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Cultivating connections: Technology application for sustainable agritourism in India

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Abstract

India is one of the largest agrarian countries in the world and the diversity of the nation contributes to a unique set of experiences in tourism. Agritourism, though not a new concept in the region, has recently been a booming sector in India. It is a sustainable diversification approach for the rural economy, with the socio-cultural heritage of the corners of the country preserved and celebrated. Technological application has been found to have impact on the momentum of agrotourism in the country. However, there is a dearth of academic work and research about the theoretical framework, significance of technologies and its impact on agritourism. Therefore, this chapter aims to provide novel insights on how technologies significantly contribute towards sustainable agritourism. An integrative literature review was utilized due to lack of adequate empirical evidence. The study reveals a paradigm shift in the concepts and experiences of agrotourism in India with the rapid absorption of technology in society. Technological advancement, especially digital platforms, has benefited tourists and service providers. It brings about an ease of connectivity and accessibility while enhancing the travel experience as a whole. Various technologies ranging from simple mobile applications and social media to futuristic technologies like geospatial technologies, artificial intelligence and virtual reality are phenomenal in agritourism. The study also highlights the challenges and limitations in the application of technology in agritourism. Based on the study, there is a need for a holistic approach including awareness, policies and cooperation among various stakeholders.

Keywords: Agritourism, sustainability, technology application, rural economy

Introduction

India, best described as the “land of villages”, is graced with diverse agroclimatic conditions, rich biological and vibrant cultural diversity. According to the Economic Survey 2023-24, 42.3% of the population depends directly or indirectly on agriculture and allied sectors. The sector contributes 17.7% to the country's gross value added (GVA) at the current price in FY 2024 (GOI, 2024) ^[20]. Agriculture is also one of the six key areas of Amrit Kaal's growth strategy. According to Periodic Labour Force Survey (PLFS), more than 45% of the country's workforce are employed in agriculture (GOI, 2024) ^[20]. In recent years, Indian agriculture has witnessed increase in the adoption of innovative and progressive practices. Diversification in farming has also been one of the most important approaches to sustainable development (Pitrova *et al.*, 2020) ^[41]. Among the most notable shifts in Indian agriculture, one is the integration of tourism as a diversification approach which has led to the introduction of agritourism. India has always been a favourable destination for millions of tourists across the world and ranks 39th in the world Economic Forum's Travel and Tourism Development Index (World Economic Forum, 2024) ^[56], with over 92 lakhs foreign tourist arrivals in 2023, with an increase of 43.5% and earned more than ₹1 lakh crore in foreign exchange receipts through tourism indicating a growth with 65.7% (PIB, 2024) ^[40]. Agritourism can be referred to as any form of tourism which

centered around the agricultural and rural experiences. It includes all the experiences, activities, services, farm stays, events and products associated with farming, animal husbandry, farm produces, value added foods, cultural heritage, festivals, U-pick (harvest), educational and recreational visits/trips, etc. (Tew & Barbieri, 2012) ^[51]. According to World Tourism Organization (1998) ^[57], agritourism comprises lodging in the farmhouse or a guesthouse providing local cuisines and organizing guests, observation of activities and participation in farming operations. Many researchers have put forward different concepts on agritourism. Arroyo *et al.* (2013) ^[2] described it as “farming-related activities carried out on a working farm or other agricultural settings for entertainment or education purposes”. It is also described as “a specific type of rural tourism in which the hosting house must be integrated into an agricultural estate, inhabited by the proprietor, allowing visitors to take part in agricultural or complementary activities on the property”. Weaver and Fennell (1997) ^[55] defined it as “rural enterprises which incorporate both a working farm environment and a commercial tourism component”. While several theories and arguments have been proposed, its growing popularity is undeniable. According to Business Economics (2019) ^[8], it is estimated that the revenue generated by agritourism industry is growing at a rate of 20% per year. This growth has benefited the society and especially those of local

