



REVIEW ARTICLE

Agritourism and rural livelihood sustainability: A systematic literature review

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Abstract

Agritourism is emerging as a key driver of rural livelihood sustainability, seamlessly blending agriculture with tourism to create economic, environmental and social benefits. This systematic literature review, conducted using the PRISMA framework, analyzes 1330 articles from the Scopus database, identifying 220 relevant studies. The review examines key aspects, including author keywords, co-authorship networks and international collaborations. The findings underscore the significant connection between agritourism and sustainable development, highlighting its crucial role in job creation, income diversification, environmental conservation and the preservation of cultural heritage. However, the development of sustainable agritourism, particularly in developing countries, faces substantial problems, including inadequate infrastructure, financial constraints and legal barriers. Overcoming these obstacles necessitates a collaborative approach involving governments, private investors and local communities. Strategic initiatives such as enhanced infrastructure, supportive regulations and financial incentives are capable of helping the sector expand. Furthermore, integrating technology, digital marketing and new business models may broaden agritourism's reach and effectiveness. Future studies should focus on ways to maximize the sector's potential, such as community-based initiatives, sustainable tourism models and cross-sectoral collaborations. With the right laws and joint efforts, agritourism has the potential to be a transformative force, promoting economic resilience, environmental preservation and long-term sustainability in rural communities worldwide.

Keywords: agritourism; rural development; rural economic resilience; sustainability

Introduction

Agritourism has evolved as a critical component of sustainable rural development, combining agriculture with tourism to generate economic, social and environmental advantages. It gives tourists interact with rural life, participate in agricultural activities and appreciate local customs and heritage. Agritourism is important in both advanced and emerging nations for fostering economic growth, increasing community resilience and conserving natural resources (1). Rural communities around the world face a range of challenges, including economic insecurity, declining agricultural output, rural depopulation and limited access to basic services. Agritourism provides an alternate economic strategy for farmers while preserving the agricultural identity of these regions. Agritourism can help rural communities attract visitors, improve job possibilities and stimulate local economies (2).

Sustainable rural livelihoods depend on a variety of revenue sources, community participation and effective long-term environmental management. Agritourism significantly contributes to these goals by generating new revenue

streams for farmers, preserving cultural heritage and promoting environmental protection (3). The tourism-agriculture nexus guarantees that small-scale farmers have greater market access, financial stability and enhanced infrastructure. Furthermore, agritourism encourages rural sustainability through education and awareness. Tourists learn about agricultural practices, organic farming and traditional food production methods, which promotes sustainable consumer behaviour (4). This connection promotes information sharing and innovation, which benefits both visitors and local farmers.

Agritourism has been viewed as a sustainable strategy for improving the livelihood resilience of rural households through income diversification, reduced dependency on mainstream agriculture and increased social and economic linkages. Recent meta-analyses highlight that agritourism not only generates additional revenues but also increases farmers' adaptive capacity through skills acquisition, market access and social engagement. Agritourism constructs livelihood resilience by diversifying incomes, social capital and empowerment, particularly in areas that face agricultural

uncertainties (5). Similarly, another study highlight that agritourism promotes sustainable rural development by protecting the household from outside shocks as well as promoting entrepreneurial orientation (6).

Agritourism in industrialized nations supports small-scale farms, diversifies rural economies and maintains source material for customs. Agritourism strategies have been effectively used by countries like Italy, the USA and France in rural economy revamp. City dwellers seeking for authentic rural experience are increasingly attracted by farm stays, wine tours and organic food festivals (1). Agritourism has also been able to contribute to environmental conservation in advanced economies. The survival of rural landscapes is upheld through policies towards agritourism, farm-based education programs and sustainable farming methods. Technology and digital marketing enhance agritourism through connecting farmers to global markets, which generates increased revenue streams (2).

Research indicates that, Agritourism has emerged as an effective technique for addressing food shortages, unemployment and rural poverty in developing nations. Agritourism has been integrated into national development plans in countries such as Vietnam, Indonesia and India in order to benefit rural people. Agritourism provides an extra revenue stream for smallholder farmers while also ensuring economic sustainability without affecting their financial stability (3). However, infrastructure issues remain a substantial barrier in many poor countries. Poor road conditions, insufficient financial resources and a lack of legal frameworks have hindered agritourism's expansion. Government initiatives, public-private partnerships and international collaborations are making steady progress in resolving these hurdles and paving the road for sustainable agritourism (4).

Technological improvements have transformed the tourism industry, including agritourism. Agritourism, once considered a specialist sector, has evolved into an important component of socioeconomic growth. A thorough literature review highlights the use of technology in agritourism, particularly in marketing, infrastructure and visitor interaction. Digital marketing, smart tourism solutions and technological interventions have all contributed to boosting agritourism. However, worries regarding sustainability and cultural heritage preservation remain, as modernization frequently threatens traditional practices and beliefs (7).

Agritourism is widely recognized as an alternative cash source for farmers and rural communities. Structured literature review and bibliometric analyses of agritourism research show a growing focus on sustainable tourism, rural entrepreneurship and community-based tourism. Over the last four decades, studies have highlighted the changing patterns in agritourism, but many developing nations, including India, still lack well-defined laws and frameworks to realise its full potential (8).

Smallholder farming remains an important part of India's rural economy, although it faces ongoing sustainability concerns. With more than 86 % of farmers holding less than two hectares, economic viability remains a

major challenge. Agritourism has the potential to increase farmers' income through diversification, with initiatives like community-supported agriculture, farm-to-market linkages and rural entrepreneurship playing important roles. Significant policy changes must be made to include agritourism into mainstream agricultural and rural development programs, ensuring long-term sustainability and economic growth (9).

Understanding client preferences is critical for the success of agritourism. A study undertaken in Tamil Nadu analyze the elements that influence tourist decisions, focusing on landscape aspects, farm activities and hospitality services. The findings show that visitors are drawn to experiences that mix natural beauty, cultural history and interactive farm activities. The study uses multivariate analysis to identify tourists based on their demographics and travel behaviour, providing significant insights for agritourism operators looking to adapt their offerings. Agritourism enterprises can improve visitor satisfaction and long-term sustainability by taking a customer-centric approach (10).

