



**WISDOM  
PUBLISHERS**



**WISDOM  
MANAGEMENT  
JOURNAL (WMJ)**



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# Welcome to the Inaugural Issue of Wisdom Management Journal

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We extend a warm welcome to the first edition of the *Wisdom Management Journal* on behalf of our authors, reviewers, editorial board, editorial team, and supporting institutions.

## Welcome Editorial: Inspiring a New Dialogue in Management Thinking

It is with immense pride and excitement that we present to you the very first issue of the **Wisdom Management Journal**. Today marks not just the launch of a new publication, but also the beginning of a scholarly journey dedicated to excellence in management research. As we unveil this peer-reviewed, open-access platform, we invite scholars, practitioners, educators, and students to participate in a community that believes in the power of knowledge, critical inquiry, and collaborative growth.

## The Significance of a Management Journal in Today's World

In an era in which change is rapid and uncertainty is constant, the role of sound management principles has never been more critical. Organisations around the world—whether multinational corporations or local start-ups, public institutions or private enterprises—face complex challenges. These range from technological disruptions and shifting consumer behaviour to global crises and environmental sustainability. In such a dynamic landscape, a journal dedicated to the dissemination of cutting-edge management knowledge becomes not just relevant, but essential. Academic journals serve as a scaffolding for intellectual progress. They validate, critique, refine, and circulate research that has the potential to shape policies, optimise practices, and guide decision making. In management, where theory and practice are deeply intertwined, the function of a scholarly journal extends beyond academia. It has become a bridge connecting thought leaders with practitioners and researchers in real-world problems.

## Why Launch Now?

The idea of launching *Wisdom Management Journal* in the present moment is both timely and strategic. We live in a period marked by digital transformation, socioeconomic realignments, and evolving organisational paradigms. Traditional management models are being questioned and revisited. Remote work, gig economies, AI-driven decisions, sustainable supply chains, and diversity in leadership are no longer peripheral discussions; they are central to how businesses operate today.

Amidst this flux, there is a pressing need for fresh perspectives, multidisciplinary research, and contextual insights to inform practice and policy. However, despite the explosion of data and the democratisation of information, there still exists a gap in access to high-quality, peer-reviewed knowledge—especially in emerging economies and among early-career researchers. By offering an open-access platform with a commitment to academic rigor, we aim to fill this gap and become a reliable resource for those seeking wisdom in management.

## Our Vision

At the core of *the Wisdom Management Journal* is the belief that knowledge, when shared wisely and applied responsibly, has the power to transform organisations and society. Our vision is to establish a journal that is inclusive, interdisciplinary, and globally relevant. We strive to become a vibrant space where diverse voices—seasoned researchers, young scholars, industry experts, and policy influencers—come together to address the pressing management issues of our time.

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We believe that "wisdom" in management is not merely about data or insight, but about the judicious use of both. It is about recognising patterns, learning from failures, adapting theories to context, and balancing long-term goals with short-term realities. Through this journal, we hope to cultivate a discourse that is not only intellectually rigorous, but also ethically grounded and socially responsible.

## Objectives of the Journal

Our key objectives are:

1. **To Disseminate High-Quality Research:** We aim to publish original, innovative, and value-added content that contributes new knowledge to the field of management. Studies that offer actionable insights and challenge existing paradigms will be given priority.
2. **To Foster Interdisciplinary Dialogue:** Management intersects with economics, psychology, sociology, technology, and more. We encourage submissions that explore these intersections and open new avenues for understanding.
3. **To Promote Access and Equity in Scholarship:** As an open-access journal, we are committed to breaking down paywalls and ensuring that knowledge is accessible to all, irrespective of geography, institutional affiliation, or economic background.
4. **To Encourage Diverse Methodologies:** From qualitative narratives and ethnographies to complex statistical modelling and digital simulations, we welcome a wide range of methodological approaches that can enrich the study of management.
5. **To support early career researchers,** we aim to provide a supportive and constructive peer-review process that not only evaluates but also evaluates mentors and nurtures budding scholars.

## How It Will Help Researchers

We understand that researchers today face increasing pressure to publish, stay relevant, and meaningfully contribute to both academia and practice. *Wisdom Management Journal* seeks to support researchers in the following ways.

- **Visibility and Reach:** As an open-access journal, your work will be freely accessible worldwide, increasing its visibility, reach, and impact.
- **Timely Publication:** We are committed to an efficient review and publication process, ensuring that high-quality work reaches the audience without undue delays.
- **Peer Review and Mentorship:** Our double-blind peer review process ensures fairness and quality, while our editorial team is committed to providing constructive feedback that helps authors refine their work.
- **Recognition and Indexing:** We are actively working towards inclusion in major indexing services to enhance the credibility and discoverability of the research we publish.

## Frequency of Publication

*The Wisdom Management Journal* will be published **quarterly**, with four issues released each year, in **April, July, October, and January**. Special issues may also be considered on emerging themes or to highlight proceedings from conferences and symposia. This frequency allows us to maintain high editorial standards while also responding to the evolving nature of management research.

## Coverage of Research Areas

True to our inclusive vision, we invite contributions across a wide spectrum of management disciplines, including but not limited to

- Entrepreneurship
- Team Building and Leadership
- Marketing and Consumer Behaviour
- Organisational Culture

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- Project and Supply Chain Management
  - Small Business and Innovation
  - Human Resource Management
  - Strategic and Knowledge Management
  - Digital Technologies in Management
  - Sustainability and Corporate Responsibility

We welcome diverse forms of submission, including **original research articles**, **case studies**, **short communications**, and **comprehensive review articles**. Studies grounded in theory, enriched by data, and aimed at real-world relevance are particularly encouraged.

### **In Conclusion**

Launching a journal is more than a publishing venture; it is a pledge to academic integrity, a commitment to intellectual progress, and an invitation to collective inquiry. With the *Wisdom Management Journal*, we are setting out to create a platform that values curiosity, critical thinking, and collaborative wisdom.

We extend our deepest gratitude to the editorial board, reviewers, contributors, and readers who have supported us in this endeavour. To all future authors and readers—*welcome*. This is your journal, your platform, and your community.

Let us, together, embark on this journey of discovery, dialogue, and wisdom.

Dr. A. Ganasoundari, PhD

### **Editor-in-Chief**

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Assistant Professor  
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Bangalore University, Bengaluru  
E-mail: dr.chanakyacn@bub.ernet.in

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RESEARCH ARTICLE

## Investigating the impact of tourism as a subject on primary educational curriculum

**Anirudh Raina\***

PhD Scholar, School of Hospitality and Tourism Management, University of Jammu, Jammu Tawi (J&K)

**Abstract:** The conventional educational system in India has significant limitations while addressing the key issues of tourism. Presently, the tourism subject is mainly introduced at the higher education level. To improve the current situation of tourism industry in India, it is important to educate the students about the power of tourism and how it plays crucial role in the development of the country's economy. India has the inherent capacity to evolve into a prominent tourism hub, with a distinct range of attractions. In this work, quantitative research design is adopted with purposive sampling in order to investigate the various factors related to tourism and its impact at primary education level. This study includes 106 respondents such as teachers (54) and students (52) from Jammu and Kashmir (UT) who belong to University of Jammu and University of Kashmir survey questionnaire is used to collect data which is analysed statistically using SPSS. This study also highlights the various aspects of tourism which directly or indirectly involved in the development of individual's growth by adopting the tourism in their education curriculum. Findings revealed that 94% of the respondents were strongly believed that tourism education has positive impact on students and must be include as a subject in primary education curriculum to meet the challenges of tourism sector and better economic growth. Finally, this paper shed light on the opportunities and challenges associated with the introducing tourism at school level and suggest some recommendations for policymakers.

**Keywords:** Educational curriculum, Primary education, Sustainable tourism, Tourism industry, Tourism

### Introduction

India has great potential to develop the tourism sector which helps the nation to become a favoured destination for foreign tourists. Tourism refers to the activities undertaken by individuals who travel and temporarily reside in locations outside their regular environment for a duration not exceeding one consecutive year. These activities encompass various purposes, including leisure, business and other non-work-related objectives that are not associated with the economic activities conducted within the destination (Mamhoori, 2015). As a socio-economic endeavour, tourism has witnessed significant development and it has emerged as one of the biggest and most rapidly expanding industries globally (Reddy, 2008). Tourism has been categorised into various subcategories, including sports tourism, nature tourism, leisure tourism, corporate tourism, backpacker tourism, extreme tourism, hobby tourism, book-store tourism, cultural tourism, music tourism, heritage tourism, coastal tourism, garden tourism, health tourism, medical tourism, rural tourism, pilgrimage tourism and ecotourism (Arismayanti, 2019). To understand the various aspects of tourism, it is important to inculcate tourism in primary education. Education has a fundamental role in the development of a civilisation. The incorporation of tourism within the educational system is a crucial measure towards progress. The inclusion of tourism as a mandatory

\*Corresponding author: School of Hospitality and Tourism Management, University of Jammu  
e-mail: araina534@gmail.com

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component within the education program is a progressive initiative that has the potential to provide a variety of advantages for students to understand the responsibilities of a host country (Cárdenas et al., 2015; Hsu, 2018). In the present educational landscape of India, tourism is not accorded substantial importance and the curriculum lacks emphasis on the significance of tourism in general. The incorporation of tourism as an academic discipline within the curriculum aims to provide students with a comprehensive understanding of the tourism sector, rather than only focusing on participation in a specific activity. This enables individuals to understand the overall importance of the tourism industry and helps to improve the residents' behaviour and perception towards the visitors (Kumar et al., 2023). The fundamental hypothesis presented by the researcher is that the inclusion of tourism as a distinct and significant field of study within the educational curriculum of primary school children offers a viable and enduring resolution to the numerous challenges confronting the Indian tourism industry. The present study aims to understand the impact of tourism as a subject on primary education in India. This helps to examine the various challenges associated with tourism in India and the present scenario of education in India. Finally, this study also highlighted the importance of tourism education to meet the tourism industry challenges.

In this work, a quantitative approach was adopted to understand the prospective of teachers and students associated with the tourism sector. This study helps to understand the real challenges and impact of including tourism education at the primary school level. The rest of the paper deals with the existing work with respect to tourism education in the second section. The third section discusses the methodology adopted for this work. The fourth section provides the analysis of the collected data. Finally, the fifth section presents the conclusion and the suggestions for future endeavours.

## **Review of Literature**

In this literature review, we examine the existing work based on tourism, tourism education, challenges related to the tourism industry.