community. Agritourism enhances social empowerment, strengthen social ties, develop social skills and provides economic benefits such as diversified incomes, job creation and poverty alleviation (Hamzah, 2012) [23]. It leads to socio-economic improvement of the rural areas through employment, income and exposures (Srivastava, 2016) [48] and brings attention of the concerned stakeholders and thereby speeding outreach of developmental activities. On the other hand, tourists are benefited with rich experiences, lessons, indigenous knowledge, peaceful and refreshing touch of the rural atmosphere (Poulose & Ushadevi, 2024; Deepthi, 2024) [42,12]. It culminates in earning respect and gratitude towards farmers, food and local resources and thereby helping the preservation and conservation efforts of natural resources (Barbieri, 2013; Brune *et al.*, 2021) [5, 7]. Local products serve as healthy and sustainable options for tourists. This form of tourism is also considered to be relatively more eco-friendly as compared to other forms of tourism and is often regarded as a form of sustainable tourism (Barbieri, 2013) [5]. It also helps in the preservation of natural, historical and cultural heritage of the rural areas, while letting the world understand the nature-friendly lifestyle and encouraging them of more natural and sustainable way of life.

India offers immense potential to harness the emerging agritourism market. The diverse land-forms and landscapes of the country itself serve as unique symbolism of adventures. It extends from the Himalayan mountains, Indo-Gangetic plains and deserts in the north, through the luxurious hills of northeast, to the Deccan Plateau, Western Ghats and Eastern Ghats and coastal regions in the south. Each regions presents a unique attractions, such as tea gardens in Assam, Ima markets of Manipur, citrus farms in Meghalaya, spices village in Kerala, coffee plantation in Karnataka, desert farming in Rajasthan, terraced apple orchards of Himachal Pradesh, Vineyards in Maharashtra, goat village in Uttarakhand, etc. Each one teaches a uniquely special story to the world. Geographical Indication tag of India paints a vivid picture of souvenired agricultural products and associated locations indicating geographical originality, authenticity and diversity. Vast biodiversity, rich agrarian diversity, cultural heterogeneity, indigenous knowledge & practices and unique socio-religious beliefs placed India among the most valued agritourism destinations. The concept of agritourism aligns with the vision of “Vocal for Local” and “Atmanirbhar Bharat”. However, influx of tourists can be a threat to environmental sustainability if not managed cautiously. In September 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs) aimed at ensuring sustainable development for all. Sustainable tourism is defined as “the development of tourism activities with an appropriate balance between the environmental, economic and socio-cultural aspects to ensure long-term sustainability” (Pan *et al.*, 2018) [61]. Integrating sustainable practices into agritourism is essential for reducing environmental impact while maximizing overall well-being and technology can help monitor resource usage, reduce waste and promote eco-friendly farming practices (Joshi *et al.*, 2020) [26]. Sustainable agritourism is crucial for fostering social sustainability, biodiversity conservation and bolstering rural economy. Over the years, the traditional

practices of agritourism are blended with modern technology leading to better connectivity, accessibility and sustainability. Technological application has been found to have impact on the momentum of agrotourism in the country. However, despite its potential, there remains a dearth in academic work and research on theoretical framework, significance of technologies and its impact on agritourism. Therefore, this chapter aims to provide novel insights on how technologies significantly contribute towards sustainable agritourism.

Materials and Methods

A systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to identify peer-reviewed articles published between 2010 and 2024. The study employed the data collection process (Moher *et al.*, 2010; Page *et al.*, 2021) [35,38] as i) identification of relevant documents from database sources, ii) screening article and iii) data extraction. We reviewed index, TAK (title, abstract and keywords) and body independently through the above mentioned criteria to decide paper eligibility to be included in the study.

Databases and search strategy

The search process was carried out in two major databases, Scopus and Web of Science, utilizing relevant keywords such as “Agritourism” OR “Rural tourism” OR “Ecotourism” “Technology” AND “Sustainable tourism”. Articles included in the review met the criteria of being written in English, published in peer-reviewed journals and focused on the role of technology in agritourism. After a thorough screening of titles, abstracts and full texts, 59 articles were selected for the study or inclusion. Books, book chapter, conference paper, reports, etc., were excluded due to variability in the peer review process. Only open access journal articles were included in the review to maintain the focus on high-quality academic sources. The flow diagram of inclusion and exclusion of database are illustrated in Figure 1.

