RESEARCH ARTICLE

Topic Modeling and Thematic Analysis of Agritourism Research: A Text Mining Approach

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Abstract

This study aims to explore the intellectual structure and thematic trends of agritourism research through advanced text mining and topic modeling techniques, addressing a significant gap by providing a quantitative synthesis of agritourism literature with a focus on how scholarly discourse has evolved across domains such as sustainability, rural development, and tourism marketing. A systematic review of 223 peer-reviewed journal articles published between 2000 and 2024 was conducted using the Scopus database, applying text mining techniques including preprocessing (tokenization, lemmatization, and stop word removal) followed by Latent Dirichlet Allocation (LDA) to extract latent topics, while bibliometric analysis complemented the findings by identifying citation patterns and prominent keywords. The analysis revealed five dominant themes: (1) Rural Development, (2) Agritourism Activities, (3) Sustainability and Environment, (4) Farm Management and Diversification, and (5) Policy and Governance, with findings showing a growing scholarly focus on sustainability, participatory development, and digital transformation in agritourism, and temporal trends indicating that post-2015 studies increasingly integrate policy and technological dimensions. This study contributes to the agritourism body of knowledge by applying text mining methods to synthesize a large volume of literature, uncovering thematic gaps and emerging research directions, offering practical guidance for academics and policymakers in aligning agritourism strategies with sustainable rural development, and proposing a conceptual model integrating technology, policy, and behavioral frameworks to better understand research trajectories.

Keywords: agritourism, rural development, topic modeling, LDA, sustainable practices.

1 Introduction

Agritourism—broadly defined as tourism activities occurring on working farms—is increasingly recognized as a sustainable development strategy for rural regions across the globe. In response to environmental degradation, economic decline, and social fragmentation that have challenged rural livelihoods in recent decades, agritourism offers a multifunctional model capable of

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balancing agricultural production with tourism services [1]. By connecting consumers with local food systems, culture, and nature, agritourism generates income diversification for farmers, preserves traditional knowledge, and enhances environmental awareness [2–5]. It encompasses a broad range of activities—such as farm tours, fruit picking, animal feeding, and harvest festivals—that combine traditional agriculture with recreational, educational, and entertainment experiences [6–10]. These experiences not only provide farmers with supplementary income but also foster rural-urban linkages, deepen understanding of food systems, and promote sustainable tourism values [11–13].

The evolution of agritourism is tightly interwoven with global shifts in consumption patterns and development discourses. Early agritourism in Europe and North America focused on leisure, farm visits, and direct marketing [14, 15]. However, contemporary models emphasize social inclusion, women's empowerment, climate resilience, and experiential learning [16–18]. In countries of the Global South, including Iran, agritourism has become an integral element in national rural development strategies aimed at reducing rural-to-urban migration, increasing local employment, and strengthening food security [19]. The rise in demand for authentic, experience-based travel and interest in sustainable food systems has further boosted the popularity of agritourism [20–22].

The theoretical foundations of agritourism research are multidisciplinary. Sustainable development theory positions agritourism as a triple-bottom-line solution encompassing economic viability, environmental stewardship, and social equity [23]. Social capital theory explores how trust and collaboration among stakeholders determine the success of such ventures. Economic diversification theory frames agritourism as a strategy for reducing rural dependence on mono-sector economies. Theories of experiential tourism and value-added production underscore the emotional, symbolic, and educational dimensions of the agritourism experience [24–26]. Agritourism, as a hybrid of "agriculture" and "tourism," now stands as a prominent sector within rural development frameworks, offering promising routes for job creation, cultural heritage preservation, and landscape conservation [27, 28].

However, agritourism is not without its challenges. Effective marketing, managing visitor impacts on working farms, and ensuring infrastructure and regulatory support remain key hurdles [29]. Hence, research into agritourism plays a critical role in understanding sectoral dynamics, developing the best practices, and guiding policy design [51, 58, 65, 66, 78, 81]. However, despite the expansion of academic literature over the past two decades, this body of knowledge remains fragmented across rural sociology, agricultural economics, tourism management, and environmental studies [49, 82].

This study explores the evolution of agritourism research between 2000 and 2024, aiming to uncover its dominant themes, trace their development over time, and examine their responsiveness to global and local dynamics such as climate change, the COVID-19 pandemic, and digital transformation. It also seeks to identify conceptual blind spots within the literature and suggests promising avenues for future inquiry. The paper is structured as follows: Section 1 presents the introduction, outlining the research background and objectives. Section 2 provides the theoretical background and conceptual foundations of agritourism. Section 3 describes the methodology, including data collection and topic modeling procedures. Section 4 presents the results and topic analysis. Section 5 discusses the findings and implications. Finally, Section 6 concludes the paper and offers directions for future research.

While several review papers on agritourism have been published since the early 2000s, most of them relied primarily on qualitative synthesis or bibliometric summaries with limited analytical depth. Table 1 summarizes the scope and methods of the most relevant reviews from 2000–2024. Compared to these studies, the present review provides a distinct contribution by employing advanced Natural Language Processing (NLP) and Latent Dirichlet Allocation (LDA) topic modeling to identify thematic structures across more than two decades of literature. This approach allows for a reproducible, data-driven understanding of the intellectual evolution of agritourism research, bridging disciplinary boundaries between tourism, agriculture, and sustainability.

In summary, this paper differs from previous reviews by combining bibliometric analysis with machine learning-based topic modeling to provide a comprehensive and replicable overview of agritourism research from 2000 to 2024.

