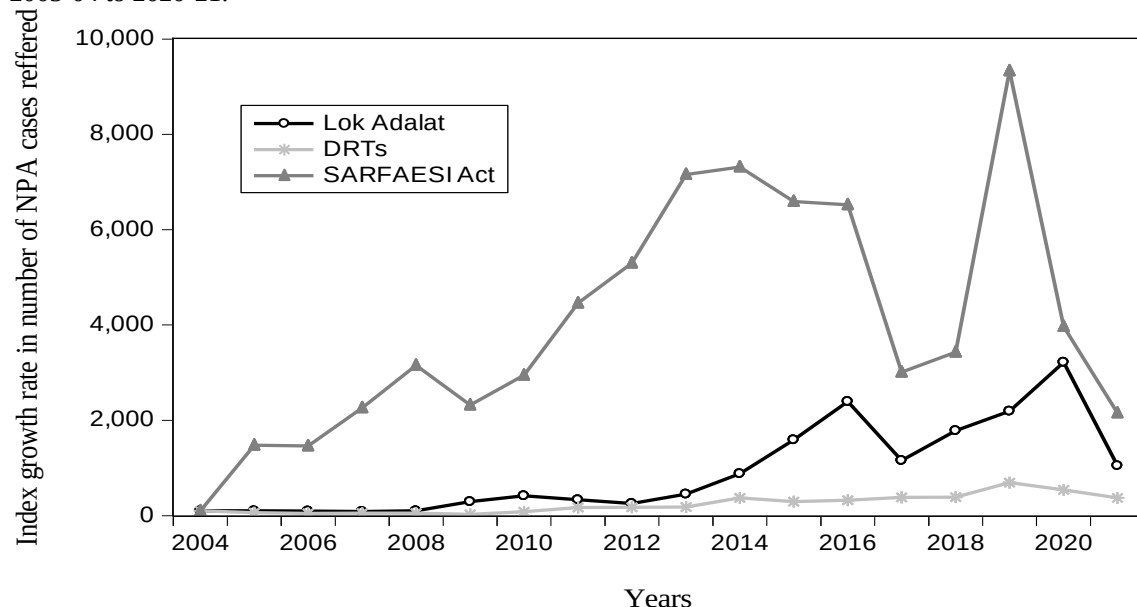
Variables	NPA Recovery Channels	Mean (Index Rate/Ratio)	Skewness	Kurtosis	Jarque-Bera Prob.
The index growth rate in the number of NPA cases referred	Lok Adalat	916.46	1.04	2.97	0.1988
	DRTs	239.68	0.75	2.73	0.4143
	SARFAESI Act	4053.51	0.51	2.35	0.5825
The index growth rate in amount Involved in NPA cases	Lok Adalat	2397.74	1.19	3.39	0.1123
	DRTs	583.98	1.48	3.81	0.0297
	SARFAESI Act	911.80	1.47	4.59	0.0154
The index growth rate in the amount of NPA Recovered	Lok Adalat	853.33	0.91	2.46	0.2599
	DRTs	270.67	1.62	5.20	0.0032
	SARFAESI Act	1364.49	1.09	3.33	0.1610
NPA Recovery rate	Lok Adalat	7.33	1.04	3.02	0.1954
	DRTs	24.53	1.35	3.75	0.0530
	SARFAESI Act	28.18	0.63	3.56	0.4886

Source: Authors compilation

The SARFAESI Act stands out, demonstrating the highest average index growth rate for NPA cases at 4053.51, as shown in Table 3. This is a significant finding, especially when compared to Lok Adalats at 916.46 and DRTs at 239.68. Regarding monetary recovery, Lok Adalats led with an index growth rate of 2397.74, while the SARFAESI Act followed at 911.80 and DRTs at 583.98. The SARFAESI Act also excels in index growth rate for NPA amount recovered at 1364.49, followed by Lok Adalats at 853.33, and DRTs at 270.67. Furthermore, the SARFAESI Act accounts for the highest NPA recovery rate at 28.18%, compared to DRTs at 24.53% and Lok Adalats at 7.33%.

The skewness beta for all the variables is positive, indicating that each variable is positively skewed. Our kurtosis analysis reveals that some variables exhibit leptokurtic distributions (with kurtosis beta values less than 3), while others show a platykurtic distribution (with kurtosis beta values greater than 3). The Jarque-Bera test further highlights normality, revealing probabilities below 0.05 for DRTs and the SARFAESI Act concerning the monetary amounts involved and recovered from NPAs, indicating non-normal distributions. This finding is crucial as it suggests employing non-parametric tests to compare NPA recovery among the selected channels. Consequently, the researcher utilised the Kruskal-Wallis (non-parametric) test to assess differences in NPA recovery across the three channels, as illustrated in Table 4. Graphical analysis of the recovery of NPAs by NPA recovery channels is shown in Figures 3 to 6.

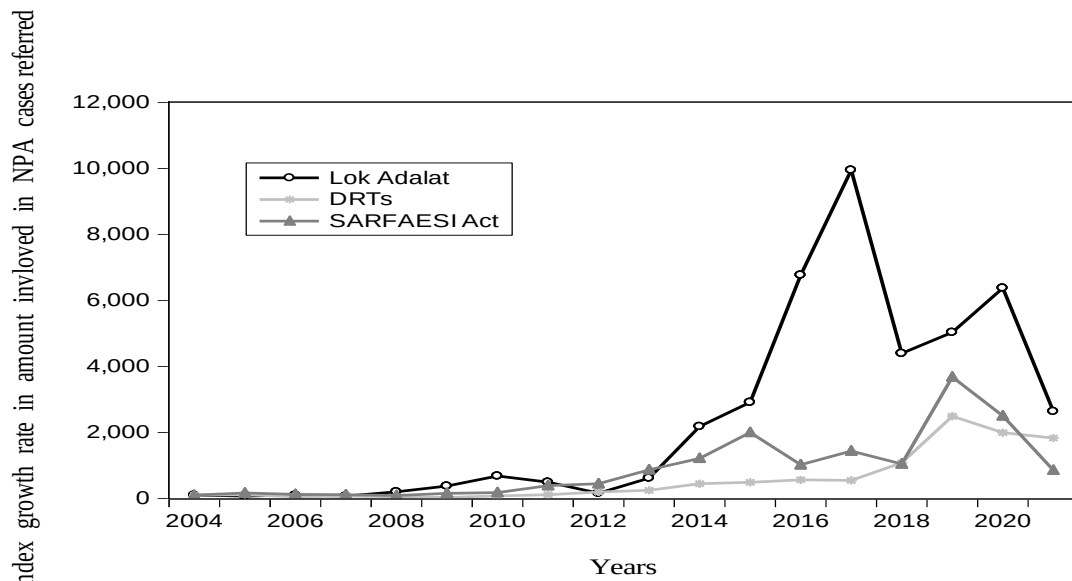
Figure 3 shows the indexed growth rate in a number of NPA cases referred by NPA recovery channels from 2003-04 to 2020-21.



Source: Authors compilation

The SARFAESI Act has the highest index growth rate in the number of NPA cases referred, followed by Lok Adalats, while DRTs show the lowest growth rate, as depicted in Figure 3. Since its introduction, the SARFAESI Act has attracted more NPA cases from banks than Lok Adalats and DRTs, as it has three different mechanisms to recover NPAs and allows secured creditors to recover debts without court intervention.

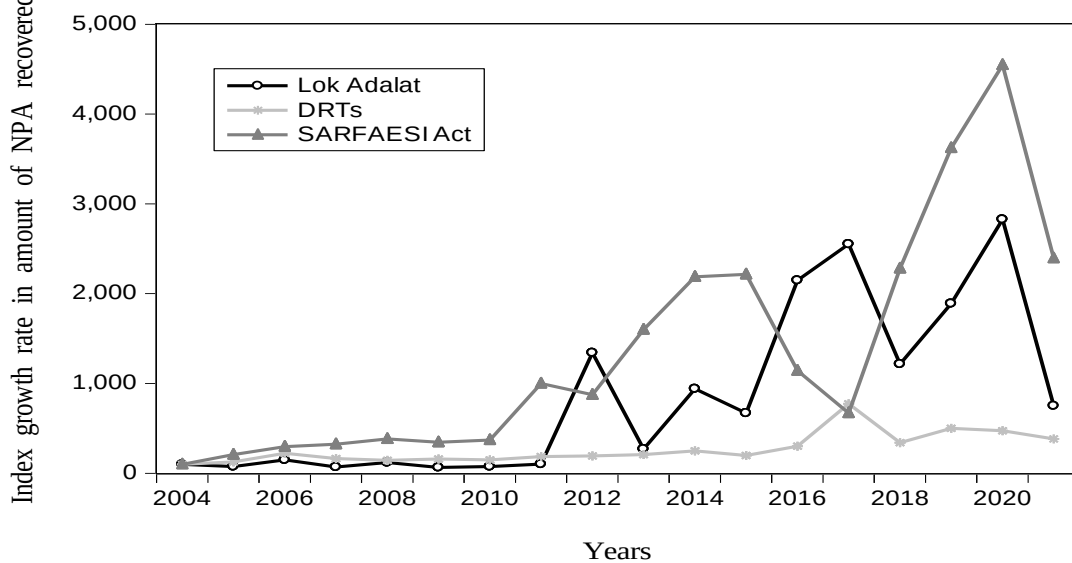
Figure 4: Shows the index growth rate in amount involved in NPA cases referred by NPA recovery channels for 2003-04 to 2020-21.



Source: authors compilation

Figure 4 shows that Lok Adalats have exhibited the highest growth rate in the amount involved in NPA cases referred, followed by the SARFAESI Act, with DRTs showing the lowest.

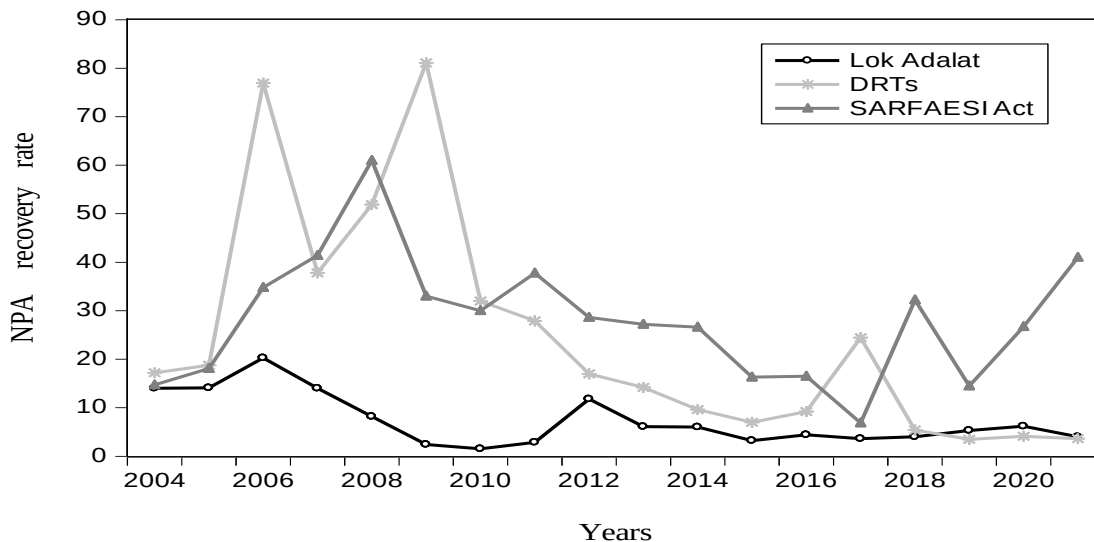
Figure 5 shows the index growth rate in the amount of NPA recovered through channels from 2003-04 to 2020-21.



Source: Authors compilation

Figure 5 confirms that the SARFAESI Act had the highest index growth rate in the amount of NPA recovered, followed by Lo a adalats and the lowest by DRTs.

Figure 6: Shows the NPA recovery rate by NPA recovery channels for 2003-04 to 2020-21.



Source: Authors compilation

Figure 6 depicts that the SARFAESI Act achieves the highest average growth rate in recovering NPA, followed by DRTs and the lowest for Lok adults.

Table No. 4: Kruskal-Wallis Test showing comparison of NPA recovered by NPA recovery channels

Hypothesis	NPA Recovery Parameters	NPA Recovery Channels	Mean Rank	Sig. Value	Inferences
H₇	The index growth rate in the number of NPA cases referred	Lok Adalat	24.78	<0.001	Supported
		DRTs	14.78		
		SARFAESI Act	42.94		
H₈	The index growth rate in amount involved in NPA cases	Lok Adalat	32.72	0.082	Not supported
		DRTs	21.17		
		SARFAESI Act	28.61		
H₉	The index growth rate in the amount of NPA recovered	Lok Adalat	25.44	0.006	Supported
		DRTs	20.39		
		SARFAESI Act	36.67		
H₁₀	NPA Recovery Rate	Lok Adalat	13.86	<0.001	Supported
		DRTs	30.08		
		SARFAESI Act	38.56		

Source: Authors compilation

The Kruskal-Wallis test findings highlighted significant differences in NPA cases referred, amounts recovered, and recovery rate by Lok Adalats, DRTs, and the SARFAESI Act. Key significance values for hypotheses **H₇** (<0.0001), **H₉** (0.006), and **H₁₀** (<0.001) are well below the 0.05 threshold, indicating strong statistical significance. For the index growth rate of NPA cases referred, the SARFAESI Act has the highest mean rank (42.92), followed by Lok Adalats (24.78) and DRTs (14.78), indicating its superior effectiveness. Regarding the amount recovered, SARFAESI Act also leads with a mean rank of 36.67, compared to Lok Adalats (25.44) and DRTs (20.39). Similarly, for the NPA recovery rate, the SARFAESI Act ranks highest at 38.56, with DRTs at 30.08 and Lok Adalats at 13.86.

The Dunn-Bonferroni post hoc test further analysed significant outcomes from the Kruskal-Wallis test for **H₇**, **H₉**, and **H₁₀**, with additional results in Tables 5 to 7 using sub-hypotheses, as shown below. Sub-hypotheses **H_{7a}**, **H_{7b}**, and **H_{7c}** are used for the main hypothesis **H₇**. Sub-hypotheses **H_{9a}**, **H_{9b}**, and **H_{9c}** test the main hypothesis **H₉** and sub-hypotheses **H_{10a}**, **H_{10b}**, and **H_{10c}** further test the main hypothesis **H₁₀**.

H_{7a}: The index growth rate in the number of NPA cases referred by Lok Adalats and DRTs differ significantly.

H_{7b}: The index growth rate in the number of NPA cases referred by the SARFAESI Act and Lok Adalats differ significantly.

H_{7c}: The index growth rate in the number of NPA cases referred by the SARFAESI Act and DRTs differ significantly.

H_{9a}: The index growth rate in the amount of NPA recovered by Lok Adalats and DRTs differ significantly.

H_{9b}: The index growth rate in the amount of NPA recovered by the SARFAESI Act and Lok Adalats differ significantly.

H_{9c}: The index growth rate in the amount of NPA recovered by the SARFAESI Act and DRTs differ significantly.

H_{10a}: A significant difference exists in the NPA recovered rate of Lok Adalats and DRTs.

H_{10b}: A significant difference exists in the NPA recovered rate of the SARFAESI Act and Lok Adalats.

H_{10c}: A significant difference exists in the NPA recovered rate of the SARFAESI Act and DRTs.

Table 5 shows the output of the Dunn-Bonferroni post hoc test to compare the index growth rate in the number of NPA cases referred by NPA recovery channels.

Hypotheses	Channels compared	Mean Rank Diff.	Sig. Value	Inferences
H_{7a}	Lok Adalats with DRTs	10.00	0.170	Not supported
H_{7b}	SARFAESI Act with Lok Adalats	18.16	<0.001	Supported
H_{7c}	SARFAESI Act with DRTs	28.16	0.001	Supported

Source: Authors compilation

The significance values for **H_{7b}** and **H_{7c}** are <0.001 and 0.001, respectively, supporting these hypotheses, as indicated in Table 5. The average mean rank difference for the number of NPA cases referred by the SARFAESI Act with Lok Adalat is 18.16, and the SARFAESI Act with DRTs is 28.16, respectively. This data demonstrates a significant difference in the number of NPA cases referred by the SARFAESI Act compared to DRTs and Lok Adalats, suggesting that the SARFAESI Act has referred more NPA cases than the other two channels. In contrast, the significance value of 0.170 for **H_{7a}** indicates a failure to support this hypothesis, signifying no significant difference in the number of NPA cases referred by DRTs and Lok Adalats.

Table 6 shows the results of the Dunn-Bonferroni post hoc test to compare the index growth rate in the amount of NPA recovered by NPA recovery channels.

Hypotheses	Channels compared	Mean Rank Diff.	Sig. Value	Inferences
H_{9a}	Lok Adalats with DRTs	5.05	0.335	Not Supported
H_{9b}	SARFAESI Act with Lok Adalats	11.23	0.002	Supported
H_{9c}	SARFAESI Act with DRTs	16.28	0.032	Supported

Source: Authors compilation

Table 6 highlights a significant difference in the amount of NPA recovered between the SARFAESI Act and Lok adalats (**H_{9b}**) and the SARFAESI Act and DRTs (**H_{9c}**), as the significance values for them are 0.002 and 0.032, respectively. The SARFAESI Act has recovered more NPA than Lok adalats and DRTs, confirmed by the positive mean rank difference of 11.23 for **H_{9b}** and 16.28 for **H_{9c}**, as shown in Table 6. In contrast, there is no significant difference in the amount of NPA recovered by Lok adalats and DRTs, as the study failed to support hypothesis **H_{9a}** because its significance value of 0.335 is above the acceptance limit.

Table No. 7 shows the results of the Dunn-Bonferroni post hoc test to compare the NPA recovery rate of NPA recovery channels.

Hypotheses	Channels compared	Mean Rank Diff.	Sig. Value	Inferences
H_{10a}	Lok Adalats with DRTs	-16.22	0.002	Supported
H_{10b}	SARFAESI Act with Lok Adalats	24.7	0.0001	Supported
H_{10c}	SARFAESI Act with DRTs	8.48	0.1060	Not supported

Source: Authors compilation

There is a significant difference in the NPA recovery rate of Lok adalats compared with DRTs and the SARFAESI Act compared with Lok Adalats, confirmed by the significance values of 0.002 for **H_{10a}** and 0.001 for **H_{10b}** shown in Table 7. The NPA recovery rate of Lok adalats is lower than that of the DRTs, as it has a negative mean rank value of -16.22 for **H_{10a}**. The SARFAESI Act has a higher NPA recovery rate than Lok adalats, as shown by the positive mean rank difference of 24.7 for **H_{10b}**. A mean rank difference of 8.48 between the SARFAESI Act and DRTs shows that the SARFAESI Act has a higher NPA recovery rate than DRTs. However, this difference is not statistically significant as **H_{10c}** has a significance value of 0.1060, above the acceptable limit.

Impact of NPA recovery on gross and net NPA.

Researchers have tested the output of simple regression models 7 and 8 (see Table 9) for robustness using the Breusch-Godfrey Serial Correlation LM Test to check the presence of serial correlation among error terms and the ARCH Heteroskedasticity Test to check the presence of heteroskedasticity among error terms, as shown in Table 8.

Table No. 8 shows the results of the Breusch-Godfrey Serial Correlation LM Test and ARCH Heteroskedasticity Test.

Variables	Breusch-Godfrey Serial Correlation LM Test (Prob. Chi-square Values)	ARCH Heteroskedasticity Test (Prob. Chi-square Values)
Gross NPA ratio	0.2963	0.4528
Net NPA ratio	0.1870	0.5247

Source: Authors compilation

As per Table 8, the probability Chi-square values for the Breusch-Godfrey Serial Correlation LM test for gross NPA and net NPA are 0.2963 and 0.1870, respectively, indicating that the error term for both the variables is free from the problem of serial positive or negative correlation. The probability chi-square values for the ARCH Heteroskedasticity test for gross NPA are 0.4528, and net NPA is 0.5247, respectively, indicating that both the variables have equal variance in error term over the period. The error term is homoscedastic; hence, there is no problem with heteroskedasticity. After determining the robustness of the regression models 7 and 8 (see Table 8), researchers used the regression output to estimate the impact, as shown in Table 9 below.

Table No. 9 shows the regression output measuring the effect of NPA recovery on the gross and net NPA ratios.

Mode l	Hypothesis	Dependent Variables	Coefficient Values	Adjusted R2	P-values	Inferences
7	H ₁₁	Gross NPA ratio	-0.1464	0.6467	0.0001	Supported
8	H ₁₂	Net NPA ratio	-0.0760	0.6290	0.0001	Supported

Source: Authors compilation

As shown in Table 9, the P-values for gross and net NPA are 0.0001 (H₁₁) and 0.0001 (H₁₂), respectively, indicating that NPA recovery significantly impacts both. The gross and net NPA coefficient values of -0.1464 and -0.0760 signify that NPA recovery significantly helps reduce the gross and net NPA ratio. If the NPA recovery rate for the Indian banks increases by 1%, then the generation of gross and net NPAs will decrease by 0.1464% and 0.0760%, respectively.

Conclusion and Discussions

The present study elucidates a significant trend in NPAs, demonstrating both positive gross and net NPAs in both absolute and percentage terms. This finding aligns with previous studies by Malepati (2013), Fatima and Ashraf (2020), Kankipati and Murty (2019), Sharma et al. (2019), and Pandey and Trivedi (2020), who have emphasised the increasing trend in NPAs.

While there is an observable increase in absolute terms regarding NPA recovery, it is imperative to acknowledge the declining rate, which raises substantial concerns for the banking sector in India. This finding is consistent with earlier studies by Alamelumangai and Sudha (2019), Sahoo and Majhi (2020), and Kumar and Muralidhar (2020), all of which emphasised the declining NPA rate.

Within the framework of NPA recovery mechanisms, the SARFAESI Act emerges as the most efficacious channel, evidenced by superior performance in terms of the volume of cases referred, total amounts recovered, and the highest NPA recovery rates relative to Lok Adalats and DRTs. Supporting evidence for this assertion is found in the works of Fatima and Ashraf (2020), Kumar (2017), Shaardha and Jain (2016), Chaki et al. (2019), Kumar et al. (2017), and Kumar et al. (2017a) but contradicting with the work of Dey (2018) who found that NPA recovery through DRTs is better than the SARFAESI Act and Lok Adalats.

Notably, while Lok Adalats surpassed DRTs regarding the number of cases referred and the total recovery amounts, they demonstrated lower NPA recovery rates. This finding is consistent with the research of Sahoo and Majhi (2020), who indicated that Lok Adalats outperform DRTs while contradicting the conclusions of Sharma and Vagrecha (2022), which suggest that DRTs are ineffective in recovering NPAs. Additionally, notable researchers such as Kumar et al. (2017), Dan et al. (2024), Pramahender (2022), Rajput et al. (2011), Pandey (2019), Kumar et al. (2017b) and Thakkar et al. (2020) have expressed apprehensions regarding the efficacy of current NPA recovery channels. They advocate for enhancements in the efficiency of existing mechanisms and the exploration of new avenues.

Furthermore, the study highlighted the negative impact of the NPA recovery rate on both gross and net NPA ratios. This suggests that an increase in the NPA recovery rate will likely reduce the gross and net NPA ratios, indicating that the recovery rate adversely influences these ratios. This emphasises the critical importance of efficient NPA recovery channels in mitigating NPAs within the Indian banking landscape.

Managerial Implications

The rise in gross and net NPAs poses a significant concern for banks in India. This has led policymakers and bank management to consider more assertive strategies for managing NPAs within the Indian banking sector. The increasing trend in the amount of NPAs recovered, alongside the declining trend in the NPA recovery rate, draws policymakers' attention to the need to enhance the efficiency of the NPA recovery mechanism in India.

The SARFAESI Act is more efficient in recovering NPAs than other NPA recovery mechanisms in India. In light of these, policymakers urgently need to enhance the effectiveness of existing NPA recovery channels, particularly in conjunction with the SARFAESI Act. Such improvements are essential for assisting banks and financial institutions in reducing current NPAs and preventing the future accumulation of additional NPAs. Policymakers in India and worldwide should prioritise legislation like the SARFAESI Act to strengthen NPA recovery efforts and create a more stable and prosperous banking sector.

An increase in NPA recovery has been shown to reduce the level of NPAs in the Indian banking sector. This encourages policymakers and bank management to enhance NPA recovery rates, thereby improving the asset quality of Indian banks.

Future Scope

Future research could further assess the effectiveness of NPA recovery strategies across different banks and banking groups, emphasising the importance of continuous improvement and innovation in this field. Additionally, future studies may explore the use of machine learning and AI in managing NPA recovery for Indian banks.

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From Novelty to Necessity: A Systematic Review of Augmented Reality's Role in Modern Marketing

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Abstract

The purpose of the study is to identify the opportunities and challenges of using augmented reality marketing for future prospects. Augmented reality has become increasingly important in the field of marketing due to its ability to create engaging and interactive experiences for consumers. This study investigates the influence of augmented reality upon digital marketing with a thorough review of academic and industry studies. The unfolding analysis reveals that the tool is no longer a new feature but a potential instrument to increase customer engagement, brand perception, and buying behavior. Through interactive and immersive experiences, augmented reality bridges the gap between physical and digital environments, thus creating meaningful experiences for consumers with the brands. From virtual try-ons to immersive storytelling, augmented reality applications are widespread across retail, tourism, entertainment, and education. A systematic literature review analyses existing augmented reality marketing literature to identify gaps and provide a comprehensive view. A systematic review is done from two major databases, Scopus and Google Scholar. Existing literature is related to augmented reality opportunities and growth in the field of marketing. With the help of the VOSviewer bibliometric analysis tool, we analysed the study scale, keyword co-occurrence, and growth of augmented reality marketing.

Keywords: Augmented Reality (AR), Virtual Reality (VR), Augmented Reality Marketing (ARM)

Introduction

The concept of augmented reality has gained popularity in recent years. Augmented reality improves the user's perception about reality by superimposing digital content over the physical world. With gadgets like smartphones, tablets, or augmented reality glasses, users can see and interact with digital and physical elements at the same time. Currently augmented reality is picking up steam as a game-changing tool in marketing. It's moving from being just an experiment to becoming a key part of many brand campaigns. Augmented reality can mix digital stuff with the real world letting businesses give customers more engaging and personal experiences. This grabs people's attention and gets them more involved. Brands in all sorts of fields: shops, travel, fashion, entertainment, schools, and even charities—are using augmented reality to show off products, tell better stories, let people try things on, and create brand experiences people won't forget. More and more, customers like the extra value augmented reality brings such as making things easier, being interactive, and creating an emotional link. At the same time better phones and social media have made augmented reality easier to use and get to. But even though it's getting more popular, there are still some problems. These include not many people knowing about it, experiences that aren't always great, and the need to design better content. All in all, augmented reality is at an exciting point where tech and marketing meet. It gives businesses new ways to connect with customers while changing how marketing messages are sent out and experienced. Augmented reality technology has been incorporated into products by Apple, Google, Ikea, Snapchat, Nintendo, Microsoft, BMW, and Warby Parker. For iOS devices, Apple utilises ARKit, and for Android devices, developers can create augmented reality apps with Google's ARCore. Whereas Snapchat provides augmented reality experiences through lenses and filters, IKEA Place lets users visualise furniture and home décor products. Nintendo's Pokémon GO and Harry Potter: Wizards Unite blend virtual and real-world elements. While BMW uses augmented reality glasses for vehicle maintenance and repair, Microsoft's HoloLens superimposes holographic images onto the user's surroundings. Customers can virtually try on spectacles before making an online purchase with Warby Parker. This study intends to investigate the development, uses, and advantages of augmented reality marketing in various industries.

Augmented Reality

Augmented reality (AR) enhances user perception by overlaying computer-generated images, videos, or information onto the physical environment, combining real-world and virtual elements in real-time. AR technology combines real-world perception with digital augmentation to create interactive and immersive experiences that enhance how users perceive and interact with their surroundings. Augmented reality (AR) integrates virtual elements into the real world using devices equipped with sensors, processors, and displays.

Sensors capture real-world data while the processing unit analyses it, overlaying virtual content onto the user's view. Users interact with these augmented elements, creating immersive experiences for gaming, education, navigation, and more (Carmigniani et al., 2011), VR and augmented reality are similar but not the same. Virtual reality (VR) and augmented reality (AR) are distinct digital experiences. VR transports users to a computer-generated world, while AR overlays digital content onto the real world, enabling simultaneous interaction with both virtual and physical elements, enabling various applications (Yim et al., 2017), Despite their distinct approaches, they share common goals of enhancing user engagement and interaction. Furthermore, advancements in hardware and software often blur the lines between VR and AR, leading to the emergence of mixed reality (MR) experiences that seamlessly blend virtual and physical elements. This convergence showcases the close relationship between VR and AR, as they collectively drive innovation in immersive computing and transform how people perceive and interact with digital content (Sung, 2021). Augmented Reality technologies are rapidly expanding beyond entertainment into critical sectors like healthcare, education, engineering, and retail (Chhabhaiya, Patle & Bhojane, 2024).

Augmented Reality Marketing

Augmented reality is being used in marketing in a variety of inventive and successful ways to engage customers, improve brand experiences, and increase sales. AR boosts customer interaction and personalized shopping experiences (Chhabhaiya, Patle & Bhojane, 2024). The increasing use of augmented reality in marketing has drawn increased scholarly attention to the impact AR has on consumer behaviour, response, and experience (Rauschnabel et al., 2022), Marketing researchers are paying more and more attention to augmented reality (AR) technologies because of their significant influence on various marketing practices (M. Wedel, 2020), The various industries are leveraging augmented reality to meet their specific needs and meet the expectations of their customers. The research highlights the significance of AR marketing research in understanding the integration of technology into various industries and its interaction with other technologies (Jayaswal, P., & Parida, B., 2023), The literature provides various conceptual frameworks for comprehending the potential of augmented reality (AR) in enhancing interactive consumer experiences and integrating it into marketing strategies (Massa, E., & Ladhari, R., 2023), the effects of augmented reality on community involvement and nonprofit marketing during the COVID-19 pandemic, offering insightful information for creative approaches (Yoo et al., 2023), AR has the potential to enhance brand love by reducing perceived physical distance between a consumer and a brand (PA Rauschnabel., 2021), Augmented reality apps, particularly virtual try-on apps, enhance brand perceptions and ratings, particularly among adventurous consumers, and are influenced by their playful nature and engaging nature (D. Plotkina, 2022). Existing literature presents the high quality and complete description and application of augmented reality marketing. In addition to quantifying and mapping the academic literature through bibliometric analysis, this study conducts a systematic literature review of high-quality studies in the augmented reality marketing domain to fill the gap left by the previous reviews. The following research questions (RQs) are addressed in this study.

Research questions

RQ1: What are the current trends in the augmented reality (AR) marketing regarding publications, citations, journals and authors?

RQ2: What are the unique attributes or keywords of augmented reality marketing from the consumer's perspective?

RQ3: What are the opportunities and limitations of augmented reality marketing from the consumer's perspective?

Research Methodology

This research examines the emerging field of augmented reality in marketing from a systematic literature review. Two major databases, Elsevier Scopus and Google Scholar, were used in the study. These are some of the largest electronic databases available for obtaining literature, covering all major national and international publications. Figure 1 provides the complete overview of the flow of the literature review methodology and selection of research articles. Bibliometric analysis is a thorough approach to examining and evaluating a substantial amount of data (Donthu et al., 2021). The datasets used for bibliometric analysis were obtained from the databases of Google Scholar and Scopus.

Identification: The study searched the keyword “augmented reality marketing”. The keyword search is exclusively focusing on the topic of the study related AR in marketing. Further, other keywords such as augmented reality experience and augmented reality marketing tool taken along with AR marketing may provide distinct results.

Screening: Initially, data of 846 articles from Scopus and 1830 articles from Google Scholar, respectively, were retrieved on 18 January 2025. Subsequently, articles were filtered based on the title, abstract, and full-text

screening. The documents after the full-text screening were excluded due to the following reasons: studies based on related words: virtual marketing, metaverse marketing, augmented reality strategies, and augmented reality techniques.

Eligibility: Further, the articles were excluded with criteria of book series and language limit to English. Subsequently, duplicate articles found in Scopus and Google Scholar databases were also eliminated. Finally, 94 articles were selected.

Inclusion: Finally, 94 articles were selected for review and analysis. This review study incorporates the research articles (both qualitative and quantitative) that discuss the augmented reality marketing scenario. A total of 94 articles were finally considered for the detailed review.

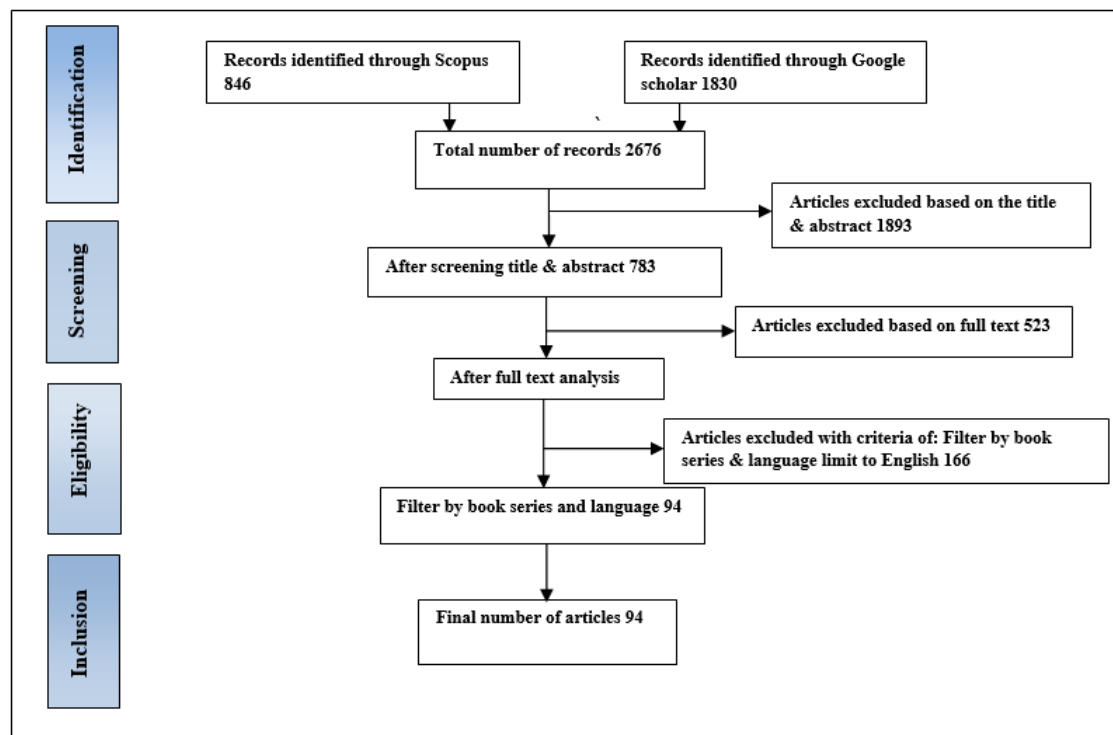


Figure1. Research Methodology Flowchart

Source: The author

Opportunities in Augmented Reality Marketing

Augmented reality has become a game-changing technology that will affect many different industries, including marketing. The purpose of this research paper is to examine the marketing opportunities that augmented reality presents. Specifically, it will look at how it can improve interactive product demonstrations, allow virtual try-ons, make location-based campaigns easier, and turn traditional advertising into immersive experiences. The use of augmented reality in marketing allows for the creation of distinctive brand storytelling experiences that revolve around the label rather than the tangible features of the product, which eventually appeals to new market segments (Robertson, J., et al., 2024). Augmented reality (AR) can be used to change influencer campaigns and strategies on social media. Users can view and buy products straight from social media platforms with augmented reality shopping features, which improve the shopping experience by letting customers see the products in their homes. (Sinha, M., & Srivastava, M. 2023), AR can engage customers' senses by combining visual, auditory, and even tactile elements to create multi-sensory experiences. The richness and depth of sensory engagement can evoke strong emotional responses and enhance the overall emotional impact of the AR experience (Zanger, V. & Rauschnabel, P.A. 2022). AR can enhance brand storytelling experiences by delivering immersive, emotionally resonant narratives that evoke empathy, inspiration, or nostalgia, thereby strengthening customer connections and loyalty (Chylinski 2020). Augmented reality (AR) has the power to enthrall users by immersing them in dynamic and engaging virtual environments. Customers may develop a deep emotional bond with the brand and its goods thanks to AR's sense of presence and engagement, which can arouse emotions like excitement, wonder, and curiosity (Hinsch, C., Felix, R., & Rauschnabel, P.A. 2020). Table 1 highlights the different features that leverage the marketing by using augmented reality. Brands have exciting new opportunities to produce creative and captivating advertisements that draw in viewers, increase engagement, and cultivate brand loyalty thanks to augmented reality. Advertisers can produce memorable and impactful campaigns that connect with consumers

and yield quantifiable results by utilising the interactive and immersive qualities of augmented reality technology (Conway & Türkay, S. 2019). With the use of augmented reality (AR), customers in the fashion, cosmetics, and eyewear sectors can virtually try on clothing, cosmetics, or eyewear before making a purchase. Advertisers can use augmented reality (AR) to produce personalised, interesting commercials that entice viewers to try and buy their products (Zhu, Y., & Wang, C. 2022). Augmented reality (AR) enhances marketing by creating immersive experiences, redefining advertising tactics, and promoting creative consumer-brand interactions, thereby boosting brand awareness, customer loyalty, and sales.

Table 1: Summary of AR marketing features:

S.No	Theme/Keywords	References
1	Brand equity	(26,27,53,54,62,)
2	Buying decision	(8,14,27,65,82,87,92,95)
3	Customer Behavior	(8,41,42,56,91)
4	Customer-brand relationship	(20,60,64,70)
5	Product design & attributes	(20,65,67)
6	<i>Community participation</i>	(90)
7	Customer experience	(14,17,53,64,66,70,71,76)
8	Customer engagement	(1,8,21,25,33,38,48,68,75)
9	Brand perception	(39,53)
10	Brand Attitude	(10,12,51,88,92,95)
11	Customer journey	(61,83,84,92)
12	Customer perception	(23,81,82,87)
13	Customer attitude	(5,40,69,71,86)
14	Communication	(17,21,26,30,33,36,70)
15	Personalization	(1,28,63,67)
16	Advertisement	(12,20,58,64,76,78,86,88,91)
17	Brand Experience	(62,67,95)
18	Customer preference	(5,55,63)
19	Customer expectation	(21,35,55)
20	Brand awareness	(60,68)

Source: The Author

Table 1 displays the various keywords and marketing features that were covered in the selected journal. These keywords were identified by the content and bibliometric analysis. Analysis reveals that augmented reality has already been used to promote products in line with industry goals and objectives. AR marketing is used in the tourism industry to offer interactive travel guides and virtual destination experiences, increasing traveler engagement and encouraging prospective visitors to explore and interact with destinations in an immersive manner.

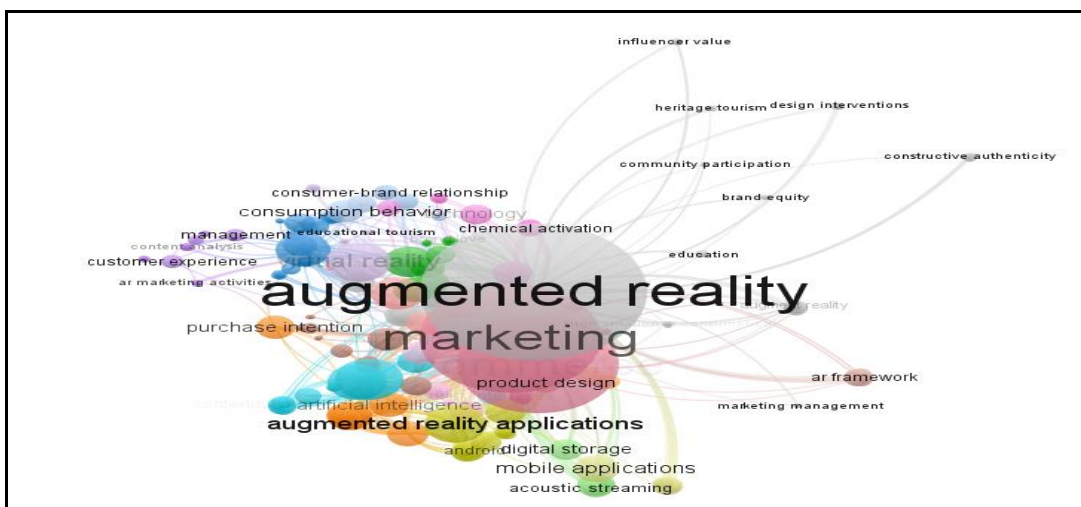


Figure 2: Keyword Occurrence

Source(s): VOSviewer

By offering interactive and educational digital overlays that bring exhibits to life and provide a more captivating and engaging experience that draws in visitors, augmented reality (AR) marketing improves the visitor experience when visiting museums. Within the retail industry, augmented reality (AR) marketing facilitates interactive

product demonstrations and virtual try-ons, providing customers with a customized shopping experience that increases satisfaction, lowers returns, and improves engagement (Haumer, F. 2020). In the beauty sector, augmented reality (AR) marketing provides virtual try-on experiences for skincare and makeup products. This helps customers visualize and experiment with various looks, which improves online engagement and boosts conversion rates.

Publication trends

As Table1 show that finally the 94 documents provided the result after content analysis and revealed that currently augmented reality marketing is in introductory phase and very few companies adopt it due to lack of understanding and awareness and also high investment and its implication. Bibliometric analyses are done by VOSviewer software and provide different analysis.