Despite its enormous potential, India's agritourism industry has hurdles due to a lack of organized rules and frameworks. A study looking into policy gaps suggests a holistic approach for agritourism growth based on customer preferences and stakeholder expectations. The study uses data from farm resorts in Tamil Nadu to identify significant drivers such as accommodation preferences, farm-based activities and local food. The proposed model highlights the critical importance of government support, infrastructure improvements and digital marketing methods in promoting agritourism development (11).

Customer experience is important to the success of agritourism operations. Research on agritourism in Tamil Nadu emphasises the importance of providing individualised experiences to attract and retain visitors. The findings suggest that current tourists prioritise unique and immersive experiences over traditional tourism options. The study promotes experiential tourism approaches and customer-driven marketing tactics that are sustainable with rural livelihoods, assuring reciprocal advantages for both tourists and local residents. The study also emphasises the need for digital transformation to enhance agritourism services, making them more accessible and appealing to a broader audience (12). This study aims to study collaboration patterns and leading contributors, we will analyze author keywords, bibliometric coupling between papers and the co-authorship network among researchers and countries, evaluating the role of agritourism in enhancing rural livelihood sustainability in both global and developing nation contexts and identification of challenges for promoting sustainable agritourism practices.

Problem focus

In many developing countries, inadequate infrastructure remains a significant barrier to the success of agritourism. Poor road connectivity makes rural places difficult to reach, discouraging potential visitors. Furthermore, the lack of adequate housing facilities and inadequate digital connection prevents the expansion of this industry. Without efficient

transportation networks and lodging choices, agritourism locations struggle to attract and keep visitors, limiting their economic viability.

Financial constraints also represent substantial barriers to the growth of agritourism. High initial investment costs hinder rural entrepreneurs from launching tourism businesses, as constructing critical infrastructure, maintaining farms and offering excellent services all demand significant financial resources. Limited government subsidies and access to financial assistance increase the problem, making it difficult many small-scale farmers to convert into tourism-related businesses. Without sufficient investment, rural entrepreneurs are unable to create sustainable agritourism models that benefit both the environment and the local economy.

Regulatory and policy hurdles complicate the formation of Agritourism companies. Those wishing to invest in the sector face uncertainty due to regulatory delays, imprecise policies and inconsistent government backing. Many rural entrepreneurs face challenges in obtaining the necessary permits, navigating zoning restrictions and adapting to changing regulations. The absence of simplified policies not only hinders new entrants into the market but also impacts the long-term success of current agritourism companies.

Environmental sustainability is a growing concern in agritourism, as uncontrolled tourism operations can lead to biodiversity loss, soil degradation and excessive resource utilisation. If not adequately managed, the influx of visitors can put an extra strain on local ecosystems, resulting in deforestation, water shortages and pollution. Without suitable restrictions and sustainable procedures, Agritourism may contribute to environmental damage rather than fostering environmentally friendly development. Balancing tourism growth with conservation efforts is critical for the long-term health of rural landscapes and agricultural communities.

Limited market accessibility and insufficient advertising restrict the success of Agritourism in rural areas. Many sites lack effective marketing strategies and a strong digital presence, making it challenging to attract visitors. Without effective branding, online presence and targeted promotional activities, many destinations struggle to compete with popular tourist sites. As a result, diminished tourist participation leads to fewer economic rewards for farmers and rural businesses. To fully realise the promise of agritourism,

better marketing and digital integration are necessary to connect agritourism businesses with a broader audience.

Methodology

The methodology for this systematic literature review (SLR) on Agritourism and rural livelihood sustainability follows a structured and transparent approach to ensure a comprehensive analysis of existing research. This study employs the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, which facilitates the identification, screening, eligibility assessment and final inclusion of relevant studies. The Scopus database was selected as the primary source due to its extensive coverage of high-quality, peer-reviewed academic literature across multiple disciplines. The inclusion and exclusion criteria are presented in Table 1.

The recent trend in agritourism has been gaining momentum since 2015, with numerous studies highlighting its economic, environmental and socio-cultural benefits. Research from this period provides a strong foundation for understanding the evolution of agritourism, particularly in areas such as sustainable farming practices and rural development. The search strategy was designed to capture relevant studies using a combination of keywords, including agritourism, sustainability, rural development, rural economic resilience. This approach ensures the inclusion of research that addresses both the concept of agritourism and its role in enhancing rural livelihood sustainability. The initial search of the database retrieved a total of 1330 articles. These articles underwent a systematic filtering process, as outlined in the PRISMA flowchart shown in Fig. 1.

By showing how studies were selected at each step, this flowchart ensures the transparency and reproducibility of the review methodology. The first step of the process was identification, during which 1330 items of literature were found in the Scopus database. Table 2 presents the list of keywords employed during the database literature searches. This suggests that Scopus was the primary source for gathering research articles on natural farming and its widespread use. Following this, the literature pool was narrowed during the screening phase by applying predetermined inclusion and exclusion criteria. Consequently, 475 articles were left for additional evaluation after 665 articles were eliminated for failing to satisfy these requirements.

Table 1. Inclusion and exclusion criteria

Databases	Inclusion	Exclusion
Time span	2015 - 2024	< 2015
Document type	Articles, Review	Conference papers, Book chapters, Books, Editorials, Conference reviews
Subject area	Social science Environmental science Business management Agricultural and biological science Decision making	Others all
Languages	English	Non- English And others all Trade journal
Source type	Journal	Book series Book Conference proceeding
Publication stage	Final	Article in press
Open access	All open access	Others