Table 1. Comparison of previous review articles on agritourism (2000–2023).

Author(s)	Year	Method	Time Period Covered	Key Focus	Identified Gap	Contribution of This Study
Phillip et al. [8]	2010	Qualitative synthesis	1990–2009	Typology of agritourism	Lack of quantitative trend analysis	Provides quantitative, topic-based synthesis
Bhatta et al. [38]	2020	Narrative review	2000–2019	Economic and social impacts	Absence of computational text analysis	Applies LDA for objective theme extraction
Roman et al. [75]	2024	Bibliometric + Cluster analysis	2000–2021	Research clusters in agritourism	Limited dataset and no topic validation	Expands dataset to 2024 with coherence-based LDA
Utama [4]	2023	Conceptual review	2005–2022	Management and sustainability	Descriptive approach only	Integrates NLP to reveal research gaps
This Study	2024	LDA Topic Modeling + Bibliometrics	2000–2024	Full-spectrum thematic analysis	Fills methodological and temporal gaps	Offers reproducible, data-driven synthesis

Table 2. Theoretical foundations of agritourism research.

Theory	Core Concept	Relevance to Agritourism
Sustainable Development Theory	Balanced integration of economic, social, and environmental objectives	Frames agritourism as a pathway toward triple-bottom-line sustainability in rural regions
Social Capital Theory	Cooperation, trust, and collective action within communities	Explains how stakeholder relationships affect agritourism success
Economic Diversification Theory	Reducing income risk by expanding non-agricultural activities	Justifies agritourism as a resilience strategy for farm households
Rural Development Theory	Strengthening rural infrastructure, livelihoods, and social services	Positions agritourism as a driver of rural revitalization
Experiential Learning Theory	Learning through direct experience and participation	Highlights the educational and emotional dimensions of farm-based tourism
Value-Added Theory	Enhancing product worth through innovation and services	Connects agritourism to higher market value and consumer engagement

2 Theoretical Background

2.1 Conceptual Foundations of Agritourism

Agritourism, situated at the intersection of agriculture and tourism, is a strategic approach to rural development [76] that diversifies income sources and preserves cultural heritage. It involves traveling to farms and rural areas where visitors engage in agricultural activities to gain educational, recreational, or cultural experiences [57, 69]. This form of tourism encompasses a variety of formats including farm tourism, eco-agritourism, edu-agritourism, and agri-commerce tourism, each emphasizing different outcomes—ranging from sustainability and learning to direct sales and digital interaction.

Recent studies (e.g., Tugade [80]) have emphasized the multifaceted benefits of agritourism, including economic growth, environmental conservation, and social empowerment. These contemporary insights underscore the evolving understanding of agritourism as a dynamic policy tool that supports sustainable rural development, necessitating comprehensive frameworks that address economic viability, ecological sustainability, and social inclusivity simultaneously.

From a definitional standpoint, Garrod et al. [48] describe agritourism as any public-facing activity conducted on a working farm that allows visitors to observe, learn about, or participate in agricultural processes. Liang et al. [64], distinguish farm tourism as a subcategory focused on daily tasks like harvesting and animal husbandry. Similarly, rural tourism—as discussed by Ghaderi et al. [50]-includes broader cultural immersion through home stays and local festivals.

The scope of agritourism activities is vast: farm and orchard visits [37], harvesting experiences [79], educational workshops [42], farm stays [71], and farm product sales [40]. These are often complemented by cooking workshops [52], recreational activities [68], and animal-related interactions [53], which altogether provide rich, interactive learning environments for visitors and diversified income streams for host communities (Table 2).

The theoretical foundation of agritourism integrates several development theories:

Sustainable development theory stresses responsible resource use for long-term benefit [77].

Social capital theory highlights the role of community trust and cooperation in tourism success [74].

Economic diversification theory supports agritourism as a mechanism to reduce income volatility [67].

Rural development theory frames it to improve infrastructure, job creation, and quality of life [62].

Experiential learning theory explains the depth of understanding gained through immersive agricultural participation [59].

Value-added theory aligns with the enhancement of farm product value through tourism-based services [73].

These perspectives collectively highlight agritourism's capacity to function as a multidimensional lever for rural transformation. However, realizing its full potential requires supportive policies, digital infrastructure, effective marketing, and capacity-building at the local level. As studies show, the integration of technology, fair distribution channels, and targeted promotion play increasingly critical roles in ensuring the sustainability and scalability of agritourism initiatives [45].

2.2 Text Mining and Topic Modeling in Agritourism Research

The proliferation of agritourism literature necessitates effective methods for synthesizing and analyzing vast amounts of textual data. Text mining, encompassing natural language processing and machine learning techniques, enables researchers to extract meaningful patterns and insights from large unstructured text corpora. Jurafsky et al. [56] provide a comprehensive overview of these techniques, highlighting their applications in various domains. Latent Dirichlet Allocation (LDA), introduced by Blei et al. [39], is a generative probabilistic model that allows for discovering latent topics within a collection of documents. By identifying word co-occurrence patterns, LDA facilitates understanding thematic structures in large text datasets, making it a valuable tool for literature reviews and content analysis. In agritourism research, Roman et al. [75] conducted a literature review and cluster analysis, categorizing publications into thematic areas such as sustainability, rural development, and consumer behavior. Their work underscores the utility of computational methods in mapping the intellectual landscape of agritourism studies.