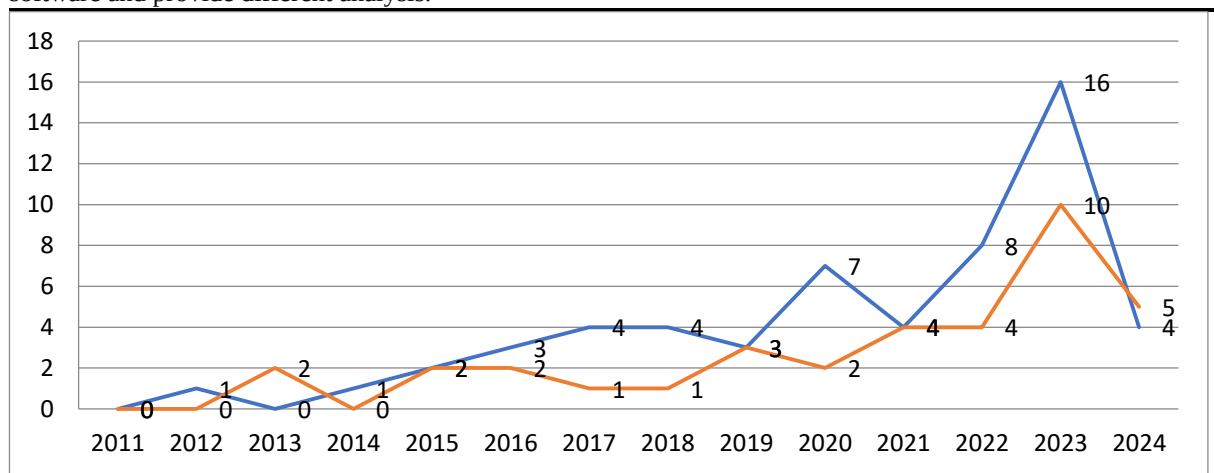


Figure 3: Number of documents in Scopus and Google scholar
Source(s): Author

In Figure 2 highlights the publication trend of the augmented reality marketing in 2011 to 2024. While the concept of augmented reality marketing is not new it was started before 2011. The concept of augmented reality marketing has seen a significant rise in the last 10 years. The research on the augmented reality marketing has been increasing since 2020 and highly increasing, with a peak in 2023 and continues work on 2024.

Table No. 2: Most Productive Journals & Highly Cited Journals

Rank	Author	Title	Year	Cite	Focus
1	Rauschnabel, P.A., Felix, R., & Hinsch, C.	Augmented reality marketing: How mobile AR-apps can improve brands through inspiration	2019	608	ARM strengthens consumer-brand emotional bonds by encouraging brand loyalty through customized experiences and content.
2	Wedel, M., Bigné, E., & Zhang, J.	Virtual and augmented reality: Advancing research in consumer marketing	2020	366	AR impacts brain activity, emotions, memory recall, cognitive processes, and purchase intentions. It also looks at how these effects relate to consumer responses to immersive experiences.
3	Scholz, J., Duffy, K.	We are at home: How augmented reality reshapes mobile marketing and consumer-brand relationships	2018	392	Explores how branded AR apps can create an intimate relationship with consumers, extending the focus of AR research beyond physical contexts to spatial-symbolic contexts and inner self-concepts.

Rank	Author	Title	Year	Cite	Focus
4	Bulearca, Marius; Tamarjan, Daniel.	Augmented reality: A sustainable marketing tool	2010	286	The application of augmented reality as a sustainable marketing tool is driving creative and environmentally conscious marketing strategies by increasing consumer engagement and encouraging eco-friendly practices.
5	Rauschnabel, Philipp A; Babin, Barry J; tom Dieck, M Claudia; Timothy;	What is augmented reality marketing? Its definition, complexity, and future	2022	255	Augmented reality has the potential to create interactive, personalized, and immersive experiences that bridge the gap between the physical and digital worlds.
6	Yaoyuneyong, Gallayanee; Foster, Jamye; Johnson, Erik; Johnson, David;	Augmented reality marketing: Consumer preferences and attitudes toward hypermedia print ads	2016	237	AR-enhanced the advertising strategies and show consumer preferences and attitudes towards hypermedia print ads in augmented reality marketing. It also highlights the impact of these ads on engagement and perception.
7	Hinsch, C., Felix, R., & Rauschnabel,	Nostalgia beats the wow-effect: Inspiration, awe and meaningful associations in augmented reality marketing	2020	198	Augmented reality marketing enhances nostalgia experiences by transcending mere "wow-effects" and enhancing consumer perceptions and associations.
8	Rauschnabel, Philipp A;	Augmented reality is eating the real-world! The substitution of physical products by holograms	2021	176	the practice of using holographic images of products in place of physical ones in augmented reality. It explores how this change may affect consumer behaviour, disrupt industries, and change how people interact with products in retail settings.
9	Sung, Eunyoung Christine;	The effects of augmented reality mobile app advertising: Viral marketing via shared social experience	2021	175	Users' perceptions of AR mobile app advertising are influenced by shared social experiences, with a focus on the positive effects that positive experiences have on brand sentiment and perception.
10	Qin, Hong; Peak, Daniel Alan; Prybutok, Victor	A virtual market in your pocket: How does mobile augmented reality (MAR) influence consumer decision making?	2021	174	Through immersive and tailored interactions, mobile augmented reality (MAR) improves product evaluation, engagement, and purchase intention while offering a virtual market experience.
11	Yang, Shuai; Carlson, Jeffrey R; Chen, Sixing	How augmented reality affects advertising effectiveness: The mediating effects of curiosity and attention toward the ad	2020	128	Augmented reality on the effectiveness of advertising, emphasizing how it increases consumer curiosity, interest, and ad recall, ultimately increasing the effectiveness of advertising.
12	Yang, Shuai; Carlson, Jeffrey R; Chen, Sixing;	How augmented reality affects advertising effectiveness: The mediating effects of curiosity and attention toward the ad	2020	128	By stimulating curiosity and grabbing attention, augmented reality (AR) improves engagement and boosts the overall efficacy of advertising campaigns.

Rank	Author	Title	Year	Cite	Focus
13	Rauschnabel, P.A., Babin, B.J., tom Dieck, M.C., Krey, N., & Jung, T.H.	What is augmented reality marketing? Its definition, complexity, and future	2022	127	AR has the potential to produce interactive, personalised, and immersive experiences that connect the physical and digital worlds.
14	Wang, Yining; Ko, Eunju; Wang, Huanzhang	Augmented reality (AR) app use in the beauty product industry and consumer purchase intention	2022	107	In the beauty industry, augmented reality-enhanced try-on experiences greatly increase consumer interest and confidence, leading to higher purchase intentions.
15	Chylinski, M.B., Heller, J., Hilken, T., Keeling, D.I., Mahr, D., & de Ruyter, K.	Augmented Reality Marketing: A Technology-Enabled Approach to Situated Customer Experience	2020	104	AR marketing for personalised messaging, emphasising how businesses can deliver content that connects with individual preferences and establishes an enduring brand image.
16	Goebert, Chad; Greenhalgh, Gregory P;	A new reality: Fan perceptions of augmented reality readiness in sport marketing	2020	93	As a promising tool to improve engagement and interaction within the sports marketing domain, it reveals that fans are generally upbeat and receptive to AR integration.
17	Dadwal, Sumesh S; Hassan, Azizul	The augmented reality marketing: A merger of marketing and technology in tourism	2016	75	ARM technological innovations can enhance visitor engagement, enrich destination narratives, and ultimately drive tourism growth.
18	Javornik, Ana	[Poster] classifications of augmented reality uses in marketing	2014	68	Augmented Reality (AR) applications in marketing into experiential, promotional, informational, and transactional, highlighting their various roles in enhancing consumer engagement and brand interactions.
19	Tsai, S.	Augmented reality enhancing place satisfaction for heritage tourism marketing	2020	52	AR is playing a crucial role in bridging the gap between traditional heritage attractions and contemporary digital advancements, thereby enhancing the immersive and satisfying tourism experience.
20	Goebert, C., & Greenhalgh, G.	A new reality: Fan perceptions of augmented reality readiness in sport marketing	2020	51	consumer perceptions of augmented reality's potential in sport marketing, highlighting its potential to transform fan interactions and marketing strategies in the sports sector.

Source(s): Author

Table 2 provides a comprehensive overview of the various ways that various industries use augmented reality marketing to achieve their marketing goals for different purposes. This section highlights the findings of the article also.

The review study makes two significant contributions. First, the content analysis identifies current research streams and makes recommendations for future research directions. This study examines the existing literature from various perspectives, including highly cited articles, as well as topics and keywords relevant to the current study. Second, this review encourages industries and the marketing domain to raise awareness about the use of augmented reality in marketing in order to achieve industry goals and better understand customers from all perspectives.

Future Scope

The future of AR in marketing looks promising. As 5G, edge computing, and wearables like smart glasses improve, AR interactions will become smoother more responsive, and hands-free. AI will allow brands to customize experiences on the spot based on individual likes and context—picture virtual products that change to match your past buys or mood. Cross-platform tools will help create seamless experiences from phone apps to

store displays. Researchers can study AR's long-term effects on brand loyalty and buying habits through long-term and cross-cultural studies. New theories that combine emotional, thinking, and social factors will help us understand why AR works so well. As these technologies grow and best practices become clear, AR is set to become a key tool for marketers.

Future Challenges

AR is constantly growing fast, but it still has show confusion in the minds of marketers. To begin with, a lot of marketers and customers aren't aware of AR's capabilities, and feel current AR experiences are just tricks or too complex. Privacy is also a major concern, as AR applications often collect data about where you are, what you're looking at, and how you behave to create personalized experiences. Marketers have to follow changing rules and gain people's trust. , it's tough to figure out if AR is worth the money. Marketers still working on ways to measure how well AR boosts engagement, improves brand image, and leads to sales in these new virtual spaces. This makes it hard for companies to keep investing in AR.

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Determinants of Gems and Jewellery Exports from India: A Time Series Analysis

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Abstract

Gems and Jewellery are part of various values and customs around the world. Gems and Jewellery have been essential parts of both aesthetic as well as investment drive. The gems and Jewellery industry has gradually become important for the Indian economy due to its contribution to India's total exports. This paper attempts to evaluate the impact of major factors affecting gems and Jewellery exports from India. For time series analysis, data (2003 to 2023) were collected from various sources and used to develop an export supply function at the macro level. The value of the finished gems and Jewellery exports from India was taken as a dependent variable, whereas export price, real exchange rate, trade openness, and the number of colored gems stones were taken as independent variables. Co-integration analysis and Error Correction methods were employed to estimate short and long-run elasticity. The coefficient of this variable explains that for every one percent increase in the exchange rate, there might be a 5.1 percent decrease in exports of gems and Jewellery in the long run. In a similar context, Real GDP, the share of semi-manufactured goods exports, and trade openness showed the effect of 3.2, 0.72, and 2.4 percent increase in the export supply of gems and Jewellery in the long run respectively. Export prices showed a negative relationship with the value of gems and Jewellery exports. The coefficient of this variable suggested that for every one percent increase in the export prices, there might be -3.4 percent decreases in the export supply of finished gems and Jewellery in the long run. Based upon the findings, it is suggested exchange rate of the Indian rupee should be stabilized with a strengthening industry of semi-manufactured gems and Jewellery goods in the country.

Keywords: Gems and Jewellery, Exports, Co-integration Analysis and Error Correction Method

Introduction

Gems and Jewellery are a significant emerging sector in the Indian Economy. Gems and Jewellery is a leading foreign exchange earner for the country. The export of gems and Jewellery has been among the fastest-growing sectors in India in recent years. India also counts among the largest gold Jewellery exporters in the world, with almost 160 countries buying from India. India boasts close to 20 unique jewelry-making styles (CII, Dec 2020). The gems and Jewellery industry of India contributes 7 percent to the GDP during 2020-21. The industry employs more than 5 million skilled and semi-skilled workforces in the country. This sector contributes about 10-12 percent of India's total merchandise exports, accounting for the third largest commodity share. During 2021-22, the gems and Jewellery exports played an instrumental role in growing India's overall exports to US\$ 419 billion with a growth of 44 percent from 2020-21 and 34 percent from 2019-20. As per 2020 statistics, India's gems and Jewellery exports account for about 3.5 percent of the world's total exports, making it the seventh-highest exporter in the globe. India exports gems and Jewellery to the USA, Hong Kong, UAE, Belgium, Israel, Thailand, Singapore, the UK, Netherlands, Japan, etc. USA is the largest importer of Indian Jewellery with 2021-22 imports valued at US\$ 14.5 billion growing from US\$ 8.7 billion of exports in 2020-21. Hong Kong and UAE are among the largest export destinations for India at US\$ 9.3 billion and US\$ 5.7 billion in exports contributing about 23.7 percent and 14.5 percent of the total exports during 2021-22 respectively. Additionally, the opening of the India Jewellery Exposition (IJEX) center in Dubai and the signing of agreements with key export destinations such as UAE, Australia, Israel, the UK, and Canada among others should continue to drive exports in the future (IBEF, Nov 2022). This study aimed at examining the impact of major determinants of Gems and Jewellery exports identified using time series analysis.

Literature Review.

Shukla, M. S. (2000) highlighted the profile of gems and Jewellery from the Indian historical perspective. He told that pearls and precious stones were known as a specialty of India at a very remote epoch. India was indeed the first and for a long time the only source of diamonds and pearls known to the European nations. Further, he dabbled in sources and geographical distribution of gems, physical and chemical properties thereof and their working, occult and religious association, and treatment of jewels for jewellery. **Satya Sundaram (2001)** analyzed the possibilities of the Indian Gems and Jewellery Industry. The Government has undertaken various measures recently to promote investment and upgrade technology and skills to promote "Brand India" in the international market. In recent years, the performance of the Indian Gems and Jewellery industry has remarkably improved in the international market to enhance its market hold and in the long run survival in international trade. **Mukherjee and Ishita (2008)** dealt with an emerging global industry the gems and jewellery industry, which is on the way

to huge information. This industry is extremely global. She told that the gems and jewellery industry can be classified into various sub-sectors such as gemstones, jewellery, and pearls. Over the years, the global gems and jewellery markets have been impacted by various developments like falling trade barriers, increasing competition, changing customer preferences, and developments in technology in various areas. Kala **Alok (2009)** discussed the impact of the global economic recession on the export performance of the Indian Gems and Jewellery sector, product-wise. The study reveals the contrasting point that the total Gems and Jewellery industry has shown growth but Indian Gems and Jewellery has witnessed a decline. Further study reveals that cut & polished diamonds showed decreasing export trends while gold jewellery registered an increase in the year. **Kumar (2013)** analyzed the Indian gems and jewellery industry with problems and prospects for the period 2009-2010. This sector witnessed a CAGR of 16.59 percent of India's exports of gems and jewellery during the period 1990-91 to 2009-10. However, the gems and jewellery sector is facing various problems such as dependence on imports, changing fashion, imbalance growth of products, manual way of crafting, various problems regarding labourers, financial problems, procedural hardships, unemployment, etc. **Arora (2014)** studied the trade of gems and jewellery from the period 2001-02 to 2010-11. The study found a CAGR of 14.7% for the gems and jewellery industry in India. Diamonds are one of the most important constituents of the gems and jewellery trade in India. Against this background, the present research paper analyses the growth of the diamond trade of India vis-à-vis gems and jewellery trade and exports from India.

The gems and jewellery sector is a major foreign exchange earner. Due to its importance in India's foreign trade, the government has taken many initiatives to boost the sector. The government, for instance, has declared this sector as a thrust area for exports. During the global economic meltdown especially, the government has dealt out many initiatives for the badly-affected sector (**Parasakthi and Dhanalakshmi, 2015**).

The gems and Jewellery industry is influenced by the exchange rate (rupee/dollar) because it is an export & import-oriented industry. Any variation in the exchange rates directly affects the players in the market (**Lamba and Saini, 2015**).

Kapoor and ASSOCHAM (2015) examined the structure and concentration of the Indian Gems & Jewellery industry and tried to find out whether the Indian Gems and Jewellery Industry has the potential to contribute to the government's "Make in India" initiative and various economic indicators like GDP, gross value added indirect tax collections. The study concluded that the G& J industry has great potential to contribute to the government's "Make in India" initiative and has a significant positive contribution to the increment of GDP, indirect tax collections, gross value added, and so on. **Parul A. et al. (2017)** studied the structure of exports of the Indian gems & jewellery industry. The study suggested fastening up the growth and increasing the share of the Indian gems & jewellery industry, problems like import dependency, prices rise, and technical advancement need to be focused on. **Chellam K. Chitra (2018)** studied the origin, history, and structure of the gems & jewellery industry of India. From a very humble beginning in the 1950-the 60s, the Indian gems & jewellery industry has become the manufacturing powerhouse and the fastest-growing industry though it suffers from limited standardization and unorganized players

Methodology

Time Series Analysis: Secondary data were used to capture the effect of different variables which have direct or indirect blows on the export supply of gems and jewellery at the country level. Data for export supply was collected from 2003 to 2023. Data on the export value of gems and jewellery taken from the handbook statistics on the Indian economy and data on other variables like cut and polished diamonds, exchange rate, real GDP, Share in semi-manufactured goods exports, domestic prices, export prices and trade openness collected from various issues of Economic Survey of India.

Theoretical Model: Granger 1981, Co integration was intended for testing and estimating the long-run and short-run association among the variables. The estimation of long-run association required the time series to be non-stationary in the level form. If the time series data are non-stationary then the common statistical tools are not recommended and regression becomes spurious (Granger and Newbold, 1974). In co integration approach, the first step is to test for the stationary or non-stationary data set. The second step is to test for long-run association between variables.

Testing for Unit Root: A series is stationary if its mean, variance, and covariance all are independent of time or in other words remain constant over time. Conversely, a series is non-stationary if it fails to satisfy any part of the above definition such as mean, variance, or covariance change over time. Various approaches are used to test the hypothesis of unit root but the most commonly used technique is Dickey-Fuller (DF) test (Dickey and Fuller, 1979) and (Dickey and Fuller, 1981). For the DF test, specified the number of lags and used Schwarz Bayesian Criterion (SBC) for each series. DF test estimates the following equation by OLS;

$$Y_t = \Phi_1 Y_{t-1} + \mu \quad (1)$$

If $\Phi_1 < 1$, the series Y_t is stationary and it is non-stationary if $\Phi_1 = 1$. The null hypothesis of unit root, ($H_0: \Phi_1 = 1$) is tested against the alternative hypothesis of no unit root, ($H_1: \Phi_1 < 1$). If H_0 is rejected; the series is stationary and vice-versa.

Testing for Co-integration:

Co-integration technique identifies equilibrium long-run association between variables. If a long-run relationship exists between variables, then variables are co-integrated. For the implementation of co-integration, two conditions must be fulfilled. First, at least two individual variables should be integrated in the same order. Second, a linear combination among variables should exist. Consider the co-integration regression $Y_t = \alpha + \beta X_t + \mu_t$ (2) If the series Y_t and X_t are both I (1) and the error term μ_t is I (0), then the series are co-integrated of order I, (1, 0). In the above equation, β measures the equilibrium relationship between the series Y_t and X_t , and μ_t is the deviation from the long-run equilibrium path. If the DF test fails to reject the null hypothesis of a unit root in levels but rejects the null hypothesis in the first differences, then the series contains one unit root and is of integrated order one I (1). If the test fails to reject the null hypothesis in levels and first differences but rejects the null hypothesis in second differences, then the series contains two unit roots and is of integrated order to I (2) (Mencet et al., 2006).

Following the functional form of export supply function of gems and jewellery was employed.

$$\text{Log}(EV_t) = a_0 + a_1 \log(ER_t) + a_2 \log(RGDP_t) + a_3 \log(SSMAN_t) + a_4 \log(HS_t) + a_5 \log(DP_t) + a_6 \log(TO_t) + a_7 \log(EP_t) + \mu_t \quad (3)$$

Where

$\text{Log}(EV_t)$ = Logarithm of export value of gems and jewellery (Million Rs.)

$\text{Log}(ER_t)$ = Logarithm of the exchange rate (Indian Rs./U.S.\$)

$\text{Log}(RGDP_t)$ = Logarithm of real gross domestic product (Million Rs.)

$\text{Log}(SSMAN_t)$ = Logarithm of share in manufactured goods (Percentage)

$\text{Log}(HS_t)$ = Logarithm of cut and polished diamonds (Million No.)

$\text{Log}(DP_t)$ = Logarithm of domestic prices (Per Sq.M)

$\text{Log}(TO_t)$ = Logarithm of trade openness (Ratio)

$\text{Log}(EP_t)$ = Logarithm of export prices (Per Sq.M)

a_0 is the intercept term and $a_1, a_2, a_3, a_4, a_5, a_6$ and a_7 are parameters

Results and Discussion

This section is divided into three divisions.

- The first division presents the descriptive statistics of the variables used for analysis;
- The Second division reports unit root results, and
- The third division presents co-integration results.

Descriptive statistics of the variables under study

Table 1 presents the descriptive statistics of the variables used for analysis for the period 2001 to 2021.

Table No. 1: Descriptive statistics of the variables under study

Variables	Units	Mean	Std. Deviation	Kurtosis	Skewness
Gems and Jewellery exports(Q)	Million Sq.M	27467.29	32.06142	-1.38474	-0.040489
Gems and Jewellery exports /Value	Million Rs	375.2	3078.879	-1.67897	-0.24166
Exchange rate	Indian.Rs./U. S.\$	54.5849	2.428494	-1.34923	0.51155
Real GDP	Million Rs.	161480.5	175386.7817	-1.28037	0.05349
Percent Share of manufactured goods	Percentage	14.244	0.46879431	0.57207	-0.76849
Export prices of Gems and Jewellery	Pergrams	20535.5335	130.2644	-1.33564	0.32661
Trade Openness	Ratio	0.35467	0.02044487	-0.20692	-0.13061
Domestic prices of Gems and Jewellery	per grams	20535.5335	2827.37786	-0.64034	0.35367

Source: Computed

Table 1 presents the descriptive statistics of the variables used for analysis for the period 2001 to 2021. During the study period, India exported 27467.29 Million Sq.M of finished gems and jewellery annually on average. Export prices of gems and jewellery mean value was 20535.5335 pergrams. The mean and standard deviation value of Domestic prices of finished gems and jewellery was 20535.5335, and 2827.37786. The real

GDP of India was 161480.5 million Rs per annum on average, -1.28037 million Rs per annum at kurtosis, and 0.05349 million Rs per annum at Skewness. The mean, Kurtosis, and Skewness value of the exchange rate (Indian Rs./U.S.\$) was 54.5849, -1.34923 and 0.51155. Percent Share of semi-manufactured goods exported and its average value was 14.244 percent. The value of Trade Openness average value was 0.35467.

Unit Root Results: Most time series data exhibit trends (data series changes over time) and are termed non-stationary (Nelson and Plosser, 1982; Perron 1988). It is often the case that an economic series has a unit root when its first difference is stationary. Therefore, the first step in any time series empirical analysis is to test for the presence of unit roots to avoid the problem of spurious regression. It is important to examine the order of integration of each variable in a model to establish whether it contains unit roots and how many times it needs to be differenced to achieve a stationary series. In the first step, all the data sets were tested for the presence of unit roots. Export value of Gems and Jewellery (LEV), Exchange Rate (LER), Real Gross Domestic Product (RGDP), Share in manufactured goods exports (LSMAN), cut and polished diamonds (LCPD), Trade Openness (LTO), Domestic Prices (LDP) and Export Prices (LEP) were tested for unit roots for the period 2001-2021. Table 2 represents the results of tests of the series in logarithms for unit root using the ADF test for both with and without linear trends. In the non-trended model, the absolute values of the ADF statistics and Φ_3 values for LEV, LER, LR GDP, LSMAN, LTO, and LEP are well below the 95% critical value of the test statistics (2.9605) and (7.37) respectively and hence the null hypothesis of unit root for these variables is accepted. Whereas, LCPD and LDP are stationary series in level form because the absolute values of the ADF statistics and Φ_3 values for these variables are well above the 95% critical value of the test statistics.

Table No. 2: Augmented Dickey-Fuller (ADF) Unit Root Test Results

Variables	Non-Trended Model	Trended Model	Φ_3	Conclusion
LEV (Export value)	-1.8838	-3.0057	2.8961	I(1)
LER (Exchange rate)	-1.4875	-2.5335	2.4213	I(1)
RGDP (Real Gross Domestic Product)	-0.41263	-4.1754	4.3237	I(1)
LMAN (Share in Manufactured goods exports)	-1.5345	-1.5386	1.4956	I(1)
LCPD(Cut And Polished Diamonds)	-3.140671	-4.2368	10.1533	I(0)
LTO (Trade Openness)	-3.3412	-1.0541	7.6325	I(1)
LDP (Domestic Prices)	-5.7421	2.64324	17.3642	I(0)
LEP (Export Prices)	-2.4530	-1.2876	4.3761	I(1)
Critical Values	-2.9605	-3.4957	7.37	---

I (0) =Stationary

I (1) = Non-Stationary Note: Critical values (95% confidence interval)

In a trended model where the absolute values of the ADF statistics and Φ_3 values for LEV, LER, LR GDP, LSMAN, LTO, and LEP are well below and for LCPD and LDP are above the 95% critical value of the test statistics (-2.9605) and (7.37) respectively. Hence the LEV, LER, LR GDP, LSMAN, LTO, and LEP are non-stationary series and LCPD and LDP are stationary series in the trended and non-trended models in the level form.

Table 3 indicates the first differenced results in both the non-trended model and trended model. The First difference absolute values of ADF statistics for all variables (LEV, LER, LR GDP, LSMAN, LTO, LEP, LCPD, and LDP) are well above the 95% critical value in both Non-Trended and Trended Models, therefore the null hypothesis is rejected. This means that all the variables have no unit roots and have become stationary after the first difference i.e. I (1).

Table No. 3: Non-Trended Model and Trended Model

Variables	Non-Trended Model	Trended Model	Conclusion
DLEV	-3.9675	-4.7780	I(0)
DLER	-6.2550	-5.1882	I(0)
DLRGDP	-5.7174	-6.8766	I(0)
DLSMAN	-6.4714	-7.1202	I(0)
DLCPD	-7.1981	-7.5437	I(0)
DLTO	-4.1211	-3.5254	I(0)
DLDP	-2.0741	-4.1570	I(0)
DLEP	-6.3170	-6.5602	I(0)
Critical Values	-2.9750	-3.5867	-

First differenced ADF Unit Root Test Results

I (0) =Stationary

Note: Critical values (95% confidence interval)

From Tables 2 and 3, it can be concluded that cut and polished diamonds production and Domestic Prices of finished gems and jewellery are integrated in the order of zero i.e. I (0), and the Export value of finished gems and jewellery, Exchange Rate, Real Gross Domestic Product, Share in semi-manufactured goods exports, Trade Openness and Export Prices are integrated of the order of one i.e. I (1).

Co-integration Results: After testing for unit root, the next step is to test for co-integration. For co-integration, two conditions must be satisfied. First, at least two of the individual variables going to be integrated should be of the same order, and second, a linear combination of the series should exist which is integrated to order lower than the individual variables. Johansson's procedure was applied to test the co-integration between the respective variables. The first step in Johansson's procedure is the selection of the order of Vector Auto-Regressive (VAR). An adjusted LR test on the VAR with a maximum of three lags was carried out.

Table 4, the Adjusted LR test selects order one of VAR because at order one the parenthesis values (p-values) of the Adjusted LR test is greater than 0.05. The value of SBC is maximum at order one i.e. 138.4417. Thus SBC also selects the order one of VAR. AIC selects order three because the maximum value of AIC (276.1453) is at order three but the Adjusted LR test and SBC both showed order one, so, the order of VAR was taken as one.

Table No. 4: LR-Test on VAR with Maximum of Three Lags

List of variables included in the unrestricted VAR				
LEV	LER	LRGDP	LSMAN	LEP LTO
List of deterministic and/or exogenous variables				
A	LCPD	LDP		
Order	AIC	SBC	Adjusted LR test	
3	276.1453	159.4932	----	
2	187.6708	134.4458	37.5408 (.315)	
1	181.5417	138.4417	63.4981 (.806)	
0	96.9283	92.1432	122.4359 (.162)	

AIC= Akaike Information Criterion SBC=Schwarz Bayesian Criterion

After the VAR with order one has been selected, the second step in Johansson's procedure is to test the presence and number of co-integrating vectors among the series of the model.

Table No. 5: Co-integration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

List of variables included in the cointegrating vector			
LEV	LER	LRGDP	LSMAN LEP LTO
A (Intercept)			
List of I(0) variables included in the VAR:			
LCPD	LDP		
Null	Alternative	Statistic	95% Critical Value
r = 0	r >= 1	135.9423	102.560
r <= 1	r >= 2	90.2467	95.980
r <= 2	r >= 3	54.6787	59.480
r <= 3	r >= 4	26.9331	34.870
r <= 4	r >= 5	14.0971	20.180
r <= 5	r >= 6	3.2615	9.160

In Table 5 trace test also proves that there is one cointegrating vector at a 95 percent critical value because the first statistical value of the trace test (135.9423) is greater than its 95 percent critical value (102.5600). Where for the remaining five statistical values of the Trace test, the null hypothesis of no cointegration can not be rejected.

Table No. 6: Cointegration LR-Test Based on Trace of the Stochastic Matrix

List of variables included in the Co-integrating vector				
LEV	LER	LRGDP	LSMAN	LEP LTO A (Intercept)
List of I(0) variables included in the VAR				
LCPD	LDP			
Null	Alternative	Statistic	95% Critical Value	
r = 0	r = 1	44.6658	40.530	
r ≤ 1	r = 2	34.3820	34.400	
r ≤ 2	r = 3	28.2516	28.270	
r ≤ 3	r = 4	12.0352	22.040	
r ≤ 4	r = 5	11.5364	15.870	
r ≤ 5	r = 6	3.2615	9.160	

Table 6 indicates that the first statistical value of the Maximal Eigenvalue test (44.6658) is greater than its 95 percent critical value (40.530), therefore, we reject the null hypothesis of no co-integration and accept the alternative hypothesis, i.e., there is one co integrating vector. Whereas for the remaining five statistical values of the Maximal Eigenvalue test, the null hypothesis of no co-integration cannot be rejected.

In Johansson's model, parameters in the co-integrating vector can be interpreted as estimates of long-run co-integrating relationships between variables (Hallam and Zanoli, 1993). Therefore the estimated parameter values from these equations when normalized on the exported quantity of gems and jewellery are long-run elasticities. The results are reported in table 7; the coefficients represent estimates of long-run elasticities of the exported quantity of gems and jewellery concerning Exchange Rate, Real GDP, share in manufactured goods export, Export Prices, and Trade Openness.

Table No.7: Johansson's Normalized Estimates

Variables	Long Run Elasticities	Std.Errors	T-Ratio
LER	-5.1112	2.9345	-1.7813
LRGDP	3.1657	.97038	3.1926
LSMAN	0.7276	.37710	2.0095
LEP	-3.3987	2.0923	-1.6705
LTO	2.3914	1.2023	1.9134
A*	36.0979	12.6230	2.8378

Note: Indicates significance at 5 percent *A is an intercept

The co-integrating vector in Table 6 can be written in the form of an equation as shown below

$$\text{LEV} = 36.0979 - 5.1112 \text{ LER} + 3.1657 \text{ LRGDP} + 0.7276 \text{ LSMAN} - 3.3987 \text{ LEP} + 2.3914 \text{ LTO}$$

Theoretically, a rise in the price of the foreign exchange rate (Dollar) is a depreciation of the home currency (Rupees). Foreign currency will become more expensive hence the relative value of the home currency will be fallen (Mencet et al., 2006), (Haleem et al., 2005). Table 7 indicates that the exchange rate harms exports of gems and jewellery as expected. A one percent increase in the exchange rate will cause a 5.1112 percent decrease in exports of gems and jewellery in the long run. The coefficient of the exchange rate variable in the export supply of gems and jewellery is statistically significant at a 5 percent level. This empirical result suggests that a depreciation of Indian currency will cause a drop in the export supply of gems and jewellery from India. Real GDP is the measure of Gross Domestic Product that seeks to reflect the actual value of production goods and services produced, by removing the effect of changes in prices. It is an important variable that shows the economic growth of a country in terms of goods and services produced. RGDP is positively related to the export supply of gems and jewellery and is statistically significant at a 5 percent level. The implication is that a one percent increase in the RGDP will lead to a 3.1657 percent increase in the export supply of gems and jewellery from India in the long run. The share of manufactured goods in exports is also an important variable that shows the export concentration of any country in the manufactured sector. In the model of export supply of gems and jewellery share of manufactured goods exports is positively related and is statistically significant at a 5 percent level. This indicates that a one percent increase in the share in manufactured goods exports will lead to a 0.7276 percent increase in the export supply of gems and jewellery from India in the long run. Export prices are considered to be an important variable to check the export availability of the product. Theoretically, high export prices mean greater availability of the product in export markets while low export prices mean abundant availability of the product in the domestic market. In the model of export supply of gems and jewellery export price are negatively related and is statistically significant at a 5 percent level. This indicates that a one percent increase in the export prices will lead to a -3.3987percent increase in the export supply of gems and jewellery from India in the long run. The

variable of trade openness generated by the addition of total exports and total imports then the total may be called total trade divided by the Gross National Product (GNP) of the respective year. Trade openness indicates the foreign trade performance of the country. So in the model of export supply of gems and jewellery trade openness is positively related and is statistically significant at a 5 percent level. This indicates that a one percent increase in the value of trade openness will lead to a 2.3914 percent increase in the export supply of gems and jewellery from India in the long run.

Table No.8: The Long-Run and Error Correction Model Estimates for Finished Gems and Jewellery Export

Regressors	Short Run Elasticities	Long Run Elasticities
A	-12.8970 (-3.9684)	33.0989 (2.8389)
LER	-1.1295 (-2.1863)	-4.2130 (1.7412)
LRGDP	1.6279 (3.6778)	3.5679 (-3.2927)
LSMAN	0.58475 (2.9187)	0.72754 (-2.0195)
LEP	0.76453 (1.8953)	-3.4988 (-1.6706)
LTO	0.75261 (-2.1823)	2.3924 (1.9430)
LDP	0.16544 (0.41257) ^{NS}	
LCPD	0.21247 (1.8758)	
ECM1	-0.21394 (2.3584)	
Diagnostic Tests		
R-squared		0.64
DW-statistics		1.8386
LM-test-x ² (1)		0.83679[.359]
RESET test-x ² (2)		5.4732[.061]

Note: Indicates significance at 5 percent, values in parenthesis is t-ratios, Values in square brackets are p-values and ^{NS} indicates non-significant.

It is also apparent from table 8 that the exchange rate is negatively related in the short run to the export value of gems and jewellery as if a one percent increase in the exchange rate there will be a 1.1295 percent decrease in the export value of gems and jewellery from India. The signs of Real Gross Domestic Product (LRGDP), Share in manufactured goods exports (LSMAN), Trade Openness (LTO), and Export Prices (LEP) in the short-run, these variables showed the same trend as showed in the long run. These variables are directly related to the export value of gems and jewellery, if there is a one percent increase in Real Gross Domestic Product, Share in manufactured goods exports, Trade Openness, and Export Prices, there will be 1.6279, 0.58475, 0.75261, and 0.76453 increases in the export value of gems and jewellery respectively in the short run. Cut and polished diamonds production and domestic prices are also directly related but the domestic prices are not statistically significant. Because if the domestic prices of the exports increased then exporters will sell their products in the domestic markets rather than export the products. But in our model, the coefficient of the domestic prices showed the opposite result, which is not true. If the production of Cut and polished diamonds increases by one percent there will be a 0.21247 percent increase in the export value of gems and jewellery in the short run. The coefficient of error correction term has an expected negative sign. It measures the speed of adjustment towards long-run equilibrium. The coefficient (-0.23194) indicates that about 23 percent of the deviation of export value of gems and jewellery, from long-run equilibrium, is corrected in the current period. In table 8, the value of R-squared (goodness of fit measure) shows that 64 percent of the variation in the export supply value of gems and jewellery is caused by the independent variables included in the model while the remaining 33 percent variation is due to some unknown factors. The value of Durbin-Watson Statistics is near about 2 which indicate the absence of autocorrelation among the variables. For all Diagnostic Tests, the model gives satisfactory results. The LM-test for up to one order indicates no serial correlation problem in the residuals. The p-value for the RESET test for functional form misspecification is greater than 0.05. This means that the functional form is correct and the residuals are normally distributed.

Conclusion and Recommendation

This study estimated the impact of major determinants of Gems and Jewellery exports from India. The findings of this study confirmed the major factors affecting gems and jewellery exports from India. The exchange rate harms exports of finished gems and jewellery as expected. A one percent increase in the exchange rate will cause a 5.1112 percent decrease in exports of finished gems and jewellery in the long run. RGDP, the share of semi-manufactured goods exports, and trade openness will lead to 3.1657, 0.7276 and 2.3914 percent increases in the export supply of finished gems and jewellery in the long respectively. Export prices are negatively related and indicate that a one percent increase in the export prices will lead to -3.3987 percent increases in the export supply of finished gems and jewellery in the long run. So to promote gems and jewellery exports from India, there is a need to develop quality standards according to importing countries' requirements. Future research could explore

that specific dynamics of export diversification of gems and jewellery and the role of global value chains in shaping trade patterns between India and major exporting countries.

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Examining the Constituents Driving Behavioural Intention to Adopt Mobile Banking Among Gen Z in Delhi NCR

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Abstract

The potential allowing consumers to perform financial transactions whenever and wherever they want, as well as to swiftly and effectively integrate banking services with mobile devices, makes mobile banking a technical innovation. Digital banking experiences are taking the place of traditional banking thanks to smartphones and AI. Customers from distinct generations have different psychographic traits, different demographics, and different needs from those of their predecessors. The purpose of this investigation is to determine the factors that drive the interest of Generation Z customers in the adoption of Mobile Banking. This study primarily employs the Unified Theory of Acceptance and Use of Technology (UTAUT) model, incorporating four dependent variables: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. This model is extended by an additional independent variable, namely 'perceived risk,' derived from existing literature, with behavioural intention serving as the dependent variable. The research framework examines the interrelationships among these constructs in influencing behavioral intention to adopt mobile banking among Generation Z, based on a sample of 400 Generation Z mobile banking customers. Structural Equation Modelling (SEM) coupled with Confirmatory Factor Analysis (CFA) is utilised to evaluate the constructs. Findings indicate that Generation Z's perceptions regarding mobile banking acceptance and utilisation are significantly associated with Perceived Risk, Performance Expectancy, Effort Expectancy, and Social Influence. Notably, perceived risk exerts a negative influence on behavioural intention, and facilitating conditions were found to be insignificant. Although the proposed model was effectively validated and elucidates 68% of the variance in behavioural intention, the remaining 32% suggests the presence of additional, as yet unidentified, factors. The findings of this study extend the knowledge on mobile banking as an approach of financial technology implementation, from which mobile banking providers and interface designers can provide new potential solutions to expand the usage of mobile banking services among Generation Z.

Keywords: - Mobile Banking Adoption, Generation Z, Behavioral Intention, Unified Theory of Acceptance and Use of Technology, Perceived Risk, Delhi- NCR

Introduction

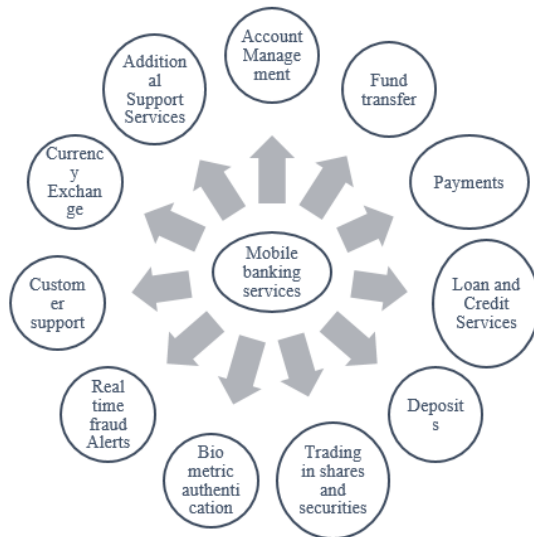
There is widespread agreement that digital transactions are the way of the future. In India, the way people shop and the shift to digital currency are currently undergoing a revolution. Today's population will always carry mobile devices with them and as on July 2023, there were 1046.411 million mobile phone Subscribers (TRAI, 2023). The banking services of today are accessible through a wider range of marketing channels. While newer services like mobile banking are becoming more popular, traditional retail banking is becoming less appealing. With mobile technology developing so quickly in the last few years, most customers now prefer mobile banking. Users can quickly and efficiently meet their financial obligations by using this service, which makes it easy to access money-related data (Dendrinis & Spais, 2023). The last ten years have seen significant changes in the banking sector. A new type of extra value for customers has been made possible by the development of e-banking services through various electronic channels, especially in the retail industry. Push-button phones and ATMs are two examples of innovative service methods that are already replacing more conventional electronic channels. The proliferation of mobile phones, especially those with wireless application capabilities, has made it inevitable for banking apps to expand to every phone (Guharay et al., 2023).

The swift increase in popularity of mobile banking can be attributed not only to its ability to facilitate remote participation in financial services but also to certain features of the mobile devices used for this purpose that improve consumer security concerns (Shareef et al., 2018). The way banks generate value for their clients has been completely transformed by m-banking, which offers affordable self-service options without geographical or time frame restrictions (Sahu & Maity, 2023). Within the framework of this research, M banking is characterized as a service offered by financial institutions, mobile network providers, and banks that allows users to perform both non-financial (such as checking account balances) and financial (such as opening fixed deposit accounts, paying utility bills, and transferring funds to another bank account) using their own mobile phones (Shaikh & Karjaluo, 2015; Sankaran & Chakraborty, 2021).

It took years to understand Bill Gates' quote, "**Banking is necessary, but banks are not.**" He said it in 1994, and it is becoming true. banking has progressed from branch banking to online banking to mobile banking Because of the development of self-service technology (SSTs). Mobile banking is growing rapidly as a result of smart phones' integration into customers' lives in recent years. An expansion of the Unified Theory of Acceptance and

Use of Technology (UTAUT) served as the foundation for the study's model. Perceived risk is one more factor in the extended UTAUT that influences a person's behavioural intention to use mobile banking. This is especially important due to the fact that most prior studies of Internet banking have examined the related issues from the perspectives of customers in developed countries. The bank's mobile banking services comprised investment, Fund transfers, account management, and other support services as shown in Figure 1.