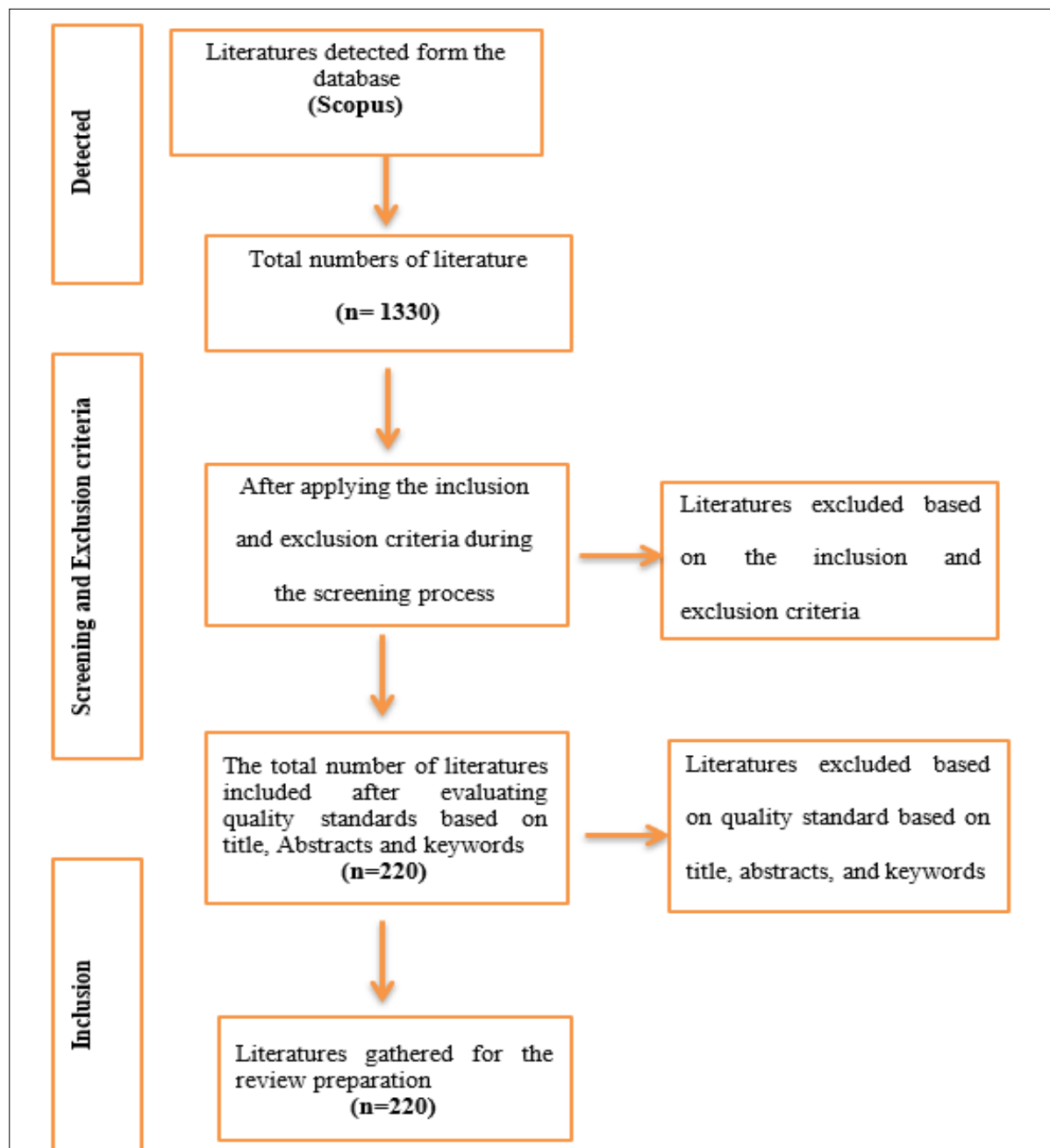


Fig. 1. The PRISMA flowchart.

Table 2. The list of keywords employed during the database literature searches

DATABASES	KEYWORDS	TOTAL NUMBER OF ARTICLE
Scopus	"Agrotourism" OR "agricultural tourism" OR "farm tourism" OR "rural tourism" AND "Sustainable rural livelihood" OR "sustainable rural development" OR "rural economic resilience."	1130

In the subsequent screening phase, the quality of the remaining 475 articles was assessed using their titles, abstracts and keywords. This step ensured that only articles with relevant content aligned with the research objectives were included. Consequently, 255 articles were excluded for not meeting the quality standards, leading to the final inclusion of 220 articles.

Justification for inclusion criteria

Only systematic reviews and peer-reviewed journal articles were used to make sure that the methodological excellence, scientific merit and dependability of the chosen literature were ensured. Journals typically go through stringent

editorial and peer-review processes, which guarantee high scholarly quality and integrity. While conference proceedings and book chapters are replete with intelligence, they also differ significantly within the framework of peer-review procedures and availability. Therefore, to embrace homogeneity in terms of quality judgment and comparability of results, these sources were excluded. It is further understood that by so doing, it may well constrain the scope of the review by depriving it of high-quality inputs from non-journal sources. Subsequent reviews can also encompass the incorporation of chapters from chosen books or proceedings, provided they are peer-reviewed and meet established quality standards.

Results and Discussion

Author keywords

The complex connections between the main themes in your study on the growth of agritourism in Western Tamil Nadu are depicted in (Fig. 2). With its close ties to agritourism, sustainable development and rural development, the network of terminology implies that agritourism is the main focus. These related topics highlight the importance of integrating tourism with sustainable farming practices while ensuring social, environmental and economic sustainability. A key component that connects many facets, including community-based tourism, cultural heritage and sustainable livelihoods, is agritourism. The existence of concepts like capital, livelihood resilience and governance implies that successful Agritourism depends on both financial assistance and efficient policies in addition to natural resources. Sustainable development, another dominant theme, emphasizes the role of community participation, agritourism and livelihood assets in fostering long-term benefits for rural communities.

Agritourism is closely tied to rural areas, cultural tourism and stakeholder involvement, indicating that it serves as a means of economic diversification for farming communities. The inclusion of regional development, astro-tourism and strategic planning implies that innovative and emerging tourism trends may contribute to strengthening the rural economy. The linkages between these concepts suggest that a well-structured agritourism model must incorporate sustainability principles, community engagement and economic resilience.

Network of co-authorship author

Highlights the cooperative links between researchers working in your field of study. A connected research community is

suggested by the interconnected nodes, which represent authors and the links that connect them, indicating co-authored papers. Strong patterns of collaboration among the listed authors are evident in the density and distribution of connections, with multiple authors forming a closely knit network. Numerous connections between writers like Rob McMorran, Martin Price and Fabien Santini indicate a high level of collaboration in studies on sustainability, agritourism and rural development. (Fig. 3).

Additionally, the visualisation shows how frequently these scholars collaborate, suggesting that their academic interests and research goals may be comparable. The network's structure implies that several researchers are equally connected to one another and contribute to a collective body of knowledge, rather than a single author controlling the collaboration. This suggests a collaborative and multidisciplinary approach in the field, which is crucial for researching the growth of agritourism. Since researchers who are already connected may continue to grow their research partnerships, the network also suggests the possibility of future joint opportunities. To increase the influence and reach of agritourism research, it might be helpful to recognize important contributions in the field and to network with seasoned professionals by comprehending these co-authorship patterns.