By integrating text mining and topic modeling techniques, researchers can systematically identify prevailing themes, track the evolution of research topics over time, and uncover gaps in literature. This approach enhances the efficiency of literature reviews and provides a data-driven foundation for future research directions in agritourism.

While Roman et al. [75] conducted an early bibliometric and cluster-based exploration of agritourism literature, their dataset was limited to publications indexed up to 2021 and lacked topic coherence validation. The present study expands the temporal coverage to 2024, employs a larger corpus (223 articles), and integrates quantitative validation metrics (UMass and Cv) to ensure the robustness and interpretability of the derived topics. Moreover, by combining bibliometric indicators with NLP-driven topic modeling, this research provides a more comprehensive and reproducible mapping of the intellectual landscape of agritourism.

In summary, the theoretical and methodological integration presented here underpins the subsequent analysis by linking agritourism's conceptual diversity with advanced computational approaches for literature synthesis.

3 Methodology

Recent bibliometric studies (e.g., Roman et al. [75]; Gascón [49]) confirm a steady and near-exponential growth in agritourism publications since 2000, reflecting the sector's expanding role in sustainable rural development and policy debates. This study builds on that evidence by applying computational text-mining techniques to systematically map the intellectual evolution of agritourism literature. While previous reviews relied mainly on subjective manual selection, the present approach integrates human judgment in the screening stage with data-driven topic modeling, thereby reducing interpretive bias and enhancing reproducibility. Existing literature reviews often suffer from subjective selection bias and limited scope. To overcome these limitations, computational techniques such as text mining and topic modeling have emerged as robust tools for analyzing large volumes of unstructured academic text [31]. Text mining applies natural language processing (NLP) methods to extract structured knowledge from textual data. Our methodology involves preprocessing and vectorizing text, applying LDA, and analyzing topic distributions across the literature corpus [44].

Among the most effective techniques is Latent Dirichlet

Table 3. Inclusion and exclusion criteria used for article selection.

Criteria Type	Description
Inclusion	(a) Peer-reviewed journal articles; (b) English language; (c) Published between January 2000 and March 2024; (d) Keywords including "agritourism," "agri-tourism," or "agro-tourism" in the title, abstract, or author keywords; (e) Available in full text through recognized databases (Scopus, Web of Science, ScienceDirect, SpringerLink, or Google Scholar).
Exclusion	(a) Conference papers, dissertations, and book chapters; (b) Non-English publications; (c) Duplicates across databases; (d) Articles not conceptually related to agritourism (e.g., pure agriculture or hospitality without farm context); (e) Incomplete metadata or unavailable abstracts.
Rationale	Ensures scientific rigor, comparability, and replicability of topic modeling.

Allocation (LDA), a probabilistic topic modeling method that detects latent themes within documents. By applying LDA to abstracts and summaries of agritourism-related academic literature, this study seeks to identify the dominant research topics, trace thematic developments, and highlight underexplored areas. This paper presents a comprehensive text-mining analysis of agritourism research using LDA. We describe methodological steps for data preprocessing and modeling, report the key findings on thematic structures in the literature, and discuss the implications for future research, policy development and agritourism practice [36].

Although systematic reviews have been conducted in areas such as rural tourism or farm stays, few studies have applied Latent Dirichlet Allocation (LDA) to analyze tourism literature. LDA is a probabilistic model for discovering hidden topics within a collection of documents. Its use in tourism studies is growing, allowing scholars to interpret thematic clusters data-driven and compare findings across time, disciplines, or regions [72].

This study employs a text-mining approach to systematically analyze the academic literature on agritourism published between 2000 and 2024. The methodology consists of five key stages: data collection, selection, and preprocessing, topic modeling using Latent Dirichlet Allocation (LDA), validation, and interpretation.

3.1 Data Collection

To obtain a comprehensive dataset of peer-reviewed publications on agritourism, we searched five major databases—Scopus, Web of Science, ScienceDirect, SpringerLink, and Google Scholar. The search was conducted using the keyword "agritourism" and its common variants (e.g., "agri-tourism" and "agro-tourism") in article titles, abstracts, and keywords. The publication date range was limited to January 1, 2000, to March 31, 2024. Although multiple databases were consulted to ensure coverage, Scopus served as the primary source due to its comprehensive indexing and reliable metadata structure. The other databases (Web of Science, ScienceDirect, SpringerLink, and Google Scholar) were used to cross-check completeness and avoid omissions.

3.2 Inclusion and Exclusion Criteria

We included only English-language, full-text, peer-reviewed journal articles. Conference papers and book chapters were excluded from the corpus due to their inconsistent metadata structure, varying peer-review standards, and limited indexing in major academic databases. This decision ensured the reliability, replicability, and scientific rigor of the topic modeling process. Articles were screened based on their relevance to the topic and conceptual alignment with agritourism as defined in the literature (Table 3). After applying these criteria, 223 articles were retained for analysis (Figure 1).The step-by-step results of the literature search and screening are summarized in Table 4.