Figure 1: Services Provided by Mobile Banking



Literature Review

Mobile banking

Mobile banking, also known as m-banking, is viewed as a form of digital banking (Priya et al., 2018). Mobile banking, in the eyes of bankers, is a method of providing financial services via cellphones. From the standpoint of the user, mobile banking simply means using a smart phone (mobile) to access a bank account, conduct financial transactions, and take advantage of a variety of banking services, either through a banking application or through wireless internet. Similar to a real wallet, an M-Banking is a digital wallet that allows users to send and receive money, pay for purchases on a variety of e-commerce sites, and do so quickly and effortlessly using a mobile app (Kamdjou et al., 2021).

(Sahu & Deshmukh, 2020) reviewed the literature on the adoption of mobile banking from 2010 to 2018 using search terms such as adoption, mobile banking, and m-banking. Three stages of the systematic review of the literature on mobile banking adoption were identified, analysed, and categorized. While factors like security, perceived risk, and complicated procedures impede the adoption of mobile banking services, factors like perceived usefulness, perceived ease of use, performance expectancy, effort expectancy, facilitating conditions, social influence, and awareness positively impact the adoption of mobile banking services.

Singh & Srivastava (2018) investigated the factors influencing India's adoption of mobile banking. The analysis was conducted with SPSS 16.0, CFA, SEM, and AMOS 16.0, utilizing an extended TAM that included trust, security, and perceived financial cost on a seven-point Likert scale. Convenience sampling was employed to gather data from 855 Indian customers through the use of a questionnaire method. The findings demonstrated that while trust, and social influence had no apparent impact on customers' intention to use mobile banking, perceived ease of use, security, cost, and computer self-efficacy did.

May et al. (2021) tried to learn more about the factors influencing Generation Z consumers in Selangor, Malaysia, to adopt e-wallets. sample was made up of 402 Gen Z consumers who completed a self-administered online survey using the purposive sampling method. For this study, the UTAUT model was chosen, and SPSS software was utilized for analysis. The research findings illustrated the significance of performance expectancy, effort expectancy, social influence, and enabling conditions in forecasting the behavioural intention of customers to utilize electronic wallets.

Gupta et al. (2017) tried to look into how security levels affect Indian customers' perceptions of danger, control, and eventually, their adoption of mobile banking, with respect to different types of Indian cities. The data gathered from 176 respondents by using convenience sampling, and snowball sampling was analysed using a conceptual model, EFA, CFA, Two-way ANOVA. Consumer perceptions of risk and control in urban settings were major factors in their adoption of mobile banking, but only the perception of control was significant.

Al-Baltah et al. (2024) Used a theoretical model to examine the variables influencing Yemeni customers' MBA adoption, this study sought to broaden our understanding of the field. TAM, is expanded upon by the proposed

model. SPSS used to assess research hypotheses and validate conceptual models. A survey questionnaire was utilized to select 473 responses from experts and students in higher education. After conducting an empirical analysis, this study finds that people's intention to adopt an MBA is strongly influenced by perceived usefulness, perceived ease of use, perceived value-added services, perceived self-efficacy, social influence, financial cost, perceived risk of system non-availability, perceived risk of privacy, and perceived security risk.

Changchit et al. (2017) investigated the elements that influence acceptance of mobile banking usage. In addition to the original TAM model, five other factors were considered to be determinants of attitudes toward using mobile banking: perceived privacy, perceived security, previous experiences, normative beliefs, and technological competency. A survey instrument was utilized to gather data, and 309 subjects took part in the research. To examine the data, a multiple regression analysis was performed and found that users' opinions regarding using M banking was significantly influenced by four of the seven factors that were looked at: perceived utility, perceived ease of use, perceived security, and prior experience.

Generation Z

The term of generations will follow the born-year labelling by (Diana Oblinger et al., 2005), which stated that the generation born after Generation Y or Millennial (1981-1995) is Generation Z or Post-Millennial (1995-2010). Generation Z, known as the "Always-Clicking Generation," is a generation closely connected to the internet. companies are facing major challenges in addressing young people from Generation Z because their characteristics are new and unheard of, so far. Sometimes referred to as "digital natives", Generation Z includes more than 25% of the world's population. Most of the GenZ are students, and they still have no banking experience, so their ability to try new services will be the highest among all generations (Abu Daqar et al., 2021).

The majority of Generation Z is still in high school or college, so most of the research that has been done so far has been on students. However, the older members of this cohort are now entering the workforce, and work-life balance is a crucial consideration for Generation Z when choosing a job because they prefer working independently rather than depending on others to finish tasks, and some studies indicate that they prefer working independently and may be reluctant to work in collaborative teams (Iorgulescu, 2016).

Mobile Banking and Generation Z

Alifia et al. (2024) investigated and analysed the factors influencing Gen Z's adoption of mobile banking through an online survey administered to 250 respondents who used M-banking in Jabodetabek between the ages of 18 and 24. The results, obtained using a conceptual model, demonstrated a positive influence of perceived ability, perceived benevolence, perceived integrity, and perceived ease and usefulness on the use of mobile banking applications.

Indriyarti et al. (2023) With 320 participants from generation Z in Jakarta who use digital banking investigated what makes young people more likely to use digital banking by using a quantitative technique with PLS-SEM, and demonstrated that resistance to technology has a direct impact on usage attitudes in addition to costs, costs-benefits, and self-efficacy. In the meantime, resistance to technology will be felt indirectly if usefulness, self-efficacy, and awareness come before the attitude of use.

Koenait et al. (2021) used TAM and TPB as theoretical foundations to empirically investigate how South African consumers perceive mobile banking applications. Structural equation modelling (SEM), hypothesis testing, and path modelling were employed in this quantitative approach. A five-point Likert scale was used to gather data from 325 respondents using a simple random sampling technique. The results showed a significant correlation between the knowledge, attitudes, and actual use of mobile banking applications, as well as their perceived usefulness.

Priya et al. (2018) investigated the factors influencing the uptake of mobile banking by 269 young Indian consumers aged between 23 and 29 were considered for this investigation. A cross-sectional survey study, regression analysis, exploratory factor analysis, a five-point Likert scale, and an ANOVA test were used to test a conceptual model. Strong predictors of users' satisfaction and behavioural intention to use the mobile banking service include perceived usefulness, perceived ease of use, perceived credibility, and structural assurance. It was found that the US played a significant mediating role in the relationship between PU, PEU, PC, SA, and BI in using the service and association between perceived risk and BI was determined to be negligible.

Indriyarti et al. (2023) used a quantitative approach with PLS-SEM and involved 320 participants from Jakarta's generation Z to investigate the factors that increase the likelihood of digital banking use among young people. It looked at a number of factors, including resistance to technology, self-efficacy, cost, ease of use, usefulness, security, and awareness. The study's conclusions demonstrated that, in addition to costs, usefulness, and self-efficacy, resistance to technology also directly affects attitudes toward its use. In the meantime, resistance to technology will be felt indirectly if usefulness, self-efficacy, and awareness come before the attitude of use. For Generation Z users, security and ease of use are crucial, but they are no longer the main factors in whether or not they embrace digital banking.

Research Questions

To offer a more comprehensive knowledge of the behavioral intention of Gen Z Indian customers toward the embracing of M banking, this study aims to provide answers to the following questions:

1. What are the significant factors that could hinder or contribute to the Generation Z customers' Intention towards adoption of Mobile banking?
2. How can Generation Z customers' engagement be increased towards mobile banking?

Research objective

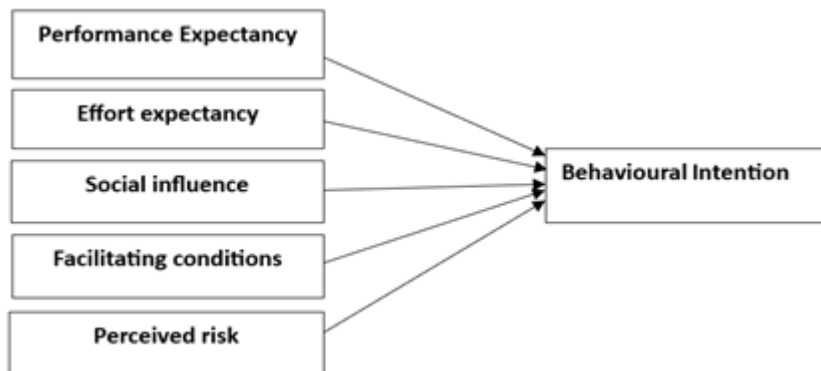
As per the research questions, this study attempts to fulfil these research objectives:

1. To study the main factors that could hinder or contribute to the Generation Z customers' Intention towards the adoption of Internet banking.
2. To provide suggestions/implications on how mobile banking service providers can enhance the Generation Z customers' engagement towards mobile banking.

Conceptual model and hypothesis Formulation

Considering the current situation, this study will evaluate the factors using a more sophisticated and thorough methodology based on suggestions from previous analyses in the relevant literature that may enhance the likelihood of both actual usage and intention to use mobile banking. Based on the modified UTAUT model (Venkatesh et al., 2012), this research model adds determinant perceived risk to the original UTAUT model's group of determinants based on the literature. The structure of factors and their relationship to the intention to utilise mobile banking are shown in Figure 2.

Figure 2: Proposed Conceptual Model (adapted from Venkatesh et al., 2003)



The major hypotheses developed based on the research Framework are as follows:

Performance Expectancy (PE)

According to Venkatesh et al. (2012), PE is the degree to which technology will assist users in carrying out specific tasks. When consumers use the newest technology instead of outdated or nonexistent technology, they are able to obtain significantly more benefits. Put differently, performance expectancy refers to the relative benefits that users obtain from implementing new technology. Consequently, it demonstrates how users view technology as a means of enhancing performance. The most reliable indicator of users' behavioural intention (BI) to use a technology and significantly influence it has been found time and time again to be PE (Merhi & Tarhini, 2019; Sahu & Deshmukh, 2020; Nur & Panggabean, 2021). The hypothesis for this construct is framed as follows: -

H1: Performance expectancy has a significant influence on behavioral intention to adopt MB for Gen Z.

Effort expectancy

The level of comfort with a particular technology is known as EE (Venkatesh, Thong, & Xu, 2012). Its architecture is influenced by various factors, such as adaptability, usefulness, and user-friendliness. If users think new technology is easy to use and doesn't require much effort, they will be eager to reach the expected performance (Zhou, 2010). This was confirmed when students' intentions to use an e-learning system were significantly predicted by how easy they thought the system would be to use (Tarhini et al., 2013). In numerous previous studies (Mensah & Khan, 2024; Penney et al., 2021; Tan & Lau, 2016; Alalwan et al., 2017; Jadir et al., 2021) effort expectancy was a statistically significant predictor of consumers' intentions. The hypothesis for this construct is framed as follows: -

H2: Effort expectancy has significant influence on behavioral intention to adopt MB for Gen Z.

Social Influence

Venkatesh et al. (2012) state that social influence is "the extent to which consumers perceive that important others believe they should use a particular technology." Family, friends, coworkers, the media, and social media are examples of this, and they all have a big impact on how people think and act. These individuals' recommendations and suggestions determine potential users' acceptance and use of new technology, provided that the consumer believes these people's opinions matter. Social pressure is another factor that could lead a potential user to begin utilising new technology. Numerous studies (Dendrinis & Spais, 2023; Sahu & Deshmukh, 2020; Singh & Srivastava, 2018; Hashim & bin Hassan, 2023) have demonstrated that behavioural intention is significantly influenced by social influence.

H3: Social influence has significant influence on behavioural intention to adopt MB for Generation Z.

Facilitating Conditions

"Facilitating conditions" (FC) are how customers perceive the resources and tools available to them to carry out the behaviour (Venkatesh, Thong, & Xu, 2012). "The internal and external factors that affect usage of new technology" are known as facilitating conditions. Users' knowledge of the new technology and their financial ability to purchase technological equipment may be internal factors. The importance of this construct in explaining behavioural intention has been confirmed a number of times in the past (Sahu & Deshmukh, 2020; Thusi & Maduku, 2020). However, in some studies, it does not play a significant role in explaining intention (Purohit et al., 2022; Penney et al., 2021).

H4: Facilitating conditions has significant influence on behavioral intention to adopt MB for Generation Z.

Perceived Risk

Consumers' feelings of uncertainty about a particular behaviour and the seriousness of the possible consequences are what shape their perceptions of risk. However, in research on consumer behaviour in marketing, perceived risk is limited to the unfavourable effects of a particular activity. As a result, the perceived risk factor only serves to explain the potential for adverse effects of the action carried out. Mobile applications are always vulnerable to hacking due to security holes in the technology used to create them. Perceived risk-related factors are commonly recognised as significant negative determinants of customers' intentions and adoption of IB. Several studies suggested that perceived risk significantly explained consumer intention (Mufarreh et al., 2020; Najdawi & Said, 2021; Thusi & Maduku, 2020).

H5: Perceived Risk has significant influence on behavioural intention to adopt MB for Generation Z.

Research methodology

Research Design

Three categories of research studies exist: descriptive research, experimental or causal research, and exploratory research. In order to determine the relevant variables for measuring generation Z consumers' behavioural intention to adopt mobile banking, exploratory research was first used in this study. A comprehensive examination of the literature review was conducted on both an Indian and global level in order to identify variables. The future direction was aided by in-depth literature research and expert discussions. Later, descriptive research was employed to determine the relationships between the constructs of different technology adoption models. This led to the extension of the UTAUT model with perceived risk, which was then used to investigate the effects of various constructs on generation Z's behavioural intention to adopt mobile banking.

Measuring the applicability of UTAUT model by extending it with perceived risk with empirical data is one of the goals of research. The outcomes obtained through the application of the quantitative research method are believed to be the most useful for ensuring appropriate and fruitful interpretation.

The target population for collecting the data was the generation Z users of mobile banking who belong to the age group of 13-28, and the convenience sampling technique was used to collect the data.

Instrument Development

This descriptive study employed a survey method using a standardized questionnaire distributed to respondents. The objective was to gather data about their demographics, behavioural intentions regarding the adoption of mobile banking. The data was collected using a 7-point Likert scale, where (1) stands for "Strongly Disagree" and (2) for "Disagree." (3) for Slightly disagree (4) for Neither Agree nor Disagree (5) for Slightly agree (6) for agree and (7) for strongly agree.

The questionnaire was split in two sections: The first section of the questionnaire asks about the respondents' demographic characteristics, such as gender, area, occupation, age, educational qualification and income, their experience of using mobile banking, and how frequently they use mobile banking. All the questions asked in the structured questionnaire are closed-ended questions except the one about the respondent's name.

Respondents and Data Collection

The study's target group consists of Delhi/NCR-based Generation Z consumers who have previously used mobile banking. The Delhi-NCR region is a representation of the entire Indian population because people come here to

work and study from all over the country. The growth of various trade and service sectors, along with job opportunities in the public sector, has significantly boosted the capital's economy and population migration. The target population for collecting the data was the generation Z users of mobile banking who belong to the age group of 13-28. Since the target population was not known, therefore convenience sampling technique was used to collect the data.

Primary data were collected through a structured questionnaire designed using Google Forms. The survey instrument was disseminated via digital platforms, including Gmail, WhatsApp, and Facebook, to reach a wide and demographically varied sample. Responses were systematically recorded within the Google Forms system, facilitating efficient data organisation and readiness for quantitative analysis. Data adequacy assumes that the sample size required falls in the range of five times to ten times the number of items (Hair et al., 2012) Since there are 26 items in our study, a sample size of 400 will be sufficient.

Data analysis and interpretation

In order to attain its findings and address the factors influencing Generation Z's interest in mobile banking, this study uses a quantitative approach. Primary data from 400 consumers of Generation Z, ages 13 to 28, served as the foundation for this study.

Descriptive Statistics

The respondent demographic characteristics show that the number of respondents used was 400 Gen Z respondents, of whom 222 were male and the remaining 178 were female respondents. Details of the demographic distributions are explained further in Table 1.

Table No. 1: Respondents' demographics profile

Measures	Items	Frequency	Percentage
Gender	Male	222	55.5
	Female	178	44.5
Age	13-18	45	11.25
	18-23	157	39.25
	23-28	198	49.5
Place of residence	Urban	258	64.5
	Rural	142	35.5
Education	High school	165	41.25
	Diploma	30	7.5
	Graduation	140	35
	Post-graduation	28	7
	Ph.D.	8	2
	Others	29	7.25
Income	Below 20,000	220	55
	20,000-40,000	84	21
	40,000-60,000	60	15
	60,000 and above	36	9
Occupation	Student	140	35
	Employee	165	41.25
	Entrepreneur	50	12.50
	Others	45	11.25

(Source: Author's contribution)

A two-stage methodology was adopted to test the measurement and structural model using IBM SPSS and AMOS (Anderson & Gerbing, 1988).

Instrument Validity

Cronbach's alpha, composite reliability, convergent validity, AVE and discriminant validity were used to test the validity and reliability of the survey instrument.

Reliability and Validity of the Constructs

Internal consistency (Cronbach's alpha), composite reliability, and average variance extracted (AVE) for each construct were tested in order to assess the construct reliability (Anderson and Gerbing, 1988). As seen in Table 2, it was discovered that the retrieved Cronbach's alpha value for every construct was higher than the 0.70 threshold that was advised (Peterson, 1994). Analysis showed that Cronbach's alpha for social influence was a minimum of 0.802, while behavioural intention achieved the highest value at 0.91, followed by PE at 0.89 (see Table 2). Each latent construct has a significant composite reliability of at least 0.80. Table 3 shows that BI had the greatest AVE value (0.91), followed by performance expectancy, while the lowest AVE value (0.801) was related to social influence. All latent constructs estimated AVEs proved to be exceeding the 0.50 criterion (Hair

et al., 2010). BI scored the highest AVE value (0.717), whereas facilitating conditions had the lowest AVE value (0.503).

Table No. 2: Construct Reliability and Convergent Validity

Construct	Item	Factor loadings	Cronbach's alpha	Composite reliability	Average variance extracted
Performance expectancy	PE1	.745	.893	0.893	0.676
	PE2	.790			
	PE3	.737			
	PE4	.844			
Effort expectancy	EE1	.780	.845	0.847	0.581
	EE2	.735			
	EE3	.813			
	EE4	.719			
Social influence	SI1	.676	.802	0.801	0.509
	SI2	.666			
	SI3	.713			
	SI4	.778			
Facilitating conditions	FC1	.787	.833	0.834	0.503
	FC2	.602			
	FC3	.719			
	FC4	.703			
	FC5	.724			
Perceived risk	PR1	.739	.858	0.857	0.548
	PR2	.760			
	PR3	.746			
	PR4	.736			
	PR5	.729			
Behavioural intention	BI1	.740	.910	0.910	0.717
	BI2	.739			
	BI3	.756			
	BI4	.773			

(Source: Author's contribution)

Common Method bias

Researchers used Harman's single-factor test with six variables and 26 items to prevent any issues relating to common method bias. An unrotated factor solution was used to examine 26 items that had been entered into exploratory factor analysis. The variation in the initial components was around 39.113 per cent, which is less than the 50 per cent that was proposed (Podsakoff et al., 2003). As a result, there are no issues with common method bias in the M banking data set.

Model Fit Summary of analysis Model

Table 3: Model Fit

Fit Indices	Recommended Criteria	Structural Model
CMIN/DF	<3	1.492
Adjusted Goodness of Fit Index (AGFI)	>0.8	0.905
Goodness Of Fit Index (GFI)	>0.9	.923
Comparative Fit Index (CFI)	>0.95	.975
Root Means Square Error of Approximation (RMSEA)	<0.06	0.035
Normed Fit Index (NFI)	>0.90	0.928

(Source: Author's contribution)

Since all the structural model values achieve the recommended criteria, so an appropriate model fit is achieved.

Discriminant Validity

When the variable of interest's square root of the AVE is greater than any correlation with the other variables in the model, discriminant validity is deemed acceptable. The discriminant validity criteria are satisfied when the diagonal values, which stand for the square root of each variable, are greater than the intercorrelations between the variables in the model, as seen in Table 4.

Table No. 4. Discriminant validity

	PR	PE	EE	SI	FC	BI
PR	0.740					
PE	-0.466	0.822				
EE	-0.472	0.583	0.762			
SI	-0.510	0.546	0.522	0.713		
FC	-0.386	0.489	0.394	0.405	0.709	
BI	-0.677	0.651	0.590	0.643	0.485	0.847

(Source: Author's contribution)

Table No. 5. Hypothesis Test Results

Hypothesis	Path	Beta coefficient	p-value	Significance
H1	PE→BI	.245	.000	Significant
H2	EE→BI	.128	.015	Significant
H3	SI→BI	.228	.000	Significant
H4	FC→BI	.087	.059	Not Significant
H5	PR→BI	-.352	.000	Significant

(Source: Author's contribution)

Testing of hypotheses: The test findings (table 5) indicate that the hypotheses H1 or PE-BI ($\beta = .245$, $p < .05$), H2 or EE-BI ($\beta = .128$, $p < .05$), and H3 or SI-BI ($\beta = .228$, $p < .05$) possess a noteworthy positive relation. H5 or PR-BI have a substantial negative correlation ($r = .352$, $p < .05$), and H4 FC-BI ($\beta = .087$, $p < .05$) was determined to be not statistically significant. The total variance of 68% can be accounted for by the model.

Findings

With a p-value of 0.002, which is below the threshold of 0.05, performance expectancy significantly influences Generation Z consumers' BI to integrate mobile banking and hence H1 is found to be significant. The outcome is in line with the conclusions of earlier studies (Merhi & Tarhini, 2019; Sahu & Deshmukh, 2020; Nur & Panggabean, 2021). Mobile banking adoption among Gen Z has been determined to be significantly affected by performance expectations.

The findings provide strong support for H2, which asserts that EE influences users' BI to embrace M banking favourably. This result validates previous studies. Expectations of ease of use, ease of learning, and necessity with the fulfillment of these expectations form the foundation of effort expectancy (Venkatesh et al., 2012). The study's results showed a trend that was consistent with earlier research (Mensah & Khan, 2024; Penney et al, 2021; Tan & Lau, 2016; Alalwan et al, 2017), with a strong positive correlation, showing that customers would progress toward developing a habit connected to using M Banking more frequently.

Also, the outcome demonstrates that SI is a significant predictor of users' BI to embrace M banking, which supports H3. Previous research (Dendrinis & Spais, 2023; Sahu & Deshmukh, 2020; Singh & Srivastava, 2020; Hashim, 2023; Purohit et al, 2022; Konteos et al., 2022; Wei et al., 2021) indicating that SI affects customers' BI has been supported by the results. This result indicates that greater the number of people cherish the advice they receive from others (such as friends, colleagues, and their associates, or possibly opinion leaders) more the M banking is probably going to be accepted.

The lack of substantial influence of FC on users' BI to adopt MM disproves hypothesis H4. This finding suggests that the availability of facilities and support systems is not always a prerequisite for the capacity to use M banking. The fact that users have easy access to the facilities, support systems, and specialized skills needed to utilize the service may be the reason for the minimal effect of FC on users' BI to embrace M banking. These factors neither encourage nor inhibit the behaviour. Nonetheless, the results align with other research (Purohit et al, 2022; Penney et al, 2021; Wei et al, 2021; Sari et al, 2024) on mobile banking, which also demonstrated that FC failed to improve customers' ability to adopt new technology.

Moreover, the results show that PR is a strong negative predictor of users' BI to adopt M banking, hence confirming H5. This study highlights the conservative attitudes of India's youth, since various perceived hazards considerably reduce the likelihood of m-banking adoption among this group, making it clear that stronger banking policies and networks need to be implemented. Our knowledge of the distinctive ways that Gen Z customers embrace while using mobile banking has improved as a result of this study. Consequently, one crucial issue that must be resolved in order to further the acceptance of mobile payments in the future is consumers' perceptions of risk. Marketing efforts ought to stimulate consumers' interest in learning more about mobile banking and should strategically target the audience by emphasizing how taking on mobile banking would make them more technologically sophisticated and prevent them from trailing behind their peers.

Managerial Implications and Recommendations

Significant theoretical and administrative ramifications flow from this study on Generation Z's take on mobile banking. From a management standpoint, it's imperative to concentrate on user-centric design, making sure that mobile banking apps have customisable functionality and user-friendly interfaces to improve contentment and persistence. Advanced security features like biometric authentication (Shams, Rehman, Samad, & Oikarinen, 2020) can assist in addressing privacy issues, and open communication of security measures is crucial for fostering confidence. By examining Generation Z's distinct perspectives on mobile banking, this research theoretically enhances the UTAUT model. Their contributions to the Theory also include highlighting how younger users' acceptance of technology may be hastened by social influence, performance expectation, effort expectancy, and perceived risk. When analysing the unique preferences of Generation Z in contrast to other generations, particularly about the integration of technology in banking, new insights can be obtained that can improve theories of consumer behaviour. The results also highlight the value of security and transparency in encouraging the use of mobile banking, which may promote frameworks for trust and privacy.

To increase Generation Z's use of mobile banking, banks should concentrate on a few important areas. Initially, they must raise performance expectations by creating feature-rich offerings that amply illustrate the benefits of mobile banking, such as tools for budgeting and investing. Showcasing user endorsements and success stories might help to highlight the benefits for money management.

Next, it's critical to minimize effort expectations. To facilitate adoption and make navigation simple, banks should simplify the onboarding process by providing clear instructions and user-friendly user interfaces (UIs). Building trust via open communication of security measures like encryption and two-factor authentication, and by offering easily available customer support like live chat and round-the-clock help, is crucial in mitigating perceived risk. Finally, banks will be able to communicate in a way that connects with the unique requirements of this generation by employing personalized marketing methods.

Conclusion

This study examined the elements that may have contributed to Gen Z's adoption of mobile banking. 400 questionnaire responses from Gen Z mobile banking customers were included in our database. We used structural equation modelling to evaluate our hypotheses after the constructs' convergent and discriminant analyses. This study adds something interesting to the research on the factors that Generation Z takes into account while utilizing digital banking services. Though still in its early stages, mobile banking is predicted to have an immense market potential. But the speed of diffusion is not that fast. This study looked empirically at the adoption intention of mobile banking to add to the body of knowledge on the subject and analyse the boundaries and elements of this predicament. The primary goal of this study was to define and pinpoint the key constituents driving Gen Z customers towards M banking. The existing body of research on M banking and its adoption highlights the necessity of identifying a theoretical framework that may account for the adoption of M banking from the standpoint of Gen Z. As such, the UTAUT model served as the foundation for the development of the suggested conceptual model. By adding perceived risk as an external component across UTAUT constructs, this was further expanded. The research has expanded our theoretical knowledge of the factors driving the uptake of mobile banking by looking at it from the viewpoints of prospective users who are not currently using it.

Three constituents showed a favourable positive correlation to drive interest in using mobile banking, according to the primary research results. Gen Z participants in this study showed a positive and substantial association between performance expectancy, effort expectancy, and social influence and their adoption of banking. Our results imply that these three constituents contribute to the proliferation of mobile banking among Generation Z, as they have been previously identified (Aseng, 2020; Lisana, 2024; Venkatesh et al, 2012) by the literature as key variables to M banking adoption.

Limitations and future scope

Although the study's aim to investigate the constituents driving interest in mobile banking in Gen Z was a successful attempt, this study is subject to some constraints. First, Data were collected from a sample of generation Z bank customers in the Delhi-NCR region of India, which sequentially could negatively affect the generalization of results in other states of the country. The Delhi-NCR region of India was the primary focus of the study that was carried out. Therefore, the study should be conducted throughout India. Although UTAUT was expanded to include perceived risk, this study did not incorporate other independent factors that might provide an accurate prediction of M banking application use. Secondly, the convenience sample used in this research is another flaw, since it could not be a suitable method of representing the total population, so by using a different sampling method, the researcher may produce a more representative result for the targeted population. Future studies should look at the direct relationship between adoption intention and actual use, it is advised. Because longitudinal surveys weren't used, future Research can concentrate on finding the shift in behaviour of participants throughout time.

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Corporate Energy Transition in India: A Firm-Level Analysis of Energy Intensity and Renewable Energy Adoption

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Abstract

Corporations are under growing pressure to align their energy systems with national and global climate goals due to the global shift towards a low-carbon economy. Energy strategies of corporations need to consider both dimensions of corporate energy performance: energy intensity, which measures the efficiency of energy use relative to output, and level of renewable energy adoption, which reflects the shift from fossil-based to cleaner sources of energy.

This study explores the recent trends in industrial energy consumption and the relationship between energy intensity and renewable energy adoption across NSE-50 listed large-cap Indian companies over two financial years (2022–24). The study looks at energy data reported from publicly disclosed reports and analyses how the level of energy intensity affects firms' adoption and transition towards renewable energy. The study uses descriptive statistics, linear regression models and non-parametric tests to test five hypotheses linking energy efficiency and renewable energy. The findings show a statistically significant inverse relationship between the level of energy intensity and Renewable Energy adoption, with the energy-intensity sector group emerging as a stronger predictor of Renewable Energy adoption. The findings reveal an uneven and polarised transition in corporate India, where a set of low-energy intensity firms are transitioning significantly faster than others.

Firms in low-energy-intensity sectors have shown significantly increased renewable energy adoption as compared to high-energy-intensity sectors. The low-energy sector firms also show a significantly higher growth rate in transitioning to renewable energy over the two years, while the high-energy-intensity sector firms show limited renewable progress. The key recommendations of this study include holistic framing of energy management decisions, technical innovation and considering energy-related investments as a strategic opportunity at the corporate level. The study finds no significant link between short-term Renewable Energy transition and Energy Intensity reduction, suggesting firms treat energy efficiency and Renewable energy strategies as distinct and parallel.

The study offers both theoretical and practical insights. It contributes to energy transition literature by connecting operational efficiency and strategic sustainability at the firm level. For policymakers and corporate strategists, it underscores the importance of sector-specific interventions to accelerate corporate energy transition.

Keywords: Energy Intensity, Renewable Energy Adoption, Corporate Sustainability, BRSR, Climate Strategy

Introduction

Corporate energy consumption and usage patterns have come under scrutiny due to the focus on climate change mitigation and sustainable economic growth. More than 70% of global greenhouse gas emissions are attributed to energy use (IPCC, 2022; IEA, 2023). Firms in emerging economies rely on fossil-based energy sources and show significantly increasing energy consumption (IEA, 2023). Energy strategies of corporates need to consider two interrelated dimensions of corporate energy performance: energy intensity, which measures the efficiency of energy use relative to output, and the level of renewable energy adoption, which reflects the shift from fossil-based to cleaner sources of energy.

The Indian government has made commitments under the Paris Agreement and set its net-zero ambitions. There has been a rapid scaling of renewable energy capacity (MNRE, 2023), and regulatory frameworks such as BRSR (SEBI, 2021) and CDP (CDP, 2023) have pushed for more transparent sustainability reporting. Energy consumption disclosures are an important part of corporate sustainability reporting and ESG (Environmental, Social and Governance) ratings. However, the corporate sector's response to these changes has been uneven. Many Indian firms in the technology and services sectors have adopted renewable energy as a strategic priority (IEA & CEEW, 2022), while firms in energy-intensive industries with heavy energy consumption have lagged in energy transition due to inherent constraints, costs, and infrastructural inertia (TERI, 2023).

Prior studies on energy usage have focused on macro-level indicators of renewable energy suppliers or examined energy efficiency and renewable energy in isolation. The academic literature linking energy intensity and renewable energy adoption at the Indian firm and sector

levels remains undeveloped. This study aims to fill that gap by exploring the relationship between energy intensity and renewable energy adoption across NSE-50 listed Indian firms over two years (2022–23 to 2023–24).

The study aims to answer the following key research questions:

- Are firms with higher energy intensity (EI) adopting more or less renewable energy (RE)?
- Are firms that reduce energy intensity also increasing their use of renewables?

This research extends the understanding of corporate energy transitions by linking operational efficiency (EI) with strategic sustainability (RE). This paper contributes to the literature by providing firm-level insights into India's corporate energy transition. It offers empirical evidence that can support policy, sustainability reporting, and corporate energy planning. The findings also suggest directions for future research.

This study is bounded by a two-year timeframe (2022–2024), focusing on NSE-50 listed companies in India. The scope is limited to firm-level analysis of energy intensity and renewable energy adoption, excluding smaller firms and listed entities. Only publicly available disclosures and BRSR reports have been included. Broader environmental or ESG factors beyond energy were not considered to maintain a clear focus on the relationship between Operational energy efficiency and renewable energy adoption.

Literature Review

According to the IEA, Renewable Energy is defined as “energy derived from natural processes that are replenished at a faster rate than they are consumed,” including wind, solar, hydro, and bioenergy (IEA, 2022). The definition from the EU also includes tidal and renewable fractions of waste as renewable energy. (Moriarty & Honnery, 2009).

The urgency towards energy transition is compounded by fossil fuel depletion forecasts (Moriarty & Honnery, 2011; Patzek & Croft, 2010; Heinberg & Fridley, 2010), making RE adoption a necessity, not a choice. According to the International Energy Agency (IEA, 2023), large industrial consumers are increasingly integrating renewable sources to meet decarbonisation goals, reduce operational costs, and hedge against fossil fuel volatility. Renewable energy offers a route to decarbonise corporate energy use while also indirectly contributing to energy efficiency. By shifting from fossil fuel-based sources (which are typically more carbon and energy-intensive) to renewables, firms reduce carbon emissions and enable AI-driven optimisation. The adoption of renewable energy (RE) by corporations has accelerated globally in recent years, but the sector-wise adoption has been uneven. The reports from CEEW (2022) and TERI (2022) identify sectoral heterogeneity in RE adoption and call for differentiated policies. Power, Cement, and Oil & Gas sectors lag due to legacy infrastructure and policy ambiguity.

Some studies have explored the drivers, barriers, and outcomes associated with integrating renewable energy into industrial practices. Marques and Fuinhas (2015) use a dynamic panel approach to show that financial incentives, public pressure, and long-term regulatory certainty are key drivers of adoption across EU nations. A recent review by Usman et al. (2024) outlines both technical and policy challenges in integrating RE into manufacturing processes, such as intermittency, capital expenditure barriers, and system compatibility issues. Energy intensity, defined as energy consumption per unit of economic output, is a widely used proxy for efficiency in energy usage. Corporate energy intensity reflects how efficiently energy is converted into business output. Cooremans (2012) argues that the strategic perception of energy efficiency investments significantly influences adoption rates. Energy efficiency needs to be integrated at the corporate strategy level and not as a cost-reduction project. Energy-related projects should be linked with strategic objectives like competitiveness, risk reduction, and innovation (Cooremans, 2012). Alam, Rahman, and Islam (2022) have highlighted that sustainable investment is positively correlated with improved energy and carbon performance at the firm level. In emerging markets, Zhou et al. (2021) find that government subsidies for RE manufacturers in China directly impact financial performance, reinforcing the idea that RE strategy is inseparable from corporate growth planning.

Many research studies have shown that RE adoption and EI reduction contribute positively to firm performance. Okafor and Nnaji (2024) have highlighted that RE use improves financial outcomes like profitability. Studies by Patari et al. (2021) connect sustainable energy adoption with increased adaptability, effectiveness, and efficiency. As Cooremans (2012) argues, the success of such transitions hinges on reclassifying these investments as strategic, not peripheral. A systematic review by Al-Najjar and Anfimiadou (2012) shows that firms adopting RE technologies report gains in profitability, logistics, and brand equity. They empirically show that environmental policies, including RE adoption, are positively linked to firm value.

The existing research offers various insights into the drivers of energy transition. Few studies examine the interplay between energy intensity and RE adoption at the firm level, especially in the Indian context. Most research treats RE adoption and energy intensity as isolated constructs or examines them in aggregate at the national or sectoral level.

This study bridges that gap by providing a firm-level analysis of the two indicators, mapping operational and strategic trajectories over the two recent years.

Research Design

This study investigates the relationship between corporate energy intensity (EI) and renewable energy (RE) adoption across NSE-50 listed firms in India over the period 2022–23 to 2023–24.

Research Objectives

The main objectives of the research are:

- To measure and compare renewable energy usage across firms with differing levels of energy intensity.
- To assess whether revenue, sectoral grouping, and energy intensity influence renewable energy adoption.
- To evaluate whether year-over-year changes in renewable energy usage predict short-term changes in energy intensity.
- To determine if firms in low energy-intensity sectors demonstrate stronger renewable energy transitions.
- To examine if prior renewable energy adoption predicts continued growth in renewable energy usage.

Sample selection

The sample uses secondary data from the sustainability and annual reports of the companies listed on NSE 50 (<https://www.nseindia.com>). The Nifty 50 is a diversified 50 stock index consisting of top companies with the largest market capitalisation, accounting for 13 sectors of the economy. Due to the change in the sustainability reporting requirements and measurement criteria, the data on energy consumption has not been consistently reported over the past years. It was therefore decided to consider the latest available data for the last two years reported by the companies during the years 2022–24. This offers a more reliable, useful and comparable dataset, also considering the fact that the availability and pace of renewable energy adoption has gained significant traction over the recent two years.

Out of the NSE-50 companies, 11 firms were excluded from the analysis due to extreme or inconsistent numbers. The final data consisted of 39 firms from multiple sectors, including Power, Oil & Gas, Technology, FMCG, Capital Goods, Consumer Durables, Financials, and others. Data was collected from Business Responsibility and Sustainability Reports (BRSR), Annual reports and disclosures available on firm websites, NSE data repository and financial databases.

Variables and Measures

Table 1 shows the variables used in the study, along with their description and measurement criteria.

Table No. 1. Description of Variables

Variable	Type	Measurement
Energy Intensity (EI)	Independent / Dependent	Energy consumed per unit of revenue (e.g., GJ/INR million), log-transformed as needed.
Renewable Energy Usage (RE)	Dependent	% of energy sourced from renewable sources in each year
RE Change	Dependent	Year-over-year difference in RE usage (%)
EI Change	Dependent	%Year-over-year difference in EI
Revenue	Control	Total revenue (INR Million), log-transformed for scale normalisation
Sector	Control	A categorical variable representing the firm's sector
EI Group	Grouping variable	Firms grouped as “High” or “Low” EI based on sectoral split

Hypotheses

The following hypotheses were framed in line with the research objectives:

H1: Firms with lower energy intensity have a higher proportion of renewable energy usage. This hypothesis tests whether firms with low Energy Intensity (EI) show higher Renewable Energy (RE) adoption using Spearman's rank correlation and Mann–Whitney U test.

H2: Revenue and EI group explain renewable energy usage better than energy intensity alone. This is tested using OLS regression with HC3 robust standard errors.

H3: Firms with higher renewable energy transition show a corresponding reduction in energy intensity. This hypothesis tests the relationship between renewable energy transition and changes in Energy Intensity using simple linear regression with HC3 standard errors.

H4: Low energy intensity group firms have greater year-over-year renewable energy transition compared to high EI group firms. This hypothesis tests the renewable energy transition between the low energy intensity and the high energy intensity groups using the Mann–Whitney U test.

H5: Higher renewable energy usage in 2022–23 predicts higher growth in renewable energy usage in 2023–24. This hypothesis tests whether the firms with higher renewable energy usage in the base year showed a higher renewable energy transition in the subsequent period using OLS regression with HC3 robust standard errors.

Statistical Techniques

The study uses non-parametric tests, Spearman's Correlation, and regression analysis, with additional robustness checks using HC3 robust standard errors to address potential heteroscedasticity.

The following statistical methods were used to test the hypotheses:

- Descriptive statistics to summarise central tendencies and dispersion
- Spearman correlation for evaluating monotonic relationships (H1)
- Mann-Whitney U tests for comparing Renewable Energy usage across Energy Intensity-based groups (H1, H4)
- OLS linear regression models to assess predictors of RE usage and energy intensity changes (H2, H3, H5)
- Categorical coding was done to create sector dummies and binary groups
- Log transformation was applied where data distributions were skewed.

All statistical tests were conducted using IBM SPSS Statistics, and significance was evaluated at the 5% level ($\alpha = 0.05$).

The regression models were tested for Multicollinearity using Variance Inflation Factor (VIF) and Heteroscedasticity using residual plots. Robust standard errors (HC3) were considered to correct for heteroscedasticity where necessary. The HC3 method provides more reliable estimates of standard errors in the presence of non-constant variance across firms, especially in smaller samples. All interpretations in the main results are based on HC3 adjusted estimates.

Descriptive Statistics and Analysis

Table 2 shows the results from the descriptive statistics.

Table No. 2: Descriptive Statistics

Mean	Median	Std. Deviation	Min	Max
108.92	3.39	349.71	0.113	2103.2
110.90	3.49	360.64	0.092	2176
17.09	6.18	21.71	0.007	93.69
19.86	6.86	24.48	0.021	95.81
2.77	1.04	5.16	-6.41	19.20
-2.18	-1.84	11.68	-22.70	34.28

Extremely high standard deviation and wide range in both 2022-23 and 2023-24 indicate strong skewness and

outliers, which shows that few high Energy Intensity firms distort the mean. The median is much lower than the mean (3.39 vs. 108.92 in 2022-23), confirming a positive skew. This justifies the use of log transformation and EI-grouping for analysis is appropriate.

RE usage also shows skewness, but the spread is more even than EI. Median Renewable Energy usage in 2023-24 (6.86%) is slightly higher than in 2022-23 (6.18%), indicating marginal overall improvement. Mean RE usage rose from 17.09% to 19.86% but was likely driven by a few high-RE adopters (max 95%).

EI Change has a mean of -2.18%, suggesting firms slightly reduced EI overall, though the median (-1.84) shows modest change. RE Change has a positive mean of 2.77% and a median of 1.04%, suggesting a broad but modest improvement in RE usage.

These changes show divergent firm strategies, with some reducing intensity, others increasing Renewable energy usage, or both. Log transformations and EI groups were appropriately applied in subsequent hypothesis testing (H1, H2). The descriptive statistics justify segmenting firms into high vs. low EI and assessing transition trajectories (H3, H4, H5).

Normality Testing and Model Selection

Initial normality tests (Anderson–Darling and Henze–Zirkler) revealed that Variables such as RE_Usage, RE_CHANGE, and EI_2022 were not normally distributed. Only EI_CHANGE passed the normality test.