Tourism is a pivotal industry within the Indian economy, holding significant importance. According to Sah, the tourism industry in India has had a consistent growth rate of 11% per year since 2013. Additionally, it plays a significant role in the nation's economy, contributing 10% to the GDP and employing 9% of the total workforce (Sah, 2014). There is a positive correlation between greater levels of education and the propensity for individuals to spend on tourist activities. Research findings indicate that families headed by females tend to allocate a comparatively lower proportion of their income towards expenditures related to tourism, in comparison to households headed by males. Sahoo discovered that there were varied impacts of travel and families' characteristics on tourist expenditure, indicating a lack of uniformity in the outcomes. The author advocated that the Indian government should focus on the improvement of tourism packages and the empowerment of women in terms of resource ownership (Sahoo et al. 2022). In addition, the economic implications of medical tourism might give rise to notable environmental impacts. Medical tourism has been shown to contribute to the economic growth of several nations by generating valuable economic resources. The practice of this particular kind of tourism has been prevalent in several nations worldwide, representing a significant facet of tourism for growth, comparable to industries such as metal production or sports. Education has a crucial role, both directly and indirectly, in the enhancement of tourism (Xu et al., 2023). The focuses on scholarly articles pertaining to the field of "Tourism Education" and the global landscape of "curriculum" in this domain. Tourism education, along with other related fields, plays a significant role in advancing knowledge and fostering the development of cumulative Tourism sector (Şimşek et al., 2023). The tourism education has its own challenges like lack of skilled faculty and practical strategies. The exercises promoted creative and active thinking among tourism students, while also enhancing their communication, collaboration, decision-making, and empathy abilities. Furthermore, it has been determined that design-based learning, a pedagogical approach that promotes experiential learning, enhances retention of information, fosters a favourable disposition towards the subject matter, cultivates collaboration among students, and promotes regular attendance in class. The study is anticipated to provide guidance to educators about the integration of the design thinking methodology into the curriculum

(Doğantan, 2023). In the study conducted by Fuchs, the focused was on examining the perceptions of university students in the field of tourism education on the efficacy of their in-house training. When industry placements are not available. To gain insights into the experiences of student interns throughout their in-house training, a research methodology using an exploratory approach was used. This study included 25 semi-structured in-depth interviews with the participants and analysed using SPSS. The empirical results indicate that the present status of the particular classroom program is not a viable long-term option for undergraduate students' tourism domain (Fuchs, 2022).

## Methodology

Tourism mostly constitutes a significant field of study at the undergraduate level. Moreover, there is a noticeable increase in the levels of education across the nation. Therefore, as a result the education industry has a strong emphasis on exclusively delivering in the context of enhancing the skill set of the workforce inside the nation. This study used a quantitative methodology (Stockemer et al., 2019). Study adopted survey method as a research instrument for data collection, the structured questionnaires were distributed online to all respondents (teachers and students) associated with University of Jammu and University of Kashmir, India and purposive sampling technique is adopted to obtain valid responses from the participants. The collected data is evaluated statistically using SPSS. The primary data collecting tool used in this study is a structured questionnaire that is delivered to the participants online and offline. This work consists of 106 respondents such as teachers and students of University of Jammu and University of Kashmir. The secondary data was acquired from scholarly publications and journals, revealing that there is a lack of elementary school curriculum that includes areas related to tourism. The primary objective of the questionnaire is to ascertain perspective of the respondents on the implementation of tourism at school level. One potential area of academic focus at the elementary school level is the study of a tourism topic and its implications. The Indian tourism industry can have positive outcomes. The survey instrument consisting of a combination of "closed and open-ended" inquiries. The primary goal of the study to concentrate on the important aspects of tourism as a subject in primary education level in India. The study develops connections between the field of tourism education at school level and identifying an effective solution to address their issues. The overview of the methodology has been discussed in Figure 1.

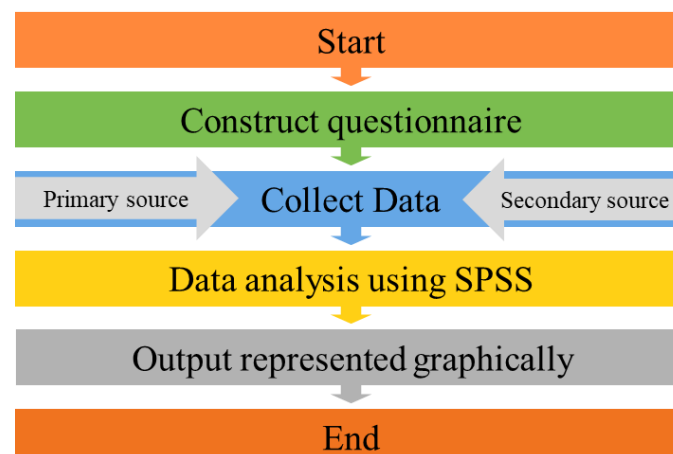
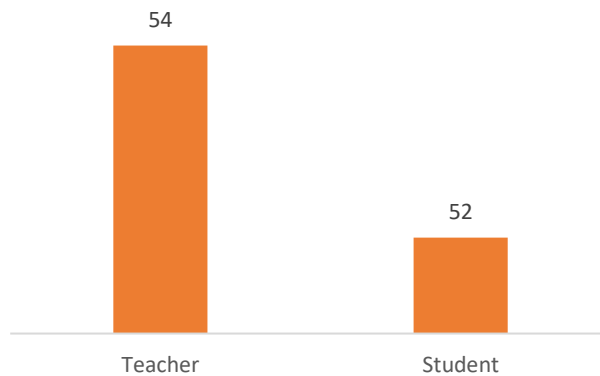


Figure 1. Overview of proposed methodology

## Results and Discussion

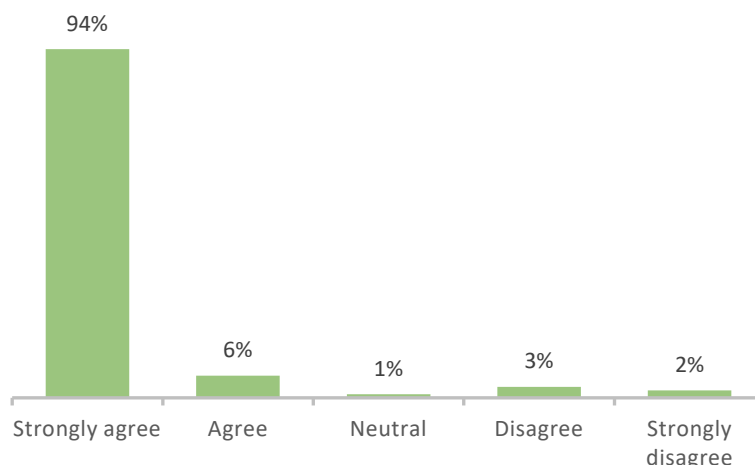
The participants were first asked about their perspective on the need of include tourism as a topic in elementary school education. The data shown in Figure 1 provides a comprehensive overview of their feedback.

The descriptive statistics indicated that present study includes similar number of teachers (54) and students (52) associated with tourism education in Jammu and Kashmir (UT) as shown in Figure 2.



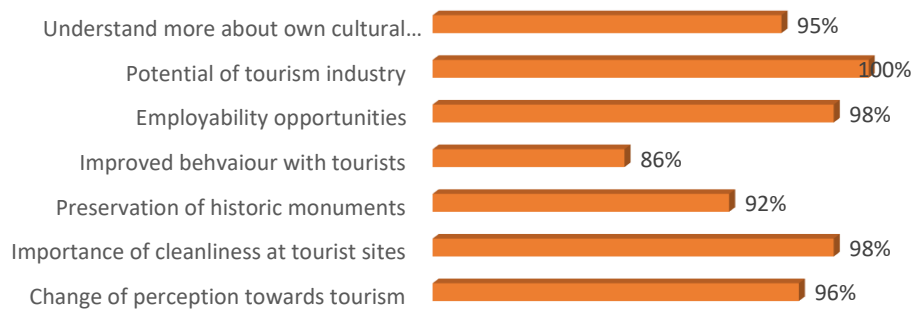
**Figure 2. Respondents**

It is found that study includes equal number of males and females having minimum post graduate qualification and most of the teachers hold more than 5 years of teaching experience. Further, five-point Likert scale is used to determine the perspective of respondents towards tourism as a subject in elementary education level. The Likert scale values show the agreement and disagreement related to study questionnaire. The responses were analysed based on Likert scale pointer between 1 to 5. It is noticeable in Figure 3 that a significant majority of the respondents, particularly 94%, expressed a strong agreement for the need of including tourism as a subject within the primary school curriculum followed by 6% agreement. The participants who provided unfavourable responses (2% to 3%) expressed concerns over children's comprehension abilities or the potential increase in their academic workload were minimum in number.



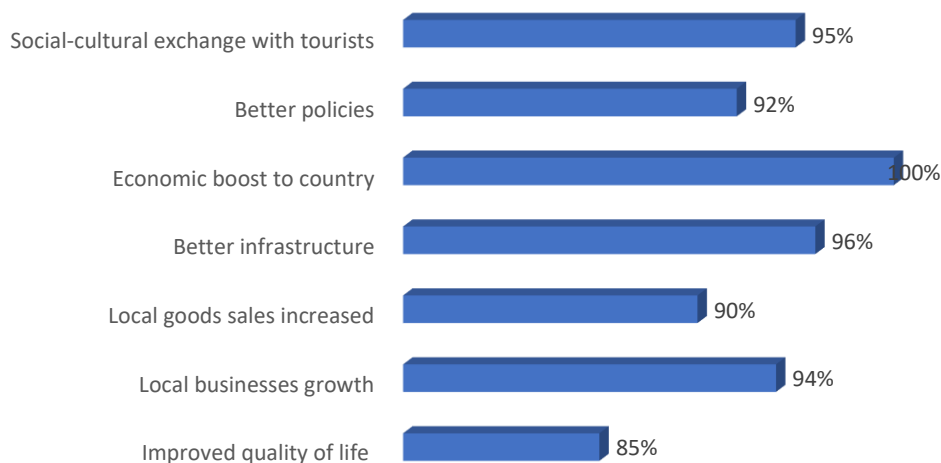
**Figure 3. Tourism as a subject in primary school level**

Nevertheless, it is worth noting that a significant majority of educators consider it essential for youngsters to study tourism. Several participants who responded positively said that the primary obstacle for Indian tourism is lack of dedicated infrastructure, as well as individual's perspective towards the tourism. The findings highlighted the discrepancies in behavioural patterns shown by international visitors and domestic tourists inside India, as well as by Indian individuals travelling overseas. Specifically, they focused on contrasting practices related to littering, defacing landmarks, and spitting in tourist places. According to respondent's statements, it is suggested that in India, there is a lack of effective administration and enforcement mechanisms for maintaining public cleanliness standards, which are comparatively more robust in other countries. This study supports the findings of Marunda (2016) and Marunda and Chaneta (2014) who advocated the tourism as subject in primary education level in Zimbabwe.