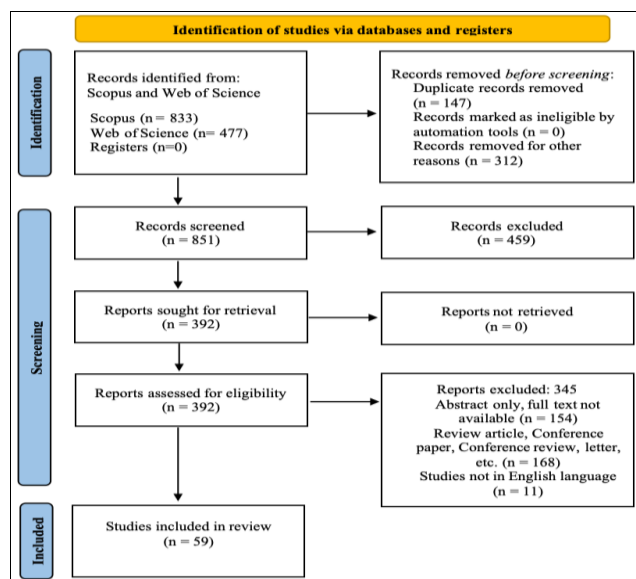


Fig 1: Flow diagram of the literature search process based on PRISMA guidelines

Results and Discussion

Technological Innovations in Agritourism in India

Figure 2 depicted the technological innovations in agritourism. India is leading in world internet population with over 1.24 billion internet users in 2023 (Statista, 2024) [49]. As India pushes forward with digitization, the outreach of digital technology has significantly improved. Technological advancement, especially digital platforms, is changing the dynamics of agritourism in India. It has

benefited tourists and service providers in various aspects providing ease of connectivity and accessibility while enhancing the travel experience as a whole. Various technologies ranging from simple mobile applications and social media to futuristic technologies like geospatial technologies, artificial intelligence and virtual reality are phenomenal in agritourism. Sustainable agriculture, through technological applications, helps in the promotion of sustainable agritourism.

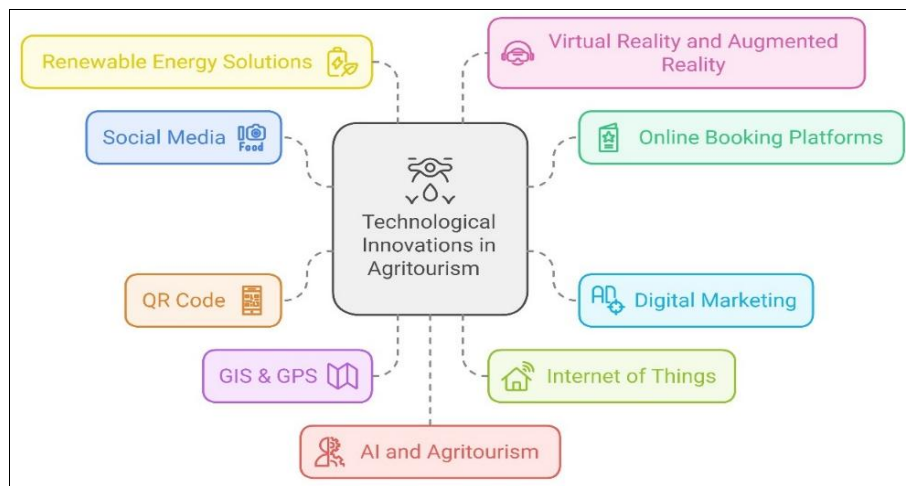


Fig 2: Technological innovations in agritourism in India

Social Media

Social media plays a significant role in attracting tourists and enhancing their experiences in agritourism. The younger generation tends to spend considerable time on social media, making them more likely to take advantage of these enticing offers. Many farms actively engage on platforms like Facebook, Instagram and YouTube, where they create groups for agritourists and post updates about their new services. These platforms are used to boost digital interactions and as a source of income too. Innovative farmers call for short term courses, farm tours, volunteer works and various educational programs through social media publicity. In this digital era, people are affected by the content shown to them, influencing their behaviour prior to travelling (Su *et al.*, 2021) [50]. Tourists often feel strong motivation to explore various shared experiences on social media, which helps them to minimize their uncertainties (Oliveira *et al.*, 2020) [37]. Social marketing plays an important role in shaping behaviour (Haldeman & Turner, 2009) [22] and the tourism industry can leverage it to promote the pro-environmental behaviours among tourists (Tkaczynski *et al.*, 2020) [54]. High-quality content, appealing graphic designs, effective advertisements, engaging photos and videos of the farm, Web Content Management (WCM), Search Engine Optimization (SEO) and polite interactions can boost sales efficiency and crowd pull. Emphasis needs to be placed on online campaigns, interactive/social media and other modern and innovative technology spheres. Incredible India digital platform can be utilized for promoting rural tourism destinations.