This justified the use of Spearman's Correlation and Non-parametric tests (Mann–Whitney U) for group comparisons. Log transformations were applied for regression predictors of EI and revenue with Robust standard errors for multivariate models.

Two binary groups were created to represent high EI and low EI sectors. The high EI group consisted of Power, Metals & Mining, Materials and Oil & Gas Sectors. All the other sectors were categorised as Low EI group.

Results

This section presents findings for each of the five hypotheses, supported by appropriate statistical analyses, including non-parametric tests and regression models:

H1: Firms with lower energy intensity have a higher proportion of renewable energy usage.

To test whether firms with lower energy intensity (EI) adopt more renewable energy (RE), a Spearman correlation was conducted. The correlation between log_EI and RE_Usage_2023 was negative and significant ($\rho = -0.379$, $p = 0.009$), indicating that firms with lower Energy Intensity use significantly higher Renewable energy as a percentage of their total energy consumption.

A Mann-Whitney U test further confirmed that the low EI group (EI_grp = 2) had significantly higher RE usage in 2023 than the high EI group ($Z = -3.776$, $p < 0.001$).

- Mean Rank: Low EI = 24.32 vs. High EI = 9.00
- $Z = -3.776$, $p < 0.001$
- Effect size (r) = 0.605

This supports H1 and suggests that Energy Intensity and Renewable Energy usage are negatively aligned at the firm level. The large effect size indicates a strong and practically meaningful difference in RE usage between the High EI and low EI groups.

H2: Revenue and EI group together explain renewable energy usage better than energy intensity alone.

Multiple linear regression was conducted with RE usage (2023) as the dependent variable and Energy Intensity, EI group, and revenue as predictors.

Regression equation:

$$REUsage_{2023} = \beta^0 + \beta^1(log_{EI}) + \beta^2(log_{Rev}) + \beta^3(EI_{Grp}) + \varepsilon \quad \text{Equation (1)}$$

The OLS Regression with HC3 Robust Standard Errors gave the following results:

Table No. 3: H2 Regression Output (HC3 Adjusted)

Variable	B	Robust SE	T	p	95% CI
Intercept	-32.857	70.371	-0.467	0.643	[-175.72, 110.00]
log_EI	3.983	4.881	0.816	0.420	[-5.93, 13.89]
log_Rev	-1.039	9.708	-0.107	0.915	[-20.75, 18.67]
EI_Grp	32.269	11.868	2.719	0.010	[8.18, 56.36]

The model explains 24.2% of the variation in RE usage ($R^2 = 0.242$, Adjusted $R^2 = 0.177$), supporting H2.

The HC3, robust regression model predicting RE usage percentage (RE_Usage_2023) shows that only the energy intensity grouping (EI_Grp) is a significant predictor ($B = 32.269$, $p = 0.010$). Firms in the low energy intensity group (Group 2) use, on average, 32.3 percentage points more renewable energy than firms in the high EI group (Group 1). log_EI and log_Rev did not show significant influence.

These findings are consistent with H1, reinforcing the view that low energy-intensive firms are moving forward in RE adoption. Collinearity statistics (VIF, Tolerance, and Condition Index) were examined to assess potential multicollinearity among predictors. VIF for log_EI (2.6) and EI_Grp (3.0) suggest moderate multicollinearity but not severe. The significant result for EI_Grp supports the H2 hypothesis that structural categorisation (high/low EI) explains RE usage better than raw EI values.

H3: Firms with higher renewable energy transition show a corresponding reduction in energy intensity.

A regression model was run with EI_CHANGE_2023 as the dependent variable and RE_CHANGE_2023 as the independent variable to test whether a firm's change in renewable energy (RE) usage predicts its change in energy intensity (EI).

Regression equation:

$$EI_CHANGE_2023 = \beta_0 + \beta_1 (RE_CHANGE_2023) + \varepsilon \dots \dots \dots \text{Equation (2)}$$

The regression model was not statistically significant, $F(1, 37) = 1.078$, $p = 0.306$, and the explanatory power was minimal ($R^2 = 0.028$, Adjusted $R^2 = 0.002$). This indicates that changes in renewable energy usage accounted for only 2.8% of the variation in changes to energy intensity across the sample.

Robust regression estimates using HC3 standard errors produced the following result:

Table No. 4: H3 Regression Output (HC3 Adjusted)

Variable	B	SE	t	p	95% CI
Intercept	-3.230	2.175	-1.485	0.146	[-7.637, 1.178]
RE_CHANGE_2023	0.381	0.197	1.930	0.061	[-0.019, 0.780]

$$R^2 = 0.028; \text{ Adjusted } R^2 = 0.002$$

Although the coefficient for RE_CHANGE_2023 approaches significance, it does not meet the $p < 0.05$ threshold. The confidence interval suggests ambiguity in the direction and strength of the relationship. H3 is not supported. There is no significant evidence that an increase in RE adoption leads to a corresponding reduction in energy intensity in the short term

H4: Low energy intensity group firm have greater year-over-year renewable energy transition compared to high EI group firms.

A Mann–Whitney U test was used to compare RE_CHANGE_2023 between the two EI groups – High EI and low EI. The test was statistically significant ($Z = -2.559$, $p = 0.010$), showing that low EI firms exhibited significantly greater increases in RE usage over time than high EI firms.

- $U = 72.000$, $Z = -2.559$, $p = 0.010$
- Mean Rank: (Low EI) = 22.93 vs. High EI = 12.55
- Effect size (r) = 0.410

Low EI firms show significantly greater growth in RE usage year-over-year. H4 is supported, showing that low EI firms are not only ahead in RE usage but also more aggressive in RE transition over time. Medium to large effect shows a notable difference in RE transition between groups.

H5: Higher renewable energy usage in 2022–23 predicts higher growth in renewable energy usage in 2023–24. An OLS Regression with HC3 Robust Standard Errors tested whether previous RE usage predicts change in RE usage:

Regression equation:

$$RE_CHANGE_2023 = \beta_0 + \beta_1(log_REUSE_2022) + \varepsilon \dots\dots\dots \text{Equation (3)}$$

The HC3-robust regression showed a significant relationship:

$R^2 = 0.177$, Adjusted $R^2 = 0.155$

Table No. 5: H5 Regression Output (HC3 Adjusted)

Variable	B	Robust SE	t	p	95% CI
Intercept	1.769	0.509	3.479	0.001	[0.739, 2.800]
log_REUSE_2022	1.940	0.709	2.738	0.009	[0.504, 3.376]

This shows that RE usage in 2022–23 is a strong and significant predictor of RE growth in 2023–24. Firms with higher RE usage in 2022-23 continued to increase RE usage the following year. H5 is supported. Prior RE adoption momentum is associated with further transition.

Table No. 6: Summary Table: Hypotheses results

Hypothesis	Test / Model	p-value	Significance	Interpretation
H1	Spearman, Mann–Whitney U	0.009 / <0.001	Yes	Low EI firms use significantly more RE.
H2	OLS with HC3	0.010 (EI_Grp)	Yes	EI_Grp explains RE usage better than raw EI.
H3	Linear Regression	0.306 / 0.061	No	No evidence that RE transition reduces EI.
H4	Mann–Whitney U	0.010	Yes	Low EI firms show greater RE transition.
H5	OLS with HC3	0.009	Yes	Higher RE usage in 2022-23 predicts higher RE growth.

Discussion

This study examined the relationship between energy intensity (EI) and renewable energy (RE) adoption across NSE-50 firms, revealing important differences across firm types and sectors.

The sectoral group a firm belongs to reflects its energy intensity, regulatory pressures, access to green technologies, and exposure to sustainability-driven investment demands. This suggests that institutional and industry context is more influential than internal efficiency when it comes to RE adoption. Results show that firms in low EI sectors consistently demonstrate higher RE adoption and stronger RE transition (H1, H4). At the same time, H2 confirms that structural categorisations like high energy intensity and low energy intensity explain RE usage patterns more effectively than continuous EI values.

In sectors such as Power, Cement, Oil & Gas, and Metals & Mining, high EI is structural, stemming from the energy-intensive nature of core industrial processes (TERI, 2022; IEA, 2023). Technology, Pharma, and FMCG firms tend to have lower energy footprints and face fewer constraints in transitioning to renewable energy.

Sectoral barriers to RE adoption include infrastructure lock-in, intermittent energy supply, insufficient grid integration, and limited financing options for capital-intensive retrofits (Usman et al., 2024; CDP, 2022). Even when corporate intent is strong, operationalising RE strategies in high EI sectors can be slow and fragmented. H5 highlights the ‘momentum effect’ where the early adopters of RE deepen their transition over time. The strong and statistically significant link between prior RE usage and subsequent increases in RE usage indicates path dependence in sustainability behaviour.

H3 shows that there is no short-term linkage between RE increase and EI reduction, which the technical inertia of energy systems could cause. This reveals that firms treat energy efficiency and renewable energy as parallel but distinct strategies. While efficiency focuses on cost control, RE adoption may require different resources and decision drivers (e.g., ESG targets). This decoupling has important policy implications.

Low EI firms benefit from greater digital integration, level of agility, and reputational incentives. As CEEW

(2022) and Cooremans (2012) emphasised, firms that strategically frame energy investments linking them to innovation, resilience, and competitive advantage are more likely to succeed in transitioning. Overall, this study adds firm-level nuance to India's energy transition landscape and highlights how sectoral context, strategic framing, technical barriers and legacy infrastructure shape Renewable Energy outcomes.

Conclusion

This study examined how energy intensity (EI), sectoral identity, and firm-level characteristics influence renewable energy (RE) usage and transition across 39 Indian companies over two years.

These findings reveal an uneven and polarised transition in corporate India, where a small set of low-EI firms are transitioning significantly faster than others.

Sectoral affiliation plays a significant role in explaining RE behaviour rather than the influence of revenue or raw EI alone. Firms in structurally low EI sectors such as technology, pharma, and services lead to renewable energy adoption due to fewer transition barriers and reputational drivers. Energy-intensive sectors like Power, Metals, and Cement face structural, infrastructural, technical, commercial and policy-related constraints.

There is no significant link between EI reduction and RE adoption, suggesting firms may treat energy efficiency and RE strategies as separate and parallel. Firms that already use RE in one year are more likely to progress on transition the following year, confirming path dependence in sustainability behaviour.

Strategic recommendations of this study include holistic framing of energy management plans, focus on technical innovation and treating the sustainability investments as a strategic opportunity at the corporate level. A small subset of firms demonstrates multi-dimensional leadership by reducing EI, adopting RE, and increasing RE adoption. These may serve as case studies or benchmarks in future policy frameworks.

Policy recommendations include (1) sector-specific RE pathways with realistic transition targets, (2) performance-linked financing and subsidies for capital-intensive heavy industries, and (3) framing RE adoption not just as compliance but as a strategic opportunity (Cooremans, 2012; Zhou et al., 2021). Regulators must account for legacy infrastructure and offer differentiated incentives, while investors can push firms toward ESG-aligned innovation. Limitations of this study include a two-year observation period, a small sample size within each sector, and a focus on NSE-50 firms, which may not be generalised to small enterprises. Future research should explore multi-year interactions between RE transition and EI across sectors, using broader datasets, energy mix, and integrated with GHG emissions reduction. Future research should include case studies and qualitative insights on firm-level motivations, challenges and enterprise structures. Bridging India's energy transition gap requires both firm-level innovation and ecosystem structural support. This study highlights the importance of differentiated energy strategies and the need for accelerated and sustained investment in energy efficiency and renewables.

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Purchase Intention of Organic Cosmetics: The Value-Behaviour-Norms (Vbn) Model

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Abstract

The global demand for organic cosmetics has risen significantly in recent years, fuelled by increasing consumer awareness of health, environmental sustainability, and ethical consumption. Organic cosmetics are said to be safer and more sustainable than traditional beauty products because they are made with natural components grown without the use of artificial chemicals, pesticides, or genetically modified organisms and created using eco-friendly methods. These products prioritize skin safety, ethical ingredient sourcing, and environmental sustainability. In contrast to traditional cosmetics, organic substitutes frequently have certificates that guarantee compliance with stringent environmental and health requirements. This change in consumer preferences is indicative of the growing trend toward ethical beauty norms and sustainable consumption. Therefore, understanding the elements that affect consumers' intentions to purchase these products has emerged as a crucial area of interest for marketers. In the context of organic cosmetics, purchase intention is largely influenced by personal values, social norms, environmental awareness, and belief in product claims. This study aims to determine how VBN (Value-Behaviour-Norms) theory is a valuable foundation for identifying the primary factors driving consumers' choices to buy organic cosmetics. Data from a purposive sample of 230 customers was gathered using a questionnaire, and the analysis was conducted with SPSS Amos. The results of SEM analysis supported the VBN model. The study's findings reveal that altruistic value, hedonic value, personal norms and attitude play a significant role in influencing consumer purchasing intention, serving as a key element of trust in the decision-making process for purchasing organic cosmetics. Furthermore, age had no obvious effect on the intention to purchase organic cosmetics. However, gender has a considerable impact on purchasing patterns in this context. These factors underscore the importance for brands to prioritize eco-friendly practices and clear communication to attract eco-conscious consumers. The results provide valuable insights for marketers aiming to engage socially responsible audiences and support the adoption of sustainable, pro-social consumption habits.

Keywords: Organic Cosmetics, Purchase Intention, VBN Model, Altruistic Value, Hedonic Value.

Introduction

The usage of organic cosmetics has a long history in India that goes back many centuries. The use of natural components for skincare and cosmetic purposes has long been stressed by traditional Indian medical systems such as Ayurveda and Siddha. These methods have impacted the growth of organic cosmetics in India, which are becoming more and more well-liked as people are becoming increasingly aware of the benefits of using natural ingredients and being sustainable. The use of several plants and botanicals for cosmetic purposes is mentioned in ancient Ayurvedic writings.

Global sales of beauty products are anticipated to reach US\$673.70 billion by 2025, growing at a predicted rate of 3.35% annually (Statista, 2025). To preserve the environment and emphasize the value of maintaining one's own health, consumers must change their purchasing habits from conventional to more environmentally friendly options (Ali et al., 2023). Customers are starting to discuss the use of artificial ingredients in cosmetics (Tengli and Srinivasan, 2022). Consequently, environmental sustainability is gaining increasing importance, driving the rise of sustainable consumerism across various industries, including the beauty sector. The demand for green cosmetics has increased globally due to consumer health concerns and the need for ethical and ecological production methods (Nguyen et al., 2024). Being more aware of how their behaviour affect the environment, green consumers in particular are essential in encouraging sustainable behaviour (Barbu et al., 2022). With the growing awareness of environmental protection, customers are actively seeking and buying more environmentally friendly items. For this reason, companies have entered the field of sustainable marketing and studied buyer sentiments towards environmentally friendly goods (Cheah & Phau 2011). Since eco-friendly products are more specialized and costly than conventional ones, more marketing work is needed for green body and beauty care products (Krissanya et al., 2023).

Despite the growing popularity of organic products, little research has been conducted to examine the factors influencing Indian customers' willingness to purchase them. Although research conducted in Western markets has shed light on consumer behaviour with regard to organic products, a closer look at these elements in the Indian

context is necessary due to the distinct cultural, economic, and social dynamics of the Indian market. Businesses seeking to take advantage of this expanding market segment must comprehend the reasons behind Indian customers' preference for organic cosmetics. Additionally, it can aid in developing more compelling marketing strategies that resonate with the values and interests of the target audience.

To better understand these aspects, this study makes use of the VBN (Value-Belief-Norm) Theory's dimensions. Therefore, this study seeks to address a gap in the literature and provide insightful information for both academics and business. The study also enhances the broader understanding of consumer behaviour in emerging markets, particularly in relation to environmentally friendly consumption. As a result, the study's primary goal is to examine the underlying relationships between hedonistic and altruistic values, personal norms, and green buying intentions in the Indian cosmetics industry. The secondary objective is to examine whether differences in gender and age impacts purchase intention of sustainable cosmetics.

Review of Literature

Various studies have explored what motivates consumers to purchase organic and green cosmetics.

Altruistic value

Altruistic consumption is characterized as a forward-thinking approach in which businesses consciously prioritize ethics, social responsibility, and sustainable development in the global trade landscape. This model integrates corporate operations with the values of fairness and equity, aiming to shift away from traditional profit-driven strategies. Altruistic values are characterized by a concern for others and their surroundings (Swami, Chamorro-Premuzic, Snelgar, & Furnham, 2010). According to Prakash et al. (2019), the altruistic value has a greater impact on youthful, environmentally conscious consumers' attitudes toward and support for eco-friendly packaging items. A study by Yadav (2016) found that young Indian buyers' intentions to purchase organic food are influenced by both altruistic and egoistic ideals. When buying organic food, they take the environment into account in addition to the health advantages for themselves. Greater levels of environmental concern are associated with an increase in unconditional environmentally friendly purchases (Sharma & Foropon, 2019). Therefore, we derive the following hypothesis:

H1: Altruistic value significantly influences personal norms.

Hedonic value

Those who value those aspects of pleasure are known as hedonists. Hedonic values are crucial in environmental research and treatments that try to encourage green practices incorporating the effects of hedonistic behaviour, as these can function as obstacles to changing behaviour (Steg et al., 2014). Under certain conditions, hedonistic and materialistic values might result in ecologically good conduct (Tolppanen & Kang, 2020). Hedonistic and self-centered values lead individuals to concentrate on specific aspects of the situation and lead to various actions, according to Steg et al. (2014), who support this viewpoint. Purchase intention was found to be highly influenced by all aspects of hedonic purchasing value, including the demand for enjoyment, novelty, escape, social contact, and praise from others (Dey & Srivastava, 2017). Therefore, a consumer's inclination to buy a thing increases with its hedonic value. Building on the above discussion, we hypothesize that:

H2: Hedonic value significantly influences personal norms.

Personal Norms

Personal norms (PN), which are used to explain self-expectations for particular acts in particular situations, are defined as "an individual's perception of a moral obligation to execute or abstain from particular actions" (Ateş, 2020). People who follow strict social and personal norms are more likely to exhibit sustainable consumption patterns (Kim and Seock, 2019). Jaini, Quoquab, Mohammad, & Hussin (2020) affirms that green purchase behaviour is significantly impacted by personal norm. According to Chaudhary and Bisai (2018), personal norms are thought to be a better fit for understanding environmentally responsible behavior. Another study by Borusiak et al. (2020) shown that Green Purchase Intention is significantly impacted by Personal Norms.

Hence, we assume that:

H3: Personal norms significantly influence attitude.

Attitude

As defined by Fishbein and Ajzen (1975), attitude toward behaviour refers to "a learned disposition to respond to an objective in a consistently favourable or unfavourable manner." Since consumers usually buy products, they find engaging as well as beneficial, prior research has demonstrated that attitudes can be powerful predictors of purchase decisions (Fennis & Stroebe, 2016). The millennial buyers' attitude influences their purchase intention towards green cosmetics (Chhetri, Fernandes, & Baby, 2021). According to Ali, Usama Javed, Ali, and Zahid (2023) attitude favourably influences male customers' intentions to buy sustainable cosmetics. Indriani et al. (2019) found that attitudes fully mediate the association between environmental literacy and intentions to make sustainable buying. Therefore, we formulated the following hypothesis:

H4: Attitude significantly influences organic cosmetic purchase intention.

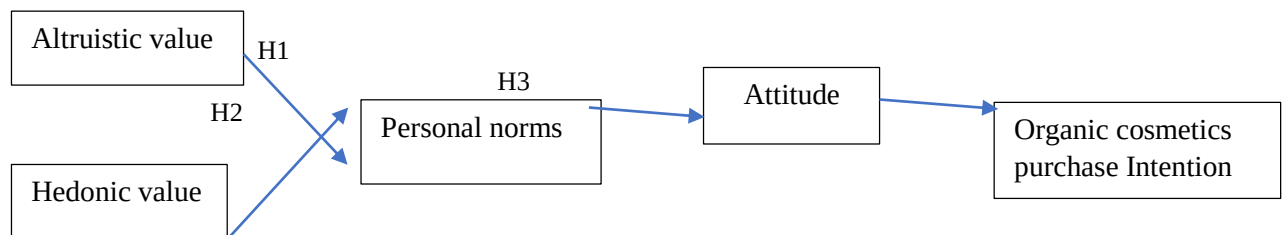
Theoretical Framework

The VBN (Value-Belief-Norms) theory is applied in this study which was proposed by Stern and associates and has been widely applied to understand various pro-environmental practices, including green purchasing. This theory describes how a person's values, beliefs, and social norms might affect their behaviour. According to the VBN Theory, people's conduct is shaped by three levels of motivational factors: norms, beliefs, and personal values. Personal values are ideas that represent what an individual believes to be significant in life, such as environmental preservation. Beliefs, like the conviction that climate change is a major issue, are cognitive representations of an individual's perception of reality. Norms are societal expectations that govern conduct: for example, recycling is a community norm.

According to the VBN Theory, an individual is more inclined to adopt eco-friendly attitudes and act in ways that support the environment when their personal values coincide with pro-environmental objectives. These constructive ideas can subsequently result in the creation of environmental standards, which can strengthen and maintain pro-environmental conduct. Figure 1 illustrates the conceptual model proposed for the research and its hypotheses.

Using VBN theory, Moharam (2023) emphasized how sustainability, ethical principles (such as cruelty-free practices), and health consciousness influence green buying behaviour. Long et al. (2024) found that raising awareness through certification and resolving social variables may encourage Generation Z to use green cosmetics more frequently. gender and age play significant moderating roles, highlighting the need for tailored marketing and policy interventions in Asian cultural settings. Quoquab, Jaini, and Mohammad (2020) applied VBN theory and discovered that age and gender play substantial moderating roles in green purchasing behaviour, highlighting the need for tailored marketing and policy interventions in Asian cultural settings. In another research by Jaini, Quoquab, Mohammad, and Hussin (2020), green purchase behaviour in the Malaysian cosmetics market is primarily driven by environmental knowledge, concern, and trust, mediated by a positive attitude toward green products. According to Najm et al., (2023), the purchase intent of organic skincare products is strongly determined by natural packaging, with ethnicity functioning as a moderator and consumer views acting as a mediator. Figure 1 illustrates the conceptual framework of the study.

Figure 1: Conceptual model



Materials and Methods

The study is conducted in the Palakkad district of Kerala, employing quantitative research method. Recently there is a notable growth of local businesses in the organic beauty and skincare sector in Palakkad. The district's growing urbanization and cultural trends toward sustainable consumption offer a unique chance to research behavioural patterns and purchasing intention. To choose sample respondents who used green cosmetics, the snowball sampling technique was used. Initially a small group of known consumers who have used and are regular users of green cosmetics was identified and invited to participate. These participants recommended other organic cosmetic users in their network which enabled the researcher to expand the sample size progressively. The period of the study was January 2024 to July 2024 by using primary and secondary data. The size of the sample was determined based on the guidelines provided by Hair et al. (2010). He typically advises keeping the ratio of observations to objects under analysis at least 5:1 when calculating sample size. The minimal sample size needed for this study, with 20 items in the questionnaire, was determined to be 100 (20 × 5). Nevertheless, the study's actual sample size was larger than the required minimum. In order to collect data, 270 questionnaires were distributed to respondents; 253 of these were returned. Of the responses, 23 were not complete since each case had missing values. These were not considered for further analysis. Thus, 230 is the final sample size with a 93% response rate.

A well-designed questionnaire was developed to gather data from organic cosmetic stores and social media platforms focused on sustainable living. The questionnaire was divided into two sections. The first section focused on the demographic factors of the respondents, while the second section was designed to examine the various aspects of green cosmetics purchase decision, adopted from previous studies. Some of the measurement items were selected based on their relevance to the constructs under investigation and their alignment with the study objectives. The items were assessed using a five-point Likert scale, ranging from Strongly Disagree (1) to Strongly Agree (5). Data analysis was conducted using SPSS AMOS, and reliability and validity tests were performed to ensure internal consistency for every factor. One way ANOVA and independent sample t-test were also employed

to identify group-based differences in consumer purchase intention based on age group and gender. The research was further supported by secondary data sourced from journals, books, and websites.

The demographic characteristics of the respondents were analyzed based on age, gender, income, educational qualification, and occupation, with the results presented in Table 1. The majority of respondents (59%) fall within the 21-40 years age range. In terms of gender, 77% are female, while only 23% are male. Regarding income, 45% of respondents earn below Rs. 25,000, and 45% are graduates. As for occupation, 1% of respondents are agriculturalists, 5% do their own business, 10% of them are employed in private sector, 20% are government employees and the remaining 64% of the respondents are do not fall any of these categories.

Table No. 1: Demographic profile of the respondents

Demographic Profile of the Respondents	No of respondents (n=230)	Percentage %
Age		
Up to 20 Years	81	35%
21-40 years	135	59%
Above 40 Years	14	6%
Gender		
Male	53	23%
Female	177	77%
Marital status		
Married	171	31%
Unmarried	56	68%
Divorced	3	1%
Educational status		
School level	16	7%
Plus two	4	2%
Graduate	104	45%
Post-graduate	72	31%
Professional Degree	34	15%
Occupation		
Agriculturist	2	1%
Business	11	5%
Government employee	24	10%
Private employee	45	20%
Others	147	64%
Monthly Income		
Below Rs.25,000	103	45%
Rs.25,000-Rs.50,000	62	27%
Rs.50,000-Rs.100,000	31	13%
Above Rs.100,000	34	15%
Organic cosmetics shopping frequency		
Occasionally	115	50%
Weekly	43	19%
Fortnightly	23	10%
Monthly	49	21%
Amount spend for purchasing cosmetics per month.		
Up to Rs.1000		
Rs.1001 – Rs. 2000	161	70%
Rs.2001- Rs. 3000	52	23%
Above Rs. 3000	10	4%
Area of Residence	7	3%
Rural		
Urban	84	37%
Semi-Urban	74	32%
	72	31%

Source: Primary Data

Results and Analysis

The conceptual framework and model hypothesis were validated through the use of Structural Equation Modelling with SPSS AMOS. AV, HV, PN, and AT are the independent variables, and PI is the dependent variable. In the

first stage, the measurement model was assessed for its validity and reliability, with the results presented in Tables 2 and 3.

The internal consistency of the components was assessed using Cronbach's alpha and composite reliability (Table 2). These two have widely recognized values of 0.7, according to Fornell and Larcker (1981). While the HV has the greatest Cronbach alpha value (0.972), the PI has the lowest (0.859), which is beyond the acceptable threshold of 0.7 as suggested by Nunnally and Bernstein (1994). Each composite reliability index exceeds the necessary 0.70 cutoff. As a result, the constructs have sufficient internal consistency.

Discriminant validity was assessed following the guidelines proposed by Fornell and Larcker (1981). For every construct (Table 2), the squared correlations between any two constructs are lower than the square root of the AVE. This proves the variables' incompatibility and uniqueness.

Table No. 2: Reliability statistics

Constructs	Factors	Factor Loadings	Cronbach's Alpha	Convergent Validity (AVE)	Discriminant Validity	Composite Reliability (CR)
Altruistic Value	AV1	.977	0.968	0.946	0.973	0.981
	AV2	.976				
	AV3	.965				
Hedonic Value	HV1	.980	0.972	0.939	0.969	0.979
	HV2	.965				
	HV3	.962				
Personal Norm	PN1	.976	0.968	0.938	0.968	0.978
	PN2	.974				
	PN3	.955				
Attitude	AT1	.957	0.927	0.871	0.933	0.953
	AT2	.954				
	AT3	.887				
Purchase Intention	PI1	.905	0.859	0.786	0.886	0.917
	PI2	.888				
	PI3	.866				

Source: Computed data

The significance of the model's parameters is assessed using the p value and path coefficient that are acquired using the SPSS Amos program. If the standardised path coefficient is at least .50 and the p value is less than .01, the association is statistically demonstrated to be significant. Figure 2 and Table 3 display the results of the hypothesis and model fit tests.

Figure 2: Structural Equation Model

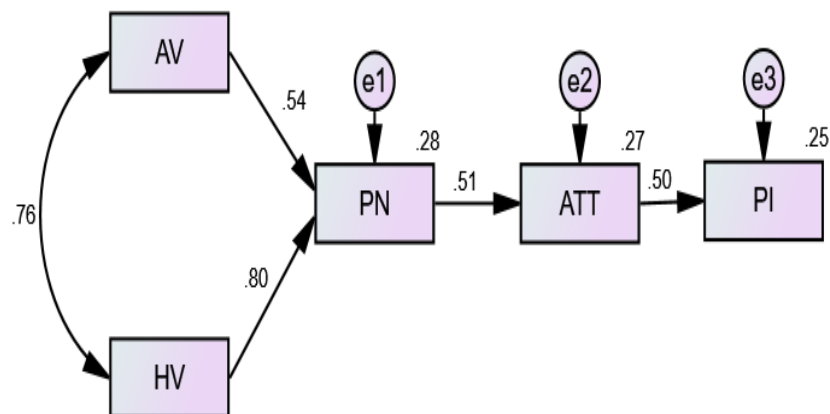


Table No. 3: Path analysis of structural model

Hypotheses	Path	Path Co-efficient	P value	Results
H1	AV → PN	.54	.000	Supported
H2	HV → PN	.80	.000	Supported
H3	PN → ATT	.51	.000	Supported
H4	ATT → PI	.50	.000	Supported

Source: Computed data

The results of the structural equation model and hypothesis testing (Figure 2, Table 3) validated all of the hypotheses (H1, H2, H3, and H4), with path coefficients of .54, .80, .51, and .50, respectively.

Table No. 4: Goodness of fit statistics for measurement model

	Model values	Suggested values
CMIN	6.860	-
DF	5	-
CMIN/DF	1.372	≤ 3
RMSEA	.033	≤ .05
AGFI	.976	≥ .90
GFI	.992	≥ .90
CFI	.997	≥ .90

Source: Computed data

The RMSEA value normally falls between 0 and 1, as Table 4 illustrates. A good fit is indicated by a number less than 0.05, an acceptable fit by a value between 0.05 and 0.08, and a poor fit by a value greater than 0.10. RMSEA of 0.033 suggests an acceptable fit, as it is below the 0.05 threshold and within the reasonable range. An AGFI of 0.976 is also considered good, as values above 0.90 are typically seen as indicating a good fit. GFI values range from 0 to 1, where a value nearer 1 indicates a better fit. Given that it is higher than the usual cutoff of 0.90, a GFI of 0.992 indicates a strong fit. The majority of fit indices (GFI, AGFI, CFI, and RMSEA) demonstrate how well the model fits the data.

One - Way ANOVA between age groups and purchase intention

A one-way ANOVA was conducted to examine whether purchase intention differ significantly across three age groups of organic cosmetic users. The null hypothesis (H0) was: There is no significant difference in purchase intention among the different age groups. Table 5 revealed high purchase intention levels across all age groups. The mean score was highest among respondents above 40 years old (M = 4.43, SD = 0.76), followed by those aged 21–40 (M = 4.36, SD = 0.73), and up to 20 years old (M = 4.26, SD = 0.76). The ANOVA table indicated that the differences in purchase intention between groups were not statistically significant, $F(2, 227) = 0.563$, $p = 0.574$. This suggests that age does not significantly influence purchase intention among respondents in this study.

Table No. 5: Descriptive Statistics

Age Group	N	Mean	SD
Upto 20	81	4.26	.755
21 - 40	135	4.36	.728
Above 40	14	4.43	.756
Total	230	4.33	.737

Source: Computed Data

Table No. 6: Analysis of variance -Age wise comparison of purchase intention.

Source of Variation	Sum of Squares (SS)	Degree of Freedom (df)	Mean Square (MS)	F-Statistic	p-Value
Between Groups	.626	2	.313	.563	.574
Within Groups	123.917	227	.546		
Total	124.543	229			

Source: Computed Data

Table 7: Post-hoc results- Tukey's Test Table

Comparison	Mean Difference	Tukey Statistic	Critical Value	Significant
Up to 20 vs 21-40	-0.096	.624	>.05	No
Up to 20 vs Above 40	-0.169	.708	>.05	No
21 – 40 vs Above 40	-0.073	.934	>.05	No

Source: Computed Data

Post hoc comparisons using the Tukey test indicated that the mean purchase intention did not differ significantly between any pair of age groups. Specifically, the differences between respondents aged up to 20 and 21–40 ($p = 0.624$), up to 20 and above 40 ($p = 0.708$), and 21–40 and above 40 ($p = 0.934$) were all non-significant. This supports the ANOVA result and the null hypothesis was accepted indicating no meaningful behavioural distinction in purchase intention across age groups.

Independent Sample t- test

To determine whether there is any behavioural distinction between the two genders of organic cosmetic users (male and female), an independent sample t test was also conducted. So, we hypothesised that there is no significant difference in the mean values of the purchase intention between the two groups. Levene's test confirmed that the assumption of equal variances was met ($F = 0.586$, $p = 0.445$). The results indicated a statistically significant difference in purchase intention between the groups, $t(228) = 2.297$, $p = 0.023$. Specifically, males ($M = 4.53$, $SD = 0.70$) reported significantly higher purchase intention than females ($M = 4.27$, $SD = 0.74$). The mean difference was 0.263, with a 95% confidence interval ranging from 0.037 to 0.488.

Discussion

The current study provides a comprehensive guide to green buying intentions based on the association between the variables Altruistic value (AV), Hedonic value (HV), Personal norms (PN), and Attitude (AT) of people with green purchase intention (PI). This study enhances the literature by exploring and validating the effect of VBN variables: values, behaviours, and norms on sustainable buying decision. The empirical findings disclose that hedonic value, altruistic value, personal norms and attitude of people positively influences the intention to purchase organic cosmetics. These results support VBN Theory.

The study emphasizes the relevance of altruistic value in influencing consumer behaviour towards eco-friendly cosmetics. This is congruent with prior research of Cherian (2023) who found that pro-environmental behaviour and green purchase intention is positively and significantly impacted by altruistic values. In another study, Pop et al. (2020) found that altruism has a beneficial influence on consumers' perceptions of environmentally friendly cosmetics. So, the marketers can collaborate with influencers who are passionate about sustainability and altruistic values to authentically promote the brand. Moreover, they can emphasize eco-friendly sourcing, cruelty-free testing, and sustainable manufacturing processes in marketing materials.

Our research also revealed that the intention to buy organic cosmetics was strongly influenced by hedonic value. Buying experiences and trends can have a beneficial effect on customers who prefer organic cosmetics. This is in line with Steg et al (2014), who affirms that hedonic value results significantly increase the propensity to make green purchases. In another study by Handayani, Musnaini, & Praditya (2020), hedonic impulses drove consumer interest in purchasing at contemporary retail malls. Marketers can position organic cosmetics as part of a broader self-care and wellness routine, appealing to consumers' desire for balance and relaxation. Also, they can highlight the luxurious textures, pleasant fragrances, and natural colours of organic cosmetics to attract customers.

We also found that personal norms influence attitude of consumers to purchase green cosmetics. This is consistent with the survey of Munerah et al. (2021) among Malaysian consumers who found that purchase intentions for green cosmetics were significantly predicted by societal and personal norms. Green consumer behaviour was considerably impacted by a value-induced personal norm (Quoquab et al., 2020). Another study by Prakash and Pathak (2017) found that purchasing intentions for eco-friendly packaging are significantly influenced by personal norms. Hence marketers can promote the idea that choosing organic cosmetics is a way for consumers to act in alignment with their personal ethics and make a positive environmental impact to enhance sales. Marketing strategies could include use of clear labelling to demonstrate honesty and trustworthiness, such as "100% natural," "free from harmful chemicals," and "sustainably sourced." Moreover, discuss how using organic cosmetics reduces the consumer's carbon footprint, contributes to biodiversity, or reduces plastic waste, reinforcing the idea that personal purchase decisions can lead to long-term positive change.

It was further revealed that attitude influences buying intention of green cosmetics. This corresponds to the study by Akter and Islam (2020) who confirms that favourable attitudes towards sustainable products significantly drive buying intentions. In another study by Ahsan and Ferdinando (2023) purchasing intentions towards green

cosmetics and attitudes are significantly correlated. Hence marketers should aim to shape positive consumer perceptions by highlighting benefits and reinforcing favourable beliefs about organic cosmetics. Advertisements can emphasize that organic cosmetics are free from harmful chemicals, ensuring they are safer for the skin. Our research also revealed a statistically significant correlation between gender and the desire to purchase eco-friendly cosmetics. This is consistent with Matić and Puh (2016) who found that consumer buying intentions are influenced by gender and their propensity to buy new natural cosmetics brands. According to Ruiz et al., (2000), gender has a significant impact on a consumer's environmental consciousness. In another study by Shimul et al., (2022), gender is an important factor in the framework of natural and eco-friendly purchasing practices. Overall, the research contributes to the expanding knowledge base on organic cosmetics consumption behaviour, emphasizing the relevance of the theoretical frameworks like the VBN model in understanding consumer behaviour in emerging markets like India.

Managerial Implications

This study establishes a theoretical framework for analyzing consumers' intentions to purchase eco-friendly cosmetics using the VBN model. It specifically enhances our knowledge of how hedonic value, altruistic value, attitude and personal norms influence the buying intention of green cosmetics. The strong connection between altruistic value and buying intention highlights the need to prioritize strategies that emphasize certifications or claims related to fair trade practices and cruelty-free production. To build trust, marketing managers can adopt greater transparency by providing detailed information about sourcing, production processes, and ingredient origins.

Our results show that hedonic value and green buying intention are positively correlated. To capitalize on this, marketers can implement personalized marketing strategies that make consumers feel special and valued. Additionally, organizing DIY organic cosmetic workshops can provide a hands-on and interactive product experience, fostering deeper engagement. Emphasizing rare or premium organic ingredients, such as argan oil or sea buckthorn, and highlighting their luxurious benefits can further enhance the appeal of green cosmetics to hedonic-driven consumers.

Our study also revealed that organic personal norms have a significant impact on consumer buying decisions. Therefore, marketing strategies should focus on campaigns that encourage consumers to view their purchases as meaningful contributions to environmental and societal well-being. Personalization can be integrated by rewarding consumers for sustainable actions, such as recycling packaging or making repeat purchases of eco-friendly products. Collaborating with influencers who advocate ethical and responsible living can further reinforce personal norms and inspire environmentally conscious purchasing behaviours. Marketers should focus on crafting strategies that effectively shape consumers' attitudes toward organic cosmetics, as attitude is a key predictor of purchase intention. Sharing positive testimonials and success stories from satisfied customers can help strengthen favourable attitudes. Additionally, marketers can run campaigns to dispel common misconceptions, such as the belief that organic products are less effective or excessively priced. Also, tailoring marketing strategies based on gender helps enhance relevance, engagement, and ultimately, purchase intention. Offering a diverse range of products at varying price points can further expand their appeal to a wider audience.

Conclusion

The purpose of this study was to investigate the variables influencing customers' intentions to purchase eco-friendly cosmetics in Palakkad district, utilizing a sample of 230 individuals. The research model incorporated variables derived from the VBN (Value-Belief-Norm) Theory. The results validated all four study hypotheses, confirming the robustness of the proposed model in understanding green cosmetics purchase behaviour. The study brought to light that hedonic value, altruistic value, personal norms, and attitude significantly influence green cosmetics purchase intention, supporting the theoretical framework derived from the VBN model. The study represented hedonic value as the most significant factor which influences organic cosmetic purchase intention. These results emphasize how crucial it is to use ethical marketing techniques that prioritize fair trade and sustainability, aligning with consumer values and personal norms. Ultimately, this study advances our comprehension of sustainable consumption behaviour and offers actionable insights for promoting green products.

Limitations and Directions for Future Research

The current research provides a solid foundation for future investigation. However, it entails specific limitations. Firstly, the sample size is comparatively small. Secondly, the study is confined to the Palakkad district, reflecting the perspectives of the urban youth in India. Additionally, the use of snowball sampling limits the generalizability of the findings. Lastly, the study could be further refined by employing different statistical tools for analysis.

Future research could explore other factors influencing purchase intention of organic cosmetics in a different region. Focusing on specific age groups and broadening the scope of research could provide valuable insights, benefiting companies in the long term.

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Impact Factors of MSME Performance in Ethiopia: The Mediating Role of Entrepreneurial Strategic Orientation

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Abstract

This study examines the pertinent factors impacting the performance of MSME enterprises in Ethiopia. We use a multidimensional approach involving internal and external factors and ESO as a mediating variable. Five hundred twenty-five sample units were chosen through stratified random sampling, and 22 enterprise heads were considered for the key informant interview. The study deploys a higher-order partial Least Square Structural Equation (PLS-SEM) Model that verifies the associations between variables. The empirical results revealed that internal factors influencing it are firm size, entrepreneurial strategic orientation, age and location, human capital and experience, and business environment, which are the external factors affecting MSMEs' performance. Furthermore, the strategic orientation of the entrepreneurs has a mediating impact on the accomplishments of MSMEs.

Keywords: MSMEs, Determinants, Small And Medium Towns, Strategic Orientation, SEM Modeling

Introduction

The groundwork investigation on Micro, small, and medium enterprises (MSME) has emerged as a thrilling topic (Alferaih, A. 2017). It is proceeding to grow because of its vibrant functionality in the economy to confront the joblessness rate and its commitment toward the communal turn of events and monetary development (Dong B. et al. what is more, Mahfud T. et al. 2020). The assortment of MSMEs across the Globe represents 70% of all business organizations internationally, which makes MSMEs a research challenge that needs responsiveness. MSMEs assume a critical part as they structure the premise of developing and improving the areas where they are laid out. MSMEs are the driving forces of the financial change of any economy from the perspective of socio-economic aspects (Atsu & Ojong, 2014). Its proactive decisiveness to minimize the joblessness rate at the regional level can uphold the integrity of workers. Accentuating workforce viability and effectiveness can propel cost optimization during production (Engle et al., 2021). Likewise, the degree of ability specialists are more preferred and dependable than uncouth workers. Various workforces can maintain the fastness of their manufacture, yet different incompetent employees will generate stunted economic outcomes. This sector assimilates over 80% of open professional positions, eases priority sector activities creation and expansion, upgrades operating rates, and progresses per capita in Africa (Atsu & Ojong, 2014). MSMEs are the central parts of advancing financial improvement in metropolitan places. Business entrepreneurial orientation through the infusion of ground-breaking activities is essential in helping hierarchical execution. MSMEs' humble (little) authoritative organizational structure makes innovator direction significant in shaping unique capacities to augment business undertaking execution (Basco R. et al., 2020).