**Figure 4. Impact of tourism education in school curriculum**

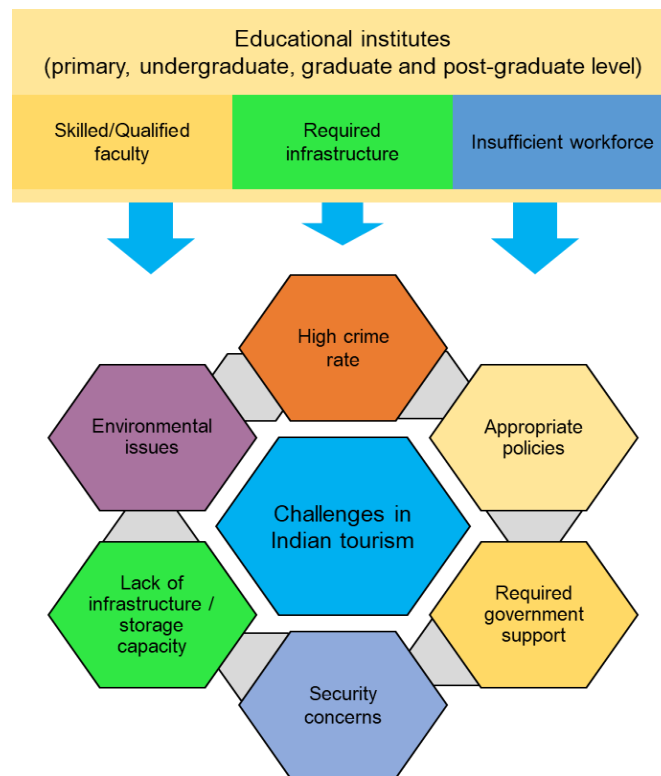
Figure 4 displayed the various positive impacts of tourism education at schools. It is important to educate the children related to tourism. A better understanding of tourism and its key motivating factors helps the nations to develop economically. Furthermore, it is said that the police and relevant authorities have challenges in effectively enforcing the existing norms and regulations pertaining to cleanliness. In this particular situation, the only means of attaining elevated levels of cleanliness is to encourage a sense of "awareness and understanding" among the general public. The individuals held the idea that initiating such awareness at the school level is vital, as it would enable young children to comprehend the reasons for discouraging actions such as littering and spitting in public.



**Figure 5. Impact of tourism as subject on tourism sector**

The respondents also share their opinion related to the other benefits which are directly or indirectly associated with sustainable tourism within the country. In Figure 5, various alternative merits of sustainable tourism have been depicted which helps to create more awareness among the citizen related to tourism sector. The education improves the quality of tourism services which have been delivered by the organisations, tourist guides and local businessman. This improves the interaction of residents with foreign tourists which helps to communicate with each other in more generous way. However, present study found that the Indian educational system disregards the relevance of tourism as a subject in primary school level and fails to emphasise its overall value. Incorporating tourism as an academics may provide students with an extensive understanding of the sector, enhancing local attitudes and perceptions towards tourists. This research supports the findings of Kumar et al. (2023) which indicated that tourism as a subject has significant impact on primary education in India, to mitigate the tourism challenges and spreading awareness among the students.

The respondents highlighted that several existing challenges such as “government indifference, unfavourable perceptions regarding safety and security, inadequate planning, inefficient development of tourist infrastructure, and the absence of suitable tourist experiences” in the tourism industry in India as shown in Figure 6 which can be potentially addressed through educational initiatives. The tourism education to children helps to play the role of ambassadors for the promotion of India's national image, specifically lobbying for improved infrastructure, enhanced safety standards, and more investment in the tourist industry. By highlighting the potential risks associated with unsustainable techniques often used in the context of tourism, individuals are encouraged to support and promote activities that effectively balance economic success with environmental preservation.



**Figure 6. Challenges in Indian tourism and education institutes**

This study found different outcomes from (Sahoo et al. 2022), who advocated for tourism expenditures and packages were the significant factors in India. This study showed that tourism education is significant factor that helps increase economic growth by encouraging Indian government to provide better infrastructure, tourism facilities and empowering youth in tourism sector by educating them in primary school level. Further, present study supports the findings of (Xu et al., 2023), who advocated for tourism education is highly crucial for industry development and ethical tourism by generating valuable resources through skilled faculty and implementation of practical strategies. This study also in line with the findings of (Şimşek et al., 2023) and showed that tourism education plays a significant role in advancing knowledge and fostering the development of cumulative Tourism sector. Finally, this study also aligns with the findings of (Fuchs, 2022; Doğantan, 2023), who advocated for promoting tourism as subject with the help of communication, collaboration, decision-making and effective classroom program for undergraduate students of tourism domain.

The respondents of this study expressed that offering an early introduction to the tourist industry would address another significant issue, namely the shortage of skilled personnel. By providing education to young kids on the field of tourism, this industry opens the new avenues for pursuing a career. It has been observed that in the present scenario, the field of tourism is not considered a favoured career option in India, as the emphasis is mostly placed on professional degrees such as engineering, medical, or law. By familiarising

young individuals with the demands and expectations of the tourist industry, it is possible to incentivise those with the appropriate disposition to choose for a vocation that maximises their likelihood of achieving success. Early induction programs may play a crucial role in mitigating the prevalence of misinformation and misunderstandings around the career prospects in the field of tourism. According to their statement, the provision of education in the field of tourism has the potential to cultivate entrepreneurial skills in young people. This is particularly significant for the government's emphasis on the 'Make in India' initiative. Young individuals might also be encouraged to engage in research pertaining to tourism-related subjects in order to discover novel approaches for enhancing the overall experience of tourism in India. This research can further lead to the identification of untapped tourist prospects, the introduction of innovative tourism services, and the enhancement of training and development initiatives.

## Conclusion

The economic advancement and prosperity are significantly influenced by the presence of tourism. The tourism education helps to enhance the underlying societal structures and develops fundamental values among students in order to provide many positive outcomes by accomplishing Sustainable Development Goals. This study significantly concluded that incorporating tourism as subject in primary education level significantly improves the mindset of the students towards tourism industry and help to improve awareness regarding tourism sector, ethical tourism and factors associated with tourism development. Study found that majority of the respondents (94%) strongly agreed that tourism must include as a subject in primary school curriculum, for increasing the students' knowledge related to Indian and global tourism landscape. Further, findings revealed that apart from positive impact such as improved understanding with tourist and residents, socio-economic development, employability opportunities. There are some limitations like high crime rate, violence threat, issue of cleanliness, traffic congestion and environment. Tourism is significantly important in terms of environmental aspects, including carbon footprints and greenhouse gas emissions. These impacts are expected to be amplified by the increasing global tourist industry and the persistent needs for materials, amenities, and goods. In future, primary education can also focus on sports tourism which helps to keep the students healthy and competitive. The new opportunities in terms of sports tourism can be included in the tourism subject at school level which helps to boost the tourism sector to greater extent. This study also provide some important recommendations for the policymakers that includes (1) tourism should be included as a mandatory topic in elementary school curriculum, (2) the primary education should extend beyond the traditional curriculum like propagation of historical, artistic, cultural, and architectural knowledge about India, (3) the courses pertaining to tourism should have a combination of theoretical knowledge, practical experience and raise awareness, (4) the introduction of tourism as a vocational subject at school level which improves the skill of the students.

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RESEARCH ARTICLE

## Investor psychology in virtual property investment: Risk perception and behavioural trends

**Rekha G.<sup>1\*</sup> and Reshma P.S.<sup>2</sup>**

<sup>1</sup>Assistant Professor and Head, Department of B.Com. (A&F and BA), PSGR Krishnammal College for Women, Coimbatore 641004

<sup>2</sup>PhD Research Scholar, Department of Commerce, PSGR Krishnammal college for Women, Coimbatore 641004

**Abstract:** Virtual property refers to the land that people can buy or sell in the metaverse. The paper analyses the key factors influencing investors' risk perception, and the factors that motivates to invest in the virtual property. The paper also looks into the impact of demographic elements on the risk perception of investors and whether experience in investment plays a role in Investors' herding behaviour and impulsive decision making. Employing questionnaires, 86 respondents provided the primary data and the secondary data has been obtained from research papers, publications and journals. The study used ANOVA, Chi square testing, and Percentage analysis. It found that gender and educational qualification have no significant impact on the investors' perception of risk. The findings reveal that the most significant factor influencing the investors' perception of risk seems to be market volatility. The study also finds that the key factors that motivates the investors to invest in virtual property includes potential high returns followed by peer influence, technological interest and perceived prestige. The results suggests that the herding behaviour and taking impulsive decisions are similar among investors irrespective of their experience in investments.

**Keywords:** *Virtual property investment, Risk perception, Herding behaviour, Impulsive decisions, Behavioural trends*

### Introduction

Owning a property in virtual environment is neither defined by physical boundaries nor legal documentation but instead supported through blockchain technology, where the principal credentials are a strategic vision and a digital key. Once a distant fantasy, this world known as the Metaverse was discovered only in science fiction books. Metaverse is a shared virtual world in which people can interact and participate in various activities, where users are represented as avatars and uses technologies like Virtual and Augmented Reality. Neal Stephenson in his 1992 cyberpunk novel Snow Crash used the term "Metaverse" for the first time. His notion of a virtual universe, allowed users to escape reality by interacting with avatars through purchase of a virtual real estate. Early the decade that followed, the first traces of this vision came to reality. Second life let users to possess land, create virtual identities, and even conduct trade. But it was still very basic with grainy avatars, and lack of sense of ownership. Then the blockchain revolution came as a solution for this. In their study, Husain et al. (2025) highlighted the way innovative technologies such as AR, VR, and blockchain could impact investment decisions via enhanced engagement, security, and revenue generating opportunities in virtual environments. Platforms such as Decentraland and the Sandbox improved virtual ownership in 2017. Supported by Decentralised ledgers, virtual property turns into an

\*Corresponding author: Assistant Professor and Head, Department of B.Com. (A&F and BA), PSGR Krishnammal College for Women, Coimbatore 641004 e-mail: [hod-afba@psgrkcw.ac.in](mailto:hod-afba@psgrkcw.ac.in)  
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actual asset with NFTs and smart contracts. Since there are no middlemen, no disputes and just digital permanence. The game changed entirely in 2021, when Facebook changed its name to Meta, implying that the Metaverse is the future and not merely a work of fiction. Billions of dollars flowed in as virtual property prices increased dramatically, and unexpectedly buying a plot of land in a virtual world has become as valuable as of a prime property in the real world. One important factor influencing the investor participation is perceived enjoyment, which provides information to improve customer involvement (Spais et al., 2024). The study intends to find out how gender and educational background influence the investors' risk perception. It also examines the impact of behavioural patterns on the investors' experience in investment by studying the investor psychology. Such insights can help financial advisors and policymakers in developing more customised investment strategies among diverse investors. Deep et al. (2023) studied and revealed that four crucial hidden factors such as confident value evaluation, distinct investment appeal, trusted property transactions, and effortless property commitment have a huge impact on how investors act. The investors of South Africa are highly aware on the investment in virtual real estate but the willingness to invest and people who have invested seems to be very less. This shows that there are certain factors preventing investments in virtual real estate (Akinsomi et al., 2024).

## **Review of Literature**

The advent of investments in Virtual property in the Metaverse has transformed the Conventional understanding of Real estate, by paving a way for new dynamics in Investor psychology, behavioural factors and risk perception. Various studies have analysed these aspects, focusing the opportunities, challenges and motivations that investors face in this rapidly evolving area. Hussain et al. (2025) investigates the motivation factors such as risk tolerance, technological knowledge etc., of individual investors to purchase virtual property in the metaverse. The study investigates the role played by the advanced technologies like VR, Blockchain, and AR while making decisions on investments. It seems that younger high earning investors are dominating this space, driven by interactive digital framework and speculative growth opportunities. Ante et al. (2023) provides a data driven analysis on the ownership of digital real estate, exhibiting 4 distinct investor motivations such as social and community aspects, aesthetics and identity, innovation and technology and speculation and investment. Their results signify that education and their potential for taking risks influences Investor behaviour. Furthermore, the speculative digital real estate, together with blockchain-based ownership through NFTs, differentiates it as a distinct asset class. Spais et al. (2024) digs into the marketing inferences of Consumer behaviour in the Metaverse, and reviews how purchasing decisions of investors are influenced by digital experiences. The study also proposes that virtual real estate brands should leverage immersive marketing and strategies to engage consumers that adds value. Thakur et al. (2023) reviews the Metaverse as a virtual expansion of smart cities, enhancing its position in economic development, urban governance, and privacy concerns. The study claims that even though the Metaverse introduces new investment opportunities, it also presents risks such as data security, regulatory uncertainty, and digital surveillance.