3.3 Text Preprocessing

The titles and abstracts of the selected articles were extracted and preprocessed using standard natural language processing (NLP) techniques [30, 54, 63]. These included:

- Lowercasing all text
- Removing punctuation, numbers, and special characters
- Eliminating stopwords (e.g., "the," "and" "of")
- Lemmatization (reducing words to their base

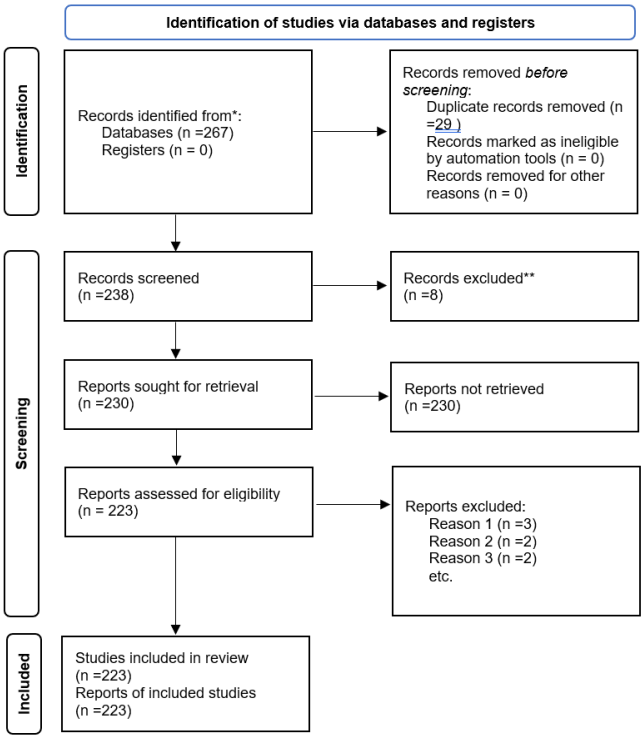

Figure 1. PRISMA flow diagram for article selection.

Table 4. Numerical summary of the literature search and screening process following PRISMA guidelines.

	(n =)
Records identified from databases	267
Registers	0
Duplicate records removed	29
Records marked as ineligible by automation tools	0
Records removed for other reasons	0
Records screened	238
Records excluded	8
Reports sought for retrieval	230
Reports not retrieved	7
Reports assessed for eligibility	223
Reports excluded (reasons)	
– Not related to agritourism concept	3
– Not peer-reviewed	2
– Insufficient metadata	2
Studies included in review	223
Reports of included studies	223

Source: Page et al. [72].

form)

- Removing words with fewer than three characters or appearing in fewer than five documents

This preprocessing ensured that the corpus was clean and suitable for topic modeling. All preprocessing and modeling procedures were conducted using Python with packages such as Gensim for topic modeling and NLTK for preprocessing. All text preprocessing and topic modeling procedures were implemented in Python (v3.x) using open-source libraries: Gensim for topic modeling and NLTK for text preprocessing. Proper acknowledgment is hereby given to the developers of these tools.

3.4 Topic Modeling with LDA

Latent Dirichlet Allocation (LDA), a widely used unsupervised topic modeling algorithm, was applied to the cleaned corpus using the Gensim library in Python. The number of topics (k) was assessed across a range of values, and k = 5 was selected based on coherence score optimization and interpretability of topic outputs. Each topic was labeled manually based on its top contributing keywords and the content of dominant documents.

Each document in the corpus contributes probabilistically to multiple topics based on word distributions. This means that a single article can have fractional associations with several topics, avoiding double counting while accurately reflecting interdisciplinary overlap.

3.5 Validation and Visualization

Model coherence was evaluated using UMass and Cv coherence scores. Additionally, representative documents for each topic were reviewed manually to ensure thematic consistency. Visualization of topic distributions and inter-topic distance maps was performed using the pyLDAvis package to enhance interpretability and support analysis. The optimal number of topics (k = 5) was determined by evaluating model coherence using both UMass and Cv metrics. The model achieved a UMass score of 0.54 and a Cv coherence score of 0.67, indicating a good balance between topic diversity and interpretability. To ensure stability, the model was re-run five times with random initializations, yielding consistent topic structures. Figure 2 illustrates the coherence scores across different k values (from 3 to 10), confirming that k = 5 provides the most coherent and interpretable solution.

Overall, the methodological framework integrates systematic screening, transparent inclusion criteria, validated topic modeling, and visual analytics. This ensures that the review is not only comprehensive and replicable but also methodologically rigorous in line with current standards for computational literature reviews.

4 Results

Topic modeling identified five major themes in the agritourism literature between 2000 and 2024: (1) Rural Development, (2) Agritourism Activities, (3) Sustainability and Environment, (4) Farm Management and Diversification, and (5) Policy and Governance.

Among these, Rural Development emerged as the most prevalent theme, representing 27.4% of the total corpus, followed by Agritourism Activities (23.1%), Sustainability (19.6%), Farm Management (16.8%), and Policy and Governance (13.1%). These proportions were derived from topic probabilities calculated using the LDA model. Each document was modeled as a mixture of topics, and each word characterized a topic. Table 5 displays the top keywords associated with the five identified topics.

4.1 Topic Descriptions and Literature Comparison

Topic 1: Rural Development
This topic is the most prevalent, accounting for approximately 27.4% of the corpus. Keywords such as rural, development, community, local, and region indicate that agritourism has been widely studied as a catalyst for rural revitalization and socio-economic diversification. Literature consistently frames agritourism as a driver of community well-being and regional sustainability [45, 62]. Studies in this category often emphasize the role of local identity, cooperation, and place-based development policies in fostering long-term rural resilience.

Topic 2: Agritourism Activities
This theme, representing about 23.1% of the corpus, highlights the experiential and educational components of agritourism. Dominant terms such as farm, tourism, visitor, experience, and products underscore the centrality of direct farm-based experiences to the overall visitor offering. Agritourism activities—including workshops, tastings, and guided farm visits—serve as the foundation of the sector's appeal [36, 41]. This focus connects to the experiential learning perspective, where tourists engage directly with agricultural environments and practices.