Document on bibliometric coupling

Bibliometric coupling visualisation was developed using VOSviewer, demonstrating the thematic composition of scientific documents on agritourism and adjacent disciplines. (Fig. 4). It demonstrates the capability of the visualization to distinguish between clear-cut clusters built upon common references among documents, enabling us to determine commutative research concerns and emerging subfields. The algorithm employed in the VOS viewer for clustering applies modularity optimisation, along with the intensity of co-

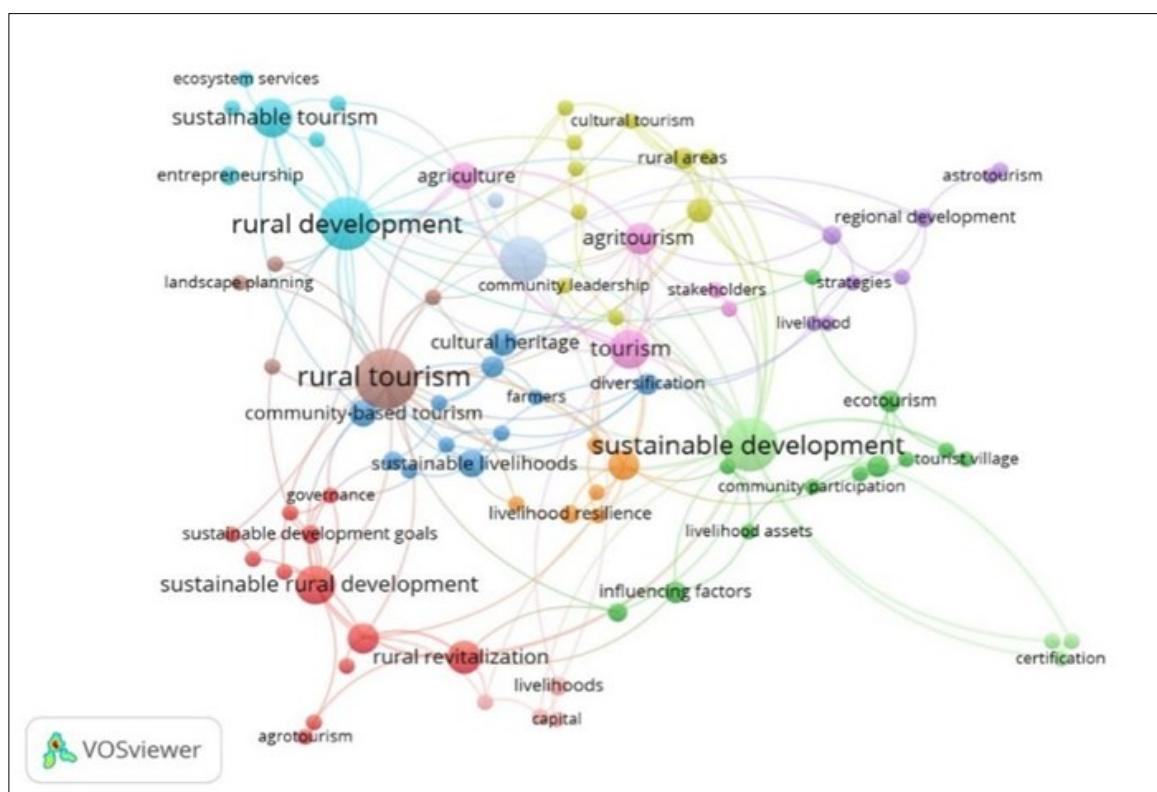


Fig. 2. Author keywords.

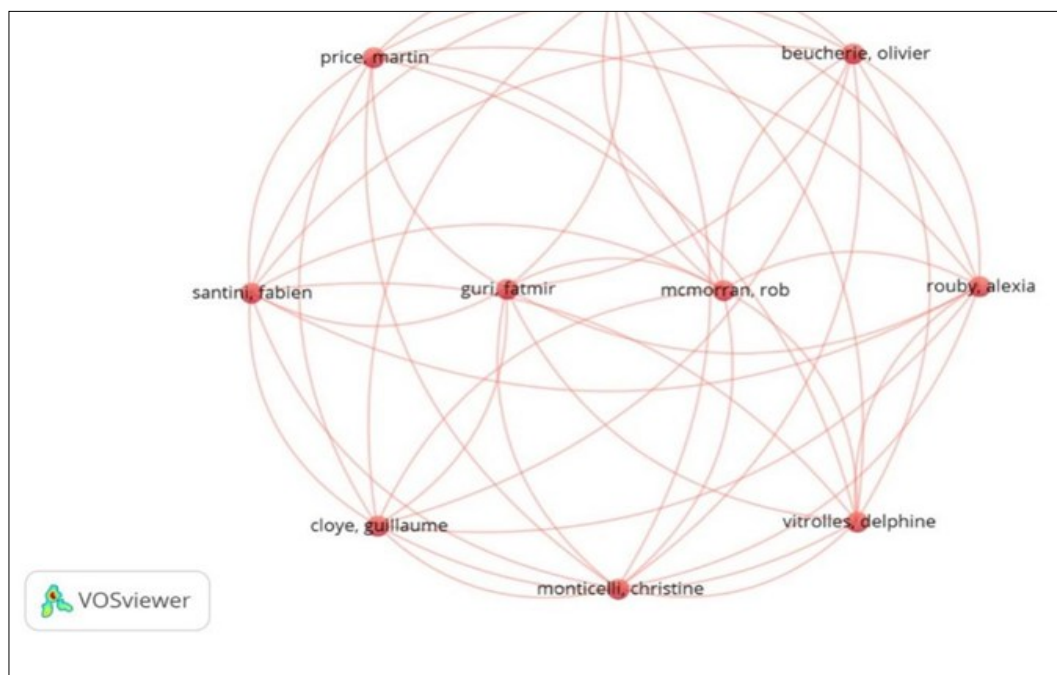


Fig. 3. Network of co-authorship author.