## **Research Methodology**

This study makes use of secondary as well as primary data, a sample of 86 respondents was obtained from various retail investors who have invested in virtual property. The questionnaire has been distributed via google forms including questions relating to the demographic characteristics, factors influencing the perception of risk in virtual property investment, and motivating factors for investing in virtual property. Furthermore, it comprised questions evaluating investor psychology including herding behaviour and investment-related regret. The snowball sampling technique has been used to select the samples for the research. Chi square, One-way ANOVA, and percentage analysis are the statistical tools utilised in this study. The secondary data was obtained from publications, research papers and previous research works. SPSS is the software used for data analysis.

## Results

### Percentage analysis

The demographic profile reveals a slight majority of female over male, with a percentage of 55.8. The majority of respondents possess postgraduate degrees, with 45.3% specifying a well-educated respondent base. Regarding occupation, the highest proportion of 43.0% encompasses private sector employees. The sample suggests that the majority includes working professionals and young investors.

**Table 1 Demographic characteristics of respondents**

Gender of Respondents			
Frequency	Percent		
1	38	44.2	44.2
2	48	55.8	100.0
86	100.0	100.0	
Educational Qualification			
1	8	9.3	9.3
2	34	39.5	48.8
3	39	45.3	94.2
4	5	5.8	100.0
86	100.0	100.0	
Occupation of Respondents			
1	1.2	1.2	1.2
4	4.7	4.7	5.8
35	40.7	40.7	46.5
37	43.0	43.0	89.5
9	10.5	10.5	100.0
86	100.0	100.0	

Source: Primary data

### Educational qualification and risk perception

**H<sub>0</sub>:** There is no major correlation among investors' educational qualification and risk perception in virtual property investment.

**H<sub>1</sub>:** There is a major correlation among investors' educational qualification and risk perception in virtual property investment.

The results state that there is no strong correlation among the education level and risk perception in virtual property investment, because the p-value is greater than the 5% standard of significance (0.809). It means that the education level does not significantly influence how risky investors perceive virtual property investments. It implies that the data does not support the hypothesis that education level leads to lower or higher risk perception.

**Table 2 Educational qualification and risk perception in virtual property investment**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.282a	9	.809
Likelihood Ratio	5.740	9	.766
N of Valid Cases	86		

Source: Primary data

### Herding behaviour and different levels of investment experience

**H<sub>0</sub>:** There is no significant variance in herding behaviour across various levels of investment experience (Beginner, Intermediate, Expert).

**H<sub>1</sub>:** There is a significant variance in herding behaviour across various levels of investment experience (Beginner, Intermediate, Expert)

Investment experience has no significant impact on the investors' herding behaviour according to the results of this data because the p value is 0.418, over the significance limit of 0.05. The results state the fact

that the Investment experience does not influence the tendency to follow other investors. The findings also reveals that the Investors irrespective of the experience of the investors, whether they are beginners, intermediaries or experts shows similar herding behaviour.

**Table 3 Herding behaviour across different levels of investment experience**

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.363	2	.682	.882	.418
Within Groups	64.125	83	.773		
Total	65.488	85			

Source: Primary data

### Gender and risk perception

**H<sub>0</sub>:** There is no major correlation between investors' gender and risk perception while investing in virtual property.

**H<sub>1</sub>:** There is a major correlation between investors' gender and risk perception while investing in virtual property.

Both male and female investors perceive risks similarly in Investing in Virtual Properties, revealing that both are willing to take risks. As the p value exceeds 5% level of significance, the results reveal that there is no major correlation between investors' gender and risk perception. The findings also signifies that the gender is not an important factor in shaping risk perception.

**Table 4 Gender and risk perception in virtual property investment**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.373	4	.251
Likelihood Ratio	5.518	4	.238
N of Valid Cases	86		

Source: Primary data

### Impulsiveness across different levels of investment experience

**H<sub>0</sub>:** There is no major variation in impulsiveness at various levels of investment experience (Beginner, Intermediate, Expert)

**H<sub>1</sub>:** There is a major variation in impulsiveness at various levels of investment experience (Beginner, Intermediate, Expert)

The results of this data state that there is no major variation between impulsiveness score and various levels of investment experience of the Investors. With a p value of 0.140, the findings are over the 5% significance level. The study also suggests that irrespective of the level of experience of the investors, beginner, intermediate or expert exhibits similar impulsive behaviour in making investment decisions. It implies that the experience of investors does not have an effect on how impulsively investors make decisions on investments.

**Table 5 Impulsiveness across different levels of investment experience**

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.335	2	2.168	2.015	.140
Within Groups	89.304	83	1.076		
Total	93.640	85			

Source: Primary data

## Discussion

Out of 86 respondents, 55.8% are female and 44.2% are male. Regarding educational qualification, 39.5% respondents fall under the category of Undergraduates and 45.3% are postgraduates making it the highest. And only the lowest of 9.3% were qualified high school level. The majority of the respondents with 40.7% and 43.0% belong to 2 and 3 categories which are self-employed and employed. 59.1% of respondents invests in Decentraland and 32.7% of respondents invests in Sandbox and 8.2% of responses invests in

other platforms. Concerning the factors influencing the risk perception of investors, majority of 87.2% of respondents have selected Market volatility, while 39.5% selects lack of regulation, 45.3% selects technology reliability and 74.4% selected speculative nature of assets. The highest proportion of 32.4% and 30.0% of respondents have chosen potential high returns and peer influence and trends as the motivating factors for investing in virtual property while 15.7% of respondents have chosen Technological interest, 11.4% long-term investment potential and 10.5% have chosen social status and ownership prestige. The chi-square tests find that the educational qualification is not significantly associated with the risk perception level of investors, suggesting that education does not significantly influence how risky investors perceive virtual property investments. Similarly, the findings reveal no major correlation between the investors' gender and risk tolerance level. Furthermore, the study does not find any major variation between the individual investors' herding behaviour and their experience in investing, which exhibits that the investors, irrespective of their experience, whether beginners, intermediaries, or experts, tend to follow the crowd. Additionally, irrespective of the level of experience of the investors, they exhibit similar impulsive behaviour in making investment decisions, implying that experience does not influence the probability of taking impulsive investment decisions. Wang et al. (2024) determined that the key factor impacting investment attitude is psychological risk and suggested that, strengthening transparency and trust mechanisms can mitigate these risks and increase investor confidence in crowdsourcing in virtual tourism.

## Conclusion

This study analysed how investors perceive risks and make decisions in this developing market. It also explores risk perception, herding behaviour and impulsiveness of investors in making investment decisions in virtual property. The findings of the study signify that educational qualification and gender of the investors do not significantly have an impact on risk perception of investors, implying that demographic factors of investors are independent in assessing risk. Likewise, the level of investment experience does not significantly impact impulsiveness or herding behaviour, indicating that whether experienced or beginner, shows similar behavioural tendencies in virtual investments. Furthermore, key factors such as market volatility, lack of regulation, technology reliability and speculative nature of virtual assets play a significant role in shaping investors' risk perceptions.

Investors often tend to make impulsive investment decisions, which may lead to financial risk to investors. These findings emphasise the need for financial education to investors, strong regulatory frameworks and better tools for risk assessment. The study also recommends the investor for independent research and portfolio diversification to reduce risks. Furthermore, the study also suggests in developing risk-adjusted investment options to investors. The study suggests that independent research can be conducted by the investors to avoid following the market trends or other investors blindly. This will help in reducing the herding behaviours and the impulsive decision making of the Investors. Investors can also diversify their portfolio by considering investments in traditional assets like stocks, mutual funds, real estate. This will reduce the impact of market volatility.

Investors can also educate themselves about the blockchain security, regulatory risks etc., to avoid taking risks. Yaqoob et al. (2023) stated in their study that interoperability, security and privacy, network capabilities, law and jurisdiction, and other challenges need to be addressed before the metaverse starts in a significant way. The present digital economy, instead of users, is still managed by centralised entities like banks and large companies. This is identified as a limitation, as metaverse just cannot be created with advanced technology but also needs a reliable and trustworthy economy. Blockchain technologies are seen as a potential solution as they support decentralisation, allowing people to own and manage their virtual assets directly (Hutson et al., 2023). Governments can set up financial education programs focusing on digital investments, risks, and investor protections by collaborating with universities and financial institutions.

There are some limitations in this study which are summarised as future recommendations for research. The future research can examine additional behavioural biases such as mental accounting, anchoring, or confirmation bias. Conducting longitudinal studies helps in acquiring changes in investor behaviour over time as the market evolves rapidly. The future studies could also increase the sample size. Overall, this research improves knowledge on the investor psychology in investing in virtual property.

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RESEARCH ARTICLE

## Integrating traditional agricultural knowledge with modern technology for climate resilience and sustainable livelihoods: A comprehensive research

Harikrishna K.L.<sup>1</sup> and Hari Priya S.<sup>2\*</sup>

<sup>1</sup>B.Com., Business Analytics, KPR College of Arts Science and Research, Coimbatore, Tamil Nadu

<sup>2</sup>Assistant Professor, School of Commerce, KPR College of Arts Science and Research, Coimbatore, Tamil Nadu

**Abstract:** Agriculture remains the backbone of India's rural economy, yet it is increasingly vulnerable to the adverse impacts of climate change, including erratic rainfall, prolonged droughts, and extreme weather events. In this context, this research explores the integration of traditional agricultural knowledge with modern technological innovations to enhance climate resilience and ensure sustainable livelihoods, with a specific focus on Tamil Nadu a state known for its diverse agro-climatic zones ranging from coastal plains to hilly terrains. The study investigates the effectiveness of traditional practices such as rainwater harvesting, crop rotation, organic fertilisation, and intercropping, and examines their synergy with modern advancements including precision farming, Early Warning Systems (EWS), and mobile-based advisory services. Using a mixed-methods approach, data were collected through field surveys, interviews, and focus group discussions with farmers across different regions of Tamil Nadu. The research employs SWOT analysis, descriptive statistics, and thematic coding to interpret the data. Findings reveal that while traditional methods offer ecological sustainability and adaptability to local conditions, modern technologies contribute to efficiency, productivity, and informed decision-making. Farmers who adopted a hybrid model integrating both traditional and modern approaches reported improved crop yields, reduced input costs, and greater resilience to climate-induced stress. However, the study also identifies barriers such as limited access to technology, inadequate training, and fragmented policy support as challenges to widespread adoption. This research highlights the need for localised, inclusive, and policy-backed frameworks to promote integrated agricultural practices. By developing a region-specific hybrid model and recommending strategies for capacity building, the study provides valuable insights for policymakers, agricultural institutions, and rural communities.