Topic 3: Sustainability and Environment
Accounting for approximately 19.6% of the analyzed corpus, this topic captures the growing environmental awareness in agritourism research. Key terms such as sustainability, environment, conservation, and resources highlight the increasing integration of ecological considerations into agritourism operations. Scholars such as Tew et al. [79] and Gascón [49] have emphasized that environmentally responsible practices are now central to the long-term viability of agritourism enterprises, linking ecological stewardship with economic diversification.

Topic 4: Farm Management and Diversification
Representing roughly 16.8% of the corpus, this topic focuses on the managerial and entrepreneurial dimensions of agritourism. Frequent terms include income, innovation, marketing, business, and value, showing how agritourism enables farmers to diversify income and enhance competitiveness. The literature in this area discusses innovation in product design, digital marketing, and customer engagement as strategic responses to changing market conditions [8, 70]. Agritourism is thus framed as both a risk mitigation and opportunity creation mechanism for farms.

Topic 5: Policy and Governance
Comprising around 13.1% of the corpus, this topic focuses on the institutional and policy frameworks that shape agritourism development. Key terms such as policy, planning, institution, support, and governance illustrate the need for structured regulation, coordination, and policy support mechanisms. Research in this category stresses the importance of coherent rural policies, stakeholder collaboration, and governance models that integrate tourism, agriculture, and sustainability agendas [45]. These studies demonstrate that agritourism thrives where policy frameworks actively facilitate participation and investment.

4.2 Topic Prevalence and Distribution

The relative distribution of topics across the dataset is as follows:

- Topic 1: Rural Development – 27.4%
- Topic 2: Agritourism Activities – 23.1%
- Topic 3: Sustainability and Environment – 19.6%
- Topic 4: Farm Management and Diversification – 16.8%
- Topic 5: Policy and Governance – 13.1%

This distribution confirms that Rural Development and Agritourism Activities remain the dominant research focuses in the agritourism literature, reflecting continued attention to community revitalization, local development, and farm-based experiences. In

Table 5. Summary of main topics identified through LDA.

Topic	Dominant Keywords	Topic Share (%)	Representative Articles
1. Rural Development	rural, development, community, region, local	27.4	Lane [62]; Roman et al. [75]
2. Agritourism Activities	farm, tourism, visitors, experience, products	23.1	Bhattaet al. [38]; Barbieri [36]
3. Sustainability and Environment	sustainability, environment, conservation, resource	19.6	Tew et al. [79]; Gascón [49]
4. Farm Management Diversification	income, innovation, marketing, business, value	16.8	Sullins et al. [15]; Roslina et al. [21]
5. Policy Governance	policy, institution, planning, governance, support	13.1	Flanigan et al. [45]

contrast, Sustainability, Farm Management, and Policy & Governance receive comparatively less emphasis, indicating opportunities for future studies to deepen understanding of environmental integration, managerial innovation, and institutional frameworks.

4.3 Visual Summaries and Temporal Trends

To further explore and illustrate the results of the topic modeling analysis, a set of visual summaries, including topic distribution, keyword co-occurrence, and temporal trends, were generated. These visualizations help contextualize the identified topics and provide additional insight into the structure and evolution of agritourism research.

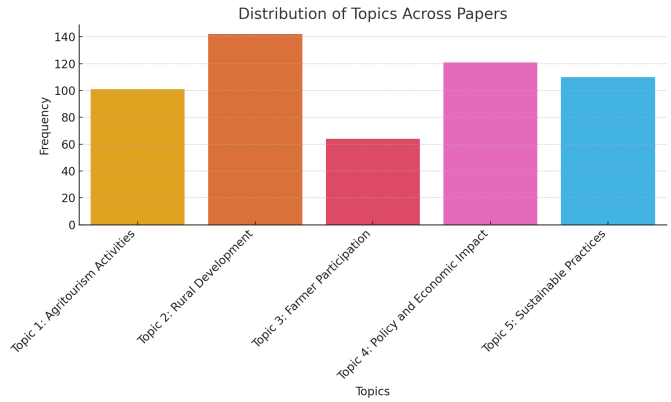

Figure 2. Topic distribution of agritourism literature (2000–2024) based on LDA modeling.

A bar chart was generated to show the proportion of each identified topic within the full dataset (Figure 2).

Figure 3 presents a keyword co-occurrence heatmap for the top 20 stemmed terms extracted from the abstracts. Darker red cells indicate higher co-occurrence frequencies, revealing stronger conceptual associations within literature. The visualization highlights frequent pairings among "develop," "sustain," and "farm," suggesting a thematic convergence around sustainable agricultural development and production practices. Moderate co-occurrences between "rural," "tourism," and "local" further point to an emerging intersection of rural livelihood and agritourism studies. In contrast, lower co-occurrence values involving "policy," "climate," and "innovation" indicate limited linkage between institutional or environmental perspectives and the core economic/production-oriented discussions. Overall, while literature increasingly connects sustainability with agricultural performance, the integration of regulatory and climate dimensions remains relatively underexplored.

A line chart was constructed to analyze how the five topics have evolved (Figure 4). This temporal analysis reveals several noteworthy trends:

Topic 1: Rural Development remained consistently strong throughout the two decades, with notable peaks around 2012 and 2018—reflecting increased academic and policy attention to rural revitalization following economic crises and migration waves [60].