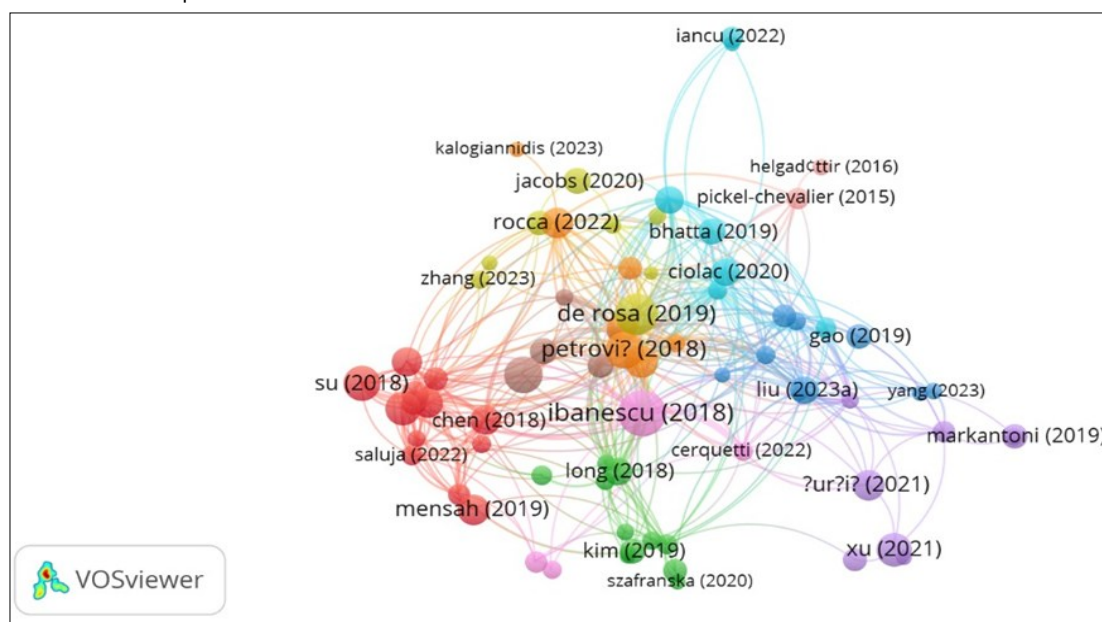


Fig. 4. Document of bibliometric coupling (Author wise).

citation, to provide robust clustering. Only documents that possessed high bibliographic coupling (i.e., minimum citation frequencies) were utilised to enhance cluster reliability and prominence.

Each colour-coded grouping represents a thematic category, including rural sustainable development, experiential tourism, rural entrepreneurship and agri-environmental education. The large nodes represent highly impactful publications, that is, milestone work that is heavily cited by other groups. Proximity among nodes suggests tight intellectual link, that is, an adulated, interdisciplinary knowledge field.

Studies act as central reference points, linking different agritourism themes and providing both conceptual foundations and empirical insights in shaping agritourism research (6, 13). Growing and increasingly vibrant agritourism research not only draws on these earlier contributions but also pushes the field in new and evolving directions (2, 14).

Specialized or niche views that are less frequently co-cited. This opens up possibilities for integrating such differentiated views within the larger agritourism discourse (15, 16). Apart from thematic clustering, patterns of co-authorship and country collaboration indicate dominant dynamics of world agritourism research. China and Spain are major contributors, as elucidated by their country emphasis on rural revitalization policies and agritourism development strategies. China's emergence in agritourism studies is supported by its rural development plan and massive investment in national tourist infrastructure. Spain, having progressed to mature wine and agritourism sectors, has developed a sophisticated corpus of research based on regional case studies and sustainable tourism models.

These trends also indicate the intensity of international collaboration: countries in Europe have high levels of trans-border researcher networks, with Asian contribution, especially

from China and India, significantly growing but less diverse in co-authorship. Determining these trends enables active research communities and identifies the need for cross-cultural or cross-regional collaboration that can be further developed within potential agritourism studies.

Fundamentally, this bibliometric coupling map not only flags important literature and theme diversity but also provides a glimpse of knowledge networks formation, where groundbreaking research stems from and how future research would fill the gaps. This form of interpretation is appropriate for a more strategic pathway for researchers newly entering the field, as it will drive collaboration and innovation.

Country of bibliometric coupling

Fig. 5 showed that a bibliometric linking network of nations was created with VOS viewer. It shows the number of references used in research outputs from various nations. The closeness and ties between nations are reflected in their collaboration on research or shared citation styles. China is the largest node in this network, indicating its substantial research contributions and robust bibliometric coupling with other nations. Other well-known nations, including Spain, India, Indonesia and Serbia, also play significant roles in the subject, indicating their enormous research output and collaborations.

The network is divided into variously coloured clusters, each of which stands for a collection of nations with close ties to one another. For instance, cooperation between the US and Asia is highlighted by the green cluster, which consists of China, Vietnam, the US and Pakistan. Collaborations mostly within Europe and the Middle East are indicated by the red cluster, which includes Spain, Iran, France and the United Kingdom. India, Sweden, South Africa and Saudi Arabia comprise the blue cluster, which symbolises collaborations among Asia, Europe and Africa. Furthermore, cross-regional research links are shown by the yellow and purple clusters, which comprise Italy, Indonesia,

Romania and Malaysia. Although cross-continental cooperation is also evident, these clusters suggest that research on specific themes is often conducted within regional or cultural contexts.

Important information about the scope and strength of research relationships can be gleaned from the network structure. The degree of bibliometric connectivity between nations is indicated by the thickness of the connecting lines (edges); bigger lines signify stronger ties. China's extensive influence on the international research community is evident in its numerous and close-knit relationships. The closeness of nodes indicates how similar the research outputs of different nations are. Spain, Iran and the United Kingdom, for instance, are positioned near together, indicating that their research paths and citation styles are similar. This network's interconnectedness suggests that international research is becoming more cooperative, with nations building on one another's findings.

From the standpoint of investigating the global adoption of natural farming, this bibliometric coupling map identifies key participants and potential partners. Collaborations with academics from nations with larger nodes and more robust connections are beneficial for gaining access to cutting-edge research, data and innovative methods, as these nations have greater influence in the field of study. Strong ties between China, India and Southeast Asian nations underscore a regional emphasis on sustainable agriculture, which aligns with the tenets of natural farming. Speaking with researchers from these areas can help you learn about both conventional and modern agricultural practices that support sustainable agriculture.