**Keywords:** Agriculture, Climate change adaptation, Technology adaptation, Climate resilience, Early warning systems

### Introduction

Agriculture is the backbone of India's rural economy, providing livelihoods to a significant portion of the population and contributing substantially to the national economy (Sharma, 2022). However, climate change presents a formidable challenge, threatening agricultural productivity and sustainability (Ghosh & Reddy, 2021).

\*Corresponding author: Assistant Professor, School of Commerce, KPR College of Arts Science and Research, Coimbatore, Tamil Nadu email: [hariPriya.s@kprcas.ac.in](mailto:hariPriya.s@kprcas.ac.in)

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This research is particularly significant as it aims to bridge the gap between traditional agricultural practices and modern technological advancements to foster climate resilience and sustainable livelihoods specifically in Tamil Nadu.

Tamil Nadu's agricultural landscape is notably diverse, encompassing a wide range of crops and climatic conditions, from coastal regions to hilly areas like Ooty and plains such as Thanjavur. This diversity provides a unique opportunity to research a representative sample of agricultural practices and their adaptation to climate change (Nair, 2021). The research will focus on integrating traditional practices—such as rainwater harvesting, crop rotation, and organic fertilisation—with modern technologies like precision farming, Early Warning Systems (EWS), and mobile-based advisory services (Saini, 2019; Chakraborty & Patil, 2020). This approach aims to develop a hybrid model tailored to Tamil Nadu's specific conditions, enhancing climate resilience and sustainability (Bhattacharya, 2022).

This study aims to investigate the effectiveness of traditional agricultural practices in managing climate-related challenges across various farming stages, to assess the current obstacles faced by farmers at different stages of farming due to climate change and evaluate the existing technological solutions and to analyse the integration of traditional agricultural practices with modern technological frameworks to enhance sustainability and productivity.

### **Scope**

The proposed research aims to explore the integration of traditional agricultural knowledge with modern technologies to enhance climate resilience and sustainable livelihoods. This study encompasses various aspects of agricultural practices, technology adoption, and socio-economic impacts, with the goal of developing effective strategies for sustainable agricultural development.

### **Statement of the Problem**

Agriculture is the cornerstone of India's rural economy, providing livelihoods for millions and contributing significantly to the national GDP (Nair, 2021). However, this sector is increasingly threatened by the adverse effects of climate change, which include unpredictable weather patterns, prolonged droughts, and increased frequency of extreme weather events (Gupta & Sharma, 2022). These climatic disruptions severely impact agricultural productivity, leading to food insecurity and economic instability in rural areas (Chakraborty & Patil, 2020).

Traditional agricultural practices in Tamil Nadu, honed over centuries, are integral to the region's cultural heritage and have historically been effective in managing environmental variability. Techniques such as crop rotation, intercropping, and organic fertilisation have sustained farming communities through various climatic challenges. However, rapid modernisation and the adoption of high-input, high-yield farming techniques have led to the gradual erosion of this traditional knowledge.

The core issue is the dichotomy between preserving traditional agricultural wisdom and embracing modern technological advancements. There is an urgent need to integrate these two approaches to develop a sustainable and resilient agricultural framework specific to Tamil Nadu (Bhatia, 2022). This integration is crucial for addressing current climate-related challenges and ensuring the long-term viability of agricultural livelihoods in the region.

Furthermore, understanding the factors influencing the adoption of technological innovations is essential for designing interventions that bridge the gap between traditional practices and modern technology. Factors such as socio-economic conditions, access to information, education levels, and perceptions of benefits and risks associated with new technologies play a critical role.

By exploring with this research, aims to develop a comprehensive understanding of the interplay between traditional and modern agricultural practices in Tamil Nadu. The ultimate goal is to formulate strategies that promote sustainable agricultural development, enhance climate resilience, and ensure the livelihoods of rural farming communities in the region.

## Review of Literature

Arora and Jain (2023) emphasised that while technological innovations can significantly enhance agricultural productivity, their successful implementation depends on understanding the unique challenges faced by rural communities, including infrastructure limitations and financial constraints.

Bhattacharya (2022) emphasised the importance of preserving and integrating traditional agricultural knowledge in modern practices. The study suggests that these methods, when combined with modern agricultural innovations, can offer a more holistic approach to farming that balances productivity with environmental preservation.

Chakraborty and Patil (2020) addressed strategies to enhance climate resilience in Indian agriculture. The authors explore various adaptive measures such as crop diversification, water management techniques, and the use of climate-resistant crop varieties to mitigate the impacts of unpredictable weather patterns.

Chauhan and Verma (2021) examined how new technologies and ideas are being used in farming. It explains both the benefits these innovations can bring like higher crop yields and efficiency as well as the problems farmers might face, such as cost and lack of knowledge.

Ghosh and Reddy (2021) explored how old, traditional farming methods can be combined with modern tools and machines. It shows that blending both can improve farming, especially in South Asia, by respecting local wisdom and using new techniques.

Gupta and Sharma (2022) examined how climate change like rising temperatures and unpredictable rains is affecting the amount of crops farmers can grow. It explains the economic effects and suggests ways to deal with these changes.

Kumar and Singh (2022) focused on why some farmers do not use new technology. It discusses reasons like lack of education, poor access, and financial issues, and gives suggestions on how to help farmers adopt modern tools more easily.

Mishra (2018) explained different farming methods used in India that protect the environment and make farming more sustainable. These include using natural fertilizers, crop rotation, and water-saving techniques.

Mitra (2019) described old farming systems used in the past and explains how some of those methods are still useful today. It highlights how traditional knowledge can contribute to modern sustainable agriculture.

Nair (2021) focused on how climate change is specifically affecting Indian farmers. It talks about lower crop yields, changing seasons, and water problems. It also suggests ways to reduce these effects, like using better seeds and farming techniques.

Prasad et al. (2020) emphasised farming practices that not only protect the environment but also help people in villages earn a stable income. It talks about eco-friendly methods that support both nature and rural communities.

Rao and Das (2023) examined how and why rural farmers use or avoid modern technology. It explains what factors—like education, government help, or social influence—affect their decisions to try new tools or methods.

Reddy and Subramanian (2021) discussed the problems in updating farming practices, especially in rural areas. It includes issues like old infrastructure, lack of money, and resistance to change among farmers.

Rao (2024) suggested government policies that can help make farming more sustainable. It includes ideas like offering subsidies for eco-friendly practices and improving farmer education.

Reddy and Subramanian (2021) compared old and new farming methods, showing their advantages and disadvantages. It explains how a mix of both can be more effective in improving agriculture.

### *Identification of research gaps*

The agricultural sector is at a critical juncture, facing the dual challenges of sustaining productivity amidst rapidly changing climatic conditions and integrating modern technologies with time-honoured traditional practices. While there is extensive research on both traditional agricultural practices and modern technological innovations independently, there is a significant gap in studies that explore the integration of these two approaches to enhance climate resilience and sustainable livelihoods.

### *Integration of traditional and modern practices*

Traditional practices include crop rotation, intercropping, and rainwater harvesting, adapted over centuries. Modern technologies like precision farming and Early Warning Systems (EWS) offer advanced solutions.

### *Climate resilience strategies*

Climate change impacts agriculture with erratic weather and extreme events. Traditional strategies include diversified cropping and water management, while modern tools offer advanced climate monitoring.

### *Technological adoption and diffusion*

Despite the availability of advanced agricultural technologies, their adoption rates among rural farmers remain low. Factors such as lack of awareness, high costs, limited access to credit, and socio-cultural barriers hinder the widespread use of these innovations. Understanding these barriers is crucial for designing effective interventions.

### *Policy and institutional frameworks*

Policy and institutional support play a crucial role in promoting sustainable agricultural practices. Various policies and programs aim to support both traditional agriculture (through schemes like Paramparogat Krishi Vikas Yojana) and modern technologies (through initiatives like Digital Agriculture Mission). However, the integration of these policies remains fragmented.

### *Socio-economic and environmental impacts*

Agricultural practices, whether traditional or modern, have profound socio-economic and environmental impacts. Traditional practices often promote biodiversity, soil health, and water conservation, while modern technologies can significantly boost productivity and income. However, the trade-offs and synergies between these impacts are not well understood.

### *Region-specific insights*

Tamil Nadu's diverse agro-climatic zones, including coastal areas, plains, and hill stations, necessitate region-specific agricultural strategies. While some studies focus on individual regions, there is a lack of research providing comparative insights across Tamil Nadu's varied regions.

### *Longitudinal analysis*

Most studies on agricultural practices and climate resilience are cross-sectional, providing a snapshot view rather than long-term insights. Longitudinal studies, which track changes over time, are essential for understanding the dynamic nature of agricultural systems and the long-term impacts of integrated practices.

## **Methodology**

This research adopts a mixed-methods approach, combining both qualitative and quantitative strategies to explore the integration of traditional agricultural knowledge with modern technology in Tamil Nadu. The study focuses on three distinct agro-climatic zones: coastal areas (e.g., Kanyakumari), delta plains (e.g., Thanjavur), and hill regions (e.g., Ooty).

### ***Data collection***

Primary data was collected through structured interviews and surveys conducted with farmers practicing both traditional and modern agriculture across the selected regions. Focus group discussions and case studies were also employed to gain deeper insights.

Secondary data was sourced from government reports, academic journals, and agricultural policy documents related to climate adaptation, technological diffusion, and traditional farming systems.

### ***Sampling method***

Purposive sampling was used to select a diverse group of farmers based on geographical location, farm size, and technology adoption level. A sample size of 150 farmers was chosen to ensure a representative cross-section of agricultural practices.

### ***Analytical tools***

SWOT Analysis was applied to assess the strengths, weaknesses, opportunities, and threats of integrating traditional and modern techniques. Thematic Analysis helped identify recurring patterns from qualitative interviews. Descriptive Statistics summarised survey responses on the effectiveness of different agricultural strategies.

### ***Research approach***

The proposed research will focus on the state of Tamil Nadu, as its primary region for investigation. Tamil Nadu offers a diverse and representative landscape for researching the integration of traditional agricultural practices with modern technologies, making it an ideal setting for this research. This section outlines the basis for selecting Tamil Nadu and the specific regions within the state that will be covered.

### ***Diverse agricultural zones***

Tamil Nadu is characterised by its varied agricultural zones, each with distinct climatic and geographical features. The state encompasses different agro-climatic regions, including Coastal Areas (Regions such as Kanyakumari and Chennai are influenced by coastal climates, which impact crop patterns and water availability), Plains and Delta Areas (Thanjavur and Cuddalore are part of the Cauvery Delta, known for its fertile lands and extensive paddy cultivation), and Hill Stations (Areas like Ooty and Kodaikanal have cooler climates and different cropping patterns compared to the plains). This geographical diversity allows for a comprehensive examination of how traditional practices and modern technologies can be adapted to varying environmental conditions, providing valuable insights for broader application.