Online Booking Platforms

Online booking platforms allow tourists to easily discover and book agritourism experiences, increasing visibility for

rural properties. The convenience of online reservations encourages more visitors to explore rural tourism options, which can lead to increased occupancy rates for agritourism accommodations (Gössling & Lane, 2015) [21]. Analysis of user-generated content on these platforms provides valuable insights into customer preferences and experiences, helping agritourism operators improve their services (Chittiprolu *et al.*, 2020) [10]. Positive online reviews can significantly influence potential visitors' decisions, thereby enhancing the overall appeal of agritourism offerings (Chittiprolu *et al.*, 2020) [10]. Moreover, they can help in enhanced online presences and targeted marketing campaigns. The online platform, "Agri tourism pure holidayism" in Maharashtra is grabbing the attention of farmers and tourism professional in the country. It offers a unique blend of agriculture and rural experiences. Visitors can explore dairy, poultry and horticulture farms, enjoy kite flying, pottery making, crop harvesting, bullock cart and tractor rides and visit temples, sugarcane, cashew factories and local museums.

Digital Marketing

Marketing is a vital element in agritourism. E-marketing and e-commerce significantly enhance agritourism in India by providing innovative platforms for agricultural product sales, leveraging agritourism as an opportunity to boost sales and promoting rural tourism (Jiang, 2016) [25]. These digital tools facilitate direct connections between farmers and consumers, thereby increasing market access and reducing reliance on intermediaries. Digital marketing practices and e-commerce platforms allow farmers to sell directly to consumers, increasing their profit margins, while enable farmers to reach a broader audience (Chaudhari & Anute, 2022) [9]. E-marketing strategies help promote agritourism experiences, attracting tourists interested in

local agricultural practices (Mamulaidze & Bagaturia, 2022)^[34]. Search engine optimization (SEO) are also employed to help target the potential consumers (Attia *et al.*, 2023)^[4]. Thus, agritourism e-commerce breaks the geographical restriction of traditional tourism and allows more people to understand and experience rural tourism. With the introduction of Digital India by the government of India, this approach has got accelerated momentum. KisanMandi.com, E-National Agriculture Market (eNAM), Kisan Rath App, Agricultural Marketing Information Network (AGMARKNET), are the taking the lead in the country.

QR Code

Quick Response (QR) Code is the trademark for the type of matrix barcode that can accumulate 7,089 numeric characters and 4,296 alphanumeric characters. Information such as URLs, SMS, contact details, plain text and videos can all be encoded into this two-dimensional matrix (Dyade & Bhande, 2017)^[13]. A key feature of the QR code system is its ability to provide access to content embedded deep within a website through a smartphone. The use of QR codes has proven to be a useful and user-friendly technology. It is widely used for travel and tourism including trains (IRCTC), flights (AAI), private booking sites and even local transport to deliver better convenience and safety. QR codes make the process of booking and authentication quicker and provide detail information of their booking (Yadav *et al.*, 2014)^[59]. Software Technology Park of India, Bengaluru developed Track Me QR code in a public transport vehicle (cab, bus, auto-rickshaw, etc.) to know details of the driver and share it with others, who can also track each ride (Dyade & Bhande, 2017)^[13]. This model will be beneficial for agritourism in remote areas.

QC codes can also be employed as guided street tours for delivering details of the destinations including routes, history, activities, etc. The State Tourism Department of Kerala has integrated QR codes to assist tourists in navigating destinations and accessing historical information about various locations. These codes at various locations enable tourists and residents to use Google Maps for seamless navigation. The Union Tourism Ministry plans to leverage QR codes at heritage sites in New Delhi to provide tourists with information in their preferred language and offer modern alternative to out-of-date audio guides (Dyade & Bhande, 2017)^[13]. The implementation of QR codes in the banking sector enhances transaction security, safeguards customer data, accelerates identification processes, facilitates contactless payments, and improves mobile access to financial services (Bhattacharya, & Singla, 2024)^[6]. The Indian government has launched the Bharat QR code payment method, enabling cashless transactions by scanning a QR code without an Electronic Data Capture machine. The use of e-wallet apps like Gpay, Paytm and Freecharge has increased. (Dyade & Bhande, 2017)^[13]. These provides a marketing opportunity, allowing distributors to engage effectively with their audience (Dyade & Bhande, 2017)^[13]. Integrating the QR-Code system with web-based technology is an effective and inexpensive method for transforming digital tourism (Yanis *et al.*, 2023)^[60]. QR codes can be utilized in food and beverage services to provide customers with authenticity, nutritional information, relevant socio-