Role of agritourism

This section provides an in-depth evaluation of the role of agritourism in enhancing rural livelihood sustainability, drawing insights from both global and developing nation contexts. Agritourism plays a critical role in supporting rural

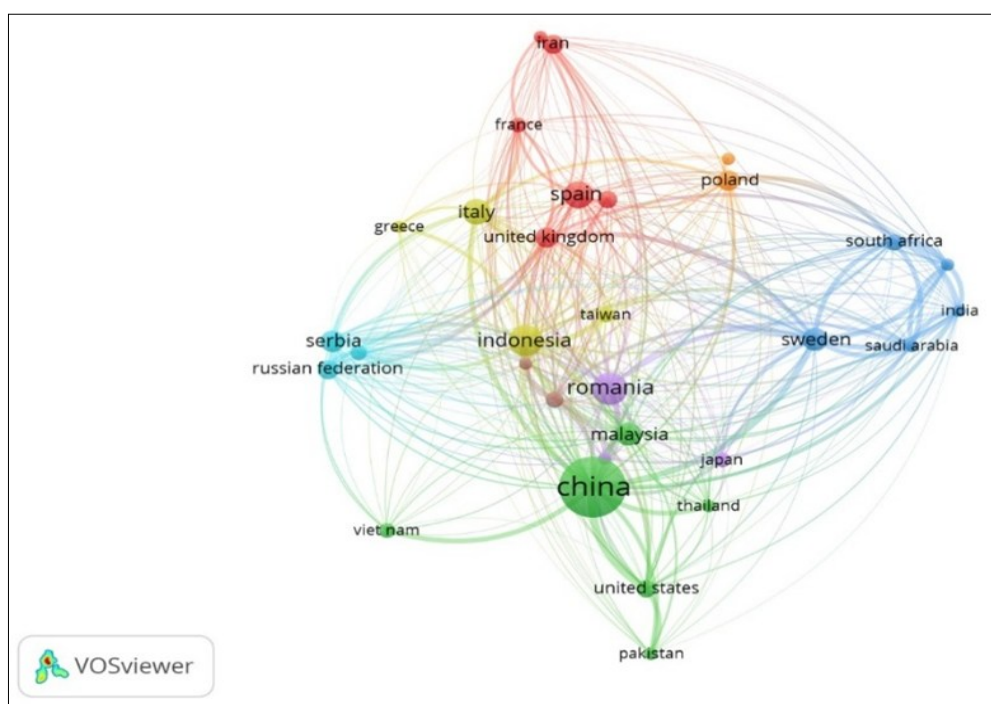


Fig. 5. Documents of bibliometric coupling (Country wise).

economies by diversifying income sources and generating employment opportunities. For example, integrating fishery cultural heritage with tourism has provided alternative income for fishermen affected by fishing bans, thereby promoting both economic and social sustainability (17). Community-based tourism (CBT) has also been shown to strengthen local businesses and create job opportunities, primarily driven by increased consumer satisfaction (18, 19). Additionally, agritourism initiatives have helped raise living standards and reduce poverty, demonstrating their potential to mitigate economic hardship in rural areas (19).

Beyond economic benefits, agritourism fosters social cohesion and helps preserve cultural heritage. In Tihingan Village, Bali, Indonesia, collaborative efforts between government authorities and local communities not only encouraged economic growth but also safeguarded traditional practices (20). The success of agritourism has been closely linked to strong local identity and active community involvement (21). Moreover, these initiatives have enhanced community pride and contributed to the preservation of cultural assets, further supporting social sustainability (22). Collectively, these findings suggest that agritourism enhances both economic resilience and social unity by reinforcing a shared cultural identity within rural communities.

Environmental sustainability is a vital aspect of agritourism, as it encourages eco-friendly practices and supports conservation efforts. For instance, studies have shown that agritourism helps reduce reliance on extractive industries, offering a more balanced approach that supports both environmental protection and economic growth (23). In Uzbekistan's Samarkand Region, agritourism has been recognized for its role in promoting economic stability while also preserving local cultural assets (24). Similarly, integrating intangible cultural elements with tourism has been shown to boost both economic development and environmental resilience, aligning agritourism with global sustainability goals (25). These examples underscore the importance of promoting environmentally responsible tourism practices to ensure long-term sustainability.

However, despite these clear benefits, agritourism faces several challenges-particularly in developing countries. In Indonesia, limited infrastructure and complex regulations have been identified as major hurdles to the growth of tourism-based rural communities (26). South African experiences further underscore the importance of accessible land, improved infrastructure and robust government support in enabling rural businesses to thrive (27). During the COVID-19 pandemic, digital tools and community-driven recovery efforts played a crucial role in sustaining agritourism activities, highlighting the importance of technology and local engagement in adapting to crises (28).

To unlock the full potential of agritourism, thoughtful policy-making and active stakeholder involvement are crucial. In China, digital innovation and environmentally conscious entrepreneurship have helped reinvigorate rural economies (29). Investments in agritourism infrastructure have proven effective in supporting rural revitalisation efforts, as seen in Kazakhstan (26). Meanwhile, in Vietnam's Mekong Delta, a

focus on improving infrastructure, encouraging agricultural innovation and strengthening local governance has contributed significantly to rural development (29). These cases demonstrate that targeted policies, financial support and capacity-building programs are crucial to overcoming barriers and promoting sustainable agritourism.

In summary, agritourism offers meaningful opportunities to enhance rural livelihoods by diversifying income sources, preserving cultural traditions and encouraging sustainable environmental practices. While the benefits are evident across various global and local settings, addressing region-specific challenges, such as inadequate infrastructure, regulatory issues and limited digital connectivity, is essential. Ultimately, strong collaboration between governments, communities and stakeholders will be the cornerstone of successful agritourism models that support long-term rural sustainability.

Challenges for promoting sustainable agrotourism practices

The challenges of establishing sustainable agritourism practices are numerous, driven by economic, environmental, infrastructure and policy considerations. Several studies have highlighted the limitations of agritourism programs, particularly in poorer countries where rural populations struggle to integrate tourism with their traditional agricultural livelihoods. One study emphasizes that insufficient government support, regulatory loopholes and inadequate infrastructure significantly hinder the long-term development of agritourism (20). Farmers face difficulties starting tourism-related ventures due to the lack of financial and technical assistance, while poor transportation and limited accommodations reduce visitor access, limited awareness, internet connectivity issues and high operational expenses (30). Similarly, inadequate investments from both public and private sectors-along with weak road networks and unreliable energy supply-have been identified as major deterrents to tourism development (27).