### ***Variety of crops and farming practices***

Tamil Nadu supports a wide range of crops, from staple grains like rice and pulses in the delta regions to horticultural crops in the hill stations. This diversity includes: Staple Crops (Rice and sugarcane in the delta regions), Horticultural Crops (Tea, coffee, and spices in the hill stations) and Commercial Crops (Cotton and groundnut in the plains). The state's diverse crop profile ensures that the research covers a broad spectrum of agricultural practices, highlighting how traditional knowledge and modern technologies can be handmade to different farming systems.

### ***Climatic variability***

The state experiences a range of climatic conditions, from the humid coastal climate to the semi-arid interior and temperate hill climates. This variability includes Monsoon Rains (Influenced by both the Southwest and Northeast monsoons, impacting agricultural schedules and water resources) and Drought-Prone Areas (Some regions face irregular rainfall, affecting crop yields and requiring effective water management strategies).

Researching Tamil Nadu's climatic variability will provide insights into how traditional and modern practices can address climate-related challenges in different settings.

### *Socio-economic factors*

Tamil Nadu is home to a diverse population with varying socio-economic backgrounds. Key factors include smallholder and marginal farmers (predominantly in rural areas, facing challenges in accessing modern technologies) and agricultural labour (A significant portion of the workforce depends on agriculture for livelihoods). Understanding these socio-economic factors is crucial for assessing how technology adoption can be facilitated and how traditional practices can be preserved or adapted to improve livelihoods.

### *Existing knowledge and infrastructure*

Tamil Nadu has a rich repository of traditional agricultural knowledge and established agricultural research institutions. The state's historical and cultural practices related to agriculture, such as those recorded in local texts and practices, provide a strong foundation for this research. Additionally, existing government and non-governmental programs in agricultural development and climate resilience offer a supportive infrastructure for conducting the study.

## **Results**

The findings of the study highlight the unique advantages of both traditional and modern agricultural practices and the potential for synergy when integrated thoughtfully:

### *Traditional practices*

Widely valued for sustainability and low input cost. Rainwater harvesting and organic fertilisation were cited as effective for maintaining soil fertility and managing water scarcity. Crop rotation and intercropping increased resilience to climate variability.

### *Modern technologies*

Precision farming and Early Warning Systems (EWS) improved yield predictability and disaster preparedness. Mobile-based advisory services facilitated access to timely information, especially during monsoon variability.

### *Integration outcomes*

Farmers employing a hybrid model reported a 12–18% increase in yield and 25% reduction in input costs. Adoption of integrated models was higher in areas with better digital connectivity and institutional support. Socio-economic barriers such as lack of awareness, credit access, and technical skills limited technology adoption in certain regions.

## **Discussion**

The results indicate that the integration of traditional agricultural knowledge with modern technology can significantly enhance climate resilience and improve livelihood sustainability. Traditional practices offer long-term ecological benefits, while modern tools bring precision and efficiency to agricultural operations. Key insights from the research include complementarity over replacement, localised adaptation, policy support needed and education and awareness. Instead of replacing traditional methods, modern technologies should complement them to maximise impact. Solutions must be tailored to local climatic, cultural, and resource conditions for effective implementation. Fragmented policy frameworks currently hinder holistic adoption. A unified policy promoting hybrid models could bridge the gap. Farmer training programs are crucial to promote technological literacy and dispel misconceptions about modern techniques. Overall, this research underscores the importance of a context-specific, participatory, and inclusive approach to sustainable agricultural development in the face of climate change.

## Conclusion

In conclusion, the proposed research represents a significant and innovative effort to integrate traditional agricultural knowledge with modern technology for climate resilience and sustainable livelihoods. By adopting a holistic, context-specific, and participatory approach, the study addresses the multifaceted challenges faced by rural farmers in India. The development of an empirical model for technological adoption and the creation of a comprehensive educational syllabus further highlight the path-breaking aspects of the research. The findings of this study will not only contribute to academic knowledge but also have practical implications for farmers, policymakers, and agricultural stakeholders, paving the way for a more sustainable and resilient agricultural future.

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REVIEW ARTICLE

## Understanding the role of financial literacy in pension planning: Overview of national pension scheme

Gomathy C.<sup>1\*</sup> and Krithishree K.<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Commerce,  
PSGR Krishnammal College for Women, Coimbatore, Tamil Nadu, India

<sup>2</sup>Research Scholar, Department of Commerce,  
PSGR Krishnammal College for Women, Coimbatore, Tamil Nadu, India

**Abstract:** Financial security after retirement is a growing concern, especially in economies where Social Security schemes and systems are limited and not well-structured. The National Pension Scheme (NPS) serves as a structured retirement savings option, depending on the individual's financial literacy level. The need to understand financial concepts such as savings, investment, and the amount of annuity to be paid adds to the process of empowering individuals to make informed pension planning decisions. This examines the factors influencing pension-related decisions and barriers to financial awareness and provides strategies that could improve overall literacy. This is a descriptive study, based on secondary data, which discusses the role of financial literacy in pension planning with a specific focus on the NPS. The study examines conceptual and policy-based insights related to financial literacy and retirement preparedness. However, challenges such as lack of awareness, certain misconceptions, and financial preferences continue to hinder this participation in various pension schemes. The findings explain that individuals with adequate financial knowledge are more likely to understand pension options like the NPS and the benefits they offer, while limited awareness and behavioural biases continue to hinder participation (Ricci & Caratelli, 2017). The significance of the study lies in highlighting the need to bridge the gap between financial knowledge and pension adoption, especially among informal sector workers and the self-employed. The study advocates for financial education and awareness programs to improve pension inclusion and long-term financial security. This study aims to contribute to the policy discussion and to enhance public awareness which altogether contributes to the efforts to enhance retirement planning in India.

**Keywords:** National pension scheme, Financial literacy, Awareness, Social security schemes

### Introduction

Retirement planning in today's world is very essential for ensuring that financial security stays in the later years, with increasing life expectancy today, all individuals are in need to make an informed decision about their level of financial stability. This study focuses specifically on the National Pension Scheme (NPS) due to its wide applicability, voluntary nature, and growing relevance as a government-backed retirement option for all Indian citizens, including self-employed and informal sector workers. Unlike traditional pension schemes, NPS offers flexibility, portability, market-linked returns, and tax benefits, making it a suitable model for examining the impact of financial literacy on pension behaviour. NPS is a government-backed pension scheme in India, which is structured and designed to provide a well-tailored retirement savings plan. However, many individuals lack awareness and understanding this pension plan is mandatory today.

\*Corresponding author: Assistant Professor, Department of Commerce, PSGR Krishnammal College for Women, Coimbatore, Tamil Nadu, India e-mail: [cgomathy@psgrkcw.ac.in](mailto:cgomathy@psgrkcw.ac.in)

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Financial literacy plays a key role in ensuring that effective participation has to be taken on those retirement schemes. This financial literacy includes the knowledge of saving, investment, and the tax benefits that can be enjoyed with the associated pension plan. Despite the availability of NPS, individuals and the informal sector remain unaware of the benefits that can be availed. The lack of understanding of the financial products and the benefits of the pension plan leads to poor retirement planning (Misra & Tankha, 2018). The paper explains the role of financial literacy and its relation to NPS adoption all over India. It also discusses the challenges that are faced, and the factors that influence it and also provides some strategies that could help in enhancing the awareness of pension schemes among the public.

### **Concept of Financial Literacy and its Relevance to Pension Planning**

Financial literacy commonly refers to an individual's ability to understand and process effectively. It includes knowledge about the savings, investment, and budgeting process, which has to be made in the beginning, and the benefits of the financial product are focused such as pension schemes (Atkinson & Messy, 2012). Financial literacy is not only focused on the education level of the individual but also the level of literacy or the knowledge they possess upon that subjective plan or the level of informed decision about income management and the future development of that financial security (Lusardi & Mitchell, 2011). Pension planning is a crucial aspect of financial literacy because it ensures that the staple income is being received after retirement. The post-retirement benefit that is enjoyed without adequate financial knowledge of the NPS, individuals may fail to save enough for their retirement and the investment would go to a poor state, many individuals delay or fail to take pension plans because of the misconception they take from the public or from any other peer to whom they ask for assistance because of the lack of awareness that individuals possess (Klapper et al., 2013). Lack of financial awareness results in poor pension participation. This is evident in cases where individuals are unable to comprehend the long-term implications of not saving adequately for retirement (Fornero & Monticone, 2011) observed that in Italy, limited financial literacy significantly reduced individuals' likelihood to participate in pension schemes, emphasising that awareness plays a vital role in informed retirement decision-making (Demirguc-Kunt et al., 2018). Financial literacy includes learning and understanding all the processes of the National pension scheme which will help the individual in planning a significantly compounding and long-term investment that they can carry for their post-retirement from the earning stage (Agarwal et al., 2007). It also enables them to evaluate the different pension schemes that are available in the current scenario and select the one which would benefit their need and strengthening the financial literacy level has to be done to have a comfortable post-retirement life (Bhushan & Medury, 2014).

### **Overview of National Pension Scheme**

NPS is a voluntary, well-structured, long-term retirement savings plan, which is launched by the government of India in 2004. This was initially designed for government employees, and it was later extended to all Indian citizens, including self-employed individuals. The scheme operates on a contribution-based system, where the individuals, whoever is interested in taking it up, can invest in the pension fund over time and this constitutes two different types of accounts, which are Tier 1 and Tier 2.

**TIER 1:** A non-withdrawable account to which the Subscriber shall contribute his/her savings for building a retirement corpus. This is mandatory.

**TIER 2:** A voluntary savings facility that provides liquidity to subscribers, i.e. subscribers will be free to withdraw their savings whenever they wish. This is optional.

This NPS system provides investment opportunities in various avenues like equity, corporate bonds, and government security and gives a wide opportunity for diverse portfolio development. Upon this retirement, a portion of the corpus is withdrawn as a lump sum and the remaining amount is used to purchase an annuity, and various sections like 80CCD (1), and 80CCD(1B) of the Income Tax Act can be availed. This scheme is regulated by the Pension Fund Regulatory and Development Authority (PFRDA), which ensures transparency and security. NPS is considered an affordable and efficient retirement solution for all investors

and individuals irrespective of income level and it gives an efficient retirement solution on a wholesome (International Labour Office, 2014). However, awareness and accessibility as well as challenges exist it is found that there is a limited adoption of NPS all over India.

NPS requires a minimum contribution of ₹500 per transaction, with an annual minimum of ₹6,000. Subscribers must contribute at least four times in a financial year. While there is no upper limit on the amount one can contribute, and no fixed periodicity is mandated, contributions can be made via cash, local cheque, or demand draft. However, transactions are only booked after the realisation of the cheque or demand draft, and outstation cheques are not accepted (Pension Fund Regulatory and Development Authority, 2022).

### **Steps Involved**

The process of pension planning can be understood as a step-by-step framework that begins with financial literacy as its foundation. The first step involves creating awareness among individuals about the importance of retirement planning. This awareness leads to a deeper understanding of various pension schemes, especially structured plans like NPS. With enhanced knowledge, individuals are better equipped to evaluate their options and make informed financial decisions. The final steps involve the actual adoption of pension plans and consistent contributions, which ultimately lead to improved financial security during retirement. This linear process emphasises the pivotal role that financial literacy plays at each stage of pension preparedness.