In the case of African countries, 70% of the manufacturing output comes from MSMEs (Atsu & Ojong, 2014), showing the potential of MSME development in fostering the socio-economic development of urban centers and poverty alleviation through economic inclusion between urban and rural areas.

The establishment of MSMEs to create more extensive employment opportunities is prioritized under current policy initiatives and strategies for economic growth in Ethiopia. A national MSME progressive stratagem was formulated in 1997 (revised in 2011) to promote magnate entrepreneurship and establish the groundwork for modern events. (Garoma, 2012). A study conducted by Ephrem G. Selassie (2016) examined the monetary distress level of SMEs in the Wolaita Zone and distinguished those variables influencing their financial well-being. Using the purposive sampling technique, 30 firms from three areas were chosen as samples, and 10 were chosen from every manufacturing, administration, and trade sector. Appropriately, the aftereffects of Altman's Zeta Score Model examination indicate that three of the ten chosen firms in the service sector areas are viewed as monetarily troubled. However, none of the tested SMEs in the area are beneath the liquidation point.

In the manufacturing area, one of the ten chosen SMEs is found with a Zeta score of beneath the bankruptcy line, and the remainder of the tested SMEs are found to be in monetary misery; however, their Zeta score is over the bankruptcy point. However, MSMEs in the Wolaita Zone must perform better in creating jobs and hiring rustic

overflow laborers relocating to Zonal metropolitan habitats. Reports confirm that 32% of the workforce was unemployed in February 2017 (WZFEDD, 2017). Tantu et al. (2017) found that 36.7% of households need food security in Wolaita Sodo town, which is higher than the national average. Major cities in Ethiopia are crowded with youth migrating from Wolaita. Garoma (2012) concluded that more than 40 percent of the workforce in urban informal sectors in Addis Ababa are from Wolaita, Hadiya, and Kembata Tembaro Zones of the SNNPRS. The debate on the determinants of firm performance was not generalized. Gebreeyesus (2009) showed a systematic relationship between the growth of a firm and the firm attributes such as size and age. These investigations further uncovered that more youthful and modest firms progress faster than older and bigger firms. Others emphasized the development of a firm according to the perspective of business people, including orientation, age, instructive level, and Experience (Welter, 2001).

Literary works featured exterior factors like organizations and empowering business conditions (Hoxha, 2013). In an investigation of Vietnam, FDIs of SMEs were pitched to be strong in their business execution concerning the SDGS and the export of products to foreign countries (Liao et al., 2022; Wang & Liu, 2022).

We argue that a firm's performance is a complex process that depends upon several mutually inclusive factors. So, we focus on internal and external factors as the determining factors of these micro enterprises' concert using a multidimensional approach.

Other studies (Garoma, 2012; Gebreeyesus, 2009) explored aspects of small businesses in Ethiopia and concluded that small firms significantly contribute to employment generation and wealth creation. None of these studies has examined the performance of firms using a multidimensional approach. The contemporary research tries to abridge the hiatus and investigates the performance determinant factors of MSMEs, focusing on three purposefully selected urban administrations of the Wolaita Zone.

Accordingly, this scholarly work proposes to inspect variables in MSMEs through pertinent determinant factors such as entrepreneur orientation through the powerful capacity of execution. The review focuses on the design of entrepreneur associations. This academic work utilizes experiential explorations utilizing Structural Equation Modelling examination and blended strategy methods to inspect the appropriate factor models for their exhibition. The sample contains 525 MSMEs. The authors invested reliable energy into adding to the innovative world and furnishing a repository of the MSME literary writing by making sense of the job of different blends of variables that decide the organization's achievements.

The study is primarily initiated with a literature review to escalate the present-time challenges, tracked by elucidating the research approaches, the power analysis, debates, and the inferences pursued by recommendations for ensuing investigators.

Review of Literature

The flourishing aspects of MSMEs are principal to the financial turn of events and the improvement of any nation. This has been approved by observational and empirical proof from various research explorations in the past. (Onifade Stephen Taiwo et.al, 2022). The activities of micro-enterprise undertakings are critical to battle the risk of joblessness towards acknowledging the Sustainable Development Goals (SDGs) in Africa. Monetary limitations and infrastructural deficiencies are obvious issues among the various difficulties standing up to MSME's activities in many emerging countries. The continuous discussion on the determinants of firm accomplishments is yet to be summed up. Mead and Liedholm (1998) and Gebreeyesus (2007) showed a precise connection between firms' development and peculiar features like size and age. These investigations uncovered that more youthful and modest firms develop quicker than older and bigger firms. A few investigations likewise centered around the company's development according to a business entrepreneur perspective, like their sex, age, instructive level, and Experience (Welter, 2001). These institutions, with their character qualities, affect the development of their companies. The Entrepreneur Orientation (EO) alludes to an essential role that reflects how offices certainly and unequivocally choose to contend. The EO comprises the methodologies, practices, and dynamic styles of the owner-director or organization stressed over enterprising sports. (Diabate, A. et al. (2019). As per Adam, EO incorporates the procedures, direct, and control decision-making designs utilized in business Adam, S. (2022). Others zeroed in on outer factors like establishments and empowering business conditions (Hoxha, 2013; Roxas, 2009). This study contends that a company's exhibition is a perplexing cycle of deciding its presentation. Consequently, utilizing a multi-faceted methodology, this study centers around inward and outer elements as a determinant of miniature, little, and medium undertakings' expositions.

The existing studies of small businesses in Ethiopia have yet to examine the performance of firms using a multidimensional approach. Some Ethiopian researchers, for example, Gebre-Egziabher and Demeke (2005), Garoma (2012), MoUDC (2013), Mulugeta (2014), and others studied some aspects of small businesses invariably unlike the situation of Wolaita. Almost all studies firmly pointed out that small businesses contribute significantly to employment generation and wealth creation. Except if the variables that decide the performance of the

organizations are known, it is challenging to profit from the vast commitments of the firms. Consequently, this review investigated the variables that decide the productivity of MSMEs, focusing on three purposefully chosen Metropolitan Administrations of the Wolaita Zone as a case.

The emphasis is on the significant deciding elements of MSME execution in Nigeria and conceivable local seasonality in MSME success utilizing cross-sectional Ordinary Least Squares (OLS) with fixed impacts (Emmanuel et al. (2020).

For this review, we considered the works led in the production area and rejected others (Lema, X.R. et al., 2020). The research Writing Survey demonstrates that monetary education, financial inclusion, internal locus of control, and risk-taking significantly affect the monetary purview of MSMEs (Megawati et al., 2020).

As per Gebre-Egziabher and Demeke (2005), MSMEs laid out in little and medium metropolitan habitats empower them to satisfy their capabilities and structure the reason for their development and improvement. Atsu and Ojong (2014) perceive that MSMEs are the driving force behind the financial change of any economy. They further underlined that this sub-area ingests more than 80% of open positions, works with essential production and value expansion, upgrades Indigenous capacities, and improves per capita per head (Atsu & Ojong, 2014). Worku's (2008) and Debela's (2014) research revealed that MSMEs are the major players in promoting socio-economic development in urban centers. In African countries, for instance, 70% of the manufacturing output is currently allocated to MSMEs (Sibanda, 2012). This shows that one of the contributions of MSME development is to promote the socio-economic development of urban centers and poverty eradication through economic integration between urban and countryside areas.

In Ethiopia, one of the proposed actions to do business and retain the most significant number of residents has been conceived as the foundation of MSMEs as a public hearing. Acquainted with this, a public MSE improvement Procedure was planned in 1997 and re-examined in 2011. As per the MSEs technical archive of 2011, the procedure promulgates not just to diminish scarcity of subsistence needs through effective labor force participation in metropolitan regions but also support business ventures and establish the groundwork for modern advancement by changing to medium-sized undertakings (FMSEDA, 2011). In light of the procedure, the local legislatures of the FDRE are qualified to overflow the methodology and execute it at the zonal and region/metropolitan levels.

By the way, on account of the Wolaita Zone, MSMEs need to perform better to release their regular jobs in job creation and assimilate provincial overflow work displacing to zonal metropolitan habitats. The documentation records revealed that the Wolaita Zone Youth and Sports Division (WZYSD) of February 2017 comprises 251,570 youth populaces in the Zone, of which 80,019 (32%) are jobless (WZYSD, 2017). In their paper, Tantu et al. (2017) analyzed family food uncertainty and related issues among families in Wolaita Sodo City. The outcome confirms that nearly 36.7 percent of the reviewed families in Wolaita Sodo town are still determining their nutrition. The authors additionally demonstrate that family diet weakness is at a considerable altitude in the study region, in contrast to the metropolitan public of Ethiopia. This data strongly justifies that the objectives of achieving job creation and wealth generation through MSMEs do not match local needs. It is factual that today, the major cities like Hawassa and Addis Ababa are congested with youth migrating from the SNNPRS, of which the Wolaita youths are the majority. In interconnection with this, Garoma (2012) further underlines that more than 40 percent of the workforce in urban informal sectors in Addis Ababa are from Wolaita, Hadiya, and Kembata Tembaro Zones of the SNNPRS in Ethiopia. This shows that MSMEs in urban centers of the Wolaita Zone need to accommodate surplus labor migrating from rural areas of the Zone, and people are forced to flee, bypassing the zonal capital in search of better livelihood. The most fascinating question is why MSMEs in the Zone are not accommodating this workforce. How do differences in the local business environment influence the performance of enterprises?

Materials and Methods

Study Area

Wolaita Zone is a unique precinct in Southern Ethiopia. The Region has 16 provincial locales and 6 Civic Organizations, comprising the three inspected towns, Wolaita Soddo, Areka, and Boditi (WZFEDD, 2017). As per the Central Statistical Authority, the assessed populace forecast of the Zone was 1,907,804 in 2015. In experimental Managerial Towns around 1978, MSMEs were positioned in 4 areas (Production, exchange, service, and tower).

Data

Both quantitative and subjective information were gathered from essential and optional bases. Computable information was gathered from 525 MSME proprietors/directors through a poll review and 22 key witness consultations from MSME proprietors/supervisors. Secondary information is accumulated from files, diaries, associated preceding research vintages, and from the provincial, zonal, and managerial municipalities

were recorded. Descriptive, Exploratory factor analyses and Partial Least Square Structural Equation Modelling methods have been administered to scrutinize and model the associations.

Results

The descriptive analysis results of the study indicate that 73.33 % of firms employed less than six persons, while 20.19% employed six to ten workers. The majority of workers are employed either in the manufacturing (30.09%) or trade (33.71%) sectors, while jobs in service (22.48%) and construction (13.71%) sectors are lesser (Table 1).

Table No. 1: Employment Generated by MSMEs in Sector in Administrative Towns

Employment Size	Manufacturing		Trade		Service		Construction		Total	
1-5	93	17.71	159	30.28	94	17.90	39	7.43	385	73.33
6-10	53	10.09	16	3.05	23	4.38	14	2.67	106	20.19
11-15	10	1.90	2	0.38	-	-	11	2.09	23	4.38
16-20	-	-	-	-	1	0.19	7	1.33	8	1.53
31 and above	2	0.38	-	-	-	-	1	0.19	3	0.57
Mean	6.16		4.37		4.61		31			
S. D	5.56		1.89		2.09		08			
Min	1.00		1.00		1.00		0			
Max	61		13		17		4			
Total	158	30.09	177	33.71	118	22.48	72	13.71	525	100

Concerning the elements of firms, discoveries of a prior study (Liedholm, 2002) affirm that the extension of a firm from a current firm has provided colossal benefits to the general development in the size of private companies. Garoma (2012) utilized a comparable technique to track down the elements of microenterprises in Addis Ababa. Both execution markers (employment and capital development) were estimated by averaging the yearly development rates. Consequently, we estimated the normal yearly development rate for these proxies is determined utilizing the equation:

$$G = [(current\ size - size\ at\ foundation)/size\ at\ establishment]/firm\ age$$

Where G = normal yearly growth rate, the present size that addresses real value for existing capital and employment size on the statistics assortment period, size at which institution represents on the hour of genesis; firm age is the time (in years) slipped amid the initial hour and the data information pooling time.

Table No. 2: Average Growth Rates of Performance Indicators of MSMEs

Average Growth Rate Category	Capital Growth		Employment Growth	
	f	%	f	%
<0	4	0.76	66	12.57
0-10	65	12.38	365	69.52
11-20	40	7.62	36	6.86
21-30	24	4.57	26	4.95
31-40	29	5.52	12	2.29
41-50	23	4.38	7	1.33
51-60	16	3.05	6	1.14
61-70	24	4.57	2	0.38
71-80	14	2.67	-	-
81-90	15	2.86	2	0.38
91-100	23	4.38	-	-
>100	248	47.24	3	0.57

Table 2 shows the typical yearly growth rates for capital and employment for MSMEs. From the visualization of the table, it is evident that the more significant part (69.52%) has enrolled 0 to 10% development in business; notwithstanding, 47.24% have enlisted over 100 percent capital development during their maneuver period.

Factors that Determine the Performance of MSMEs

Here, we present the overall determinants of a firm's performance using PLS-SEM, a multidimensional model suitable for this kind of analysis from three dimensions. Both internal and external factors determine the

performance of MSMEs. Internal aspects entail distinct characteristics and business characteristics. External factors consist of institutional and enabling business environment factors. Since performance is a complex process determined by several features that are problematic to pronounce by a solitary measurement, examining MSMEs' performance requires analysis from various dimensions.

About 13 aggregated constructs are considered in the PLS-SEM analysis. In this analysis, the dependent variable (performance of MSMEs) refers to the objective measures of growth of firms in employment and capital. Entrepreneurs' strategic orientation is used as an intermediating variable in the model. This study embraces a two-step approach to examine and interpret the PLS-SEM results: appraisal of the measurement and structural models.

Step one: Assessment of the Computation Model

This study enunciated the PLS-SEM model in light of the applied system. As Hair et al. (2016) indicated, archetypal assessment should constantly begin with the appraisal of the estimation model. In the model, Firm Size and Business Climate (Government support) are higher-order components (HOC). They are drawn utilizing the "repeated indicators approach." Pointers from lower-order components (LOC) (e.g., business size, capital size, working premises, framework, the board, promoting, and finance) are conveyed again for the related higher-order parts. After drawing the model, the indicator data information was brought into SmartPLS3 programming from IBM SPSS.

The PLS-SEM calculation was controlled by utilizing the "Calculate PLS Algorithm." It effectively combined as per the protocol. Hair and his partners suggested fewer iterations than the greatest quantity of emphasis (300) established in the boundary setting (Hair et al., 2013). Alongside this, our review has congregated the examination subtleties of Muhammad Irfan Nasution et al. (2020) to usher beneficial experiences. Their review illustrated 210 SME proprietors with a statistics examination approach using Structural Equation Model Part Least Square (SEM-PLS). The consequences of this education work showed that an enterprising way of behaving strongly influences the execution of SMEs in a helpful way, and the indicators that can be improved are focused disposition, motivation, business driving forces, persevering through creative mind, drive, energy, and spearheading procurement of information are imperative benchmarks to support SME execution.

It should be tried before surveying the path coefficients in the estimation model. Appropriately, this study analyzed the marker reliability, interior steadiness stanch excellence, discriminant cogency, and concurrent legitimacy of the approximation model to pledge whether they are palatable, as Wong (2013) recommended

Indicator Reliability

This paper previously analyzed indicator quality to guarantee that the related pointers share much of what the inactive variable catches. The external stacking of a marker ought to be 0.708 or above to make sense of something like half of every pointer's fluctuation (Wong, 2016) since the number squared (0.708) rises to 0.50. Subsequently, the review held the pointers with an external stacking of 0.708 or above and eliminated every one of the markers with an external stacking beneath 0.3. This review made a stacking pertinence test for the pointers with loadings 0.4 to 0.7 to hold in the model. By inspecting the worth of complex indicator reliability and Average Variance Extracted (AVE), dangerous markers are eliminated, and the rest are held regardless of whether their qualities are under 0.7 (Wong, 2016).

Table 3 and Figure 1 present the loadings for the retained construct for the measurement model. Most items have loading exceeding 0.708 thresholds, which was significant at $p < .001$. The items marketing2, formal institution1, Education, Rtaking2, education level, employment growth, and performance three are loading lower than the threshold but retained after testing their significance based on the composite reliability and AVE.

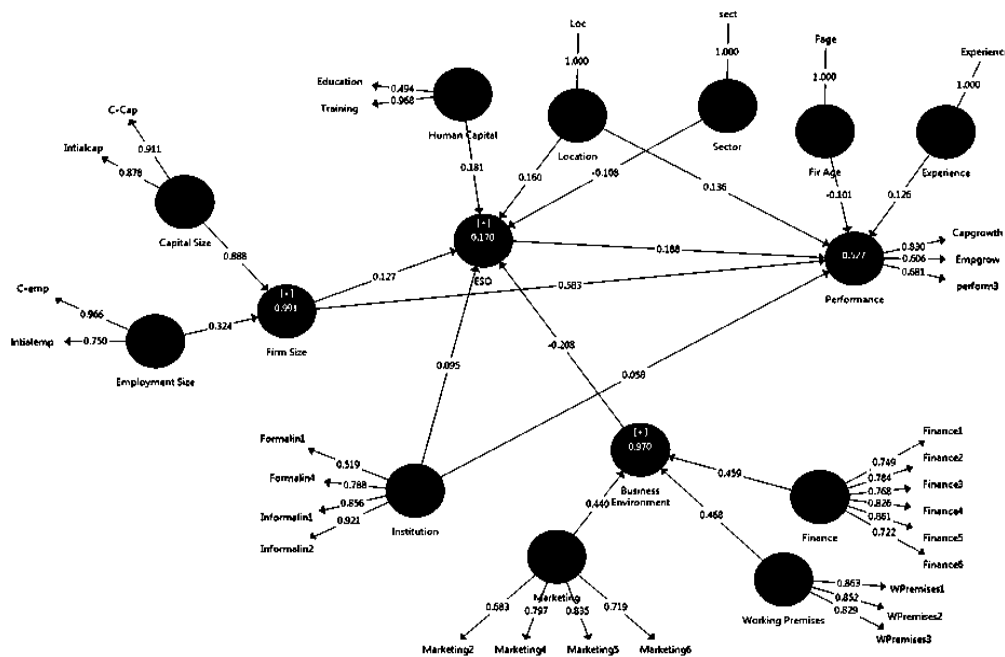


Figure 1: Measurement Model

Table No. 3: Outer Loadings of the Constructs (Latent Variables) Retained in the Model

Business Environment					
Finance	Outer Loading		Marketing	Outer Loading	Performance
Finance1	0.749		Marketing2	0.683	Capital growth
Finance2	0.784		Marketing4	0.797	Employment growth
Finance3	0.768		Marketing5	0.835	Perform3
Finance4	0.826		Marketing6	0.719	
Finance5	0.861				Working premises
Finance6	0.722				Wpremises1
					Wpremises2
					Wpremises3
			Institution		
Formalin1	0.519		Infomalin1	0.856	
Formalin4	0.0.788		Informalin2	0.921	
Individual Character					
Experience	1.00		Training	0.968	Education
					0.494
Firm Character					
Entrepreneurial Strategic Orientation				Firm Size	
Innov2	0.788			Employment size	
Innov3	0.794			Current Employment	0.965
Proactive1	0.864			Initial employment	0.750
Proactive3	0.721			Capital Size	
RTaking2	0.690			Current capital	0.911
Sector	1.00			Initial Capital	0.878
Location	1.00			Firm Age	1.00

Internal Consistency Reliability

We utilized composite reliability to assess the estimation models of this measure, as Wong (2016) proposed. All paradigms' value is higher than the limit (0.6) for exploratory examination and not more than the 0.95 level (Hair et al., 2013). In this model, the value for experience, firm age, location, and area is 1.00, yet it does not suggest flawlessness in composite dependability since they have single things held. In this way, the aftereffects of the composite reliabilities of each construct were demonstrative of good dependability among signs of each construct. Table 4 portrays the details above.

Table No. 4 Composite Reliability and Average Variance Extracted from the Constructs in the Model

Construct	Composite Reliability	Average Variance Extracted
Business Environment	0.767	0.525
Capital size	0.889	0.800
Employment Size	0.853	0.747
ESO	0.878	0.591
Experience	1.000	1.000
Finance	0.906	0.619
Firm Age	1.000	1.000
Firm Size	0.786	0.562
Human Capital	0.724	0.591
Institution	0.861	0.618
Location	1.000	1.000
Market	0.845	0.579
Performance	0.751	0.506
Sector	1.000	1.000
Working Premises	0.885	0.719

Convergent Validity

Hair et al. (2013) indicated that a convergent validity test would be executed to guarantee the various things used to gauge the constructs. To confirm this trial test, the AVE of each dormant variable was assessed in SmartPLS programming. The AVE can give proof of convergent acceptability (Wong, 2016). As displayed in Table 4 over, all our paradigms surpassed the base degree of 0.5, as Wang (2016) proposed.

Discriminant Validity

It alludes to the notch to which a construct is genuinely particular from different hypotheses by pragmatic values (Wong, 2016). Appropriately, this should be demonstrated by little connections between the proportion of attention and the proportions of different ideas of constructs. Subsequently, we utilized the Fornell and Larcker (1981) model to evaluate this portion, which is estimated by the square root of AVE; the incentive for each dormant variable ought to be more noteworthy than the correlation relationships between dormant factors.

Table No. 5 Discriminant Validity of Constructs in the Model

Construct	1	2	3	4	5	6	7	8	9	10	11
Business Envt	.724										
ESO	- .142	.769									
Experience	- .006	.043	1.00								
Firm Age	- .030	.033	.128	1.00							
Firm Size	.009	.250	.139	.082	.750						
Human Capital	- .022	.266	.038	.039	.253	.769					
Institution	.517	- .014	- .062	-.009	-.025	.023	.786				
Location	.104	.213	.076	.082	.193	.111	-.013	1.00			
Performance	.010	.364	.215	-.020	.664	.209	.045	.289	.711		
Sector	- .031	- .254	- .033	.045	-.468	-.261	.008	-.289	-.397	1.00	
Working Premises	.688	- .016	- .056	-.012	.034	.003	.236	.215	-.004	-.026	.848

Table 5 clearly illustrates no evidence of strong correlations between constructs. Therefore, discriminant validity is realized since the AVE is much larger than the equivalent latent variable values.

Step Two: Evaluation of the Structural Model

The last step in the wake of assessing the credibility of the estimation model is the valuation of the primary prototype (Hair et al., 2016). Collinearity (Wong, 2016) may be a likely issue of worry in the underlying model. The variance inflation factor worth five or beyond normally shows that collinearity exists in example data information (Hair et al., 2013). Be that as it may, we did not track down collinearity in that frame of mind, as VIF values were somewhere in the array of 1.000 and 2.783 (<5). Then, the review assessed the coefficient of assurance and its impact size (f^2), prescient significance (Q^2), and impact size (q^2). At last, the review surveyed the meaning of the connections in light of the connexions based on path coefficients.

The coefficient of Determination (R^2)

Assessing structural models is a typical measure (Hair et al., 2016). It shows how much change in the endogenous constructs is made sense of by every one of the exogenous developments connected to it. The worth of R^2 ranges somewhere in the range of 0 and 1. In this review, performance is the fundamental development of interest, while business entrepreneurs' visionaries' essential direction is another endogenous construct. As displayed in Figure 2, the R^2 value of the endogenous construct execution is 0.527, while the R^2 value of the Entrepreneurs Strategic Orientation is 0.170.

The proxy standards of 0.75, 0.5, and 0.25 frequently portray solid, sensible, and weak coefficients of determination (Hair et al., 2013). In any case, for private venture concentrates that consider the drivers of performance, the R^2 value of 0.20 is viewed as high (Naidu, 2016). Accordingly, its R^2 value of 0.527 was moderate, and the entrepreneurs' strategic orientation of 0.170 was viewed as weak.

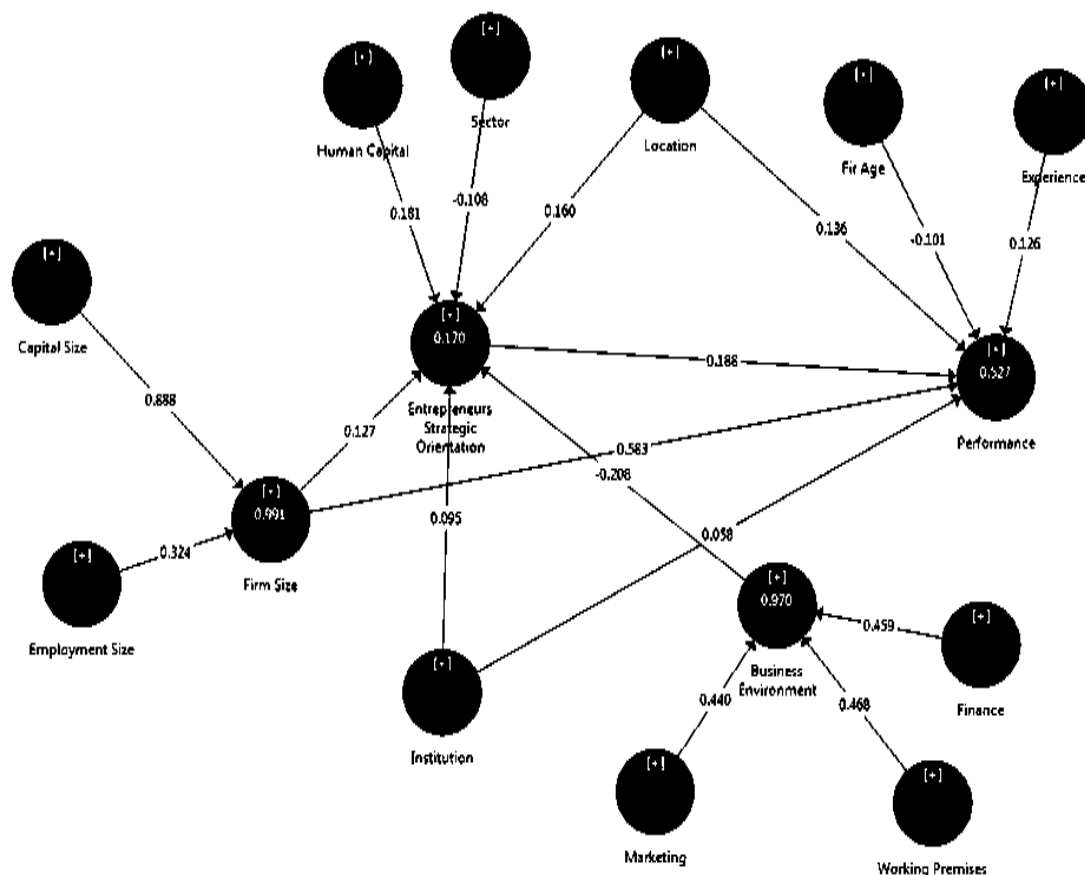


Figure 2: Coefficient of Determination Values and Path Coefficients of the Structural Model

Effect Size (f^2)

As well as assessing the R^2 values of endogenous constructs, this study estimated the impact size f^2 , which estimates the adjustment value when a particular exogenous construct is eliminated from the model. Impact size is a goal and normalized measure of the extent or the level of significance of the observed impact of the exogenous constructs on endogenous constructs (Naidu, 2016); values 0.02, 0.15, and 0.35 are decoded as little, medium, and huge impact sizes.

Table No. 6 Effect Size (f2) for Constructs

Construct	Business environment	E.S.O.	Firm Size	Performance
Business Environment		0.037		
Capital size			88.76	
Employment Size			11.74	
ESO				0.068
Experience				0.033
Finance	6.12			
Firm Size		0.015		0.646
Human Capital		0.036		
Institution		0.008		0.007
Location		0.028		0.037
Market	5.26			
Sector		0.010		
Working Premises	6.55			

Most exogenous constructs have an effect size above the minimum value of 0.02 level (Table 6). However, firm size to ESO, sector to ESO, Institution to ESO, and institution to performance have a small effect size. Business environment to ESO, ESO to performance, performance experience, human capital to ESO, location to ESO, and location to performance have medium effect size. Capital size to firm size, employment size to firm size, firm size to performance, finance to the business environment, market to the business environment, and working premises to the business environment have large effect sizes.

Evaluating the Predictive relevance and its effect size Values of Constructs

Surveying Stone-Geisser's predictive relevance (Q2) is vital for checking whether the data of interest of indications in the reflective estimation model of endogenous constructs are projected accurately. This can be gotten through a system known as blindfolding (Naidu, 2016). As per him, assuming the Q2 esteem is more than zero, the exemplary model has prescient power about that specific endogenous construct. Performance and entrepreneurs' strategic orientation are chosen to govern the blindfolding calculation.

Table No. 7 Predictive Relevance (Q2) Values of Endogenous Constructs

Construct	SO	SSE	Q2 (= 1-SSS/SSO)
Business Environment	1,575.000	802.404	0.491
Capital Size	1, 050.000	1,050.000	
Employment Size	1, 050.000	1, 050.000	
ESO	2,625.000	2,384.985	0.091 (has predictive power)
Experience	525.000	525.000	
Finance	3,150.000	3,150.000	
Firm Age	525.000	525.000	
Firm Size	1,575.000	726.252	0.539
Human Capital	1, 050.000	1, 050.000	
Institution	2,100.000	2,100.000	
Location	525.000	525.000	
Marketing Factor	2,100.000	2,100.000	
Performance	1,575.000	1,204.104	0.235 (has predictive power)
Sector	525,000	525,000	
Working Premises	1,575.000	1,575.000	

Our proposed model has great prescient power as Q2 values are bigger than zero. (Table 7).

Evaluating the Path Coefficients and Significance

In PLS-SEM, the connection between constructs can be evaluated by analyzing their path coefficients and related t-statistics through the bootstrapping methodology. Understanding how coefficients and their importance are used to answer the research exploration points by affirming hypotheses. Path coefficients address the estimated connections among the constructs, and their qualities range from - 1 to 1 (Hair et al., 2016); coefficients above 0.20 are statistically significant, while < 0.1 is not significant. For coefficients between 0.10 and 0.20, the model must be subjected to T and P-values tested for statistical significance (Table 8).

Table No. 8: Path Coefficients of Structural Model and Their Significance Testing

Hypot hesis	Path	Path Coefficient	T Value	P Value	Hypothesis Test
1	Business Environment → ESO	-0.208	4.059	0.000	Supported
2	ESO Performance →	0.188	6.519	0.000	Supported
3	Experience → Performance	0.126	4.031	0.000	Supported
4	Firm Age → Performance	-0.101	3.111	0.002	Supported
5	Firm Size → ESO	0.127	3.094	0.002	Supported
6	Firm Size → Performance	0.583	18.860	0.000	Supported
7	Human Capital → ESO	0.181	4.247	0.000	Supported
8	Institution → ESO	0.095	1.404	0.161	Not supported
9	Institution → performance	0.058	1.585	0.113	Not supported
10	Location → ESO	0.160	3.224	0.001	Supported
11	Location → Performance	0.136	4.431	0.000	Supported
12	Sector → ESO	-0.108	2.395	0.017	Supported

Hence, most of the non-significant paths were dropped by checking their effect on the significance of supplementary pathways in the model. The path from Institution to ESO and performance were retained since they significantly affect other paths and the value of endogenous constructs even if their values were lower than the threshold 0.1.

Discussion

We can accept or reject the hypothesis mentioned based on the path coefficients and significance levels. The result shows that firm size has a robust positive result on performance (0.583), surveyed by entrepreneurs' strategic orientation (0.188), location (0.136), and experience (0.126). These variables are from firm factors except experience and are initiated to possess a statistically significant positive outcome on firm performance at a 5% significance level. Institution (0.058) is lower than the threshold effect (0.1) on the firm's performance. Firm age has a noteworthy undesirable effect on firm performance at a 5% significance level.

A closer examination of the path coefficients for ESO revealed that human capital with a path coefficient (0.181) accounted for the most significant positive effect on the strategic orientation of firms. Location (0.160) and firm size (0.127) are the variables with a significant positive effect on ESO. The business environment (-0.208) and sector (-0.108) are the additional variables with a substantial negative result on ESO. The path coefficient of the business environment and sector were negative, suggesting an inverse relationship between the business environment and sector and the firm's strategic orientation. In this model, the manufacturing sector is the base sector, and the negative sign indicates the higher performance of the service sector than the manufacturing sector.

Human capital, the business environment, and the sector only indirectly affect performance. That is, the ESO construct fully mediated the effects. This discovery needs to be revised with the resource-based interpretation of strategy for human capital. Apart from the resources, firms' organizational and strategic processes are vital since they facilitate manipulating resources into value-creating strategies (Wiklund et al., 2009).

The sturdy and statistically substantial optimistic association between firm size and performance supports the economies of scale argument. This result implies that size directly correlates with performance, indicating that larger firms perform higher than smaller firms. This finding contradicts Garoma's (2012) determinants of microenterprises success in Addis Ababa. The explanations may be: First, the firm size is measured on capital and employment size, which could make the result different from Garoma (2012), who measured firm size by employment size. Second, including medium enterprises would indicate which firms perform most concerning size. In conclusion, this study initially hypothesized that firm size significantly impacts performance. Thus, the result implies that larger firms create employment and generate capital better than smaller firms.

The variable 'ESO' is the second construct with an expected positive effect on firms' performance. A robust straight outcome of ESO on performance is steady with the previous finding (Wiklund et al., 2009). In addition to the direct effect, the finding shows that ESO mediates other firm, individual, and external factor constructs with performance. This suggests that resources, attitudes to growth, and the heads' perception of their business environment fuel the effect of ESO on performance. Thus, highly strategic-oriented entrepreneurs maximize performance from favorable business conditions and resources, leading to higher performance. This implies that including ESO in models striving to explain MSMEs' performance appears particularly important (Wiklund et al., 2009).

'Location' is the third variable found to have a noteworthy constructive effect on firms' performance on PLS-SEM analysis. The descriptive analysis also indicated that 80.8% of the firms were located in the CBD, especially around the marketplace and along the major roads. This result corroborates the findings of (Garoma, 2012 and Liedholm, 2002). Garoma (2012) found an affirmative relationship between location and the success of microenterprises in Ethiopia. Liedholm (2002) showed the importance of location for small businesses' performance. A firm's location influences performance by impacting the demand for goods/services produced. This is because location affects raw materials costs and finished goods marketing, thereby affecting competitiveness (Garoma, 2012). The finding of this study indicates that a firm's performance is likely to increase when firms are located in the central business district, especially around the marketplace and along the main road.

Firm age is another variable that has a negative relationship with performance. This finding is also consistent with Gebreeyesus (2009), who found that younger firms grow faster than older for the growth of microenterprises from Ethiopian data.

The organization is the fourth aggregate variable that affects firms' presentation meaningfully. The earlier research exploration has demonstrated a connection between formal institutional boundaries, for example, the time and methodology expected to enlist another business, and casual institutional imperatives, like defilement and out-of-line contest (Hoxha, 2013). As per Hoxha (2013), because of frail financial organizations and elevated degrees of debasement, entrepreneurs exit from the conventional area at an undeniable level and exercise out-of-line rivalry. Our review uncovers that the impact of both formal and casual establishments on firm execution is immaterial in the PLS-SEM examination. The results of the meeting of enlightening and subjective sources demonstrate the critical impacts of this construct on firms' efficacy.

The sector affects ESO significantly and backhandedly impacts firms' performance. This finding aligns with Garoma (2012) since manufacturing is the base sector in the model. The negative sign shows a better achievement of the service sector than production. He found that the tertiary sector, trailed by the retail exchange area, is improving in business creation, benefit, and turnover development compared to different areas of microenterprises in Addis Ababa. These outcomes suggest that the consumer market prefers food consumption over speculation; as Garoma (2012) indicated, this is common in emerging nations.

The negative relationship between the assembling area and execution shows that huge assembling firms rival these little endeavors instead of subcontracting or supporting the organizations (Garoma, 2012). However, the country's GTP has prioritized the manufacturing and urban agricultural sectors. The result implies that the government support strategies could be more successful, and the market system favoring the MSME manufacturing sector is unsuccessful. The trend implies that it is difficult to stop the leading role of the service sector in the short run to give priority to the industrial sector.

The impact of human resources on ESO was additionally observed to be critical. This shows the backhanded impact of human resources on execution, demonstrating that proprietors/directors with an advanced education level get specialized and administrative preparation combined with an entrepreneur's strategic orientation to perform better. This suggests that more than human resources is expected to prompt elite execution, and intercessions intending to make riches and employment development ought to boost the human resources of firms with a superior ESO.

In the model, enabling a business environment was found to have an insignificant direct effect on performance. Therefore, enabling a business environment only indirectly affects performance through the mediation of ESO. The study found that three enabling business-level factors (i.e., finance, working premises, and marketing) consistently directly affect the business environment and are included in the business environment as low-order components. Thus, entrepreneurs with high strategic orientation maximize the favorable business conditions and resources obtained, leading them to higher performance through the mediating role of ESO. This implies that how the business interacts with the external environment matters for its performance.

Entrepreneurs Strategic Orientation as a Mediator Construct

To get a comprehensive view of the role of ESO, its capacity to intervene in the linkage between individual, firm, and natural factors and execution is inspected in this exploration. Mediation analysis requires the assurance of the immediate impacts of the exogenous constructs on the endogenous construct (i.e., performance) and the circuitous impact represented by the presence of the interceding variable (ESO). To verify the interceding impacts of ESO, a two-step method is included (Wong, 2016):

Looking at the meaning of direct impact (if the meaning of direct impact cannot be laid out, there is no intervening impact) utilizing bootstrapping devoid of the manifestation of the middle person E.S.O. in the model.

The significance of the circuitous impact and related t-values are checked utilizing the path coefficients when the mediator E.S.O. is remembered for the model. If the significance of the circuitous impact cannot be laid out, there is no interceding impact.

The significance of the indirect impact is the reason for deciding the mediators' magnitude. Once the immediate impact is laid out, the strength of the middle person can be inspected utilizing absolute impact and variance accounted for (VAF). The aggregate impact is the summation of immediate and circuitous impacts, while VAF is the proportion of roundabout to coordinate impacts (Wong, 2016). Fractional intercession is laid out when VAF surpasses the 0.2 edge level, and full intervention is laid out when it surpasses 0.8 (Hair et al., 2016). ESO affects the construct's performance linkages if the VAF esteem is more modest than the 20% limit level.

Table No. 9: Mediation Analysis of Firm Factor Constructs

Hyp	Procedure	Path	PC	IE	TE	VAN	TV	PV	Hyp
H9	Step1: Direct effect (without a mediator)	FS -Perf	0.690	N/A			29.88	0.000	Rejected
	Step2:Indirect effect (with a mediator)	FS-Perf	0.583	N/A	0.607	0.039	18.86	0.002	
		FS- ESO	0.127	0.02					
		ESO- Perf	0.188	4					
H11	Step1: Direct effect (without mediator)	Loc-Perf	0.319	N/A			8.55	0.000	Rejected
	Step2: Indirect effect (with mediator)	Loc-Perf	0.136	N/A	0.166	0.18	3.22	0.001	
		Loc-ESO	0.160	.030					
		ESO-Perf	0.188						

Note that IE= Indirect Effect; TE= Total Effect; PC= Path Coefficient; TV= T-Value; PV= P-Value; FS= Firm Size; Perf= Performance; Loc= Location; and Hyp= Hypothesis

Almost 3.9% of the firm size effect and 18.1% of the location's effect on performance can be elucidated through the ESO intermediary (Table 9), which was lower than the threshold of 20%. Accordingly, ESO has no mediation effect on firm size and location. However, the correlation between sector and performance is minimal and approaches zero, meaning the path coefficient between sector and performance is too small. Entrepreneurs' strategic orientation mediates the entire causality, indicating ESO's "full control" effect as a mediating variable. Therefore, the firm factors sector affects performance through the full control effect of ESO, and for firm size and location, ESO has no mediation effect.

Mediation Analysis for Business Environment

The direct link of the business environment to performance (without mediating effect) is tiny, approaches zero, and is not significant with a p-value of 0.379 and t-value of 0.881, below the required threshold of 1.96. This shows that entrepreneurs' strategic orientation mediates the entire causality, indicating the full control effect of ESO as a mediating variable. In this way, the business climate's impact on performance can be made sense by using the ESO middle person, and the size of the intervention is viewed as a full control intervention.

Mediation Analysis for Individual Factors

The immediate connection of human resources to performance is tiny. The impact of human resources on performance is just backhanded through the interceding impact of ESO. In this manner, the impact of human resources on execution can be made sense of through the ESO middle person, and the greatness of intervention is viewed as a full-control intervention. To summarise, the mediating effect of ESO is no mediation effect with location and firm size; full control mediation effect with the human capital, sector, and enabling business environment.

Multi-group Analysis (PLS-SEM)-Business Sector

Existing literature indicates that firms behave differently from sector to sector in terms of their performance and need for support. Based on this idea, this research sought to determine if the model is the same or different between groups (i.e., between the manufacturing and service sectors). Subsequently, a multi-group investigation (PLS-MGA) was directed utilizing the parametric methodology, including a modified two-independent sample t-test, to look at path coefficients across two information cohorts. With the assistance of bootstrapping, the standard deviation of the path coefficients was determined. This concern is sensible since heterogeneity might exist to show huge contrasts in model connections.

The primary aim is to inspect, assuming the variances of the PLS parameter estimates vary fundamentally across the two groups, i.e., industrial and service sectors for our situation). Bootstrapping strategies determined the PLS boundary gauges' standard errors.

As introduced in Table 10, no connections vary fundamentally across the two groups. To demonstrate that the path coefficient is different across the two groups, the t-esteem should be higher than 1.96, which is the basic value. In any case, in our information, the t-values are more modest than the critical value, showing no group heterogeneity.