A lack of viable economic alternatives and growing environmental concerns also pose serious challenges. In rural areas such as the Zapatos Marsh in Colombia, communities remain dependent on extractive industries instead of transitioning to sustainable tourism, which limits environmental gains (23). Moreover, unregulated tourism has led to ecological degradation, threatening biodiversity and local food security. Climate change further exacerbates these issues. In Uzbekistan, frequent droughts and floods have been shown to reduce agricultural productivity, making agritourism less attractive and viable (24). These examples underline the urgent need for sustainable land-use policies that balance tourism development with environmental preservation.

Financial barriers remain one of the most persistent obstacles to the expansion of agritourism. Rural entrepreneurs often face difficulties in obtaining funding for long-term projects, largely due to a lack of government subsidies and the high upfront investment required (31, 32). Innovation deficits in tourism offerings also limit competitiveness, as many rural communities struggle to integrate modern technologies into their agritourism

programs. The absence of reliable transportation, accommodation and internet connectivity in rural regions further stifles business growth (32). Inadequate marketing strategies and weak online visibility exacerbate the challenges faced by rural tourism entrepreneurs in reaching potential customers, further compounding their financial difficulties.

Policy and regulatory hurdles also obstruct the growth of sustainable agritourism. Complex government regulations and bureaucratic delays create significant obstacles for entrepreneurs trying to launch or expand agritourism initiatives (33). Cultural resistance within rural communities further complicates these efforts. In Western Sichuan, China, ethnic communities have struggled to reconcile tourism development with their traditional livelihoods, particularly when government policies fail to account for their unique cultural and economic contexts (34). Community-level barriers, including scepticism and reluctance to adopt unconventional farming practices, also limit the broader adoption of agritourism strategies.

In addition to structural and financial issues, seasonal dependency and workforce limitations further constrain the long-term success of agritourism. Many operations are seasonal in nature, leading to inconsistent income and financial insecurity for rural enterprises (35). A shortage of trained personnel and limited access to tourism-focused training programs reduce the quality of visitor experiences. Without adequate expertise in hospitality and sustainable tourism, rural communities struggle to attract and retain tourists, thereby hindering the overall growth of the sector.

Solving these challenges involves a combination of policy measures, stakeholder cooperation and innovative approaches. Governments must prioritize support specifically delivered by means of incentives to come up with funds for infrastructure development as well as open regulatory

frameworks to facilitate sustainable tourism (36). In addition, the employment of digital technology in marketing, increased rural internet penetration and building collaboration between various communities, public agencies and private stakeholders has the potential to counter structural limitations and restraints (37). It should then prioritise longitudinal studies that analyse the long-term effects of agritourism on rural livelihoods and identify scalable best practices in various socio-economic settings (38, 39). Agritourism can reach its full potential as a sustainable force for rural development, economic stability and cultural heritage if these strategies are effectively implemented.

As shown in Fig. 6, the top ten most important challenges to the development of sustainable agritourism have a direct impact on its future growth and sustainability. Among these, poor infrastructure is the most significant challenge, accounting for 20 % of all challenges. Poor road networks, inadequate accommodation facilities and limited internet access discourage tourists from visiting the destinations and hinder the growth of agritourism businesses (40). Within the scope of an unreliable infrastructural backbone, rural targets cannot create repeat tourist streams, thus constraining economic prospects and sustainable long-term development (41).

Financial limitations account for 18 % of the impediments, as high initial capital demands, inadequate access to funds and low subsidies deter rural entrepreneurs (42). Agritourism businesses may require high capital outlays on infrastructure, product development and service provision -issues that disproportionately affect smallholders and female-headed businesses. Inadequate financial support is most likely to induce stagnation or collapse in firms, which would undermine industry growth.