### ***Role of financial literacy in adoption of national pension scheme***

The adoption of NPS is significantly influenced and impacted by every individual's ability to face the structure, and benefits and attain the long-term impact it gives through financial literacy. It enhances the individual's knowledge to access all those various investment avenues within NPS, such as equity corporate bonds and government securities. The scheme is chosen based on the risk tolerance and the retirement goals of every individual and will attach to their preferences. Many individuals hesitate to take up pension schemes due to the misconceptions that are being spread by other peers and family members that they require high contributions and receive only low returns. Well-informed and financially literate individuals will understand the power and need of compounding and the relaxation that tax benefits provide them when they get associated with NPS. This scheme works as an attractive retirement saving tool in which individuals can compare the benefits of NPS with any other retirement saving options like EPF or PPF, which will help them to make quality decisions. Digital financial literacy plays a role in the adoption of online enrolment fund selection and portfolio building and monitoring which are key aspects of managing the National pension scheme. One disadvantage of NPS, which is seen among the individuals in the society is lack of financial knowledge, which makes them often rely upon some informal sources of advice, which gives a negative solution or advice to them, which will lead to suboptimal pension planning. Government initiatives and workplace pension awareness programs have to be initiated and the involvement of financial advisors can help to bridge this gap and add to the development of a National pension scheme in India (Thaler & Benartzi, 2004). To significantly enhance NPS participation the action that can be taken is by encouraging proactive financial planning through targeted campaigns and simplified pension-related communication that can strengthen financial literacy, it is very crucial because it is not just for increasing enrolment in NPS, but it ensures that there exists a better financial preparedness for retirement.

### ***Factors influencing pension planning decisions***

Pension planning decisions differ from individual to individual based on the preferences that make up their post-retirement benefits. Several factors influence the individual decision whether to participate in pension schemes like NPS or to choose an alternate scheme but the income level plays a very crucial part as higher earnings pave the way for higher contributions towards the retirement funds. Savings behaviour and financial discipline will determine whether the individual prioritises long-term security or the expenses that

they face in the journey (Agarwal et al., 2015). Risk perception will affect pension investment because certain individuals will avoid National pension schemes due to the fear of market-linked volatile movements. Government policies and tax benefits along with employer contributions can encourage the pension planning process and awareness and accessibility will influence the adoption rate of pension schemes especially in rural areas. While deciding to invest in pension plans, individuals might suffer from making decisions because of the short-term financial priorities that they may have like funds for education, healthcare, or repayment of loans take priority at that particular time over the long-term savings that could help them in their post-retirement. Other important factors, which also add up to the influencing factor, are social and cultural influences, family expectations, and peer influence as well as societal norms that are put upon the individuals which might shape their attitude and perception towards joining or enrolling in a retirement saving scheme. The positive influencing factor, which is seen in today's world is the technological advancement that happens every day, that is the digital platforms and fintech solutions make the pension investment and plans more accessible to individuals who need them. So, understanding these factors can help policymakers to design better strategies for increasing the adoption of NPS.

### ***Challenges faced about financial literacy on pension awareness***

Many individuals struggle to access pension schemes due to their limited financial literacy. While efforts to promote financial education continue, a significant portion of the population remains unaware of the importance of retirement savings. Many individuals prioritise their immediate financial needs over long-term retirement planning, leading to lower engagement with pension schemes. A major challenge is the lack of access to formal financial education (OECD, 2016). Complex financial jargon further discourages individuals from understanding pension schemes, creating a cycle of confusion and inaction. Additionally, misinformation about the risks and returns associated with pension plans contributes to hesitation in adopting schemes like NPS. Self-employed individuals and those in the informal sector face additional barriers due to irregular income streams, making it difficult for them to commit to long-term savings (Gallery et al., 2011). A lack of trust in financial institutions and pension fund managers further deters participation (Paskelian et al., 2019). Women and marginalised groups encounter even greater obstacles due to lower financial literacy levels and limited income, compounded by the inadequate reach of financial education programs (Nguyen et al., 2019) in rural areas. Employers and financial advisors play a crucial role in simplifying pension schemes and encouraging participation. Addressing these challenges is essential to improving financial preparedness for retirement, and ensuring broader access to pension benefits for all segments of society.

### ***Strategies to enhance financial literacy towards national pension scheme***

Improving financial literacy can play a crucial role in increasing pension planning awareness and boosting the adoption of NPS in India. Government initiatives, such as financial literacy workshops and awareness campaigns, can effectively educate individuals about the benefits of pension schemes. Integrating pension-related education into school and college curriculums can also have a long-term impact by instilling awareness in young individuals before they enter the workforce. Encouraging early adoption of pension schemes as soon as individuals start earning can significantly enhance NPS participation in the future. Banks and financial institutions should simplify pension-related information, ensuring it is easily accessible and understandable for individuals. Digital platforms and fintech solutions can further aid retirement planning by offering user-friendly resources tailored to different income levels. Additionally, employers can play a vital role by conducting pension awareness programs in workplaces and helping employees make informed decisions about their retirement savings. Collaboration between the regulator's financial advisors and the community leaders can improve the outreach of the national pension scheme into society. Social media usage in today's world is leveraging day to day and the online tools that can help in leveraging to spread pension literacy programs among the younger generation can also be encouraged in the society. Mobile application and pension calculation tasks can help individuals to make even more informed decisions about

the contribution that they have to make and the amount of corpus that they have to give every month or with relevance to the scheme that they choose and the expected return which they could enjoy by doing so. Introducing the NPS simulation tools for decision-making might create an interactive online portal that would stimulate different contribution levels and retirement benefits, and can help users to understand the long-term impact of their investment choices. Additionally, mandatory pension literacy sessions can be taken before the employment onboarding. The companies can include pension awareness as a part of HR onboarding programs and that could ensure that the employees are aware of NPS options from the start of their career. Incentives and tax benefits should be effectively communicated to encourage the participation of the individuals, a well-planned and tailored financial literacy strategy can enhance leading the society to a better financially secured life post-retirement.

## Conclusion

The National Pension Scheme is structured reliably for individuals to secure their retirement and to effectively enhance the adoption of NPS. Financial literacy plays a vital role in ensuring that the effect of pension planning is being done to sustain the long-term financial security of individuals. However, there is a lack of awareness, rotation of misconceptions and financial illiteracy altogether forms a wall in limiting the adoption of NPS in India, strengthening financial education through government initiatives (Chauhan, 2024), employer programs, and digital tools will help in bridging the gap. Simplifying the pension-related information and addressing the trust issues can enhance the adoption of NPS among the public and make them participate. The self-employed individuals and informal workers must be targeted in the awareness campaign must be delivered in an understanding and beneficial sense (Chatterjee, 2010). Integrating financial literacy into the education curriculum can significantly enhance awareness about pension schemes and encourage their adoption. Educating young individuals about the importance of retirement planning at an early stage can lead to better financial preparedness in the future. To achieve this, collaborative efforts between policymakers, financial institutions, and employers are essential. Such partnerships can help expand pension coverage by increasing awareness and providing accessible financial education (Sane & Thomas, 2015). By fostering a culture of early retirement planning, these initiatives can ensure greater participation in pension schemes and contribute to long-term financial security. The individuals can make better decisions for their retirement by ultimately contributing to a more financially secure future.

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REVIEW ARTICLE

## Role of artificial intelligence in micro small and medium enterprises

Lakshmi G.<sup>1\*</sup> and Sujitha R.<sup>2</sup>

<sup>1</sup>Associate Professor, Department of B.Com. (PA), PSGR Krishnammal College for Women, Coimbatore 641004

<sup>2</sup>PhD Research Scholar, Department of Commerce, PSGR Krishnammal College for Women, Coimbatore 641004

**Abstract:** The foundation of the Indian Economy, Micro, Small and Medium-sized Enterprises (MSMEs), play a major role in industrial production, employment creation, and regional development. Artificial Intelligence is transforming marketing strategies for companies of all sizes with the emergence of digital transformation and new technologies. This study examines the way in which AI enables MSMEs to improve customer engagement tailor marketing tactics, streamline processes and make informed decisions. MSMEs are using technology from chatbots driven by AI to automation tools and predictive analytics to increase overall efficiency lower operating costs, and remain competitive. The report also emphasises a number of government programs that are crucial in promoting AI use in MSME industries including Digital India and the MSME champions schemes.

**Keywords:** MSME, Artificial intelligence, Marketing strategies, Customer engagement, Government initiatives

### Introduction

The foundation of the Indian economy is made up of Micro, Small and Medium-sized Enterprises (MSMEs) which play a major role in industrial production, job creation, and economic expansion. These companies, which are categorised by the Indian government according to their yearly revenue and equipment investment, are essential to the growth of both rural and urban areas. After the Ministry of Small Scale Industries and the Ministry of Agro and Rural Industries merged, the Ministry of Micro, Small and Medium Enterprises was created in 2007. MSMEs have experienced substantial changes since the introduction of the Micro, Small and medium Enterprises Development Act (2006) was introduced and revised in 2020 especially with the use of modern technologies (Agrawal, 2024). AI is changing marketing strategies for businesses of all kinds in today's quickly changing digital economy. MSMEs are becoming more aware of how AI may improve customer interaction optimise marketing efforts, and boost operational efficiency, even as big firms make significant investments in AI-driven solutions (Kumar et al., 2022). Through data driven decision predictive analytics, process automation, and customised customer experiences, AI helps MSMEs to more successfully compete with larger companies (Bagale et al., 2024). Recent research indicates that about 45% of MSMEs have implemented AI in some capacity to improve their marketing and business operations (Kumar et al., 2023). MSMEs are using technology to promote innovation, agility and a long-term competitive advantage, from AI-powered customer care chatbots to machine learning algorithms that facilitate tailored product suggestion (Agarwal, 2024; Kumar et al., 2023). By analysing its benefits, real-world uses and contrast with conventional marketing techniques, this paper investigates the role of AI in MSME marketing strategies.

\*Corresponding author: Associate Professor, Department of B.Com. (PA), PSGR Krishnammal College for Women, Coimbatore 641004 e-mail: lakshmi@psgrkcw.ac.in

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## **Benefits of AI Help MSMEs**

### *Enhanced customer engagement and experience*

AI chatbots and virtual assistants driven by AI allow MSMEs to offer round-the-clock customer service, answering questions and resolving problems quickly. Stronger bonds are cultivated and client satisfaction is increased by this constant availability. AI-powered customer support solutions are transforming how Indian SMEs communicate with their clients, improving user experiences, claims (Bhatia, 2023). Furthermore, 46% of MSMEs acknowledge AI's potential to improve customer engagement, according to a white paper by (NASSCOM and meta, 2024).

### *Personalised marketing and sales*

To develop individualised marketing strategies, AI examines consumer data, such as past purchases and surfing patterns. This focused strategy boosts revenue and enhances client retention. AI helps companies to efficiently customise their marketing campaigns which improves client engagement (Kumar et al., 2022). Furthermore, according to the NASSCOM-meta white paper (2024) 48% of MSMEs believe AI has a lot of potential for marketing and content development.