Topic 2: Agritourism Activities have shown steady growth since 2010, coinciding with the global rise of experiential and nature-based tourism [46]. The post-COVID era further accelerated interest in farm stays and open-air destinations, as Baby [34] discussed.

Topic 3: Farmer Participation exhibited several spikes tied to regional policy shifts promoting agri-entrepreneurship and diversification, as seen in Iran [19] and Georgia [33].

Topic 4: Policy and Economic Impact fluctuated significantly, reflecting reactive interest in regulatory changes or funding programs at national levels.

Topic 5: Sustainable Practices have been showing a slow but steady rise in frequency since 2016, aligning with global shifts toward responsible tourism [43] and the growing incorporation of UN Sustainable Development Goals (SDGs) in academic research [32].

4.4 Interpretation and Implications

The temporal analysis offers several critical insights:

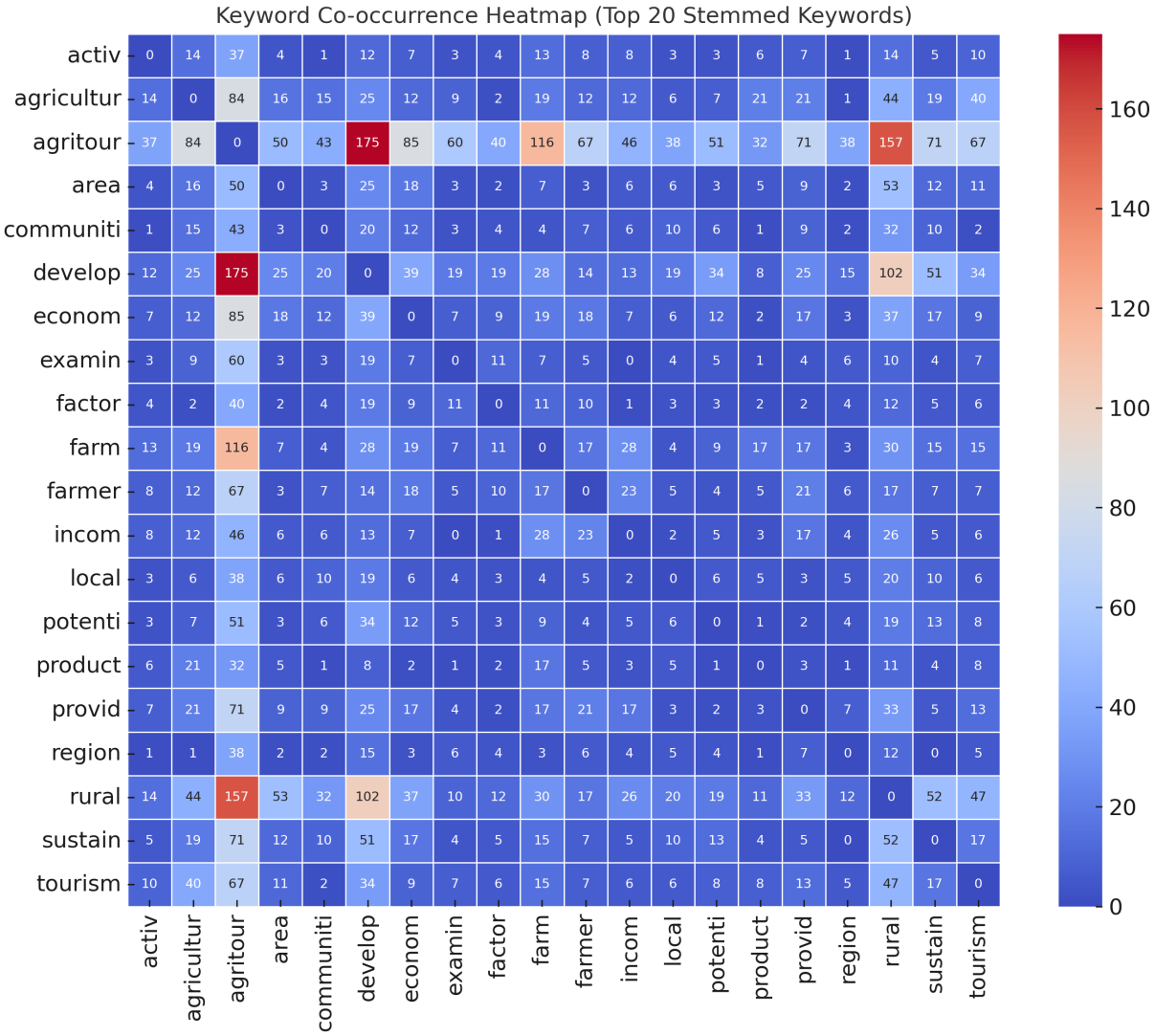

Figure 3. Keyword co-occurrence heatmap (top 20 stemmed keywords).

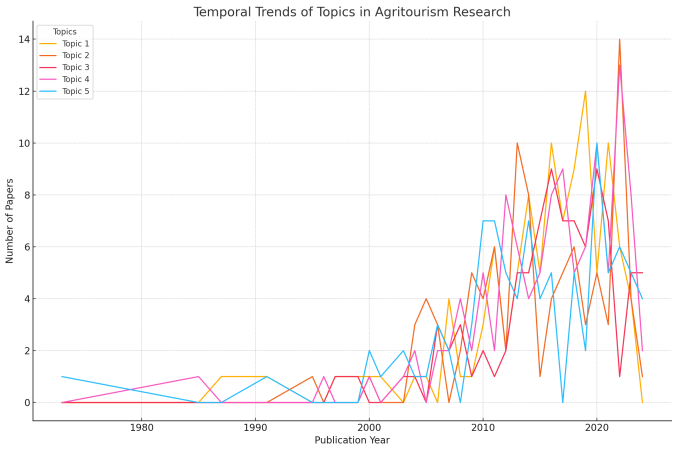

Figure 4. Temporal Trends in Topic Prevalence.