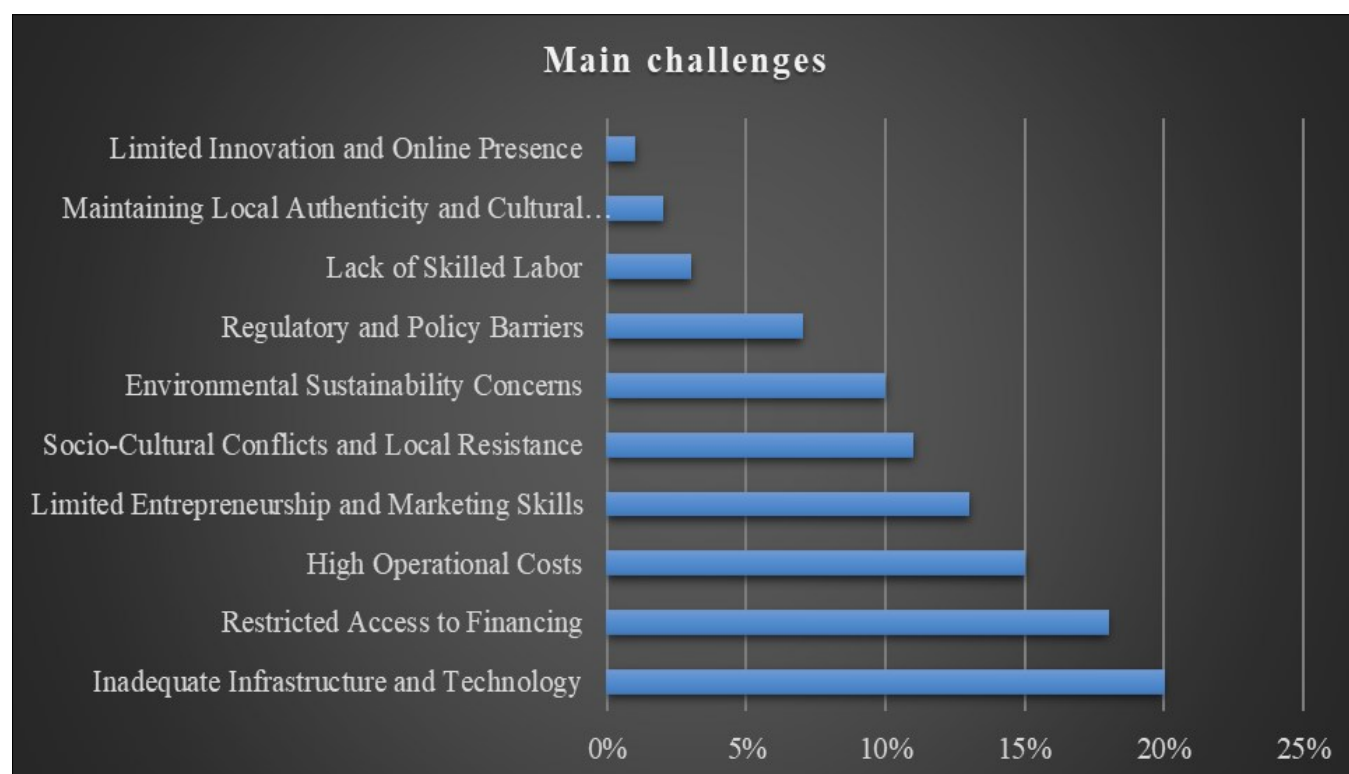


Fig. 6. Challenges for promoting sustainable agritourism practices.

Regulatory and policy hindrances, which account for 14 % to this day, continue to exist in the majority of regions. Red tape, policy uncertainty and the lack of official categorisation hinder agritourism registration and enterprise development (43). Redundant domains and outdated land-use legislation in India and Southeast Asia add complexity to the agritourism entrepreneur compliance (44). Transparency within regulation machinery and risk reduction through licensing mechanisms are crucial in the facilitation process of entrepreneurship. Environmental concerns account for 12 % of the concerns, with tourist degradation, including erosion of biodiversity, land use and resource depletion, posing threats to the ecological basis of agritourism. Climate risks to agricultural dependability, including droughts and extreme climatic events, also affect the viability of agritourism models. The incorporation of sustainable agriculture and imposition of agritourism regulation can make conservation management consistent with economic growth (45).

Market extension and limited promotion make up 10 % of the issues. Rural business entrepreneurs lack both the digital competence and the financial resources to execute effective marketing, thereby inhibiting market expansion possibilities (46). E-professional brand and digital solutions such as online reservation systems, which are unavailable, restrict publicity, particularly among urban consumers. Increased digital reach and rural brand investment can create more demand.

Community acceptance issues (8 %) still exist because some farmers are reluctant to shift from traditional farming due to a lack of awareness or fear of cultural change. Resistance occurs due to the perception that tourism may commodify local culture or strain rural resources. Participatory planning, social education and benefit-sharing approaches are necessary in order to increase approval and active engagement.

Private and public limited investment accounts for 7 % of the constraints. Perceived financial risk, long repayment periods and uncertainty of return discourage investors from financing agritourism activities (47). Government-supported incentives, provided in the form of tax relief and grants, can de-risk investment and stimulate capital flow to rural areas.

Skill deficiency accounts for 5 % of the problems, specifically in tourism, customer service and sustainable tourism management. Formal training restricts the quality of visitor experience and tourist satisfaction (48). Rural training facilities and incorporating modules of tourism within agricultural extension courses can help developing an effective rural workforce.

Dependence on seasons is 4 %, as the majority of agritourism activities are linked with growth or harvest seasons. Seasonality is equated to uncertain earnings and empty rooms during off-season periods. Year-round continuous product innovation, including food displays, indoor exhibitions and cultural festivities, will help minimise revenue volatility.

Lastly, technology and innovation are the cause of 2 % of the problems. Most rural regions have not yet adopted practices such as web booking, e-commerce, or intelligent farming systems into agritourism (49). The adoption of technology would help maximize efficiency in operations alongside drawing more

young and technology-oriented tourists.

It calls for an integrated, multi-dimensional approach to deal with these challenges successfully. Synergies, including investment in infrastructure, financial products, policy changes, environmental protection, electronic promotion and capability building, are critical to agritourism's long-term viability. Overcoming these challenges will make agritourism a beacon of rural sustainability, inclusive growth and preservation of culture.

Conclusion

Agritourism offers a viable way to enhance rural livelihoods' resilience by presenting a myriad of advantages, including economic diversification, cultural preservation and raising awareness about the environment. It enables farmers to diversify their income, access more markets and maintain traditional planting methods. Yet, the industry's full potential is typically hindered by ongoing challenges, including poor roads, poorly defined policy frameworks and minimal participation by major stakeholders.

To meet the challenges of this kind, governments need to implement policy measures that include guaranteed investment in rural infrastructure, such as all-weather roads, dependable electricity supply, internet connectivity and supportive infrastructure for hospitality. All these infrastructure setups are necessary to boost the accessibility and attractiveness of rural areas. Moreover, the adoption of fiscal incentives in the form of low-interest loans, subsidies and tax breaks can make it simple for rural entrepreneurs to step into agritourism activities. Effective regulatory frameworks need to be developed for promoting agritourism development, including efficient approval processes, effective environmental protection and transparent land-use policies. The local governments need to enable participatory management through education campaigns, participatory planning and cooperative models to ensure it is inclusive and sustainable in the long term.

Digital innovation is also a primary driver of development. Technological integration, like booking applications, electronic-commerce local products sites and virtual farm tour functionalities, can widen market access and visitor experience. Public-private partnerships should be streamlined to assist in building these digital tools and training programs to create local capacity in tourism, hospitality and digital marketing. Future work must emphasize longitudinal studies assessing the long-term socio-economic and environmental effects of agritourism in various areas. Comparative research can be used to identify best practices that can be adopted in various agro-ecological regions. Additionally, evaluation of the contributions made by digital innovations like artificial intelligence, augmented reality (AR) and precision agriculture, in augmenting agritourism business can highlight rural development opportunities. Through the integration of focused policies, public participation and evidence-based innovation, agritourism can potentially become an agent for change in rural development, economic resilience and the preservation of cultural and environmental heritage.

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Authors' contributions

SB contributes to article collection, analysis and interpretation of a systematic literature review. BP contributed to the development of ideas, validation and review of the manuscript. MK participated in reviewing the manuscript. SS¹, VG, HN and SS² were involved in validating the manuscript. All authors read and approved the final manuscript. [SS¹ stands for Selvanayaki S and SS² stands for Sarath Sennimalai].

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