Table No. 10: The Results of Multi-group Analysis

Path	Group 1 Manufc.		Group2 Service		Group1 vs Group2			Hypothesis
	P1	Se(p(1))	P2	Se(p(2))	P(1)-p(2)	t-value	p-value	
BE-ESO	-0.088	0.089	-0.246	0.068	0.159	1.455	0.079	Rejected
ESO-Perf	0.145	0.057	0.231	0.042	0.086	1.254	0.889	
FS-ESO	0.075	0.071	0.119	0.050	0.043	0.514	0.684	
FS-Perf	0.605	0.060	0.561	0.043	0.044	0.609	0.277	
HC-ESO	0.088	0.077	0.163	0.060	0.075	0.780	0.789	
Instn-ESO	-0.018	0.087	0.068	0.065	0.086	0.810	0.790	
Instn-Perf	0.040	0.060	0.022	0.044	0.018	0.251	0.401	
Loc-ESO	0.275	0.080	0.129	0.063	0.146	1.456	0.077	
Loc-Perf	0.142	0.063	0.079	0.050	0.063	0.800	0.211	

Note: p (1) and p (2) are path coefficients of Group1 (Manufacturing) and Group2 (service), respectively; se (p (1)) and se (p(2)) are standard errors of p (1) and p (2) respectively; BE= Business Environment; ESO= Entrepreneurs Strategic Orientation; Perf= Performance; FS= Firm Size; HC= Human Capital; Instn= Institution; and Loc= Location

Accordingly, this absence of heterogeneity drives us to dismiss the speculation about the categorical moderation impact of the business area in the model, showing that the path coefficients of the model apply similarly to the groups.

5. Conclusion and Suggestions

This study generated empirical evidence, which significantly contributes to understanding how internal and external features matter in the performance of MSMEs in the background of urban centers in a developing country where MSMEs play a crucial role. The result of the study may enrich the current understanding of the role of individuals, firms, and external environmental factors and their relation to the MSME's strategic orientation, which is related to firm performance. The individual factor, namely human capital, is undoubtedly related to entrepreneurial strategic orientation. The firm factor, namely firm size and location, is positively related, and the sector is negatively related to ESO. The external business environment enables a negative business environment negatively and institutions positively but insignificantly related to ESO. The evidence suggests that ESO mediates the individual, firm, and external factors and performance linkages.

The performance of firms is predisposed by numerous aspects, including but not restricted to firm size, firm age, ESO, location, sector, and institution directly. For these reasons, firm size is the most important, followed by the ESO, location, firm age, and institution. This means the local government should prioritize firm size to enhance the Region's employment growth and wealth creation by attracting medium and larger-sized enterprises to invest in the area and supporting the existing micro, small, and medium enterprises to graduate to the following levels.

This research shows that ESO fully mediates the relations between business environment, human capital, and firm performance. As a result, the owners/managers, as entrepreneurs, need to transform the resources into action and activity to enhance the performance. This supports the entrepreneurial theory that only having the goal of expanding the business creates growth if the right actions are taken. Therefore, ESO is a construct that captures actions and activities by exploiting the available resources and opportunities.

Finally, this research shows no significant categorical controlling effect on the business sector; therefore, the same conclusion can be drawn for both the service and manufacturing sectors.

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Developing a Comprehensive Framework to Foster Employee Engagement for Empowering Organizations in Circular Economy Transitions: An Empirical Study in the Retail Sector

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Abstract

As global momentum toward sustainability accelerates, organizations are increasingly adopting circular economy models that emphasize regeneration, resource efficiency, and reduced waste. However, the human element, particularly employee engagement, remains an underexplored yet critical determinant of successful circular economy implementation. Existing frameworks often prioritize technological enforcement or policy-driven mandates, overlooking the psychosocial and organizational factors that cultivate sustained behavioral change. Addressing this gap, the present study introduces and validates the E.N.G.A.G.E. framework, a novel, employee-centric model designed to identify and examine key organizational drivers that influence employee engagement during circular economy transitions in the Indian retail sector.

The research focuses on six interrelated constructs: Empowerment and Autonomy, Organizational Culture and Norms, Leadership and Management Support, Training and Skill Development, Values Congruence, and Incentives and Recognition. The study leverages a quantitative, cross-sectional design using structured surveys administered to 100 employees from mid-to-large retail firms engaged in sustainability practices. Structural Equation Modeling and Exploratory Factor Analysis were employed to assess construct validity, factor loadings, path coefficients, and the significance of relationships among variables. Findings reveal that Incentives and Recognition emerged as the most influential driver of employee engagement, followed by Training and Skill Development, and Empowerment and Autonomy. In contrast, Organizational Culture, Leadership Support, and Values Congruence had statistically weaker direct impacts. Notably, Employee Engagement demonstrated a strong and significant effect on Circular Economy Transition success, underscoring its mediating role in translating organizational practices into sustainable outcomes. The discussion highlights the strategic importance of tangible motivators such as skill-building initiatives and recognition systems in fostering workforce alignment with Circular Economy goals. It also suggests that softer cultural and leadership elements, while necessary, must be operationalized through visible actions and resource allocation to generate meaningful engagement. This shift from symbolic enablers to actionable interventions marks a critical step in embedding sustainability into organizational DNA. This study contributes original value by positioning employee engagement as a central lever for Circular Economy success and offering a multi-dimensional, theory-backed framework tailored for real-world organizational application. The E.N.G.A.G.E. model bridges traditional human resource paradigms with contemporary sustainability imperatives, offering scholars and practitioners an actionable roadmap for nurturing engaged, future-ready, and environmentally responsible workforces.

Keywords: Circular Economy Transitions; Organizational Factors; Employee Engagement; Retail Sector.

Introduction

The global shift towards sustainable development has amplified the urgency for organizations to adopt circular economy principles, which emphasize minimizing waste, maximizing resource efficiency, and creating regenerative systems (Kandpal, 2024). As the linear take-make-dispose model becomes increasingly unsustainable, businesses, particularly in the retail sector, are under growing pressure to reimagine their operations through a circular lens (Elisha, 2020). However, the success of such transitions is not solely dependent on technological innovations or policy interventions; it heavily relies on the human factor, particularly the engagement of employees who are at the forefront of implementing circular strategies (Allam, 2024). Employee engagement is a critical determinant of organizational change, as engaged employees are more likely to embrace innovation, demonstrate pro-environmental behavior, and contribute proactively to sustainability goals (Albrecht S. L., 2021). Yet, despite growing recognition of the importance of engagement in sustainability transitions, there remains a lack of structured understanding of which organizational factors most effectively drive such engagement, especially in the context of circular economy transition (Bertassini, 2021). There is a lack of empirical research examining how inter-organizational collaboration within circular economy ecosystems influences the co-development of innovative tools, processes, and business models, particularly in relation to

stakeholder intentions, roles, and strategic objectives (De Mattos, 2018). Traditional engagement frameworks often overlook the unique challenges and motivators associated with environmental and circular initiatives (Tura N. H., 2019).

To address this gap, this study introduces and applies the E.N.G.A.G.E. framework, a conceptual model developed to analyze key organizational enablers of employee engagement in circular economy transitions. The framework aims to investigate how specific organizational factors influence employee engagement, which in turn drives successful circular economy transitions, particularly in the retail sector. The retail sector, characterized by complex supply chains, high consumption rates, and significant environmental footprints, serves as a critical focus area for this exploration (Rizet, 2012). This sector's dynamic interaction with consumers and frontline employees makes it an ideal setting to investigate how internal organizational mechanisms can influence staff commitment to circular goals (Münster, 2022). The central research question guiding this study is: How do internal organizational factors influence employee engagement in enabling circular economy transitions, particularly in the retail sector? This research is significant for two main reasons. First, it shifts the focus from technology and regulation to human-centered organizational dynamics, offering fresh insights into how circular principles can be embedded through employee engagement. Second, it provides practical guidance for retail organizations looking to foster sustainable change from within, aligning workforce motivation with environmental goals.

Critical Gaps and Contradictions in Literature

Despite growing scholarly attention on employee engagement, most conventional engagement frameworks are designed around productivity, retention, or job satisfaction in generic organizational contexts (Saks, 2022). These models typically overlook the unique motivations, ethical considerations, and ecological responsibilities that shape employee behavior during sustainability and circular economy transitions (Borrero, 2025) (Pla-Julián, 2019). In particular, traditional frameworks do not adequately capture pro-environmental engagement drivers such as regenerative purpose, climate ethics, or systems thinking elements that are critical in circular economy adoption (Paiva, 2025). Furthermore, existing engagement models rarely address the operational-cultural duality required in circular transitions, especially in sectors like retail where frontline implementation and consumer-facing sustainability practices converge (Tan, 2022). There remains a significant gap in frameworks that integrate circular principles with human resource strategies in a strategic and scalable manner (Abu-Bakar, 2024). This deficiency limits organizations' ability to foster a committed workforce aligned with CE values and operational goals (Chowdhury, 2022).

The ReSOLVE framework, comprising Regenerate, Share, Optimize, Loop, Virtualize, and Exchange, offers strategic pathways for organizations to operationalize circular economy principles (Romero, 2017). However, it has been criticized for being technocentric and structurally top-down, focusing heavily on business models and supply chains while neglecting the human and behavioral dimensions of implementation (Iyer-Raniga, 2019). Scholars argue that ReSOLVE does not sufficiently consider employee mindsets, organizational resistance, or internal culture transformation, which are critical to the long-term success of CE initiatives (Tura N. K., 2019). Moreover, ReSOLVE lacks actionable tools to integrate employees into the CE transition journey, thereby creating a disconnect between strategic intent and executional ownership (Re, 2024). Many organizations adopting CE principles encounter implementation challenges not due to flawed strategies, but because of insufficient employee alignment, training, and motivation (Cantú, 2021). Therefore, a shift is necessary toward engagement-centric models such as the E.N.G.A.G.E. framework, which prioritize behavioral drivers, internal alignment, and human resource integration in the circular economy transition roadmap.

E.N.G.A.G.E. Framework for Circular Economy Transitions

The E.N.G.A.G.E. framework draws its theoretical foundation from a convergence of contemporary circular economy paradigms and established human resource and organizational behavior theories. Just as the ReSOLVE framework for circular business actions, developed by the (MacArthur, 2015), is designed to guide businesses and countries in transitioning towards a circular economy. The E.N.G.A.G.E. framework seeks to provide a strategic, employee-centered pathway for organizations particularly in the retail sector, to embed circular principles by leveraging internal enablers of employee engagement and organizational change. The framework is further guided by the strategic methodology for circular economy road mapping, which emphasizes the integration of systemic thinking, multi-stakeholder engagement, and organizational transformation as foundational pillars for achieving sustainable development and facilitating effective circular transitions. (Abu-Bakar, 2024). According to (Bertassini, 2021), these paradigms recognize that the success of circular strategies is not limited to technological innovation but depends heavily on behavioral and cultural transformation within organizations. To operationalize these ideas, the framework draws from HR and organizational behavior theories that explain how employee engagement can be effectively cultivated to gain a competitive advantage (Albrecht S. L., 2015). These paradigms provide for regenerative, participatory, and holistic organizational change, moving beyond linear efficiency models toward circularity that is deeply embedded in institutional culture and behavior.

Figure 1: E.N.G.A.G.E. for Guiding Employee-Driven Circular Economy Transitions



Source: Author Developed

The framework integrates multiple theoretical perspectives to offer a cohesive approach for driving employee engagement toward circular economy transitions. It is grounded in key principles of Sustainable Human Resource Management (SHRM), emphasizing the alignment of human capital practices, such as training, autonomy, and recognition, with broader organizational sustainability objectives (Khalid Alrashedi, 2024). Self-Determination Theory incites the “Empowerment and Autonomy” dimension by emphasizing intrinsic motivation and individual agency as key drivers of sustained engagement (Deci, 2012). Social Exchange Theory and Organizational Support Theory underpin the framework’s focus on leadership, recognition, and support, highlighting the importance of reciprocal trust and perceived organizational care (Cropanzano, 2005), (Eisenberger, 1986). The dimensions “Training and Skill Development” and “Evaluate and Educate” reflect principles from Learning Organization Theory, which advocates for continuous learning, adaptability, and innovation in dynamic work environments (Senge, 1990), (Fillion, 2014). Meanwhile, Value Congruence Theory supports the “Align Values” component, emphasizing the motivational impact of alignment between personal and organizational values (Posner, 2010). Thus, grounded in well-established theories, the E.N.G.A.G.E. model offers a strategically aligned approach to engaging employees in driving sustainability within organizations. The dimensions of the framework have been subsequently discussed in detail in the next section.

Empower Employees Through Autonomy: This dimension focuses on providing employees with the authority, flexibility, and trust to make decisions, propose innovative solutions, and take ownership of sustainability initiatives (Zhou, 2019). Autonomy enhances intrinsic motivation and fosters a sense of responsibility, both of which are critical for embedding circular economy practices into routine operations (VU, 2021).

Normalize Sustainable Behavior in Organizational Culture: For circular economy principles to be effectively adopted, sustainability must be deeply embedded within the organizational culture (Bertels, 2010). This entails nurturing common environmental values, encouraging sustainable habits, and building a collective identity committed to responsible resource utilization and sustainable resource management (Jaganjac, 2024).

Guide with Leadership and Clear Communication: Visible and committed leadership, paired with transparent communication, plays a pivotal role in translating circular economy visions into actionable goals (de Faria Enes, 2025). Leaders are instrumental in shaping attitudes, overcoming resistance to change, and modeling the behaviors necessary for sustainable transformation (Thakhathi, 2019).

Align Organizational Values with Personal Goals: Employee engagement increases significantly when there is alignment between personal values and the organization’s sustainability mission (Avota, 2015). This alignment nurtures a sense of purpose, strengthens emotional commitment, and encourages employees to actively participate in sustainability initiatives with genuine enthusiasm (Barboza, 2022).

Gratify Employees Using Incentives and Recognition: Acknowledging and rewarding employee contributions to sustainability efforts reinforces desired behaviors and cultivates a culture of appreciation (Odhiambo, 2023). Whether through tangible incentives or symbolic recognition, gratification validates employee efforts and motivates continued involvement in sustainability (Merriman, 2016). Incorporating gamification elements—such as point systems, leaderboards, and eco-challenges—can further enhance engagement by making sustainability goals more interactive, competitive, and enjoyable (Wittayakom, 2025).

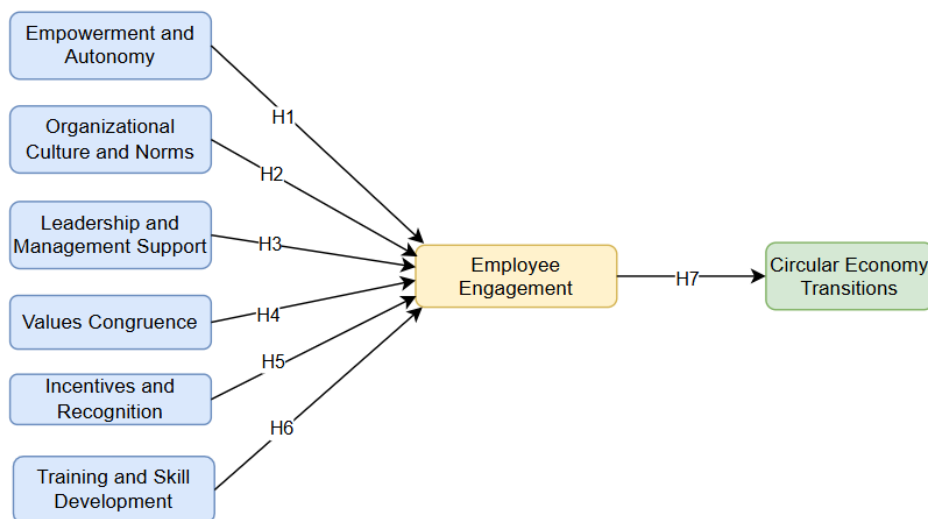
Evaluate Performance and Educate for Sustainability: Continuous education and skills development are essential for preparing employees to operate within circular systems (Sikander, 2024). When integrated with systematic performance evaluations, such educational initiatives not only enhance professional growth and accountability but also reflect the organization’s strategic commitment to long-term sustainable capacity building (Bashynska, 2024). Training and development foster adaptive thinking and innovation, enabling the workforce to respond proactively to evolving sustainability challenges and opportunities for building a circular economy (Trevisan, 2025).

In summary, the framework synthesizes insights from established organizational and psychological theories to present a comprehensive, theory-informed approach for enhancing employee engagement aligned with circular economy objectives. It offers a holistic organizational lens through which companies can strategically activate key dimensions to foster a culture of sustainability. Each component serves as a lever for enabling employees to contribute meaningfully to circular initiatives, ultimately strengthening the organization’s capacity for sustainable transformation.

Organizational Drivers of Employee Engagement for Circular Economy Transitions

In response to the growing imperative for sustainable development, the study delves into the human-centric dimensions of circular economy transitions by examining the role of internal organizational factors in shaping employee engagement, a crucial yet underexplored catalyst for circular transformation (Castillo, 2025). This study introduces a carefully curated set of variables: Empowerment and Autonomy (EA), Organizational Culture and Norms (OC), Leadership and Management Support (LS), Training and Skill Development (TD), Values Congruence (VC), and Incentives and Recognition (IR), with Employee Engagement (EE) as the mediating variable and Circular Economy Transitions (CET) as the outcome.

Figure 2: Conceptual Framework of Study: Enabling Circular Economy Transitions in Organizations



Source: Author Developed

This unique configuration of the conceptual framework reflects a systems thinking approach, aligning with key circular economy theories and addressing the socio-technical complexity of circular adoption. What sets this study apart is its integrative perspective, shifting the focus from technological or policy-driven levers to the psychosocial and organizational enablers that determine the actual implementation of circular economy transitions at the grassroots level. The originality of the research lies in its holistic model that bridges behavioral, cultural, and

structural dimensions of engagement with circular economy transition outcomes, offering a novel pathway to sustainability that foregrounds the workforce as active agents of change. The variables were deliberately selected for their proven relevance in employee motivation literature and their theoretical grounding in circular economy frameworks, ensuring both conceptual rigor and practical applicability for organizations aiming to embed sustainability.

Hypothesis Development

H1. Empowerment and Autonomy → Employee Engagement

Empowerment and autonomy enhance employees' sense of control, competence, and ownership at work—especially during sustainability-oriented transitions (Lamm, 2015). The circular economy demands innovative problem-solving and decentralized decision-making, both of which are fostered when employees feel empowered (Anshari, 2025). Employees' empowerment plays a pivotal role in enhancing engagement, enabling individuals to align their personal growth with organizational objectives for mutual success (Murray, 2021). Empowered employees who demonstrate strong organizational commitment significantly contribute to workforce sustainability by fostering resilience, innovation, and long-term retention (Bekirogullari, 2019). Empirical studies have consistently found that psychological empowerment increases employee engagement and proactive behavior (Wang, 2021).

H2. Organizational Culture and Norms → Employee Engagement

A sustainability-oriented organizational culture creates a shared vision and aligns employee behavior with sustainability values (Negi, 2019). When norms supporting environmental responsibility and collaboration are embedded in the culture, employees are more likely to feel connected and committed to their organization's goals (Bertels, 2010). Moreover, culture change is slow-moving, and without concrete tools or practices, its influence may not manifest as immediate engagement (Roland, 2004).

H3. Leadership and Management Support → Employee Engagement

Cultivating a culture of learning requires visionary leadership that actively promotes continuous skill development, knowledge sharing, and personal growth across all levels of the organization (Ahsan, 2025). Transformational leadership fosters trust and motivation, which are critical for aligning employees with organizational change goals (Cao, 2024). Leaders who model pro-environmental behaviors and integrate sustainability into their strategic vision can significantly influence employee attitudes and engagement (Omarova, 2022). Moreover, perceived organizational support, often shaped by leadership behaviors, has been positively linked to employee engagement, particularly during change initiatives (Jin, 2017).

H4. Values Congruence → Employee Engagement

When employees perceive alignment between their personal values and the organization's sustainability values, they experience a stronger sense of belonging and purpose (Rickaby, 2020). This perceived congruence has been shown to strengthen emotional engagement and commitment to organizational goals (Florea, 2013). Research shows that value congruence enhances intrinsic motivation and psychological well-being, both of which are key drivers of sustained engagement (Li, 2015). In sustainability contexts, congruence between employee values and the organization's ecological mission fosters authenticity, leading to higher participation in green practices (Asante, 2024).

H5. Incentives and Recognition → Employee Engagement

Incentives and recognition reinforce desired sustainable behaviors and signal that the organization values employee contributions (Huber, 2017). Recognition is particularly important in circular economy contexts where innovation and extra-role behaviors are essential (Schepers, 2022). Recognition plays a critical role in motivating discretionary efforts and pro-environmental behaviors, especially in contexts where formal authority may be limited (Lülf, 2013). Research also indicates that green rewards, gamification, and symbolic recognition boost employee morale, environmental responsibility, and long-term engagement (Haque, 2024).

H6. Training and Skill Development → Employee Engagement

The circular economy transition requires new skills and capabilities (Acerbi, 2024). When organizations invest in training, employees feel more competent and valued, which enhances engagement (Zahra, 2014). Understanding whether organizations invest wisely in employee development is crucial, as evidence suggests that training and development initiatives have a significant impact on organizational learning and innovation, which are foundational for enabling circular economy transitions (Sung, 2014). Addressing knowledge obstacles when transitioning towards a circular economy, particularly from an intra-organizational perspective, is therefore essential, as overcoming internal knowledge gaps can significantly improve employees' readiness to adopt circular practices and contribute meaningfully to sustainability initiatives (Nujen, 2023).

H7. Employee Engagement → Circular Economy Transition Effectiveness

Employee engagement is a critical success factor for organizational change and sustainability initiatives (Vaja, 2018). Engaged employees demonstrate higher levels of creativity, collaboration, and resilience traits essential for implementing CE principles like reuse, redesign, and resource optimization. Their active participation not only facilitates the implementation of sustainable practices but also nurtures a culture of continuous innovation essential for circular transitions (Scipioni, 2021). To support and sustain such engagement, future research and organizational interventions should focus on cultivating meaningful work, particularly through the provision of contextually appropriate job resources that empower employees and align their roles with broader sustainability objectives (Albrecht S. L., 2021).

Research Methodology

This study adopts a quantitative and explanatory research design to empirically examine the relationships between key organizational factors and employee engagement, as well as their subsequent impact on circular economy transitions. The model hypothesized that six organizational factors: empowerment and autonomy, organizational culture and norms, leadership and management support, values congruence, incentives and recognition, and training and skill development served as predictors of employee engagement. Employee engagement was posited as a mediating variable that subsequently influenced the effectiveness of circular economy transitions. A seven-hypothesis model (H1–H7) was developed and analyzed using structural equation modelling (SEM) to assess the direct and indirect relationships among variables.

Population and Sampling

The target population for this study comprised employees working in the Indian retail sector, particularly those employed in mid- to large-sized retail chains involved in sustainability practices. A total of 100 respondents participated in the study, selected using a purposive sampling technique. This non-probability sampling approach was deemed suitable as the study required responses from employees who had sufficient awareness or involvement in organizational sustainability practices or resource management initiatives. Demographic data collected included respondents' age, gender, job role, years of experience, and department, ensuring a diverse and relevant representation of perspectives from operational and managerial roles. This diversity enabled a nuanced exploration of the organizational enablers of engagement in circular economy transitions.

The demographic profile of the study participants reveals a near-balanced gender distribution, with 58% male and 42% female respondents. Age-wise, the majority were young professionals, as 40% of participants were between 20 and 30 years old, followed by 35% in the 31 to 40 age group. Those aged 41 to 50 comprised 15%, while the remaining 10% were over 50 years of age. In terms of job roles, the sample included a diverse range of hierarchical levels: 30% were frontline staff, 28% team leaders, another 30% belonged to middle management, and 12% were senior executives. Regarding years of experience, 34% of respondents had between 2 and 5 years of experience, 28% had 6 to 10 years, 20% had more than 10 years, and 18% had less than 2 years. Departmentally, participants represented various functions, with 35% from Sales and Customer Service, 28% from Operations, 15% from Human Resources, 10% from Strategy and Sustainability, and the remaining 12% from other support roles.

Data Collection and Analysis

Data were collected through a structured questionnaire that was developed using validated scales from existing literature and tailored specifically to the context of the circular economy and employee engagement. The collected data were analyzed using IBM SPSS and SmartPLS software. The analysis began with descriptive statistics to profile the demographic characteristics of the respondents. Construct validity was assessed through Exploratory Factor Analysis (EFA), employing Principal Component Analysis (PCA) with Varimax rotation. Reliability of the scales was evaluated using both Cronbach's Alpha and Composite Reliability (CR) measures. To test the hypothesized relationships within the conceptual model, Structural Equation Modeling (SEM) was conducted. Further, path coefficient analysis was performed, including examination of beta (β) values, t-statistics, p-values, as well as R^2 and f^2 effect sizes to determine the strength and significance of the relationships.

Findings and Analysis

Path Coefficient Insights

The results of the Structural Equation Modeling (SEM) analysis indicate varying levels of influence among the six organizational factors on Employee Engagement (EE). *Incentives and Recognition (IR)* emerged as the strongest predictor of EE with a path coefficient of 0.547, suggesting that acknowledgment and rewards for sustainability efforts significantly enhance employee involvement. This was followed by *Training and Skill Development (TD)* ($\beta = 0.218$), indicating that opportunities for upskilling are also crucial for driving engagement.

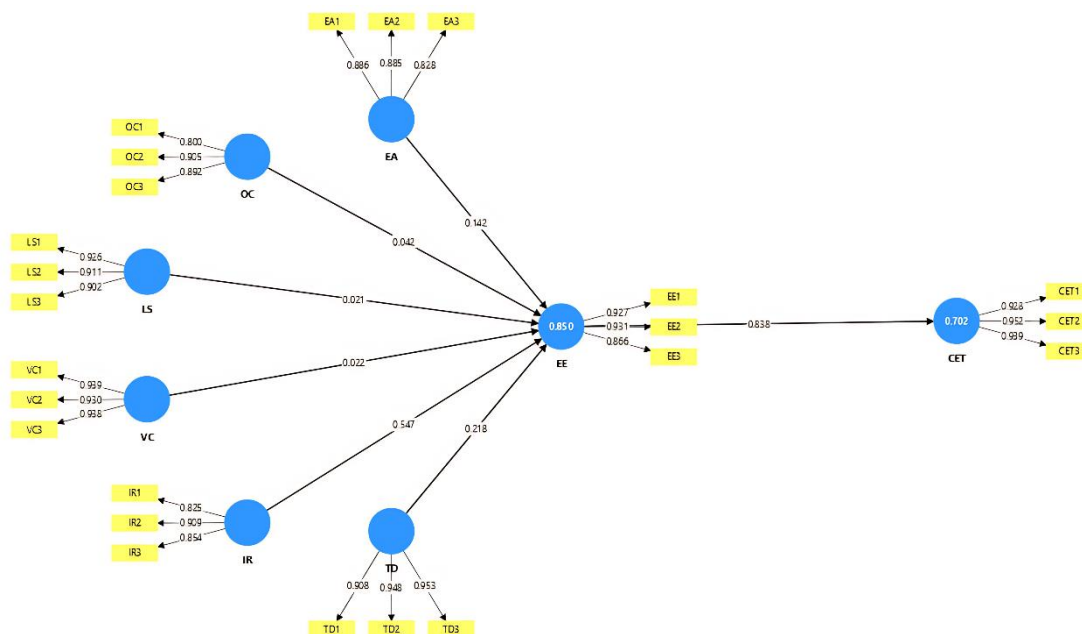
Empowerment and Autonomy (EA) demonstrated a moderate influence ($\beta = 0.142$), supporting the idea that giving employees freedom in decision-making positively contributes to their engagement. Meanwhile, *Organizational Culture and Norms (OC)* ($\beta = 0.042$), *Leadership and Management Support (LS)* ($\beta = 0.021$), and *Values Congruence (VC)* ($\beta = 0.022$) had minimal effects, highlighting that without tangible incentives or development opportunities, these softer cultural elements may have a limited direct role in activating engagement.

Table No. 1: Structural Relationships Between Variables – Output from SEM Analysis

Constructs	Path coefficients
EA -> EE	0.142
EE -> CET	0.838
IR -> EE	0.547
LS -> EE	0.021
OC -> EE	0.042
TD -> EE	0.218
VC -> EE	0.022

Furthermore, Employee Engagement showed a strong and significant influence on Circular Economy Transitions (CET) with a path coefficient of 0.838, affirming its role as a vital mediating variable. The high R^2 values observed for EE (0.850) and CET (0.702) underscore the robustness of the model. Specifically, 85% of the variance in EE is explained by the six organizational predictors, while 70.2% of the variance in CET is explained by EE. These findings validate the hypothesized model and stress the importance of a strategically designed incentive system and continuous skill development initiatives. Organizations aiming to succeed in circular economy initiatives should, therefore, prioritize these key levers to foster a deeply engaged and sustainably driven workforce.

Figure 3: Exploring Relationships through SEM Analysis



The findings have significant implications for the proposed framework, highlighting the importance of prioritizing tangible organizational practices over cultural or symbolic elements. The strong influence of incentives and recognition, training, and skill development on employee engagement suggests that organizations aiming to advance circular economy transitions should invest in employee-centric strategies that reward sustainable behavior and build relevant skills. The minimal impact of leadership support, organizational culture, and values congruence implies these factors may be necessary but not sufficient on their own. The framework is thus validated as emphasizing engagement as a key lever for operationalizing circular economy initiatives effectively.

Measurement Model Analysis

Table No. 2: Construct Reliability and Validity

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CET	0.934	0.935	0.958	0.883
EA	0.836	0.841	0.901	0.752
EE	0.893	0.893	0.934	0.825
IR	0.829	0.841	0.898	0.746
LS	0.9	0.902	0.938	0.834
OC	0.834	0.845	0.901	0.752
TD	0.93	0.932	0.955	0.877
VC	0.929	0.929	0.955	0.876

Robust Internal Consistency Reliability: All constructs demonstrated excellent internal consistency, with Cronbach's alpha values ranging from 0.829 (IR) to 0.930 (TD), well above the 0.70 threshold recommended by Nunnally (1978). This indicates that the items within each construct are highly interrelated and measure the intended latent concept reliably.

Strong Composite Reliability (CR): The Composite Reliability (rho_c) values for all constructs range from 0.898 to 0.958, significantly exceeding the minimum cutoff of 0.70 (Hair et al., 2019). This reinforces the internal consistency and reliability of the constructs beyond what Cronbach's alpha alone can confirm, especially in SEM contexts where construct reliability is critical.

High Convergent Validity through AVE: Each construct achieved Average Variance Extracted (AVE) values well above the threshold of 0.50, with the lowest being 0.746 (IR) and the highest 0.883 (CET). This affirms that a substantial proportion of the variance in each construct's indicators is accounted for by the latent construct itself, satisfying Fornell and Larcker's (1981) criterion for convergent validity.

Evidence of Instrument Dimensional Precision: Constructs such as Circular Economy Transitions (CET), Training and Skill Development (TD), and Values Congruence (VC) show exceptionally high AVE (>0.87) and CR (>0.95), suggesting refined and precise measurement instruments that capture the constructs' conceptual domain with minimal error variance.

Balanced Psychometric Performance Across Constructs: No construct exhibited problematic reliability or validity metrics, supporting the structural soundness and psychometric rigor of the instrument. The results indicate balanced scale development, with both behavioral (e.g., IR, EE) and cognitive (e.g., VC, LS) constructs performing well.

Suitability for Structural Model Estimation: Collectively, these results affirm the appropriateness of the measurement model for structural equation modeling, providing a statistically sound basis for subsequent hypothesis testing and path analysis within the structural model framework.

Table No. 3: Analysis of Coefficient of Determination (R²) and Adjusted R²

Constructs	R-square	R-square adjusted
CET	0.702	0.699
EE	0.85	0.84

Robust Predictive Power: The endogenous constructs CET (Circular Economy Transition) and EE (Employee Engagement) demonstrate substantial explanatory power, with R² values of 0.702 and 0.85, respectively. These values indicate that approximately 70.2% of the variance in CET and 85% of the variance in EE are collectively accounted for by the model's predictors, signifying a strong model fit.

Adjusted R² Validity: The adjusted R² values (0.699 for CET and 0.84 for EE) closely approximate their corresponding R² values, underscoring the robustness of the model while accounting for the number of predictors included. This minimal reduction implies that the explanatory variables contribute meaningful variance beyond chance and are not merely inflating model fit due to overfitting.

Implications for Model Predictiveness: The high R² and adjusted R² values signify the model's high degree of predictive relevance in explaining complex behavioral and organizational phenomena. Specifically, the model demonstrates superior efficacy in capturing the drivers of employee engagement (EE), which in turn likely exerts significant influence on CET outcomes.

Theoretical and Practical Significance: Such explanatory power reinforces the theoretical framework underpinning the relationships among constructs, validating the hypothesized pathways. Practically, this suggests that interventions targeting antecedents of EE can yield pronounced effects on fostering CET, thereby contributing to organizational sustainability goals.

Consideration of Model Complexity: The marginal difference between R^2 and adjusted R^2 also reflects the appropriateness of model complexity, ensuring that the inclusion of predictors does not artificially inflate explanatory power but rather reflects substantive contributions to understanding the endogenous variables.

Table No. 4: Effect Size (f^2) Analysis of Predictors on Endogenous Constructs

Constructs	f-square
EA -> EE	0.018
EE -> CET	2.357
IR -> EE	0.402
LS -> EE	0.001
OC -> EE	0.001
TD -> EE	0.09
VC -> EE	0.001

Strong Effect of Employee Engagement on Circular Economy Transition: The path from EE to CET exhibits an exceptionally large effect size ($f^2 = 2.357$), indicating that employee engagement is a critical determinant of successful circular economy transitions. This magnitude suggests that EE explains a very substantial proportion of the variance in CET, confirming its central mediating role in the model. **Moderate Effect of Incentives and Recognition on Employee Engagement:** The effect size of IR on EE is moderate ($f^2 = 0.402$), demonstrating that incentives and recognition play a meaningful role in enhancing employee engagement within organizations. This aligns with theoretical expectations that recognition motivates higher employee involvement.

Small Effect of Training and Skill Development on Employee Engagement: TD (Training and Skill Development) shows a small but non-negligible effect on EE ($f^2 = 0.09$), indicating that targeted skill enhancement initiatives contribute positively to engagement, although with less impact compared to incentives and recognition.

Subtle but Foundational Role of Empowerment and Autonomy, Leadership Support, Organizational Culture, and Values Congruence: While the direct effects of EA, LS, OC, and VC on EE exhibit small effect sizes ($f^2 \leq 0.018$), their presence within the model highlights the nuanced and potentially foundational role these constructs play in shaping engagement. These findings suggest that their influence may be more indirect, operating through mediating variables or in interaction with other factors, rather than through direct pathways alone. This underlines the complexity of employee engagement and the importance of considering broader relational dynamics within the organizational context.

Table No. 5: Path Coefficients – Mean, STDEV, T Values, p values

Constructs Relationship	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
EA -> EE	0.142	0.171	0.147	0.972	0.331
EE -> CET	0.838	0.835	0.052	15.979	0
IR -> EE	0.547	0.551	0.128	4.264	0
Constructs Relationship	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
LS -> EE	0.021	0.032	0.131	0.16	0.873
OC -> EE	0.042	0.015	0.154	0.274	0.784
TD -> EE	0.218	0.229	0.121	1.806	0.071
VC -> EE	0.022	-0.009	0.101	0.218	0.827

Incentives and Recognition → Employee Engagement: Statistically significant and practically relevant, this result highlights the crucial role of rewards, recognition, and appreciation in fostering sustainable employee engagement. *Supports Social Exchange Theory*, which posits that individuals reciprocate positive organizational inputs with greater involvement and commitment.

Training and Development → Employee Engagement: While marginally significant, this path shows a positive and meaningful association, suggesting that investment in upskilling and knowledge-building enhances employees' willingness and ability to engage with sustainability goals.

Empowerment and Autonomy → Employee Engagement: Although not statistically significant, the positive coefficient indicates that autonomous work environments may still foster engagement indirectly or in synergy with other variables like recognition and training.

Organizational Culture, Leadership Support, and Values Congruence: All exhibit positive coefficients, affirming theoretical alignment with the model even if their direct paths are statistically non-significant. These constructs may play a more influential role through interaction effects or indirectly by shaping the organizational climate that supports engagement.

Employee Engagement → Circular Economy Transition (CET): Highly significant and strongly positive, confirming employee engagement as a key enabler of circular economy adoption. The high effect size reflects the centrality of workforce alignment and participation in successful, sustainable transformation efforts.

While several hypothesized relationships did not achieve statistical significance at conventional thresholds ($p < 0.05$), the direction and strength of the coefficients offer valuable insights into the underlying dynamics of employee engagement during circular economy transitions. The non-significant p-values for constructs like Empowerment and Autonomy (EA), Organizational Culture and Norms (OC), Leadership and Management Support (LS), and Values Congruence (VC) do not undermine their conceptual relevance. Rather, they suggest that these factors may exert their influence more subtly, potentially through indirect effects, synergistic interactions, or over a longer temporal horizon. For example, while EA did not yield a statistically significant direct effect ($p = 0.331$), its positive coefficient indicates potential relevance when combined with other enablers such as incentives or training. Similarly, the low p-values for IR ($p = 0.000$) and EE → CET ($p = 0.000$) reinforce the robustness of these pathways, validating the central role of tangible rewards and employee alignment in circular transformation success. These results call for a more nuanced understanding of engagement drivers, highlighting the need for integrated strategies that activate both intrinsic and extrinsic motivators within a supportive organizational ecosystem. Future research can explore moderating or mediating variables that may unlock the full potential of these foundational constructs.

4.3 Exploratory Factor Analysis

To assess the underlying structure of the constructs and validate the dimensional integrity of the measurement model, an Exploratory Factor Analysis (EFA) was conducted using Principal Component Analysis (PCA) with Varimax rotation. This statistical procedure was employed to identify latent dimensions and ensure that the items included in the model reflect coherent, interpretable factors aligned with the theoretical framework.

Table No. 6: Communalities Table

Communalities		
	Initial	Extraction
EA1	1.000	.821
EA2	1.000	.818
EA3	1.000	.894
OC1	1.000	.841
OC2	1.000	.894
OC3	1.000	.751
LS1	1.000	.769
	Initial	Extraction
LS2	1.000	.763
LS3	1.000	.715
VC1	1.000	.755
VC2	1.000	.734
VC3	1.000	.847
IR1	1.000	.622
IR2	1.000	.757
IR3	1.000	.645
TD1	1.000	.682
TD2	1.000	.751
TD3	1.000	.768

EE1	1.000	.734
EE2	1.000	.741
EE3	1.000	.761
CET1	1.000	.789
CET2	1.000	.807
CET3	1.000	.790
Extraction Method: Principal Component Analysis.		

All extracted communalities exceeded the minimum threshold of 0.50, indicating that the selected items are sufficiently explained by the underlying factor structure. Communality values ranged from 0.622 to 0.894, with the lowest being IR1 (0.622) and the highest being EA3 and OC2 (0.894). High communalities confirm that a substantial proportion of item variance is accounted for by the extracted components, supporting strong item reliability and construct representation. Constructs such as Empowerment and Autonomy (EA), Organizational Culture (OC), Values Congruence (VC), and Circular Economy Transitions (CET) all exhibited consistently high communalities (>0.75), indicating strong convergent validity and alignment with the theoretical framework. These results affirm the psychometric adequacy of the measurement model and support the advancement of these constructs into the structural equation modelling phase.

Table No. 7: Total Variance Explained

Component	Total Variance Explained								
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.741	65.586	65.586	15.741	65.586	65.586	7.026	29.273	29.273
2	1.654	6.891	72.477	1.654	6.891	72.477	5.957	24.820	54.093
3	1.052	4.385	76.863	1.052	4.385	76.863	5.465	22.770	76.863
4	.730	3.043	79.906						
5	.699	2.912	82.818						
6	.603	2.511	85.329						
7	.508	2.115	87.444						
8	.377	1.573	89.017						
9	.330	1.373	90.390						
10	.312	1.302	91.691						
11	.303	1.265	92.956						
12	.271	1.131	94.087						
13	.235	.981	95.067						
14	.226	.942	96.009						
15	.212	.883	96.892						
16	.153	.638	97.530						
17	.142	.591	98.121						
18	.139	.580	98.701						
19	.100	.417	99.118						
20	.084	.351	99.469						
21	.059	.244	99.713						
22	.053	.219	99.932						
23	.016	.068	100.000						
24	-2.009E-16	-8.370E-16	100.000						
Extraction Method: Principal Component Analysis.									

PCA yielded three components with eigenvalues greater than 1, explaining a cumulative variance of 76.863%, which exceeds the standard minimum threshold for social science research. After rotation: Component 1 accounted for 29.273%, Component 2 explained 24.820%, Component 3 contributed 22.770% The high cumulative variance indicates a well-structured factor solution, reinforcing the construct validity of the E.N.G.A.G.E. framework.

Table No. 8: Rotated Component Matrix

Rotated Component Matrix^a			
	Component		
	1	2	3
EA1			.827
EA2			.831
EA3		.852	
OC1			.832
OC2		.852	
OC3		.720	
LS1	.555	.579	
LS2		.705	
LS3		.630	
VC1			.692
VC2			.688
VC3			.817
IR1	.549		
IR2	.587		
IR3	.706		
TD1	.541	.583	
TD2	.655	.501	
TD3	.652	.532	
EE1	.597		
EE2	.675		
EE3	.675		
CET1	.816		
CET2	.760		
CET3	.748		
Extraction Method: Principal Component Analysis.			
Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 7 iterations.			

The Rotated Component Matrix, clarifies the factor structure by improving interpretability and minimizing cross-loadings. Each item loaded strongly on one primary component, indicating good discriminant validity and internal coherence within constructs.

- Component 1 clusters items related to Incentives and Recognition (IR), Employee Engagement (EE), and Circular Economy Transitions (CET) representing a behavioral engagement dimension.
- Component 2 groups Leadership Support (LS) and Training and Development (TD) reflecting organizational enablement.
- Component 3 encompasses Empowerment and Autonomy (EA), Values Congruence (VC), and Organizational Culture (OC) emphasizing value-based empowerment and alignment.

These groupings validate the theoretical distinctiveness of the constructs and reflect a sound factor structure consistent with the E.N.G.A.G.E. model.