Emerging Topics: Sustainability has been gaining scholarly attention in recent years. This suggests a growing awareness of agritourism's environmental dimensions, which align with global climate priorities.

Established Topics: Rural development and agritourism activities are well-established themes, showing consistent presence across the time spectrum.

Underexplored Areas: The lower prevalence and co-occurrence of policy and sustainability suggest under-researched intersections. These findings echo calls by Lak et al. [61] for stronger integration of governance, environment, and community dimensions.

Understanding the dynamic evolution of agritourism research topics can guide future research agendas and policy frameworks by identifying underrepresented themes, emerging concerns, and persistent gaps in literature.

The insights highlighted in this section are directly supported by topic distributions and co-occurrence patterns. For instance, the strong link between "policy," "sustainability," and "rural development" (Figure 2) reflects a shift in agritourism scholarship toward interdisciplinary perspectives that connect environmental, economic, and institutional aspects after 2018.

Overall, the results indicate a clear evolution in agritourism research: earlier studies emphasized descriptive and activity-based themes, while recent works increasingly focus on sustainability, governance, and integrated rural development. This thematic progression demonstrates both the diversification and maturation of the field.

5 Discussion

This discussion interprets the five topics identified by the LDA model considering the broader agritourism literature and the evidence reported in the Results. We explicitly link each interpretation to the topic distribution (Figure 2) and the keyword co-occurrence heatmap (Figure 3). In doing so, we avoid over-generalization beyond the analyzed corpus and highlight where the findings corroborate or extend prior reviews (e.g., Roman et al. [75]).

5.1 Rural Development: Agritourism as a Strategic Lever

Rural Development is the most prevalent theme in the corpus (≈27% in Figure 2). Co-occurrences between *rural*, *development*, *community*, and *local* (Figure 3) indicate a sustained emphasis on agritourism's contributions to income diversification, place-based revitalization, and social cohesion. These findings corroborate long-standing arguments about the role of agritourism in rural policy and planning (e.g., Lane [62]; Flanigan et al. [45]; Galluzzo [47]). The prominence of this topic suggests that research has matured from descriptive case narratives to policy-relevant analyses linking farms, communities, and regional development strategies.

5.2 Agritourism Activities: Experience-Based Value Creation

The Agritourism Activities topic (≈ 23.1 % of the corpus; Figure 2) reflects the experiential and educational foundations of agritourism. Dominant keywords such as *farm*, *visitor*, *experience*, and *products* highlight how on-farm interactions remain central to the sector's identity. Rather than focusing on the "centrality" of terms, the analysis interprets topic prevalence and high-loading keywords to show that experiential encounters—workshops, tastings, and demonstrations—continue to define visitor engagement. These results align with prior studies emphasizing the importance of authenticity and participation in shaping tourist satisfaction and revisit intentions [36, 64]. The keyword co-occurrence heatmap (Figure 3) reinforces this link, revealing frequent pairings between *farm*, *experience*, and *tourism*. Collectively, these findings confirm that the experiential dimension remains the conceptual and commercial core of agritourism.

5.3 Farmer Participation: Between Opportunity and Constraint

Topic 3 highlights both opportunities (e.g., additional revenue, market access) and constraints (e.g., skills, capital, regulation) shaping farmers' participation. The distribution of terms such as benefits, support, and challenges reflects a persistent focus on capacity building and enabling conditions. Prior studies similarly emphasize training, marketing capabilities, and institutional support as key determinants of participation (e.g., Bagi et al. [35]; Joo et al. [55]). Our results suggest that future research could more systematically examine which support instruments are most effective, and under what conditions.

5.4 Policy and Economic Impact: Governance as an Enabler

The Policy & Governance topic (≈13% in Figure 2) underscores the importance of regulatory clarity, investment mechanisms, and infrastructure in scaling agritourism. Pairings of *policy*, *regulation*, *investment*, and *support* in Figure 3 indicate that governance is frequently discussed alongside growth and risk mitigation. These patterns are consistent with evidence that targeted incentives and public–private coordination can catalyze agritourism in regions with underdeveloped tourism infrastructure (e.g., Galluzzo [47]; Ohe [70]). The field would benefit from comparative evaluations of specific instruments (e.g., grants vs. tax credits) and their measurable outcomes for farm viability.

5.5 Sustainability: Emerging but Integrating with Governance and Development

Although Sustainability & Environment is less prevalent than activity- and development-focused topics (≈19.6%; Figure 2), the heatmap (Figure 3) shows frequent co-occurrences between *sustainability*

and terms linked to development and policy. This pattern suggests a gradual interdisciplinary convergence, with environmental considerations increasingly embedded within discussions of rural planning and institutional frameworks. The literature has called for stronger operationalization of sustainability in agritourism (e.g., Barbieri [36]; Gascón [49]); our results indicate that such integration is underway but not yet dominant at the corpus level.