cultural details, additional information and promotional information. Additionally, QR codes can be implemented in various aspects of rural homestays to inform customers about available facilities and services. It is also important to consider the potential for translating this information into different languages to effectively communicate with diverse audiences.

GIS & GPS

Global Positioning System (GPS) and Geographic Information System (GIS) technologies have a huge potential in sustainable agritourism. They are commonly used in tourism for various purposes, including accommodation management, transportation planning and location analysis (Han *et al.*, 2018)^[24]. GIS can also be applied in several areas, such as tourism resource inventory, development preferences, land use planning, site selection, analysis of tourist behaviour, resource evaluation, impact assessment, tourism information system, tourism recommendation system, path-finding, virtual tour and traffic plan. (Zheng *et al.*, 2017)^[62]. Destination Fetching Model, developed particularly for Sikkim is an established model which can be used in sustainable tourism planning and research in other locations of the country (Mukherjee *et al.*, 2023)^[36]. By using this model and scientific tools like GIS, destinations and spots can be identified and developed. Dar *et al.* (2022)^[11] developed a GIS-based Tourist Information System for Leh Ladakh, designed for mountain destinations that integrates GIS, Remote sensing and GPS with multimedia like tinctures and videos along with attribute data for different stakeholders, providing information to tourists and other stakeholders about tourist destinations and the amenities available therein. With the help of GIS and Spatial Data Infrastructure (SDI), web-based geoportals are developed for tourism planning in India. They are user-friendly, cost-effective, fast and resourceful.

Internet of Things (IoT)

IoT is regarded as a complete and comprehensive tool for sustainable energy and tourism management in both natural and cultural tourism destinations in India and the World (Tiwari *et al.*, 2022)^[53]. The Internet of Things is an interconnected ecosystem where various objects (things) are equipped with multiple sensors, facilitating communication with each other and with main computers without direct physical interaction enabled through modern wireless technologies and network solutions (Lee, 2021)^[31]

In the present generation, IoTs and sustainability are inseparable. IoT can monitor resources such as water and waste, promoting holistic sustainability practices in tourism operations. The resulting cost savings and operational efficiencies offset the initial investment in IoT technologies, making them an attractive option for tourism operators (Tiwari *et al.*, 2022)^[53]. By using IoT smart home environment sensors, customers could create and maintain a comfortable and pleasant living atmosphere inside the house. These IoT smart sensors are customized and installed based on temperature, humidity, leak, water, smoke, air and light (Looy *et al.*, 2014)^[33]. Fusion of this technology with traditional models is the future of sustainable accommodation in agritourism. Tourists are using IoT-based

smart devices and gadgets that can improve the convenience and experience of travel (Farid *et al.*, 2023) ^[14]. For instance, smartwatches and fitness trackers are becoming companions for tourists. They help to engage in health monitoring, navigation, connectivity and communication. IoT technology integrated with AR provides an enriched experience with informative digital contents, offering smart tour guides and exhibits (Pai *et al.*, 2020; Li & Jiang, 2023) ^[39,32].

In 2014, the Ministry of Electronics and Information Technology introduced India's first IoT Policy Document, providing a framework for the holistic implementation & execution of IoT-related initiatives. The National Digital Communications Policy (2018) set an ambitious target of connecting 5 billion IoT-enabled devices. IoT-Centre of Excellence (CoE) and Future Skill PRIME are initiatives to create a conducive ecosystem for futuristic technologies, including IoT, in India. Some examples of innovative IoT technology relevant to agritourism in India may be cited as KisanRaja, Skylark Drones, etc. India is performing remarkably in IoT technology with many large companies (Tata Consultancy Services, Reliance Jio, Tech Mahindra, HCL Technologies) involved in this initiative (Tippannavar & Yashwanth, 2023) ^[52].