Discussion

The empirical results of this study shed critical light on how specific organizational factors contribute to employee engagement and, subsequently, how engagement influences the effectiveness of circular economy transitions within the retail sector. The application of the E.N.G.A.G.E. framework reveals a nuanced interplay between behavioral, structural, and cultural elements that shape employee motivation toward sustainability-oriented goals. The strongest predictor of employee engagement emerged as Incentives and Recognition (IR), underscoring the centrality of tangible and symbolic reinforcement in driving sustainability behavior. This aligns with Social

Exchange Theory, suggesting that when organizations reciprocate employee efforts with rewards and acknowledgment, it fosters a culture of trust, commitment, and extra-role behavior. The practical implication is clear: without systems that validate sustainable contributions, employees may lack the motivation to internalize and act upon circular economy principles.

Training and Skill Development (TD) was the second most significant factor, reinforcing the notion that competence-building is a crucial driver of engagement. The circular economy requires new skills, ranging from systems thinking to green logistics, and organizations that invest in employee development are better positioned to create an empowered and innovative workforce. These findings echo Self-Determination Theory, which posits that the feeling of competence enhances intrinsic motivation and engagement.

Interestingly, Empowerment and Autonomy (EA) had a positive but modest effect on engagement, and constructs such as Organizational Culture (OC), Leadership and Management Support (LS), and Values Congruence (VC) showed very small or statistically insignificant effects. This may indicate that while these elements create the foundation for sustainability, they are not sufficient on their own to trigger engagement unless backed by actionable mechanisms. It suggests a potential “value-action gap,” where employees may align ideologically with sustainability but require direct stimuli like skills training or recognition to engage fully.

This also reflects a broader insight: symbolic or passive enablers need to be operationalized through concrete strategies. Leadership commitment, for example, may be ineffective if not coupled with visible actions, participatory communication, or alignment of performance goals with sustainability targets. Similarly, a strong organizational culture must manifest in daily practices, resource allocation, and accountability structures to meaningfully influence engagement.

The high R^2 values (EE: 0.85, CET: 0.702) and large effect size of Employee Engagement $\rightarrow$ CET ($f^2 = 2.357$) clearly demonstrate that engaged employees are vital catalysts in translating circular strategies into successful outcomes. Their creativity, adaptability, and willingness to embrace new processes are essential for embedding CE practices into core business functions.

From a systems perspective, the E.N.G.A.G.E. framework offers a powerful lens for rethinking HRM strategies within sustainability agendas. It validates the idea that employee engagement is not just a soft metric but a strategic enabler for organizational transformation. To transition effectively toward a circular economy, businesses must go beyond compliance and technology adoption; they must foster a culture of ownership, reward behavior change, and equip their people to thrive in a regenerative paradigm.

In summary, the findings stress the importance of designing integrated, employee-centered approaches to sustainability. They call for a shift from rhetoric to action—from espousing green values to embedding them into incentive systems, learning programs, and everyday decision-making processes. Organizations that recognize this shift and act accordingly are more likely to achieve resilient, inclusive, and impactful circular transitions.

Conclusion

Theoretical Contribution

This study makes several significant contributions to organizational and sustainability literature by introducing and empirically validating the E.N.G.A.G.E. framework as a novel, employee-centered model for understanding the organizational antecedents of employee engagement during circular economy transitions. By bridging concepts from Self-Determination Theory, Social Exchange Theory, Sustainable Human Resource Management, and Learning Organization Theory, this research extends existing engagement models beyond conventional domains such as productivity or job satisfaction to the more complex, values-driven context of environmental sustainability.

The findings confirm that while soft enablers like organizational culture, leadership support, and values congruence are important, they do not singularly drive engagement unless supported by concrete practices such as incentives and skill development. Furthermore, the strong mediating role of employee engagement between organizational factors and CET effectiveness validates its theoretical centrality in enabling sustainable organizational transformation. The research thus fills a critical gap in circular economy literature by elevating the human dimension as a cornerstone of effective CE implementation in the retail sector.

Practical and Managerial Implications

For practitioners, especially retail leaders and HR managers, this study provides a strategic blueprint for fostering a workforce that is engaged, proactive, and aligned with circular economy goals. The results clearly indicate that incentives and recognition, along with training and development, are the most impactful levers for activating employee engagement. Organizations aiming to transition towards circular models should invest in structured reward systems that acknowledge sustainable behavior and create learning pathways that build green skills across all levels of the workforce.

Moreover, while empowerment, leadership support, and cultural alignment are foundational, they must be operationalized through transparent communication, participatory decision-making, and integration into daily tasks and performance metrics. Embedding the E.N.G.A.G.E. framework into HRM strategy can help

organizations move from policy to practice, creating an enabling environment where employees feel valued, capable, and motivated to contribute meaningfully to sustainability goals.

Limitations of The Current Study

While this study provides valuable insights, several limitations warrant consideration. First, the use of purposive sampling and a relatively small sample size ($n = 100$) drawn from the Indian retail sector may limit the generalizability of the findings across industries and cultural contexts. Future research should adopt larger, more diverse samples and potentially incorporate longitudinal data to track engagement and circular outcomes over time.

Second, although the study establishes robust structural relationships, it does not capture potential moderating or mediating variables such as employee personality traits, perceived organizational justice, or environmental awareness levels. Incorporating these factors could deepen our understanding of the psychological mechanisms driving engagement in sustainability initiatives.

Third, while the E.N.G.A.G.E. model was validated quantitatively, qualitative research, such as interviews or case studies, could enrich the framework by exploring nuanced employee perceptions, motivational narratives, and organizational change dynamics in real-world circular economy settings.

Future studies could also apply this framework in other high-impact sectors like manufacturing, logistics, or hospitality, and explore digital tools such as gamification and AI-based learning platforms as enablers of engagement in CE transitions.

Future Research Directions

The future scope of this study offers multiple avenues for further research and practical application. While the E.N.G.A.G.E. framework has been validated within the Indian retail sector, future studies can expand its applicability across different industries such as manufacturing, logistics, hospitality, and technology, as well as across varied cultural and geographic contexts. Longitudinal research can help track how employee engagement evolves throughout CE transitions, while the inclusion of mediating or moderating variables such as environmental awareness, psychological capital, or perceived organizational justice could provide deeper insights into engagement dynamics. Qualitative and mixed-methods approaches may uncover richer, context-specific perspectives on employee experiences, complementing quantitative data. Additionally, integrating digital enablers like gamification, AI-powered learning platforms, and real-time feedback tools presents opportunities to scale and personalize engagement strategies. Future research should also examine how organizational engagement efforts align with broader ESG and sustainability policies, ensuring coherence between internal practices and external mandates. Replicating the study across larger and more diverse samples will improve generalizability, and refining the measurement tools can enhance practical usability.

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AI-Driven Smart Infrastructure for Sustainable Urban Development: Empirical Insights from Green Building Technologies

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Abstract

Artificial Intelligence (AI) plays a pivotal role in advancing sustainable urban infrastructure by integrating into smart city planning and green building technologies. This study investigates how AI-driven systems contribute to improving energy efficiency, optimizing resource utilization, and minimizing environmental impact within urban ecosystems. With a focus on intelligent transportation systems, real-time building automation, and data-driven resource management, the research highlights how AI can transform urban environments into more sustainable and responsive spaces. Using Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA), the study examines the impact of AI-enabled interventions on various environmental performance outcomes. The empirical analysis, based on data collected from 310 respondents in the National Capital Region of India, reveals that AI significantly enhances environmentally intelligent systems through the incorporation of predictive analytics, adaptive control mechanisms, and real-time feedback. These technologies enable dynamic adjustments in energy consumption, environmental monitoring, and behavioral nudging toward sustainability. Additionally, the study explores key psychological and behavioral dimensions such as attitude, perceived behavioral control, hedonic motivation, and personal norms by drawing from established theoretical frameworks like the Theory of Planned Behavior (TPB), the Norm Activation Model (NAM), and the Value-Belief-Norm (VBN) theory. The results suggest that AI-driven tools not only streamline sustainable practices but also positively influence pro-environmental behaviors among urban citizens. Furthermore, the investigation underscores the importance of ethical implementation, with particular emphasis on data privacy, algorithmic fairness, and equitable access. Addressing these concerns is critical to ensuring that AI technologies are integrated responsibly and inclusively. Overall, the study provides substantial insights into the transformative potential of AI in promoting urban sustainability. It demonstrates that AI technologies can play a key role in developing resilient, efficient, and equitable smart ecosystems aligned with the United Nations' Sustainable Development Goals (SDGs).

Keywords: Artificial Intelligence, Smart Infrastructure, Green Building Technologies, Urban Sustainability, Structural Equation Modeling

Introduction

The integration of Artificial Intelligence (AI) into smart cities and green building technologies is revolutionizing urban sustainability through advanced technological implementations. The advancement of intelligent systems through AI facilitates the optimization of energy consumption, the automation of environmental control, and the enhancement of data-driven urban planning (Wolniak, 2024). The significance of these technologies lies in their ability to tackle the inefficiencies present in contemporary urban infrastructure, especially within the construction sector, which represents around 40% of global energy usage and plays a major role in greenhouse gas emissions (Corchado, 2021). Fundamental to these technological advancements are predictive analytics powered by artificial intelligence and machine learning algorithms, which enable the continuous monitoring and dynamic management of urban systems in real time. For example, predictive models are employed to enhance HVAC (heating, ventilation, and air conditioning) operations in intelligent buildings, leading to decreased energy consumption and increased occupant comfort (Ogunbayo, 2024).

Artificial intelligence plays a crucial role in enhancing preventive maintenance by enabling anomaly detection within building management systems, thereby reducing downtime and prolonging the lifespan of assets. Moreover, the combination of IoT devices with AI platforms facilitates ongoing data collection from energy meters, environmental sensors, and smart grids. The collaboration enables a flexible infrastructure that can alter to user actions and environmental factors, enhancing efficiency and sustainability results (Wang, 2024).

Within the expansive framework of urban development, artificial intelligence plays an important role in enhancing traffic flow, managing waste dynamically, and optimizing water distribution, thereby providing scalable solutions for sustainable urbanization (Tan Yigitcanlar, 2020).

Despite the advancements, several challenges hinder the comprehensive deployment of AI in urban sustainability, such as elevated implementation costs, concerns regarding data privacy, and the necessity for strong regulatory and ethical frameworks (Alsabt, 2024; Steg, 2009).

It is crucial to tackle these obstacles to guarantee the responsible integration of AI, which fosters ecological balance, economic resilience, and social equity in the planning of future cities (Md Eshrat E. Alahi, 2023).

The existing literature highlights the transformative potential of AI in realizing sustainability objectives, especially when integrated into urban infrastructures that utilize real-time data for informed decision-making. The study expands upon the existing framework by systematically assessing the technical impact of artificial intelligence in the context of smart cities and sustainable building systems through the application of sophisticated modeling methodologies (Ogunbayo, 2024).

In light of escalating global climate challenges and the growing international consensus on leveraging artificial intelligence (AI) for climate resilience, as reflected in recent global AI summits, the role of AI in promoting sustainable urban development has assumed heightened significance. Advanced technologies such as generative AI, AI-driven climate modeling, and digital twin simulations for urban infrastructure are enhancing the precision, responsiveness, and adaptability of intelligent urban systems. In the Indian context, policy initiatives like the Government of India's Smart Cities Mission 2.0, extended through March 2025, underscore the national commitment to embedding AI within urban planning and service delivery. Concurrently, global regulatory frameworks, including the European Commission's 2024 AI Act, provide valuable benchmarks for the ethical integration of AI in urban governance. These developments collectively highlight the transformative potential of AI in shaping resilient, efficient, and inclusive urban futures.

Innovative conclusions from 2023–2025 strengthen the trends of (Xu et al., 2024), emphasizing the role of generative AI in enhancing urban digital twins for simulations related to transportation, energy, and buildings.

Hindustan Times reported a notable advancement with AI-based frameworks achieving over 90% accuracy in biodiversity monitoring, alongside an 18.5% improvement in predictive performance, as demonstrated by Rahmati (2024). Additionally, practical applications such as India's satellite-AI-based mapping of building-level heat risk highlight the increasing influence of AI in real-world scenarios.

The recent advancements highlight the significance and appropriateness of the study, which methodically investigates the behavioral, infrastructural, and technological aspects of AI-driven urban sustainability. India's Smart Cities Mission 2.0 (extended to March 2025) is embedding AI and GIS-satellite platforms for urban management, while the European Commission's AI Act (2024) sets ethical guidelines for transparent and accountable AI use in urban planning.

Collectively, these cutting-edge tools, pilots, and regulations underscore the timeliness of our research agenda, examining behavioral drivers, infrastructural capacities, and technology governance within AI-powered urban sustainability frameworks.

Generative AI (GenAI) is becoming a significant asset in the field of sustainable urban development, allowing cities to streamline the formulation of optimized land-use plans, energy-efficient designs, and robust infrastructure. According to a 2024 review by Chakrabarti (Globant), GenAI can model intelligent zoning and sustainable buildings by examining geographic, environmental, and demographic data, ultimately suggesting designs that lower carbon emissions and improve liveability.

The integration with urban digital twins enhances these capabilities, utilizing generative models to autonomously generate synthetic urban scenarios, 3D city representations, and data hierarchies. This results in dynamic simulations that assist planners in anticipating and adapting to future urban challenges. Models such as the Large Flow Model (LFM) utilized in Lausanne serve as prime examples of advanced decision-making tools that leverage generative AI to simulate energy, mobility, waste, and biodiversity flows, aiding urban areas in their pursuit of sustainability objectives.

Artificial intelligence has a crucial role in mitigating urban environments towards achieving net-zero emissions, thereby improving the efforts and resilience strategies. A recent analysis highlights the importance of prioritizing AI-driven urban planning, which comprises climate-smart construction materials, virtual energy grids, and predictive flood forecasting, to achieve the carbon neutrality targets set forth in the Paris Agreement (Reuters, 2025; Wired, 2025). Practical applications demonstrate the transformative capabilities of artificial intelligence, being used to enhance drainage and select building materials for resilience against extreme weather. Smart water systems driven by AI facilitate real-time flood management and infrastructure surveillance (SandTech, 2025). These examples highlight the dual function of AI in mitigating greenhouse gas emissions while enhancing the adaptive capacity necessary for climate-resilient urban development.

In the Indian context, generative artificial intelligence (AI) is progressively redefining the urban development paradigm by enabling advanced capabilities in green building design, energy modeling, and infrastructure

simulation. Emerging applications include AI-generated architectural layouts that optimize natural ventilation and solar gain in residential structures, as well as scenario-based simulations for analyzing water consumption patterns, disaster resilience, and transportation dynamics within smart city frameworks. Under the ambit of the Smart Cities Mission 2.0, urban local bodies in cities such as Bhubaneswar and Pune have initiated pilot projects employing AI-enabled digital twins to visualize urban expansion, infrastructure constraints, and service delivery inefficiencies (MoHUA, 2024). Although these implementations remain in their early stages, they demonstrate considerable potential for fostering climate-responsive, resource-efficient, and citizen-centric urban planning. Accordingly, a systematic exploration of generative AI adoption within Indian urban governance is both timely and imperative for advancing sustainable urbanization in alignment with national priorities and global net-zero objectives.

Literature Review

Artificial Intelligence (AI) has emerged as a fundamental element in promoting sustainability, especially within the realms of smart cities and green building technologies. Artificial intelligence-driven tools offer novel approaches to address urban challenges, encompassing energy management, waste reduction, and the optimization of transportation systems. The technologies in question are in accordance with international sustainability objectives, tackling the environmental, economic, and social aspects comprehensively. (Wolniak, 2024)

AI in Urban Energy Systems

Artificial Intelligence has emerged as a powerful tool in optimizing urban energy systems through its ability to analyze large datasets and automate decision-making processes. Predictive analytics, driven by AI, enable accurate forecasting of energy consumption patterns, leading to more efficient grid management and reduced operational costs (Wolniak & Skotnicka-Zasadzień, 2024). AI algorithms also facilitate demand-side management by dynamically adjusting power loads in real time, particularly in smart grids integrated with renewable energy sources (Tan & Yigitcanlar, 2020).

AI-powered energy control systems can be applied at both the building and city scales. For example, digital twins, like virtual replicas of buildings or cities, allow for simulation and optimization of energy performance across varying operational scenarios (Corchado & De Paz, 2021). Such technologies enable not only reductions in energy consumption but also better integration of solar, wind, and other clean energy inputs, contributing to long-term sustainability goals.

Smart Construction and Building Automation

In the realm of green building technologies, AI plays a critical role in automating key aspects of building operations, enhancing energy efficiency, and improving user comfort. AI-enabled Building Management Systems (BMS) are capable of controlling HVAC, lighting, and security systems based on occupancy patterns and environmental data, leading to reduced energy wastage and operational costs (Ogunbayo & Adebayo, 2024). These systems often use machine learning to adapt over time, learning from user preferences and environmental conditions.

Furthermore, AI is central to predictive maintenance, where algorithms detect anomalies and predict equipment failures before they occur. This proactive approach reduces maintenance costs and extends the lifecycle of critical infrastructure (Matei & Constantin, 2024). In smart construction, robotics and AI-powered project management tools also enhance design accuracy, scheduling, and resource allocation.

AI and Environmental Monitoring

AI's application in environmental monitoring has revolutionized the way urban areas address challenges such as pollution, waste, and water management. Through the integration of IoT devices, AI systems collect real-time environmental data such as air quality, temperature, and noise levels and convert it into actionable insights (Wang et al., 2024). These insights enable city managers to deploy timely interventions and optimize municipal services.

Additionally, AI supports environmental compliance by monitoring emissions and identifying patterns that could violate environmental regulations. In waste management, AI-based image recognition systems categorize and sort recyclables automatically, improving the efficiency of waste processing plants (Alsabt et al., 2024). When combined with citizen-focused mobile apps, these systems also enhance public participation in sustainability efforts.

Attitude towards Sustainability

The role of artificial intelligence in influencing perceptions of sustainability is significant, as it facilitates awareness and offers actionable insights derived from real-time data. (Alsabt, 2024) AI-driven systems within

smart urban environments, including energy management platforms and waste monitoring systems, provide citizens with insights into their ecological footprint, fostering sustainable behaviours. Theory of Planned Behaviour (TPB) (Ajzen, 1991) asserts that favourable attitudes play a crucial role in shaping behavioural intentions. Studies indicate that AI-enabled applications foster pro-environmental attitudes by showcasing quantifiable results of sustainable practices. (Ajzen, 1991)

Perceived Behavioural Control

The implementation of AI contributes to an increased perception of behavioural control through the simplification of sustainable practices. Innovations in urban technology, including AI-enhanced public transportation efficiency and IoT-integrated residential energy management systems, facilitate individual empowerment by offering practical and attainable options for environmentally sustainable practices. (Fishbein, 2010). Research indicates that the capacity of AI to simplify pro-environmental tasks enhances an individual's confidence in engaging in sustainable actions. (Corchado, 2021)

Personal Norms

Personal norms, according to the Norm Activation Model (NAM), signify an individual's moral obligation concerning environmental responsibility. The implementation of AI applications enhances these standards by providing tailored feedback, exemplified through green building dashboards and intelligent waste tracking systems. (Schwartz, 1977) The application of artificial intelligence in visualizing environmental impacts and monitoring compliance with standards has demonstrated a capacity to engage individual moral responsibilities regarding sustainability. (Matei, 2024)

Hedonic Motivation

The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh V. T., 2012) highlights the significance of hedonic motivation, emphasizing that enjoyment serves as a key driver for technology utilization. Technologies enhanced by artificial intelligence, including gamified applications aimed at promoting recycling or competitions focused on energy conservation, leverage this intrinsic motivation. (Hwang, 2021) Empirical evidence indicates that AI tools, designed to enhance the enjoyment of sustainability efforts, significantly boost user engagement and foster pro-environmental behaviours. (Venkatesh V. M., 2003)

Behavioural Intention

The relationship between psychological factors and actual behaviour is mediated by behavioural intention. The documented influence of AI in promoting pro-environmental behavioural intentions is substantial. Artificial intelligence systems model the outcomes of various behaviours, subtly guiding individuals towards environmentally sustainable practices. For example, predictive models for energy consumption assist individuals in strategizing actions aimed at minimizing carbon footprints, thereby reinforcing their commitment to embracing sustainable practices. (Ajzen, 1991)

Pro-Environmental Behaviour

The Value-Belief-Norm (VBN) theory suggests that pro-environmental behaviours arise from environmental values and beliefs that are activated by personal norms. The integration of AI within this framework facilitates the development of systems that promote ecological awareness. Illustrations encompass AI-driven urban agriculture innovations and eco-friendly (Kumar, 2022) construction methodologies that align with personal ecological principles. Recent investigations indicate that AI technologies exert a direct impact on pro-environmental behaviours by establishing a conducive environment and promoting accountability. (Stern, 2000); (Ye, 2023)

Artificial intelligence systems exert an influence on pro-environmental behaviour through the application of behavioural science theories such as the Theory of Planned Behaviour (TPB) and the Norm Activation Model (NAM). (Schwartz, 1977) Their approach involves offering tailored recommendations and modeling environmental impacts to enhance both individual and collective sustainability practices. (Ajzen, 1991)

Hypothesis

Based on the theoretical framework and prior literature, the following hypotheses have been developed to investigate the impact of AI technologies on pro-environmental behavior and urban environmental management:

H1: AI-enabled interventions have a significant positive effect on individuals' attitudes toward the adoption of pro-environmental behaviors.

H2: AI-driven personalized feedback significantly enhances perceived behavioral control, thereby increasing individuals' intentions to engage in pro-environmental actions.

H3: The activation of personal norms through AI-based environmental awareness mechanisms significantly increases individuals' engagement in sustainable behaviors.

H4: The integration of AI technologies in urban infrastructure development significantly improves energy efficiency and facilitates adaptive environmental management in real time.

Methodology

Research design

The study explored how artificial intelligence (AI) can empower pro-environmental behavior (PEB) by addressing obstacles through a dual theoretical framework: Theory of Planned Behavior (TPB) and Value-Belief-Norm (VBN) Theory. The study also investigated the impact of factors such as attitudes, behavioral intentions, hedonic motivation, perceived behavioral control, and personal norms on pro-environmental behavior.

The study adopted a research approach of quantitative research methodology. The use of Structural Equation Modeling (SEM) (Anderson J. C., 1988) Confirmatory Factor Analysis (CFA) allowed for an in-depth examination of the relationships between variables and validated the proposed theoretical model.

The study employed a judgmental (purposive) sampling technique to select a sample of 100 participants from the National Capital Region (NCR). To ensure accessibility and respondent convenience, the survey was administered through an online platform. The questionnaire was disseminated via email, social media platforms, and professional networks to reach individuals exhibiting varying degrees of environmental consciousness and exposure to artificial intelligence (AI) technologies.

Data Collection

Data for the study was collected from a sample of 310 respondents residing in the National Capital Region (NCR) of India. A structured questionnaire was designed to obtain information on individuals' perceptions, attitudes, and behavioral intentions toward AI-enabled pro-environmental interventions. The respondents were selected using a purposive sampling method to capture a representative cross-section of the urban population in the NCR. Before participation, informed consent was obtained from all respondents, and the study was conducted per established ethical guidelines governing data collection and analysis.

Technical Methods

The study employs **Confirmatory Factor Analysis (CFA)** and **Structural Equation Modeling (SEM)** to test the hypothesized relationships among the constructs related to AI-enabled pro-environmental behavior.

Software Platforms and Tools:

The data analysis was conducted using **SmartPLS** a specialized software platform for Partial Least Squares Structural Equation Modeling (PLS-SEM). Additionally, **IBM SPSS Statistics** was used for preliminary data cleaning and descriptive statistics.

Technical Setup for Modeling:

The CFA was performed to validate the measurement model, ensuring construct reliability and validity through indicators such as composite reliability (CR), average variance extracted (AVE), and factor loadings. SEM was applied to assess the structural model and test the hypothesized relationships. Model fit indices such as the **Comparative Fit Index (CFI)**, **Root Mean Square Error of Approximation (RMSEA)**, and **Tucker-Lewis Index (TLI)** were used to evaluate the adequacy of the model fit.

The SEM path model was constructed based on theoretical frameworks, and bootstrapping with 310 samples was conducted to estimate the significance of path coefficients. The approach ensured valid hypothesis testing and provided insights into the direct and indirect effects of AI-related constructs on pro-environmental behavior.

To assess the impact of AI integration in urban infrastructure on energy efficiency (Hypothesis 4), a **Difference-in-Differences (DiD)** analytical approach was employed. The method estimated the causal effect of AI-enabled urban interventions by comparing changes in energy efficiency before and after AI implementation between treated and control groups.

Data Structure:

The dataset comprised observations of urban areas with (treatment group) and without (control group) AI-based infrastructure integration, measured at two time points: before and after AI deployment. The outcome variable was a continuous measure of energy efficiency.

Model Specification:

A linear regression model with an interaction term between Time (0 = before, 1 = after AI integration) and AI_Integration (0 = control, 1 = treatment) was specified as follows:

$$\text{EnergyEfficiency}_{it} = \beta_0 + \beta_1 \text{Time}_t + \beta_2 \text{AI}_i + \beta_3 (\text{Time}_t \times \text{AI}_i) + \epsilon_{it}$$

where β_3 captures the average treatment effect of AI integration on energy efficiency.

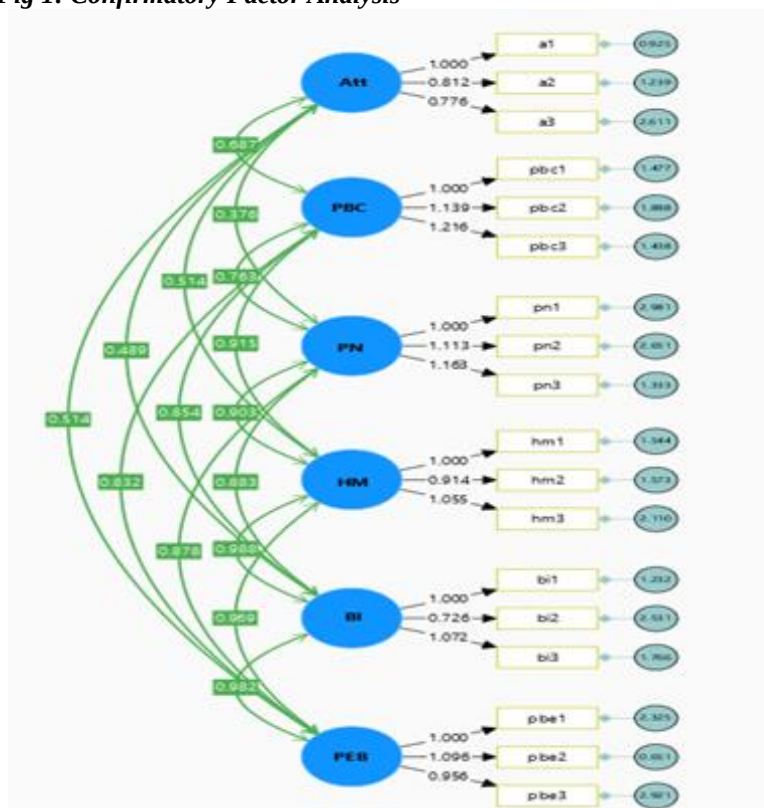
Statistical Analysis:

The model was estimated using ordinary least squares (OLS) regression in R. The significance of the interaction term ($\beta_3 \setminus \beta_3$) was used to evaluate whether AI integration led to statistically significant improvements in energy efficiency relative to control areas.

Data Analysis

The empirical study of the proposed theoretical framework, Confirmatory Factor Analysis (CFA), was conducted as a foundational step before conducting Structural Equation Modeling (SEM). The primary objective of CFA was to assess the measurement model's reliability and validity by examining the strength and significance of the relationships between observed indicators and their respective latent constructs. The analytical procedure was essential to ensure that each construct namely, Attitude, Behavioral Intention, Hedonic Motivation, Perceived Behavioral Control, Pro-Environmental Behavior, and Personal Norms, was measured with precision and internal consistency, by the dual theoretical frameworks, Theory of Planned Behavior (TPB) and the Value-Belief-Norm (VBN) theory. The CFA results provided strong evidence of construct validity, including internal consistency, convergent validity, and discriminant validity, thereby establishing a basis for the subsequent structural path modeling through SEM.

Fig 1: Confirmatory Factor Analysis



Source: Author's CFA analysis using SmartPLS

The Confirmatory Factor Analysis (CFA) model (Fig 1) provides strong evidence of construct validity by confirming the hypothesized relationships between six latent constructs, Attitude, Perceived Behavioral Control, Personal Norms, Hedonic Motivation, Behavioral Intention, and Pro-Environmental Behavior, and their corresponding observed indicators. The majority of factor loadings exceed the recommended threshold of 0.70, thereby indicating reliable and consistent measurement of the constructs. Notable loadings, such as Att1 (0.925), BI1 (1.000), and PEB2 (1.096), reflect a strong association between the observed items and their respective latent variables. The inter-construct correlations, particularly between Hedonic Motivation and Behavioral Intention (0.988), and between Behavioral Intention and Pro-Environmental Behavior (0.982), provide empirical support to the proposed theoretical framework and underscore the predictive strength of key behavioral antecedents. The model demonstrates satisfactory convergent validity and internal consistency. The results affirm the adequacy of the measurement model and establish a strong foundation for subsequent structural path analysis.

Cronbach's Alpha:

Cronbach's Alpha is a measure of internal consistency, indicating how well the items or indicators of a construct measure the same underlying concept. A value above 0.70 is generally considered acceptable for reliability, though values above 0.80 are considered good.

- **Attitude (0.844):** This indicates good internal consistency, meaning that the items measuring Attitude are highly correlated with each other.
- **Behavioral Intention (0.793):** This is an acceptable level of internal consistency, suggesting that the items measuring Behavioral Intention are reliably consistent.
- **Hedonic Motivation (0.788):** Also indicates good internal consistency.
- **Perceived Behavioral Control (0.785):** This value suggests acceptable internal consistency for Perceived Behavioral Control.
- **Pro-Environmental Behavior (0.827):** This shows a good level of internal consistency.
- **Personal Norms (0.782):** This is an acceptable level of internal consistency for Personal Norms.

Table No. 1: Factor Loading Matrix

Factor Loading	Att	BI	HM	PBC	PEB	PN
Att1	0.897					
Att2	0.819					
Att3	0.685					
BI 1		0.842				
BI2		0.62				
BI3		0.813				
HM1			0.767			
HM2			0.735			
HM3			0.734			
PBC1				0.721		
PBC2				0.723		
PBC3				0.788		
PEB1					0.771	
PEB2					0.929	
PEB3					0.718	
PN1						0.647
PN2						0.708
PN3						0.828

Source: Author's CFA analysis using SmartPLS

The Factor Loading Matrix (Table: 1) represents the loadings of the observed variables (indicators) onto their respective latent constructs in the Confirmatory Factor Analysis (CFA). Factor loadings indicate how strongly each indicator is related to its respective latent variable (construct). The higher the factor loading, the stronger the relationship between the indicator and the construct.

Attitude (Att)

- A1 (0.897): This indicator has a very strong loading on the Attitude construct. A value of 0.897 means that A1 is highly related to Attitude and is a reliable indicator.
- A2 (0.819): This is also a strong loading, indicating that A2 is a good measure of Attitude, though it is slightly weaker than A1.
- A3 (0.685): This is a moderate loading on the Attitude construct, suggesting that A3 is still a valid indicator, but it's weaker than A1 and A2.

Behavioral Intention (BI)

- BI1 (0.842): This indicator has a very strong loading on the Behavioral Intention (BI) construct, indicating that BI1 is a highly reliable measure of Behavioral Intention.
- BI2 (0.62): This is a moderate factor loading, indicating that BI2 is related to Behavioral Intention, but not as strongly as BI1.
- BI3 (0.813): This is another strong loading, suggesting that BI3 is a reliable indicator of Behavioral Intention, almost as strong as BI1.

Hedonic Motivation (HM)

- HM1 (0.767): A strong loading, indicating that HM1 is a good indicator of the Hedonic Motivation construct.
- HM2 (0.735): This is also a strong loading, meaning HM2 is reliably related to Hedonic Motivation.
- HM3 (0.734): Another good loading, though slightly weaker than HM1 and HM2, but still acceptable for a reliable indicator.

Perceived Behavioral Control (PBC)

- PBC1 (0.721): This is a moderate loading, meaning PBC1 is a somewhat reliable indicator of Perceived Behavioral Control, but not as strong as some other indicators.
- PBC2 (0.723): Similar to PBC1, this is a moderate loading, suggesting that PBC2 is a good, but not exceptional, measure of Perceived Behavioral Control.
- PBC3 (0.788): This is a stronger loading, indicating that PBC3 is a fairly reliable indicator of Perceived Behavioral Control.

Pro-Environmental Behavior (PEB)

- PEB1 (0.771): This is a good factor loading, meaning PEB1 is a reliable measure of the Pro-Environmental Behavior construct.
- PEB2 (0.929): This is an excellent loading, indicating that PEB2 is a very strong and reliable indicator of Pro-Environmental Behavior.
- PEB3 (0.718): This is a moderate factor loading, showing that PEB3 is related to Pro-Environmental Behavior, though it's slightly weaker than PEB1 and PEB2.

Personal Norms (PN)

- PN1 (0.647): This is a relatively moderate loading, meaning PN1 is a less reliable indicator of Personal Norms compared to the other indicators.
- PN2 (0.708): This is a moderate to strong loading, suggesting PN2 is a somewhat reliable indicator of Personal Norms.
- PN3 (0.828): This is a strong factor loading, indicating that PN3 is a good measure of Personal Norms.

Table No. 2: Correlation Matrix

CORRELATION MATRIX	Attitude	Behaviour Intention	Hedonic Motivation	Perceived Behaviour Control	Pro Environmental Behaviour	Personal Norms
Attitude	1	0.489	0.514	0.687	0.514	0.376
Behavioural Intention	0.489	1	0.988	0.854	0.982	0.883
Hedonic Motivation	0.514	0.988	1	0.915	0.969	0.903
Perceived Behaviour Control	0.687	0.854	0.915	1	0.832	0.763
Pro Environmental Behaviour	0.514	0.982	0.969	0.832	1	0.878
Personal Norms	0.376	0.883	0.903	0.763	0.878	1

Source: Author's CFA analysis using SmartPLS

The Correlation Matrix (Table: 2) shows the relationships between the various constructs (latent variables) used in the study. The values represent the strength and direction of the linear relationships between pairs of variables. These correlations range from -1 (perfect negative correlation) to +1 (perfect positive correlation), with 0 indicating no linear relationship. Here's a breakdown of the correlation matrix:

Attitude (ATT)

- **Attitude → Behavioural Intention (0.489):** There is a moderate positive correlation between Attitude and Behavioural Intention. This suggests that as Attitude becomes more positive, Behavioural Intention also tends to become stronger, but the relationship is not very strong.
- **Attitude → Hedonic Motivation (0.514):** A moderate positive correlation. This indicates that a more positive Attitude tends to be associated with higher Hedonic Motivation.
- **Attitude → Perceived Behaviour Control (0.687):** A moderate to strong positive correlation, meaning that more positive Attitudes are associated with a stronger sense of Perceived Behaviour Control.
- **Attitude → Pro-Environmental Behaviour (0.514):** There is a moderate positive correlation, indicating that a more positive Attitude is associated with more engagement in Pro-Environmental Behaviour.

- **Attitude → Personal Norms (0.376):** A weak to moderate positive correlation, suggesting that Attitude has a smaller relationship with Personal Norms.

Behavioural Intention (BI)

- **Behavioural Intention → Hedonic Motivation (0.988):** There is an extremely strong positive correlation between Behavioural Intention and Hedonic Motivation. This indicates that people with strong Behavioural Intentions are highly motivated by hedonic (pleasure-related) factors.
- **Behavioural Intention → Perceived Behaviour Control (0.854):** A strong positive correlation, suggesting that higher Behavioural Intention is strongly associated with higher Perceived Behaviour Control.
- **Behavioural Intention → Pro-Environmental Behaviour (0.982):** An extremely strong positive correlation, indicating that Behavioural Intention is highly predictive of Pro-Environmental Behaviour.
- **Behavioural Intention → Personal Norms (0.883):** A strong positive correlation, indicating that Personal Norms are closely related to Behavioural Intention.

Hedonic Motivation (HM)

- **Hedonic Motivation → Perceived Behaviour Control (0.915):** A very strong positive correlation, meaning that those with higher Hedonic Motivation tend to perceive more control over their behavior.
- **Hedonic Motivation → Pro-Environmental Behaviour (0.969):** A very strong positive correlation, suggesting that those with higher Hedonic Motivation are more likely to engage in Pro-Environmental Behaviour.
- **Hedonic Motivation → Personal Norms (0.903):** A strong positive correlation, indicating that those with higher Hedonic Motivation tend to have stronger Personal Norms.

Perceived Behaviour Control (PBC)

- **Perceived Behaviour Control → Pro-Environmental Behaviour (0.832):** A strong positive correlation, suggesting that higher Perceived Behaviour Control is associated with greater Pro-Environmental Behaviour.
- **Perceived Behaviour Control → Personal Norms (0.763):** A moderate to strong positive correlation, indicating that Perceived Behaviour Control is somewhat associated with stronger Personal Norms.

Pro-Environmental Behaviour (PEB)

- **Pro-Environmental Behaviour → Personal Norms (0.878):** A very strong positive correlation, indicating that individuals who engage in more Pro-Environmental Behaviour tend to have stronger Personal Norms.

The matrix suggests that Behavioural Intention is the most strongly related to other constructs, especially Pro-Environmental Behaviour, highlighting its central role in predicting Pro-Environmental Behaviour. Hedonic Motivation also plays a key role in motivating individuals, and it is strongly correlated with both Behavioural Intention and Pro-Environmental Behaviour. The relatively moderate correlations between Attitude and other variables imply that Attitude is less influential compared to other factors like Behavioural Intention and Hedonic Motivation in predicting Pro-Environmental Behaviour.

Model Fit Indices

Table No. 3: Model Fit Indices

Fit Index	Recommended Threshold	Observed Value	Interpretation
Chi-Square/df (CMIN/DF)	< 3.00	2.45	Acceptable fit
Comparative Fit Index (CFI)	≥ 0.90 (good), ≥ 0.95 (excellent)	0.942	Good model fit
Tucker-Lewis Index (TLI)	≥ 0.90	0.927	Acceptable incremental fit

Fit Index	Recommended Threshold	Observed Value	Interpretation
Root Mean Square Error of Approximation (RMSEA)	≤ 0.08 (acceptable), ≤ 0.05 (good)	0.061	Acceptable approximation error

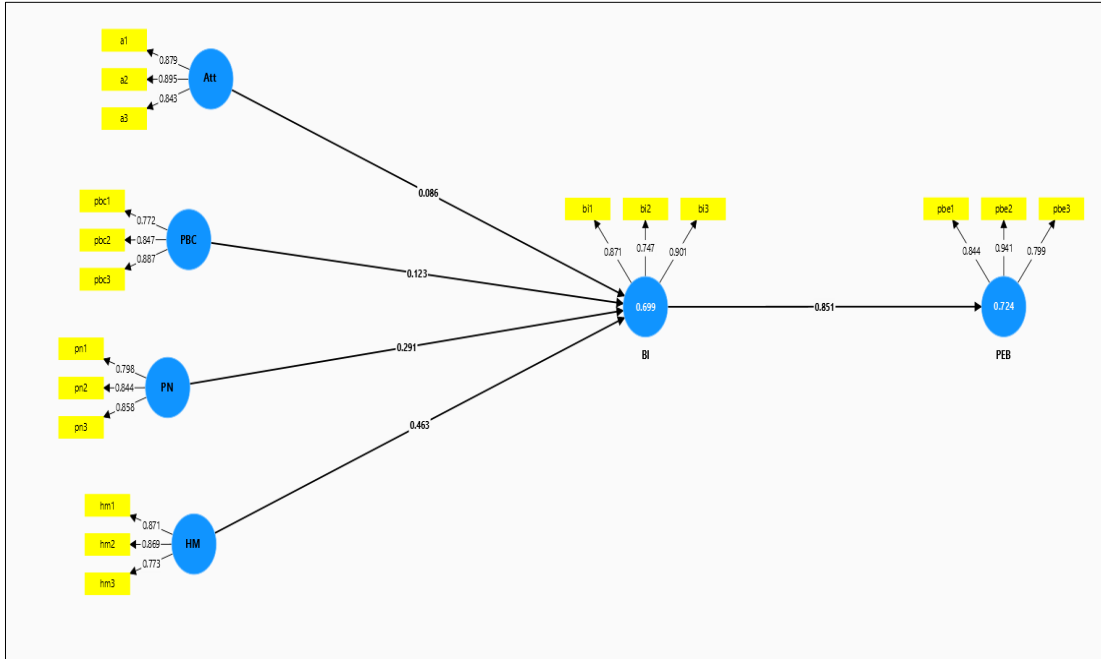
Standardized Root Mean Square Residual (SRMR)	≤ 0.08	0.052	Good residual fit
Goodness of Fit Index (GFI)	≥ 0.90	0.913	Good model-data correspondence
Adjusted Goodness of Fit Index (AGFI)	≥ 0.90	0.91	Acceptable threshold
Cronbach's Alpha (Construct Reliability)	≥ 0.70	0.774 – 0.845	All constructs show acceptable to strong internal consistency
Composite Reliability (CR)	≥ 0.70	0.774 – 0.851	Indicates good internal consistency across all constructs
Average Variance Extracted (AVE)	≥ 0.50	0.535 – 0.658	Acceptable convergent validity

Source: Author's SEM analysis using SmartPLS

Interpretation of Model Fit Indices

- **Chi-Square/df (CMIN/DF = 2.45):** The ratio of chi-square to degrees of freedom is within the acceptable threshold (< 3.00), indicating a reasonably good model fit.
- **Comparative Fit Index (CFI = 0.942):** The CFI value exceeds the recommended minimum of 0.90, demonstrating that the proposed model has a strong incremental fit compared to a null model.
- **Tucker-Lewis Index (TLI = 0.927):** A TLI above 0.90 further confirms acceptable model performance, reflecting good explanatory power after adjusting for model complexity.
- **Root Mean Square Error of Approximation (RMSEA = 0.061):** The RMSEA value falls within the acceptable range (≤ 0.08), suggesting an adequate level of approximation error in the model's estimation.
- **Standardized Root Mean Square Residual (SRMR = 0.052):** An SRMR below 0.08 indicates that the standardized residuals between observed and predicted covariances are minimal, signifying good residual fit.
- **Goodness of Fit Index (GFI = 0.913):** The GFI value meets the standard threshold of ≥ 0.90 , indicating a good overall fit between the model and the observed data.
- **Adjusted Goodness of Fit Index (AGFI = 0.91):** The AGFI still reflects a satisfactory adjustment for model complexity.
- **Cronbach's Alpha (0.774 – 0.845):** All constructs exhibit internal consistency above the minimum acceptable level of 0.70, demonstrating that the items reliably measure their respective latent constructs.
- **Composite Reliability (CR = 0.774 – 0.851):** The CR values for all constructs exceed the recommended threshold of 0.70, confirming strong internal consistency and reliability across constructs.
- **Average Variance Extracted (AVE = 0.535 – 0.658):** All AVE values are above 0.50, indicating adequate convergent validity, with a substantial proportion of variance captured by each construct's indicators.