### *Data-driven decision making*

AI help firm analyse vast datasets to better understand customer preferences, market trends and operational performance. This analytical competence enables MSMEs to make more informed decisions about product development, pricing, and resource allocation. According to Kumar et al. (2022), AI driven analytics enable MSMEs to respond quickly to market developments and customer demands. Furthermore, (Krishnan, 2022) argues that AI adoption can help MSMEs narrow the digital transformation gap by allowing for speedier decision-making processes.

### *Fraud deduction and risk*

AI improves fraud detection by evaluating financial transactions for unique trends and flagging questionable activity. This proactive approach enables MSMEs to avoid financial losses and retain stability. As stated by MSys Technologies (2024), AI and machine learning technologies have the ability to alter enterprises by increasing efficiency and detecting fraud. Kumar et al. (2022) also explain how AI implementation in SMEs leads to effective revenue development via improved risk management.

### *Improved productivity and automation*

AI automates tedious operations, freeing up staff time for strategic pursuits. AI can optimise delivery routes in logistics resulting in faster deliveries and lower costs. According to Kumar et al. (2022), AI deployment in SMEs results in considerable increases in productivity and operational efficiency furthermore, Krishnan (2022) notes that AI adoption might assist MSMEs narrow the digital transformation gap by automating regular activities, increasing overall productivity and conducting business smartly.

## **AI Applications Used by MSMEs**

The MSMEs used some of the AI application to help them in operations, enhance customer engagement and gain a competitive edge.

### *Predictive analytics for MSMEs*

MSMEs may use previous data to predict future trends thanks to AI-driven predictive analytics. AI-powered sales forecasting, for example, enables companies to evaluate demand variations according to economic factors and seasonal trends improving inventory and resource management (Schoenberger, 2023). AI models also examine consumer behaviour including as preferences and buying patterns, which helps companies divide up their clientele for more focused advertising and more customer satisfaction (Ljomah

& Lyelolu, 2024). Additionally predictive analytics enables MSMEs to take proactive steps and improve business continuity by anticipating financial risks and supply chain interruptions (Borah et al., 2023).

#### ***Automation and process optimisation for MSMEs***

AI-powered automation drastically decreases MSMEs manual workload by automating repetitive tasks like data input invoice processing and order fulfilment. This not only reduces human mistake but also improves speed and cost efficiency (Schoenberger, 2023). RPA and AI-based CRM system help MSMEs automate client interactions, follow ups and lead management (Ozgen & Kurt, 2024). Additionally, AI improves logistics by discovering effective delivery routes and controlling inventory in real time.

#### ***AI-powered chatbots and virtual assistants***

MSMEs are increasingly using AI powered chatbots and virtual assistants to boost customer service and engagement. These technologies offer 24×7 customer assistance, answer frequently asked questions and handle product requests without requiring human agents (Ozgen & Kurt, 2024). In internet shopping, chatbots personalise customer experiences by proposing products based on previous purchases and interests. Voice enabled assistants allow for hands free interactions, which increases user convenience and operational efficiency (Borah et al., 2023).

#### ***Personalised marketing and customer engagement AI***

AI-powered customer engagement and personalised marketing have revolutionised MSMEs' client interactions, increasing both reach and retention. In order to make personalised product or service recommendations and increase conversion rates, recommendation engines examine customer behaviour and previous interactions. In order to maintain profitability and competitiveness, dynamic pricing allows for real-time price adjustments based on consumer preferences, rival pricing and demand. Through content personalisation and send time optimisation, AI powered email marketing automates campaign execution increasing client loyalty and engagement. By providing a more personalised purchasing experience these AI powered solutions enable MSME to build stronger bonds with their customers. Business may forecast client demands and present pertinent offerings by utilising data analytics, which raises customer satisfaction and brand affinity. MSME can successfully compete with larger companies thanks to AI's cost-effective targeted marketing solution. By lowering manual labour and operating expenses, automated insights aid in the improvement of marketing tactics. Because consumers are more likely to stick with firms that know their preferences, personalisation also increases customer retention. In the end, AI powered marketing improves consumer interaction and propels MSMEs long term success in the online market.

#### ***AI financial management***

AI is essential to MSMEs' financial management since it increases security and efficiency. Accounting software powered by AI such as Xero and QuickBooks, streamline payroll administration and cost tracking by automating bookkeeping. AI is used by fraud detection systems to spot questionable transactions and stop financial fraud. AI-based loan processing also assesses creditworthiness and recommends the best financing choices, making it easier for MSMEs to obtain capital. MSMEs can increase overall financial stability, lower risks and expedite financial planning by incorporating AI solutions.

### **Government Initiatives Supporting AI Adoption in MSMEs**

#### ***Digital India and MSME digital transformation***

The Digital India initiative is a flagship program initiated by the government of India, intends to turn the country into a digitally enabled society and knowledge economy. As part of this effort, MSMEs are urged to implement AI powered technology to improve business operations. These include automating corporate operations refining marketing techniques and improving financial management efficiency. AI powered business intelligence solutions help MSMEs make data driven choices while AI based fraud detection

systems improve the security of digital transactions. Furthermore, AI integrated e-commerce platforms enable MSMEs to expand their market reach and acquire a larger client base. This initiative plays an important role in bridging the digital gap and enables MSMEs to compete with larger firms by adopting cutting edge AI technologies (Ministry of Electronics and Information Technology (MeitY), 2022).

### ***MSME champions scheme and AI support***

The Ministry of Micro Small and Medium Enterprises has established the MSME champions scheme, a comprehensive support initiative aiming at improving MSMEs competitiveness through financial and technological assistance. This program encourages the use of AI powered solutions like chatbots and virtual assistants to expedite business operations and increase consumer interaction. Furthermore, the government provides specific incentives and subsidies to stimulate the use of AI in a variety of role, such as factors automation, marketing optimisation and logistics management. The schemes interventions aim to increase productivity, reduce operational expenses, and boost small enterprises digital capabilities, allowing them to compete more effectively in the evolving digital economy (Ministry of MSME, 2023).

### ***NITI Aayog's initiative for AI***

The AI for all program, sponsored by NITI Aayog, seeks to democratise AI adoption across a variety of industries, including MSMEs. This program encourages AI-powered market intelligence products that help MSMEs with demand forecasting and supply chain optimisation. AI-powered credit evaluation tools developed under this program assist MSMEs in obtaining loans and financial support base on real-time data analysis. Furthermore, AI-enhanced risk management solutions help MSMEs avoid significant financial losses and operational disruptions. Through AI for all the government guarantees that MSME have access to breakthrough AI technology, allowing them to make better business decisions and create long-term growth.

### **SIDBI's AI-based Financial Support for MSMEs**

The Small Industries Development Bank of India (SIDBI) has created AI powered financial solutions to help MSMEs gain access to financing and manage their finances better. AI-powered credit evaluation technologies analyse financial data to give MSMEs faster and more accurate loan approvals. AI-powered fraud detection systems help to prevent financial anomalies and ensure the security of digital transactions. Furthermore, SIDBI uses AI-based loan matching tools to connect MSMEs with appropriate government schemes and financial products. By integrating AI in financial support, SIDBI improves the efficiency, accessibility and transparency of funding alternatives for MSMEs, promoting business growth and stability.

### **AI-powered Skill Development Programs for MSMEs**

Recognising the relevance of AI literacy in today's digital economy the Indian government has launched a number of AI powered skill development projects aimed primarily at MSMEs . These programs provide structured training sessions for both entrepreneurs and employees on topics such as AI powered digital marketing, Manufacturing automation and business analytics. AI certification courses are also offered to help MSMEs get specialised knowledge in process optimisation and data analysis. These initiatives are frequently aided via collaborations with institutions such as the National Skill Development Corporation (NSDC) and industry partner. By prioritising AI skill development, the government enables MSMEs to successfully integrate emerging technologies, encourage innovation, and maintain long-term competitiveness in an AI centric business environment (National Skill Development Corporation (NSDC), 2022).

### **AI Adoption Trends among MSMEs**

#### ***Increasing awareness and digital readiness***

Artificial Intelligence (AI) has dramatically raised awareness among MSMEs in India in recent years. The post pandemic rise in digital transformation has promoted even tiny businesses to reassess traditional

approaches. Many MSMEs today see the benefits of AI in boosting customer service, increasing efficiency, and preserving competitiveness as a result of advancements in digital infrastructure (Deloitte, 2022). Government programs like Digital India have been essential in helping small company owners become more knowledgeable about AI tools and their useful uses (MeitY, 2023).

### ***Sector-wise growth in AI adoption***

AI adoption by MSMEs is highly sector specific, reflecting their diverse operating requirements. Retail MSMEs use AI for demand forecasting, fleet management and route optimisation. In the manufacturing industry AI aids in production planning, quality control, and predictive maintenance, Meanwhile MSMEs in logistics employ AI to tailor marketing campaigns and recommend products based on user behaviour (PwC India, 2023). These developments suggest that AI integration is strategically linked with industry specific needs.

### ***Rise of affordable cloud-based AI tools***

The availability of low cost, cloud-based AI technologies is a key driver of AI adoption among MSMEs. Platforms like Google AI, Tally prime with AI features, and Zoho CRM offer low-cost solutions that do not require considerable infrastructure or technical skills. These Software-as-a-Service (SaaS) Solutions provide subscription-based pricing, making advanced technology available to Small Enterprises (NASSCOM, 2023). The democratisation of AI technology allows MSMEs to compete on a more equal digital playing field with larger corporations.

### ***AI in financial management and loan processing***

Artificial Intelligence is also altering the financial operations of MSMEs. AI-powered systems are rapidly being employed for automating payroll, real-time financial analysis, and intelligent bookkeeping (EY, 2023). SIDBI and other fintech businesses use AI algorithms to assess creditworthiness and streamline loan disbursement processes. Furthermore, AI-powered fraud detection solutions improve the security of MSME financial transactions by detecting suspicious trends and averting losses (RBI, 2022).

### ***Upskilling and workforce adaption to AI***

As AI becomes more integrated into MSME operations, businesses engage in employee training programs. AI-focused training is available from government supported initiatives and private tech companies, including certificates and webinars customised to the needs of small businesses (MSME Ministry, 2023). These programs focus on practical applications such as process automation, customer analytics and AI-enabled digital marketing. As a result, MSME employees and entrepreneurs are gaining confidence in using technology to drive their firms' digital transformation (MPMG, 2022).

## **Conclusion**

Artificial Intelligence (AI) is transforming the competitiveness, efficiency, and growth of India's MSMEs. As digital transformation intensifies in the aftermath of the pandemic, MSMEs are increasingly using AI-powered technologies for marketing, customer engagement, financial management and operational efficiency. Government-led programs like Digital India, the MSMEs champions Scheme and SIDBI'S AI integration support have all helped to raise awareness and acceptance of AI technologies among small enterprises. Sector- specific AI solutions are strategically aligned with industry demands. Affordable cloud-based AI tools and SaaS platforms have made advanced technology available to even micro-enterprises, levelling the playing field. Furthermore, upskilling and AI literacy initiatives are helping MSME employees and entrepreneurs accept technological change with confidence. The democratisation of AI not only helps MSMEs save money and increase productivity, but it also allows them to create robust and future-ready business models. In the long run, widespread AI adoption is predicted to have a significant impact on India's economic development by encouraging innovation, inclusion and sustainability in the MSMEs sector.

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