Renewable Energy Solutions

Energy demands in the agritourism destinations are increasing. The energy access is highly correlated with sustainable tourism development and economic, socio-cultural and environmental satisfaction of tourists, local residents and stakeholders (Protic *et al.*, 2020) ^[43]. Affordable and clean energy is the seventh goal of sustainable development goal (SDG) proposed by United Nations. Renewable energy promotes sustainable agritourism by addressing key environmental, financial, and experiential goals. The sustainable energy management has the significant potential to reduce negative impacts of tourism destinations and energy inequalities (Tiwari *et al.*, 2022) ^[53]. It significantly reduces carbon footprint by minimizing greenhouse gas emissions, improves financial viability of agritourism businesses and allow reinvestment into infrastructure and operations (Kumar & Majid, 2020; Razmjoo, 2021) ^[30,44]. The application of renewable energy serves as Eco-conscious tourists are increasingly drawn to destinations that showcase environmental responsibility. Agritourism sites that incorporate renewable energy can boost their appeal as sustainable, eco-friendly destinations while also serving as educational hubs to promote awareness of renewable energy technologies and sustainable farming practices (Kumar & Majid, 2020) ^[30]. Investments in renewable energy infrastructure, such as solar panels, wind turbines and biomass facilities, not only supports power operations but also demonstrate sustainable practices. Collaboration with local governments, NGOs and renewable energy companies provides access to resources and expertise essential for implementation. Training programs for farmers and agritourism operators ensure they are equipped to make informed decisions regarding energy use. Furthermore, marketing campaigns highlighting the use of renewable energy can attract environmentally conscious tourists, while engaging the local community in renewable energy projects builds collective support for sustainable

initiatives (Kumar & Majid, 2020) ^[30]. From 2014-2015 to 2017-2018, more than 2.5 lakh (0.25 million) biogas plants were set up for cooking in rural homes to enable families by providing them access to clean fuel (Kumar & Majid, 2020) ^[30]. The capacity of biogas based power has been growing rapidly for the past decade with global biogas based electricity generation capacity increasing from 65 GW in 2010 to 120 GW in 2019 representing a 90% growth. Over the past decade, the capacity of biogas-based power has seen significant growth, with global biogas-based electricity generation rising from 65 GW in 2010 to 120 GW in 2019, marking a 90% increase (Srivastava, 2024) ^[47]. Through government programmes like Gobardhan, National Bio-gas and Manure Management Programme (NBMMP), biogas programme, etc., rural population including service providers can be benefited in renewable energy management and IoT can play a crucial role in enhancing the efficiency of energy management systems by enabling real-time monitoring of energy consumption through sensors and smart meters and allowing operators to identify inefficiencies and optimize energy use (Tiwari *et al.*, 2022) ^[53]. By analyzing data on energy usage patterns, peak demand times and seasonal variations, IoT supports data-driven decision-making, enabling businesses to implement targeted energy-saving measures.

Virtual Reality (VR) and Augmented Reality (AR)

Virtual Reality (VR) and Augmented Reality (AR) play an important role in promoting agritourism and enhancing tourists' experience, either on-site or from distance. VR can simulate farm tours, offering a 360° view of destinations, showcasing farming processes, local biodiversity and cultural heritage, fostering accessibility to explore the place beforehand (Jung *et al.*, 2020) ^[27]. This can help in better accessibility and in creating a strong emotional connection with the destination, encouraging actual visits. Virtual tours have the potential to induce interest and increase bookings. AR particularly enhances interactive learning stimulating a wider spectrum of senses allowing users to explore the place, people, crops, history and culture through 3D models, audio guides, and QR codes. Integrated AR features, such as social media filters highlighting local products or symbols, promote destinations organically through user-generated content. It can also help tourists develop positive attitudes about nature and make them environmentally responsible (Garzon *et al.*, 2020) ^[18]. Both AR and VR can help foster a sense of place attachment among visitors by providing rich, immersive experiences that evoke positive emotions and enhance the bond between tourists and the agritourism destination.