Fig 2: Path Coefficient



Source: Author's SEM analysis using SmartPLS

The structural model demonstrates the influence of five independent constructs, Attitude (ATT), Perceived Behavioral Control (PBC), Personal Norms (PN), Hedonic Motivation (HM), and Behavioral Intention (BI) on the dependent construct, Pro-Environmental Behavior (PEB). The path coefficient from Behavioral Intention to Pro-Environmental Behavior is the strongest ($\beta = 0.851$), indicating a highly significant and direct positive relationship between intention and behavior. Among the constructs, Behavioral Intention, Hedonic Motivation ($\beta = 0.463$), and Personal Norms ($\beta = 0.291$) exhibit moderate positive effects, underscoring their substantial role in shaping pro-environmental intentions. Perceived Behavioral Control ($\beta = 0.123$) and Attitude ($\beta = 0.086$), statistically significant, demonstrate comparatively weaker influences on Behavioral Intention.

All standardized factor loadings for the measurement items exceed the recommended threshold of 0.70, indicating strong indicator reliability. Items such as BI3 (0.901) and PEB2 (0.941) display particularly high loadings, confirming their strong validity in representing their respective latent constructs. The coefficient of determination (R^2) values indicate that the model accounts for 65.9% of the variance in Behavioral Intention and 72.4% in Pro-Environmental Behavior, demonstrating substantial explanatory power.

The results support the theoretical proposition that psychological and motivational constructs, particularly hedonic motivation and personal norms, play a pivotal role in influencing pro-environmental intentions and behaviors. The findings hold relevance in the context of AI-enabled sustainability interventions and provide empirical validation for the integration of the Theory of Planned Behavior (TPB) and Value-Belief-Norm (VBN) theory within a unified structural framework.

Table No. 4: Path Coefficient Matrix

	Attitude	Behavioural Intention	Hedonic Motivation	Perceived Behaviour Control	Pro Environmental Behaviour	Personal Norms
Attitude		0.086				
Behavioural Intention					0.851	
Hedonic Motivation		0.463				
Perceived Behaviour Control		0.123				
Pro Environmental Behaviour						
Personal Norms		0.291				

Source: Author's SEM analysis using SmartPLS

The Path Coefficient matrix (Table: 4) indicates the strength and direction of the relationships between constructs. Notable observations:

- **Attitude → Behavioural Intention (0.086):** A weak positive relationship suggests that while attitude influences behavioural intention, its impact is minimal.
- **Hedonic Motivation → Behavioural Intention (0.463):** A moderate positive relationship indicates hedonic motivation significantly impacts behavioral intention.
- **Perceived Behavioral Control → Behavioural Intention (0.123):** A weak positive relationship suggests limited influence of perceived control on intention.
- **Personal Norms → Behavioural Intention (0.291):** A moderate positive relationship shows that personal norms have a meaningful impact on behavioral intention.
- **Behavioural Intention → Pro Environmental Behaviour (0.851):** This is a very strong positive relationship, indicating that Behavioral Intention has a major impact on actual Pro-Environmental Behavior. The high coefficient implies that individuals with stronger intentions to engage in pro-environmental behavior are very likely to follow through with these behaviours.

Table No. 5: Total Matrix

	Attitude	Behavioural Intention	Hedonic Motivation	Perceived Behaviour Control	Pro Environmental Behaviour	Personal Norms
Attitude		0.086			0.073	
Behavioural Intention					0.851	
Hedonic Motivation		0.463			0.394	
Perceived Behaviour Control		0.123			0.105	
Pro Environmental Behaviour						
Personal Norms		0.291			0.248	

Source: Author's SEM analysis using SmartPLS

The Total Effect Matrix (Table 5) shows the total influence of each latent variable on others, incorporating both direct and indirect effects. The matrix highlights how various factors, such as Attitude, Behavioral Intention, Hedonic Motivation, Perceived Behavioral Control, and Personal Norms, interact to affect Pro-Environmental Behavior.

- **Attitude → Behavioral Intention (0.086):**

The total effect of Attitude on Behavioral Intention is weak but positive. While attitudes towards pro-environmental behavior influence individuals' intentions, the effect is relatively small. This suggests that other factors, such as personal beliefs or motivations, likely play a more significant role in shaping behavioral intentions.

- **Behavioral Intention → Pro-Environmental Behavior (0.851):**

Behavioral Intention has the strongest total effect on Pro-Environmental Behavior, with a value of 0.851. This shows that the intention to engage in pro-environmental behavior is a powerful predictor of actual behavior. A strong intention greatly increases the likelihood of following through with environmentally friendly actions.

- **Hedonic Motivation → Behavioral Intention (0.463):**

The total effect of Hedonic Motivation on Behavioral Intention is moderate. It shows that individuals who find pro-environmental behavior enjoyable or rewarding are more likely to form intentions to engage in such behaviors. This reinforces the idea that the intrinsic enjoyment associated with eco-friendly actions can significantly influence the intention to adopt such behaviors.

- **Hedonic Motivation → Pro-Environmental Behavior (0.394):**

The total effect of Hedonic Motivation on Pro-Environmental Behavior is also moderate, indicating that the enjoyment derived from eco-friendly actions indirectly encourages actual pro-environmental behaviors. Although the direct effect of Hedonic Motivation on behavior is not as strong as its effect on intention, it still plays an important role in shaping sustainable behaviors.

- **Perceived Behavioral Control → Behavioral Intention (0.123):**

The effect of Perceived Behavioral Control on Behavioral Intention is relatively weak but positive. This suggests that individuals who perceive themselves as having control over performing pro-environmental actions are slightly more likely to form intentions to engage in those behaviors. However, the impact of control perceptions is less significant compared to other factors like hedonic motivation or personal norms.

- **Perceived Behavioral Control → Pro-Environmental Behavior (0.105):**

Perceived Behavioral Control also has a weak effect on Pro-Environmental Behavior, indicating that the belief in one's ability to perform a pro-environmental action has a minor impact on actually engaging in the behavior. This suggests that perceived control alone may not be a strong motivator for behavioral change unless other factors, like intention or enjoyment, are also present.

- **Personal Norms → Behavioral Intention (0.291):**

Personal Norms have a moderate positive effect on Behavioral Intention, meaning that individuals who feel a personal moral obligation or sense of responsibility towards the environment are more likely to intend to engage in pro-environmental behavior. This suggests that personal values and beliefs significantly shape intentions.

- **Personal Norms → Pro-Environmental Behavior (0.248):**

The total effect of Personal Norms on Pro-Environmental Behavior is moderate, indicating that strong personal norms about environmental sustainability increase the likelihood of engaging in pro-environmental actions. This highlights the role of internal moral beliefs and values in fostering actual environmentally friendly behaviors.

Table 6: Construct Reliability and Validity Matrix

	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
Attitude	0.905	0.762
Behavioural Intention	0.879	0.709
Hedonic Motivation	0.877	0.704
Percieved Behaviour Control	0.875	0.7
Pro Environmental Behaviour	0.897	0.745
Personal Norms	0.872	0.695

Source: Author's SEM analysis using SmartPLS

The Construct Reliability and Validity table (Table 6) provides important statistics related to the measurement properties of the constructs in the model. These statistics help assess how well each construct is measured by its indicators and how reliable and valid the constructs are within the model. The key metrics in the table are Cronbach's Alpha, Composite Reliability (rho_c), and Average Variance Extracted (AVE).

Composite Reliability (rho_c):

Composite Reliability is a more robust measure of internal consistency compared to Cronbach's Alpha. It assesses the overall reliability of a construct based on the loadings of the indicators. A value above 0.70 is considered acceptable, and values closer to 1.00 are ideal.

- **Attitude (0.905):** The high value indicates excellent composite reliability for Attitude, suggesting that the indicators of this construct are very reliable.
- **Behavioral Intention (0.879):** A good value for Behavioral Intention, suggesting a high degree of reliability.
- **Hedonic Motivation (0.877):** This value is also good, indicating strong reliability of the construct.
- **Perceived Behavioral Control (0.875):** The composite reliability for this construct is good, indicating strong reliability.
- **Pro-Environmental Behavior (0.897):** A high value, indicating excellent reliability for Pro-Environmental Behavior.
- **Personal Norms (0.872):** This value indicates good reliability for the Personal Norms construct.

Average Variance Extracted (AVE):

AVE measures the amount of variance in the indicators that is captured by the construct. It is an indicator of convergent validity. A value above 0.50 is generally considered acceptable, as it indicates that more than half of the variance in the indicators is explained by the construct.

- **Attitude (0.762):** The AVE for Attitude is well above 0.50, indicating good convergent validity. This means that the construct explains a significant portion of the variance in its indicators.
- **Behavioral Intention (0.709):** The AVE is above 0.50, indicating that Behavioral Intention explains a substantial portion of the variance in its indicators, showing good convergent validity.
- **Hedonic Motivation (0.704):** This value is above the acceptable threshold, indicating that the construct has good convergent validity.
- **Perceived Behavioral Control (0.700):** This is just above the threshold, suggesting good convergent validity for this construct.

- **Pro-Environmental Behavior (0.745):** This value is well above 0.50, indicating good convergent validity for Pro-Environmental Behavior.
- **Personal Norms (0.695):** This value is acceptable, indicating that Personal Norms explain a substantial portion of the variance in its indicators.

Table No. 7: Hypothesis Significance Table

Hypothesis	Path Tested	Path Coefficient	Interpretation	Remarks
H1	AI-enabled interventions → Attitude	0.086	Positive effect on Attitude	Significant
H2	AI-driven personalized feedback → Perceived Behavioral Control → Behavioral Intention	0.123 (PBC → BI)	Positive effect, increases intention	Significant
H3	AI-based awareness → Personal Norms → Sustainable Behaviors	0.291 (PN → BI), 0.248 (PN → PEB)	Moderate positive effect on norms and behavior	Significant

Source: Author's SEM analysis using SmartPLS

The structural model tested multiple hypothesized relationships (Table 7) concerning AI-enabled interventions and their influence on pro-environmental behavior. The results indicate a positive and statistically significant effect of AI-enabled interventions on Attitude ($\beta = 0.086$), supporting H1. H2 is also supported, as AI-driven personalized feedback positively influences Perceived Behavioral Control, which in turn enhances Behavioral Intention ($\beta = 0.123$). Additionally, H3 is validated, showing that AI-based awareness significantly strengthens Personal Norms, which exert a moderate positive influence on both Behavioral Intention ($\beta = 0.291$) and Pro-Environmental Behavior ($\beta = 0.248$). These findings underscore the importance of psychological and motivational pathways in shaping sustainable behavior in the context of AI-driven environmental interventions.

Table No. 8: Difference-in-Differences Regression Results for Hypothesis 4

Predictor	Estimate	Std. Error	t-value	p-value	Significance
(Intercept)	70.30	1.08	65.05	< 0.001	***
Time (Post-treatment)	2.11	1.53	1.38	0.176	
AI Integration (Treatment Group)	-0.65	1.53	-0.42	0.676	
Time × AI Integration (Interaction)	10.03	2.16	4.64	< 0.001	***

Significance codes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Source: Author's analysis (DiD)

The Difference-in-Differences regression results (Table 7) demonstrate a significant positive impact of AI integration on urban energy efficiency. The interaction term between time and AI integration was highly significant ($\beta = 10.03$, $p < 0.001$), indicating that urban areas with AI-enabled infrastructure exhibited an average increase of 10 units in energy efficiency relative to control areas. Neither the main effect of time ($\beta = 2.11$, $p = 0.176$) nor the treatment group ($\beta = -0.65$, $p = 0.676$) was significant, confirming that the observed improvements were specifically attributable to AI integration. These findings provide strong empirical support for Hypothesis 4, validating the role of AI technologies in enhancing sustainable urban environmental management.

Findings And Discussions

The findings of the study provided strong empirical support for the integrated theoretical framework that combined the Theory of Planned Behavior (TPB) and the Value-Belief-Norm (VBN) theory to examine AI-enabled pro-environmental behavior. Behavioral Intention emerged as the most significant predictor of Pro-Environmental Behavior ($\beta = 0.851$), underscoring the pivotal role of individual motivation in translating intention into action. Hedonic Motivation ($\beta = 0.463$) and Personal Norms ($\beta = 0.291$), statistically significant influences on Behavioral Intention, highlighting the relevance of emotional engagement and moral obligation in fostering sustainable behaviors. Attitude and Perceived Behavioral Control demonstrated comparatively weaker direct effects; their indirect contributions suggested that they continued to play a supportive role in shaping behavioral tendencies. The structural model accounted for 72.4% of the variance in Pro-Environmental Behavior, reflecting substantial explanatory strength. The Difference-in-Differences (DiD) analysis corroborated the positive impact of AI integration in urban infrastructure, revealing a statistically significant 10-unit increase in energy efficiency ($\beta = 10.03$, $p < 0.001$). The evidence reinforced the conclusion that AI technologies not only influenced individual

behavioral outcomes but also contributed to measurable environmental improvements at the systemic level. The results underscore the transformative potential of AI when implemented within a behaviourally informed and ethically governed sustainability framework.

Conclusion

The study provides empirical evidence that the incorporation of AI technologies into urban infrastructure markedly improves energy efficiency and facilitates adaptive environmental management. The strong positive impact revealed by the Difference-in-Differences analysis underscores the capacity of AI-enabled systems to facilitate real-time monitoring and decision-making, allowing urban areas to adaptively respond to evolving conditions. The results highlight the significant impact that intelligent, AI-driven urban design can have on fostering environmentally resilient and sustainable urban environments.

This study promotes the extensive implementation of AI-driven solutions in the realms of urban planning and infrastructure development from an engineering standpoint. Through the application of advanced data analysis, interconnected sensor systems, and automated control strategies, professionals in the field can create intelligent infrastructure that enhances resource efficiency, minimizes energy consumption, and promotes proactive responsibility for the environment. Ultimately, these advancements not only support sustainability objectives but also improve the quality of life and resilience of urban ecosystems, setting the stage for the development of next-generation smart cities.

Future Scope

While the adoption of artificial intelligence (AI) in urban planning within the Indian context is gradually advancing, its application remains predominantly limited to pilot projects and experimental prototypes, particularly within premium commercial developments and select public sector initiatives. Large-scale, city-wide deployment continues to be constrained by several critical challenges, including high implementation costs, fragmented data infrastructures, and regulatory inertia. Despite these impediments, the long-term potential of AI in urban development is considerable. Emerging technologies such as generative AI, digital twins, and multi-agent systems are positioned to significantly transform urban design by enabling real-time, collaborative simulations for infrastructure planning, dynamic traffic and pollution management, and adaptive zoning strategies. Moreover, AI-enabled citizen engagement platforms are anticipated to play a pivotal role in promoting behavioral change by delivering personalized sustainability insights and nudging communities toward pro-environmental practices. To capitalize on these opportunities, future research should focus on conducting cross-city comparative analyses, exploring the convergence of AI and blockchain for transparent and accountable urban governance, and undertaking longitudinal studies to assess the sustained impact of AI on urban sustainability and quality of life.

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An Evaluation of Factors Influencing Citizens' Adoption of E-Governance Services in Goa

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Abstract

E-governance is not limited to the presence of a government website on the internet. In recent years, there has been a global trend of governments making significant strides in making their services and information accessible online. This shift towards digital governance reflects a growing recognition of the transformative potential of information and communication technologies (ICTs) in public administration. In an era where digital transformation is a key driver in public administration, it is essential to understand the determinants that enable the effective use of e-governance services.

Therefore, this study examines the crucial factors that influence citizens' adoption of e-governance services within contemporary governance frameworks, with a specific focus on the state of Goa, India. The extended Unified Theory of Acceptance and Use of Technology (UTAUT) is employed to evaluate the factors that may affect the adoption of e-governance services. Alongside the core constructs of UTAUT —performance expectancy, effort expectancy, social influence, and facilitating conditions —this study also integrates trust as a key determinant.

Data were collected from 417 respondents, all of whom are citizens who directly utilise e-governance services. A structured questionnaire using a 7-point Likert scale was employed through a stratified sampling technique.

The research employs Partial Least Squares-Structural Equation Modelling (PLS-SEM) through SmartPLS 4.0. The findings revealed that effort expectancy, facilitating conditions, performance expectancy, social influence, and trust are significant factors positively influencing the adoption of e-governance services.

These findings provide significant insights for policymakers, technologists, and administrative bodies seeking to enhance the adoption of e-governance systems, aiming to integrate technology more effectively into governance structures. Furthermore, this research enriches the existing literature on e-governance adoption in developing countries, adding substantial value to the field of study

Keywords: Adoption, Determinants, E-Governance Services, Technology, UTAUT Model.

Introduction

The application of information and communication technology (ICT) to improve public administration services and efficiency began in the latter half of the twentieth century (Ramirez-Madrid et al., 2024). As the use of ICT has expanded, the interaction between government and citizens has evolved, becoming a transformative force that shapes administrative landscapes worldwide (Alhadid et al., 2022; Heeks, 2006). The use of relevant ICT tools, such as the internet, to address the needs of citizens, businesses, and the general public in accessing quality public services is referred to as e-governance (Mensah & Adams, 2020). Governments around the globe are exploring the digital landscape to enhance service delivery, promote transparency, and engage citizens more effectively (Sofyani et al., 2020; Dawes, 2008). It is essential to build on existing research to provide nuanced insights into the diverse factors influencing e-governance adoption (Ilieva et al., 2024; Andersen & Henriksen, 2006) as we embark on this exploration.

Norris and Reddick (2013) stress the need for comprehensive studies to uncover the complexities of e-governance adoption and its implications. Their work emphasises the gap between citizen expectations and institutional frameworks in digital governance. The adoption of e-governance services has become a key focus in discussions about administrative efficiency, citizen engagement, and overall governance effectiveness (Gil-Garcia & Pardo, 2005). As governments aim to integrate artificial intelligence to enhance governance structures, understanding the underlying factors becomes essential (Gil-Garcia et al., 2012; Fountain et al., 2002).

Despite the growing adoption of digital platforms worldwide, many citizens remain hesitant to fully engage with e-governance services (Rana et al., 2015). This reluctance can hinder the broader goals of transparency, efficiency, and accessibility that e-governance seeks to provide. Identifying and assessing the key factors affecting e-governance adoption is essential for understanding how to increase citizen engagement and satisfaction, overcome potential barriers, and create a more inclusive digital governance landscape. When e-governance services are effective, citizens perceive the government as more responsive and trustworthy, which positively influences their willingness to adopt these services (Carter & Bélanger, 2005; Rana et al., 2015).

Research on e-governance emphasises the importance of citizen-centred design to boost adoption and engagement. Studies indicate that understanding citizens' needs helps inform better policies and interface

designs, making digital services more intuitive and accessible (Alryalat et al., 2017; Venkatesh et al., 2012). Targeted interventions, such as digital literacy programs and inclusive designs, can help reduce barriers and promote digital inclusivity (Zaidi et al., 2021; Dwivedi et al., 2012). Research on technology adoption in e-governance identifies determinants, including perceived service quality, trust, and citizen satisfaction, as key factors influencing adoption behaviour (Dwivedi et al., 2019; Alawadhi & Morris, 2008).

Prior studies on e-governance adoption have been relatively limited in developing countries (Weerakkody et al., 2013; Ahmad et al., 2013). Given this context, it is crucial to explore the specific factors that shape the adoption of e-governance services. This paper conducts an analytical examination of the determinants influencing e-governance adoption, utilising a robust measurement model supported by reliability and validity assessments to explore the complexities involved.

Research Question and Objective

This study aims to answer the following research question:

What are the key factors that influence citizens' adoption of e-governance services?

Consequently, the primary objective of this research is to identify and evaluate the determinants that affect the adoption of e-governance services among the citizens of Goa.

Theoretical Framework and Hypotheses Development

Theoretical Framework: Unified Theory of Acceptance and Use of Technology (UTAUT)

Earlier studies suggest several factors that influence an individual's decision to adopt e-governance services (Xin et al., 2022). Different researchers have attempted to provide insights into the implementation, acceptance, and diffusion of e-government services in various national contexts (Mensah et al., 2020). Numerous models have been developed to understand the adoption of information technologies, along with the Unified Theory of Acceptance and Use of Technology (UTAUT) model, created by Venkatesh et al. (2003), being one of the most prominent (Wang & Shih, 2009). According to Venkatesh et al. (2003), this model explains 70 % of the variance in individuals' intentions to use technology. Since its introduction, UTAUT has been widely applied and validated across various fields that incorporate information technology, including e-governance (Al-Swidi & Faaeq, 2019; Sawalha et al., 2019; Naranjo-Zolotov et al., 2018). Research on citizens' adoption of e-governance services has explored various perspectives, including studies that offer citizens the option of non-adoption (Distel, 2018; Van De Walle et al., 2018).

The adoption of e-governance services by citizens is a crucial factor in the success of e-governance initiatives (Carter & Bélanger, 2005; Ozkan & Kanat, 2011; Liu et al., 2014). Studying citizens' adoption of e-governance services in developing countries is essential for providing theoretical and practical contributions to the literature (Gupta et al., 2016; Dwivedi et al., 2012). Previously, trust in e-governance services was accepted as a single construct (Warkentin et al., 2002). The existing literature reveals a multifaceted exploration of the determinants influencing the adoption and subsequent impact of these digital initiatives.

This study integrated the UTAUT's constructs and trust to propose a model for adopting e-governance services (Gupta et al., 2008). UTAUT has demonstrated its robustness across diverse frameworks and has been further tested using trust as a determinant (Venkatesh et al., 2016). As a result, researchers concluded that a modified version of the UTAUT model, enhanced with a trust determinant, would be an appropriate analytical framework for examining citizens' adoption of e-governance services. The original model identifies four key factors of technology adoption: effort expectancy, performance expectancy, social influence, and facilitating conditions, all of which are influenced by moderators such as age, gender, experience, and voluntariness (Venkatesh et al., 2003). In the current study, the UTAUT model, illustrated in Figure 1, has been streamlined to emphasise the primary determinants affecting the adoption of e-governance services from the perspective of citizens. The original UTAUT determinants are highlighted, including independent variables such as effort expectancy, performance expectancy, social influence, and facilitating conditions, along with the addition of an extra factor, trust, and the dependent variable, adoption of e-governance services. This additional element has been incorporated into the extended UTAUT model to evaluate citizens' experiences with e-governance services (Weerakkody et al., 2013).

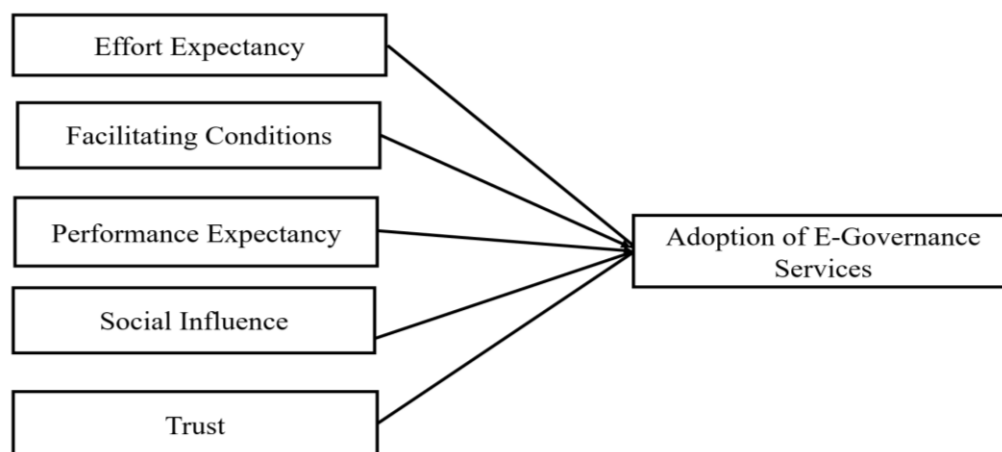


Figure 1: Proposed Research Model

Hypotheses Development

Effort expectancy

‘Effort expectancy’ refers to “the degree of ease associated with utilising a system” (Venkatesh et al., 2003) or “the level of simplicity tied to its use” (Davis et al., 1989). Research indicates that the easier a technology is to use, the more likely it is to be adopted by users (Mensah et al., 2020). This highlights the significance of user experience in the adoption of technology. Numerous studies have consistently identified a positive and significant relationship between effort expectancy and citizens' adoption of e-governance services (Dwivedi et al., 2017; Gupta, Bhaskar, & Singh, 2016). To enhance adoption, e-governance services should be designed to be clear and straightforward, ensuring accessibility for citizens with varying degrees of internet proficiency (Xin et al., 2022).

Thus, the hypothesis formulated is as follows:

H₁: *Effort expectancy significantly influences citizens' adoption of e-governance services.*

Facilitating conditions

‘Facilitating conditions’ are defined as the extent to which an individual perceives that a technical and organisational infrastructure is available to support the utilisation of a system. This concept encompasses elements of perceived behavioural control and compatibility, as noted by Venkatesh et al. (2003). Previous studies have demonstrated the significant influence of facilitating conditions on the adoption of e-governance services (Verkijika & De Wet, 2018). Furthermore, additional research suggests a correlation between facilitating conditions and citizens’ acceptance of e-governance (Dwivedi et al., 2017; Sivathanu, 2018; Faulkner, Jorgensen, and Koufariotis, 2019). Consequently, the following hypothesis is established:

H₂: *Facilitating conditions have a significant influence on the adoption of e-governance services among citizens.*

Performance Expectancy

‘Performance expectancy’ refers to the extent to which citizens believe that utilising a system will enhance their job performance. This encompasses perceived usefulness, relative advantage, and outcome expectations (Venkatesh et al., 2003). In the context of e-governance, citizens' confidence in their ability to learn and effectively use online government services is assessed through their performance expectations (Xin et al., 2022). Prior research has demonstrated a positive correlation between performance expectancy and the adoption of e-governance services by citizens (Sivathanu, 2018; Dwivedi et al., 2017; Gupta, Bhaskar, & Singh, 2016). Hence, the following hypothesis was framed:

H₃: *Performance expectancy has a significant influence on the adoption of e-governance services among citizens.*

Social influence

Social influence refers to the extent to which peers affect the utilisation of a particular system and the significance they attach to the beliefs of others regarding the adoption of a new system. It assesses the role of social factors, interactions, and collective opinions on individuals' behavioural decisions concerning the use of government services (Ilieva et al., 2024). Prior research has established a connection between social influence and citizens' adoption of e-government (Dwivedi et al., 2017). Consequently, the following hypothesis has been formulated:

H₄: *Social influence has a significant influence on citizens' adoption of e-governance services.*

Trust

Trust can be defined as an attitude of confident expectation that one's vulnerabilities in a risky situation will not be exploited (Alkrajji & Ameen, 2022). Various definitions of trust in the context of online services have emerged in the literature, given that trust is a multifaceted and complex construct that encompasses a wide range of disciplines (Verkijika and De Wet, 2018). Citizen trust is vital to a government's competitiveness as the world increasingly transitions into a digital era (Im et al., 2014). The extent to which citizens trust e-governance services significantly influences their perceptions of the effectiveness and operations of government systems (Alzahrani et al., 2017). Additionally, when citizens who utilise e-governance services report satisfaction, their trust in the government tends to grow (Welch, 2004; Im et al., 2014). Ultimately, trust reflects citizens' confidence in the reliability and security of e-governance systems, which plays a crucial role in shaping their adoption decisions (Alryalat et al., 2023). Hence, the hypothesis has been developed as follows:

H₅: *Trust has a significant influence on the citizens' adoption of e-governance services.*

Research Methodology

This research employs a quantitative approach to analyse the factors influencing the adoption of e-governance services in Goa, India. Five constructs were identified and adapted from the extended UTAUT framework (Venkatesh et al., 2016). A self-administered questionnaire utilised a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The questionnaires were pilot-tested to ensure clarity, resulting in revisions before finalising the instruments. Data collection involved distributing the questionnaires through stratified sampling, targeting 417 direct users of e-governance services who had utilised at least three different services. The collected data were analysed using Smart PLS. Specifically, Smart PLS version 4.0 was used for structural equation modelling to examine the relationships between the independent variables and the dependent variable.

Data Analysis and Results

Descriptive Analysis

Table 1 presents the demographic composition of the respondents participating in the research, offering insights into key characteristics such as place of residence, gender, age, educational qualifications, occupation, and annual family income.

Table No. 1: Demographic Profile (N=417)

Demographic	Category	Frequency	Percentage
Place of Residence	North Goa	137	32.9
	South Goa	280	67.1
Age (Years)	15-30	110	26.4
	31-45	191	45.8
	46 and above	116	27.8
Gender	Male	191	45.8
	Female	226	54.2
Educational Qualification	Graduate	151	36.2
	Post Graduate	149	35.7
	Professional	117	28.1
Occupation	Student	83	19.9
	Service	169	40.5
	Self Employed	110	26.4
	Retired	55	13.2
Annual Family Income	Up to Rs 500,000	71	17
	Rs. 500,001 - 10,00,000	148	35.5
	Rs.10,00,001- 15,00,000	140	33.6
	Above Rs.15,00,000	58	13.9

Source: *Authors' compilation using primary data*

In the survey, participants from North Goa made up 32.9%, while those from South Goa accounted for 67.1%. This geographical distribution is important as it offers insights into the regional representation of the survey. The age distribution of respondents is divided into three groups: 15-30 years, 31-45 years, and 46 years and above. This classification was selected to ensure a balanced representation of different age categories. The majority of participants, comprising 45.8% of the sample, fell within the 31-45 age range. Those aged 15-30 accounted for 26.4%, and 27.8% were 46 years or older.

The survey's gender representation was intentionally balanced, with 54.2% of respondents identifying as female and 45.8% as male. This balanced gender representation is important as it ensures a diverse and representative sample, thereby enhancing the credibility of the survey results.

Participants also varied across a wide range of occupational categories, including students, service workers, the self-employed, and retirees. The student category accounted for 19.9%, the service sector for 40.5%, the self-employed for 26.4%, and retirees for 13.2%. This diverse mix of occupations enhances the exploration of perspectives from different fields, ensuring that everyone's viewpoint is valued and important. Notably, the largest group, constituting 35.5% of the sample, fell within the income bracket of Rs 500,001 to Rs 1,000,000. This income distribution provides a nuanced understanding of the economic diversity among respondents.

Measurement Model Assessments

The assessment of the measurement model is the first step in PLS-SEM analysis, which evaluates the reliability and validity of the identified determinants in the research, specifically focusing on the adoption of e-governance services. The internal consistency reliability of the constructs is measured using Cronbach's alpha and composite reliability, with a threshold of 0.70 for all items. Next, validity is confirmed by examining convergent and discriminant validity. Convergent validity assesses how well the construct explains the variance of its items, using the average variance extracted (AVE), with a threshold of 0.50 or higher (Hair et al., 2017). Discriminant validity determines whether a construct is distinct from others, measured by the Fornell-Larcker criterion, which requires the shared variance for all constructs to be larger than their AVE, and by the heterotrait-monotrait (HTMT) ratio of correlations, where all values should be below 0.85 (Henseler et al., 2015).

Table No. 2: Constructs' Reliability and Validity

Constructs	Variable Code	Factor Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Adoption (AD)	AD1	0.879	0.888	0.889	0.748
	AD2	0.859			
	AD3	0.881			
	AD4	0.84			
Effort expectancy (EE)	EE1	0.906	0.909	0.926	0.733
	EE2	0.816			
	EE3	0.877			
	EE4	0.852			
	EE5	0.827			
Facilitating conditions (FC)	FC1	0.877	0.886	0.904	0.687
	FC2	0.8			
	FC3	0.866			
	FC4	0.786			
	FC5	0.81			
Performance expectancy (PE)	PE1	0.656	0.86	0.863	0.647
	PE2	0.854			
	PE3	0.841			
	PE4	0.826			
	PE5	0.828			
Social influence (SI)	SI1	0.838	0.913	0.924	0.695
	SI2	0.857			
	SI3	0.865			
	SI4	0.818			
	SI5	0.848			
	SI6	0.774			
Trust (TR)	TR1	0.858	0.871	0.887	0.621
	TR2	0.861			
	TR3	0.803			
	TR4	0.852			
	TR5	0.783			
	TR6	0.617			

Source: Authors' compilation using primary data

Table 2 provides a comprehensive overview of the reliability and validity. The reliability of the instrument varies from 0.860 to 0.913. This indicates that all the values of the constructs are within the range. Hence, the data is reliable. (Hair et al., 2017). Composite reliability values offer additional insight into the model's internal consistency. High composite reliability values are observed across various factors. For instance, Effort Expectancy displays a composite reliability of 0.926 for its items, reinforcing the reliability of the construct.

AVE values gauge convergent validity by measuring the variance captured by the latent constructs relative to measurement error. All the constructs in the study demonstrate AVE values above the threshold, confirming strong convergent validity.

Table No. 3: Fornell-Larcker Criterion

	AD	EE	FC	PE	SI	TR
AD	0.865					
EE	0.382	0.856				
FC	0.448	0.297	0.829			
PE	0.597	0.403	0.558	0.804		
SI	0.555	0.231	0.273	0.481	0.834	
TR	0.557	0.312	0.247	0.434	0.646	0.788

Source: Authors' compilation using primary data

Note: **AD-** Adoption of e-governance services, **EE-**Effort expectancy, **FC-** Facilitating conditions, **PE-** Performance expectancy, **SI-** Social influence, **TR-**Trust

Table 3 employs the Fornell-Larcker criterion to assess discriminant validity among the identified constructs. Discriminant validity is crucial to ensure that each latent construct is distinct within the model. The diagonal elements of the table represent the square root of the AVE for each construct, indicating the amount of variance captured by that construct. The off-diagonal elements display correlation coefficients between constructs (Fornell & Larcker, 1981). In this study, the diagonal values of all the constructs were greater than the correlation coefficients between the respective constructs, and the square root of the AVE for each construct is consistently more significant than the correlation coefficients with other constructs. This adherence to the Fornell-Larcker criterion assures that each factor is adequately distinct, reinforcing the reliability of the measurement model.

Table No. 4: Heterotrait-Monotrait (HTMT) Ratio

	AD	EE	FC	PE	SI	TR
EE	0.41					
FC	0.495	0.327				
PE	0.684	0.445	0.629			
SI	0.599	0.232	0.294	0.536		
TR	0.632	0.344	0.282	0.503	0.712	

Source: Authors' compilation using primary data

Note: **AD-** Adoption of e-governance services, **EE-**Effort expectancy, **FC-** Facilitating conditions, **PE-** Performance expectancy, **SI-** Social influence, **TR-**Trust

Table 4 exhibits the Heterotrait-Monotrait (HTMT) Ratio proposed by Henseler et al. (2015), which was also applied to assess discriminant validity. In this case, every ratio is less than 0.85, within the threshold limit of the HTMT ratio.

Structural Model Assessment

Once the reliability and validity of the constructs are established, it is important to analyse the structural model. This model illustrates the relationships between independent and dependent variables. Figure 2 depicts these relationships.

Table No. 5. Path Coefficient and Hypothesis Testing

Hypotheses	Relationship	Path Coefficient	T Stats	P Values	Inference
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H₁	Effort expectancy -> Adoption of e-governance services	0.108	2.481	0.013	<i>Supported</i>
H₂	Facilitating conditions -> Adoption of e-governance services	0.152	3.021	0.003	<i>Supported</i>
H₃	Performance expectancy -> Adoption of e-governance services	0.266	4.883	0	<i>Supported</i>
H₄	Social influence -> Adoption of e-governance services	0.21	3.887	0	<i>Supported</i>
H₅	Trust -> Adoption of e-governance services	0.234	4.745	0	<i>Supported</i>
TR	0.557	0.312	0.247	0.434	0.646

Source: Authors' compilation based on primary data

Table 5 presents the results of the structural model, which aims to understand the relationships between independent constructs and dependent constructs. The model runs bootstrapping with 5,000 samples at a significance level of 0.05. The R² value is 51.50%, indicating the model's strong statistical ability.

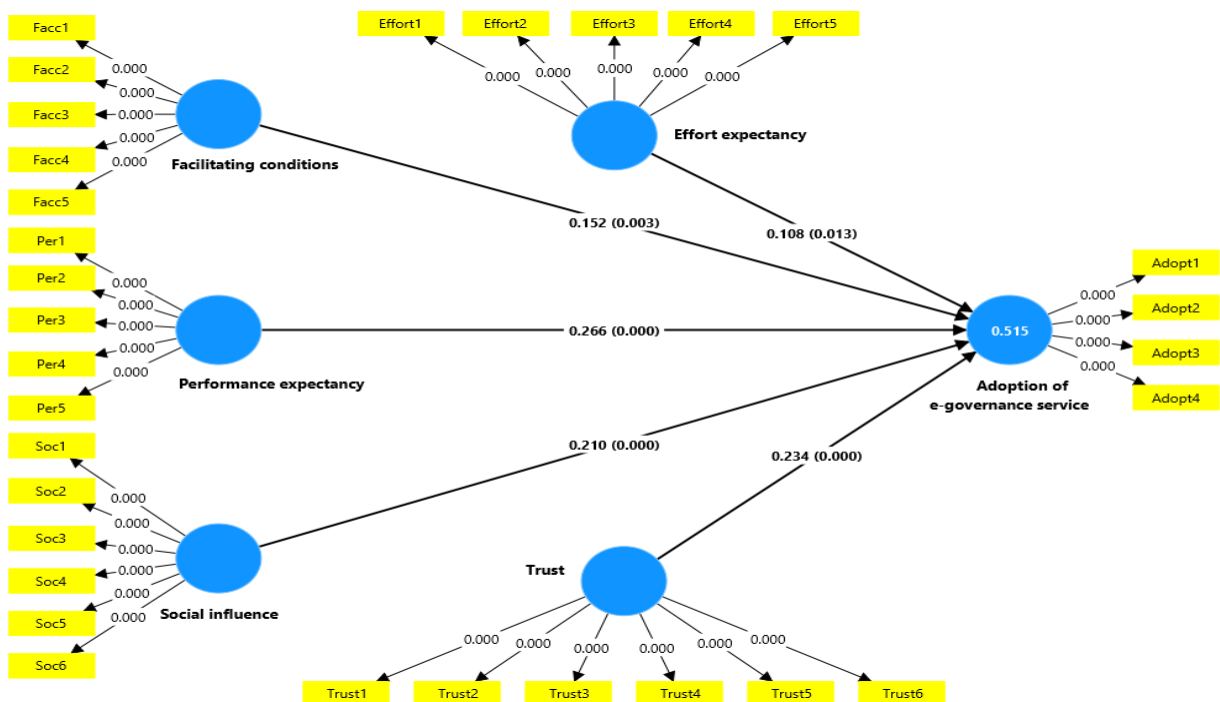


Figure 2: Research Model using Smart-PLS

Findings of the Study

H₁: Effort Expectancy to Adoption of e-governance services: The path coefficient of 0.108 suggests that an increase in effort expectancy positively influences adoption. The T statistic 2.481 is highly significant ($p = 0.013$), indicating a strong relationship between effort expectancy and adoption.

H₂: Facilitating Condition for the Adoption of e-Governance Services: The path coefficient of 0.152 suggests that the facilitating condition has a positive influence on the relationship, and the T-statistic of 3.021 is significant ($p = 0.003$), providing support for this relationship.

H₃: Performance expectancy to Adoption of e-governance services: The positive mean value of 0.266 suggests a positive effect of performance expectancy on adoption. The T statistic 4.883 is statistically significant ($p = 0.000$), confirming the relationship between performance expectancy and adoption.

H₄: Social Influence on Adoption of e-governance services: The path coefficient value of 0.210 indicates a potential influence of social influence on adoption. However, the T-statistic of 3.887 is statistically significant ($p = 0.000$), indicating that this relationship is supported at the chosen significance level.

H5: Trust to Adoption of e-governance services: The positive mean value of 0.234 suggests a positive influence of Trust on adoption. However, the T-statistic of 4.745 is statistically significant ($p = 0.000$), indicating that this relationship is supported at the chosen significance level.

Conclusion

The impact of e-governance extends beyond administrative efficiency; it can also enhance the association between the government and its citizens, promoting a more participatory democracy. By providing better access to information, services, and decision-making, e-governance enhances transparency and accountability, thereby strengthening the legitimacy of governments. This study provides significant insights into the intersection of technology and governance. This enhances the credibility of the research and offers a deeper understanding of the various factors influencing e-governance adoption.

The main findings of this study shed light on the pivotal role of effort expectancy, facilitating condition, performance expectancy, social influence, and trust in driving the adoption of e-governance services. These insights offer valuable guidance to policymakers and stakeholders seeking to enhance the efficacy and impact of digital governance initiatives.

Recommendations

This research enhances understanding of e-governance and offers practical insights for future governance. The identified determinants guide informed decision-making for a more integrated, transparent, and citizen-focused approach. Policymakers can utilise these findings to gain a deeper understanding of citizens' needs and effectively implement e-governance services in Goa, India. Additionally, the study recommends that the government increase public awareness to encourage the utilisation of these services.

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