5.6 Synthesis and Research Implications

Taken together, the topics indicate an evolution from descriptive accounts of farm-based experiences toward policy-relevant and sustainability-aware analyses. Two implications follow. First, researchers should examine policy effectiveness through quasi-experimental or comparative designs to determine which instruments best support farmer participation and community outcomes. Second, future work could incorporate contextual heterogeneity (e.g., different regulatory regimes, market maturity), carefully operationalized within the data, rather than inferring country-level effects not directly measured in this corpus. Extending analyses to full texts and multilingual sources would further refine these insights.

5.7 Robustness, Reproducibility, and Originality

To assess robustness, we optimized the number of topics using UMass and Cv coherence and confirmed stability across multiple random initializations (see Section 3.5). The final model (k = 5) balances interpretability and thematic coverage, as reflected in Figures 2 and 3. Relative to Roman & Kawecki (2023), this study's originality lies in (i) an extended time window (2000–2024), (ii) a larger corpus (n = 223 studies retained), (iii) explicit coherence-based validation and stability checks, and (iv) integrated use of bibliometrics with NLP-driven topic modeling. Together, these choices provide a reproducible, data-driven map of agritourism research that complements and extends prior bibliometric overviews.

In summary, the discussion aligns each interpretation with quantitative evidence from the topic distribution and co-occurrence structure. The field appears to be transitioning toward more policy- and sustainability-integrated analyses while retaining the experiential core that initially defined agritourism.

6 Conclusion

This study applied Natural Language Processing and Latent Dirichlet Allocation (LDA) to a curated corpus of 223 English-language, peer-reviewed journal articles on agritourism published between 2000 and 2024. Five coherent themes emerged—Rural Development, Agritourism Activities, Sustainability & Environment, Farm Management & Diversification, and Policy & Governance—validated through coherence metrics and stability checks. The topic distribution (Figure 2) and the keyword co-occurrence structure (Figure 3) jointly indicate a clear progression in the field: while early work concentrated on descriptive, activity-based narratives, more recent scholarship increasingly links agritourism to integrated rural development, governance, and sustainability. Compared with previous reviews (e.g., Roman et al. [75]), this research extends the time window to 2024, uses a larger corpus, and incorporates explicit validation to offer a reproducible, data-driven map of the intellectual landscape of agritourism.

6.1 Practical Implications

- Policy design & targeting. Use the observed topic prevalence and co-occurrence patterns to priorities' funding instruments (e.g., small grants, micro-credit, or tax incentives) that demonstrably co-appear with *participation* and *investment* terms in the literature.
- Integrated rural programmes. Embed agritourism within place-based rural development plans (infrastructure, mobility, broadband, signage), reflecting the dominance of the Rural Development theme.
- Sustainability mainstreaming. Where *sustainability* co-occurs with policy and *development*, they create minimum sustainability standards (waste, water, energy, biodiversity) tied to eligibility for public support.
- Capacity building for farmers. Align training with topics that load on *marketing*, *experience*, *product*, *innovation* (e.g., experience design, digital marketing, safety, pricing), delivered via extension services and DMOs.
- Governance & coordination. Establish multi-stakeholder platforms (producer associations, DMOs, municipalities) to coordinate product development, events, and branding where *policy/governance* co-occurs with *growth* and *support*.

- Market intelligence & branding. Use the Activities and Experience topic to focus branding on authentic farm experiences (hands-on learning, tastings, seasonal events), supported by data-driven content calendars.
- Risk & resilience planning. Given the literature's post-shock emphasis, integrate risk management (weather, biosecurity, demand volatility) into certification and training programmes.

6.2 Limitations

- Coverage & language. The corpus is limited to English-language, peer-reviewed journal articles; non-English and grey literature (e.g., reports, theses) were excluded.
- Databases & metadata. Scopus served as the primary source; other databases were consulted for completeness. Coverage differences and metadata inconsistencies may remain.
- Abstract-centric analysis. Topic modeling relied on titles/abstracts; full-text nuance (methods, results, context) may be under-represented.
- Keyword substitution. For a small share of records without author keywords, high-frequency abstract terms were substituted; this may introduce minor noise.
- Model dependence. Findings depend on LDA assumptions and parameterization (e.g., number of topics k). Although coherence and stability were assessed, alternative models (e.g., CTM, BERTopic) might yield different granularities.
- No country-level disaggregation. The analysis did not stratify by country/region; thus, contextual and policy heterogeneity is not causally identified here.
- Temporal cut-off. The search window ends March 2024; subsequent publications are not captured.

6.3 Directions for Future Research

- Full-text and multilingual corpora. Extend to full texts and non-English publications to capture policy instruments, operational practices, and context-specific mechanisms.
- Comparative policy evaluation. Use quasi-experimental or comparative designs to estimate the effectiveness of specific support measures (grants vs. tax credits vs. training).
- Methodological triangulation. Compare LDA with neural topic models (e.g., BERTopic) and network methods (co-citation, bibliographic coupling) to test robustness.
- Contextual stratification. Stratify models by region/country, farm type, market maturity, and shock periods (e.g., pandemics, climate events) to identify heterogeneous patterns.
- Practice-level sustainability. Link sustainability terms to measurable practices (energy, water, soils, biodiversity) through coding of full texts and case-comparative synthesis.

Data Availability Statement

Data will be made available on request.

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Conflicts of Interest

The authors declare no conflicts of interest.

AI Use Statement

During the preparation of this work, the authors used ChatGPT by OpenAI to improve language clarity and readability. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

Ethical Approval and Consent to Participate

Not applicable.

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