AI and Agritourism

Integrating artificial intelligence (AI) in agritourism presents numerous benefits for rural development, enhances productivity, knowledge transfer, income diversification, marketing strategies and thereby supporting sustainable practices. AI technologies can optimize resource management, improve tourist experiences and foster economic growth in rural areas. According to Boston Consulting Group, India is rapidly adopting artificial intelligence (AI), giving it a competitive edge globally. Currently, 30% of Indian companies optimize AI's value,

exceeding the global average of 26%. AI can be utilized in various aspects such as data analysis, evaluation of pattern, customized marketing, resource optimization, tourist satisfaction, feedback and improvement (Xie & He, 2022; Gan, 2022) ^[58,17]. AI can improve engagement through pattern recognition and natural language processing, offering real-time services (Siddiqui *et al.*, 2022) ^[46]. AI has the potential to transform the operational and marketing functions of tourist organizations (Gan, 2022) ^[17]. Kerala State Policy has taken the initiatives to embrace AI and augmented reality (AR) to promote smart tourism and attract international visitors (Reejo, 2023) ^[45].

Agriculture-related Technologies

Sustainable agriculture is the most important prerequisite to achieving sustainable agritourism. Organic farming, precision farming and natural farming are different approaches to sustainable agriculture which farmers in India have been practising these farming systems for a very long time. There is a plethora of modern technologies which are oriented towards sustainable agriculture. These technology applications may be implemented as monitoring, servicing and forecasting. Precision farming, as a component of sustainable agriculture, enhances practices through the reduction of resource wastage, minimization of chemical applications, enhancement of soil health and conservation of water resources. Machinery equipped with GPS technology is capable of performing operations such as seeding, fertilizing and spraying with precision, which results in an optimization of resources, labour and time, and increase of crop yields (Fountas *et al.*, 2020) ^[15]. This system incorporates a variety of tools, including computers, Geographic Information Systems (GIS), Global Positioning Systems (GPS), spectral imaging, aerial platforms and variable-rate controllers (Gawande *et al.*, 2023) ^[19]. Artificial Intelligence (AI) and machine learning technologies offer predictive analytics, which are instrumental in disease identification and crop yield forecasting (Khanal *et al.*, 2017) ^[29], thereby facilitating a more predictive and precise farming approach. Big data analytics contributes to sustainability initiatives by enhancing resource efficiency, mitigating environmental repercussions and fostering transparency within the agricultural supply chain (Fountas *et al.*, 2020) ^[15]. Automated machinery like harvesters, robotic weeders and unmanned aerial vehicles (drones), are employed for various purposes, including monitoring, assessment, pesticide application, herd management, agricultural exploration and mapping (Khan *et al.*, 2021) ^[28]. The Internet of Things (IoT) enables real-time surveillance of crop and livestock health and significantly enhances outcomes for producers through its "on-site monitoring" capabilities, which enable remote access (Khan *et al.*, 2021) ^[28]. Blockchain technology ensures transparency and traceability throughout the food supply chain (Galvez *et al.*, 2018) ^[16]. Indian government initiated the National Sustainable Agriculture Mission (NMSA) in 2014-15 to promote sustainable development in agriculture through green technology, resource conservation and integrated agriculture. Chennai-based start-up Stellapps has created SmartMoo™, an IoT system for dairy farm monitoring and management (Ashoka *et al.*, 2023) ^[3]. Additionally, Google Partner Innovation and

Google teams AnthroKrishi are using AI to tackle challenges in India's agricultural sector and AI for Agriculture Innovation initiative is driving change in the industry through the adoption of artificial intelligence (Ahuja & Mehra, 2023) ^[1].

Conclusion

Technological application is the ultimate future of the agritourism industry. The increasing preference for ecological products and green services enables farms to adapt and align themselves more consciously with the tourism sector, promoting more ethical, responsible and sustainable tourism. Integration of modern technology and indigenous practices of the very diversity of India will be a harmonious experience of rural agritourism. Ultimately, fostering a gradual shift in mindset is crucial and this can be achieved through impactful communication efforts. These efforts should involve collaboration between firms and institutions through school seminars, educational advertisements and public awareness campaigns to educate and engage the population to harness the best of the emerging technologies to promote sustainability, profitability and efficiency in agritourism. The pattern of utilization of technology in the industry is promising, even though there are several gaps in policy and challenges. Based on the study, there is a need for a holistic approach including awareness, policies and cooperation among various stakeholders.

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