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***Review Article***

# E-COMMERCE AND FARMERS' REVENUE: A BIBLIOMETRIC ANALYSIS OF SCOPUS DATABASE

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## ABSTRACT

E-commerce has transformed agricultural markets by providing farmers with direct market access and innovative sales channels, particularly in developing economies. While existing studies confirm its positive impact on farmers' income, a comprehensive bibliometric analysis of this research domain remains lacking. This study addresses this gap by analyzing 79 Scopus-indexed publications (2008–2025) using VOSviewer and Bibliometrix to examine: (1) the field's historical evolution, (2) influential publications, nations, institutions, and authors, (3) key papers shaping debates, (4) dominant research themes, (5) emerging trends, and (6) future research directions. The analysis identifies China as the dominant contributor, with Fudan University as the leading institution. Li *et al*. (2021) study in Food Policy emerges as the most influential work, demonstrating e-commerce's income-boosting effects through empirical evidence from China. Thematic analysis reveals three research clusters: (i) socio-economic and human-related aspects, (ii) commerce and agricultural efficiency, and (iii) agricultural income and digital divides. Recent trends indicate that COVID-19 accelerated e-commerce adoption as a critical crisis-response mechanism while exposing unequal benefit distribution, particularly favoring commercially oriented farmers. The field is witnessing transformative innovations, including blockchain-based traceability systems and AI-powered marketplaces, though their effectiveness depends on supporting infrastructure such as digital financial services and agricultural cooperative participation. Evidence suggests substantial yet uneven poverty reduction impacts, with vulnerable farming households achieving greater income stability when e-commerce adoption is combined with strengthened social capital networks. Theoretically, this study contributes by applying Innovation Diffusion Theory as its framework. Future research directions include exploring macroeconomic impacts, psychological adoption barriers, and regional disparities in e-commerce usage among farmers. Emerging areas such as AI-powered marketplaces and blockchain traceability require further investigation, alongside gender-inclusive approaches to e-commerce adoption. The study also highlights under-researched areas, including the psychological and macroeconomic effects of e-commerce in developing countries. By providing a systematic overview, this paper establishes a foundation for future research, aiding scholars, policymakers, and stakeholders in leveraging e-commerce's potential to enhance farmers' income.

**Keywords:** e-commerce; farmers revenue; bibliometric analysis; scientific mapping; Literature mapping; agricultural income.



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## INTRODUCTION

E-commerce platforms have emerged as a transformative force in agricultural development, particularly in developing economies where smallholder farmers face persistent challenges such as information asymmetry, limited market access, and exploitative intermediaries (Yi, 2016; Gupta and Sharma, 2018). Earlier literature has shown a significant relationship between e-commerce and farmers' revenue (Dai and Zeng, 2023; Ye *et al.,* 2024). By enabling farmers to bypass traditional supply chains, e-commerce adoption can generate Pareto improvements—reducing transaction costs, simplifying logistics, and enhancing bargaining power (Yi, 2016). E-commerce channels consistently generate higher income than traditional markets particularly through rural initiatives that enhance farmers' livelihoods demonstrated both through comparative analysis and supporting empirical evidence (Liu *et al*., 2023; Ye *et al*., 2024). Wei and Ruan (2022) showed that government policies and farmers' cognitive factors critically influence e-commerce participation, which in turn drives income growth. The COVID-19 pandemic further underscored e-commerce's role in stabilizing

agricultural supply chains, with (Gu and Wang, 2020) highlighting how digital platforms mitigated income risks for farmers during crises, while Li *et al*. (2024) documented their potential to reduce product wastage through direct sales.

However, the impact of e-commerce is not uniformly positive nor equitably distributed. Recently, Feng (2024) reveals that small farmers often remain subsumed by platform monopolies and corporate e-tailers, despite gaining alternative marketing channels. Similarly, Du *et al*. (2024) warn of a "mean trap," where benefits concentrate among digitally skilled farmers, exacerbating income disparities and creating new forms of digital inequality in agricultural markets. Moreover, despite these documented benefits, the scholarly literature remains fragmented, lacking comprehensive analysis of its intellectual structure and diffusion patterns.

While there is evidence to support the link between e-commerce and farmers' revenue, no substantial effort has been made to comprehensively examine the dynamics of this emerging research area. Furthermore, the scientific mapping of the literature remains unexplored. Therefore, a bibliometric analysis of e-commerce and farmers' revenue is required to address this gap. The present study aims to address this gap by integrating the fragmented body of literature, identifying growth patterns, and examining current trends. It also seeks to explore potential future research directions in the area of e-commerce and farmers' revenue. Additionally, the study employs a theoretical framework—Innovation Diffusion Theory (IDT)—to contextualize the diffusion of rural e-commerce. The IDT elements of observability, relative advantage, and the S-shaped diffusion curve are utilized as theoretical lenses to interpret the patterns and adoption dynamics evident in the data.

This study aims to address several critical research questions to comprehensively map the scholarly landscape of the domain. It explores how the literary landscape has evolved over time and identifies the most influential publications, nations, organizations, and authors contributing to this field. Additionally, it highlights the top 10 most prominent papers where key research topics and debates are concentrated. The study also examines the main research themes that define the domain, investigates emerging research trends, and ultimately identifies potential areas for future research exploration.

## MATERIALS AND METHODS

To investigate this research area, two primary methodologies—performance analysis and science mapping—were employed (Cobo *et al*., 2011). These techniques were extensively employed to analyse the particular research topic (Liao *et al*., 2018). Therefore, bibliometric investigation gives researchers a strong tool to assess a particular field of study by investigating citations, top authors, nations, organisations, sources, and word frequency. This study employs Innovation Diffusion Theory (IDT) as its theoretical framework to explore the diffusion of rural e-commerce within the context of farmers' income in the existing literature. By leveraging IDT, the study focuses on three key elements namely, the S-shaped diffusion curve, observability, and relative advantage to interpret patterns and adoption dynamics evident in the bibliometric data. The S-shaped diffusion curve contextualizes the historical evolution of rural e-commerce adoption, charting stages such as introduction, early adoption, growth, and maturity. This curve reflects the progression of e-commerce innovations toward widespread acceptance within the agricultural sector. Observability is demonstrated through bibliometric visualizations, including network maps and Sankey diagrams, which highlight contributions from authors, institutions, keywords, and journals. These representations provide measurable evidence of the transformative effects of rural e-commerce on farmers' income. Additionally, the analysis of prominent papers offers further insights into observability by showcasing tangible and visible outcomes of e-commerce innovations.

Relative Advantage emphasizes how e-commerce significantly outperforms traditional methods in improving farmers' income. Bibliometric analysis highlights top scholarly contributions (Papers) that showcase these superior outcomes, underlining the global academic interest in rural e-commerce as a transformative innovation. By demonstrating its benefits, relative advantage reinforces the increasing adoption of e-commerce in agricultural practices.

By synthesizing these elements, IDT provides a comprehensive framework to understand the dynamics of rural e-commerce and its impact on farmers' income. The search technique is used to collect data from the database. The necessary information for this analysis was gathered after discovering and picking an appropriate database. Following the inclusion and exclusion criteria, the data set is evaluated using bibliometric tools. A detailed examination of the data's sources, documents, institutions, and authors was first carried out. Subsequently, network maps were created to visually represent the data, emphasizing its conceptual, intellectual, and social dimensions (Aria and Cuccurullo, 2017). The data collection process for this study is illustrated in Figure 1.

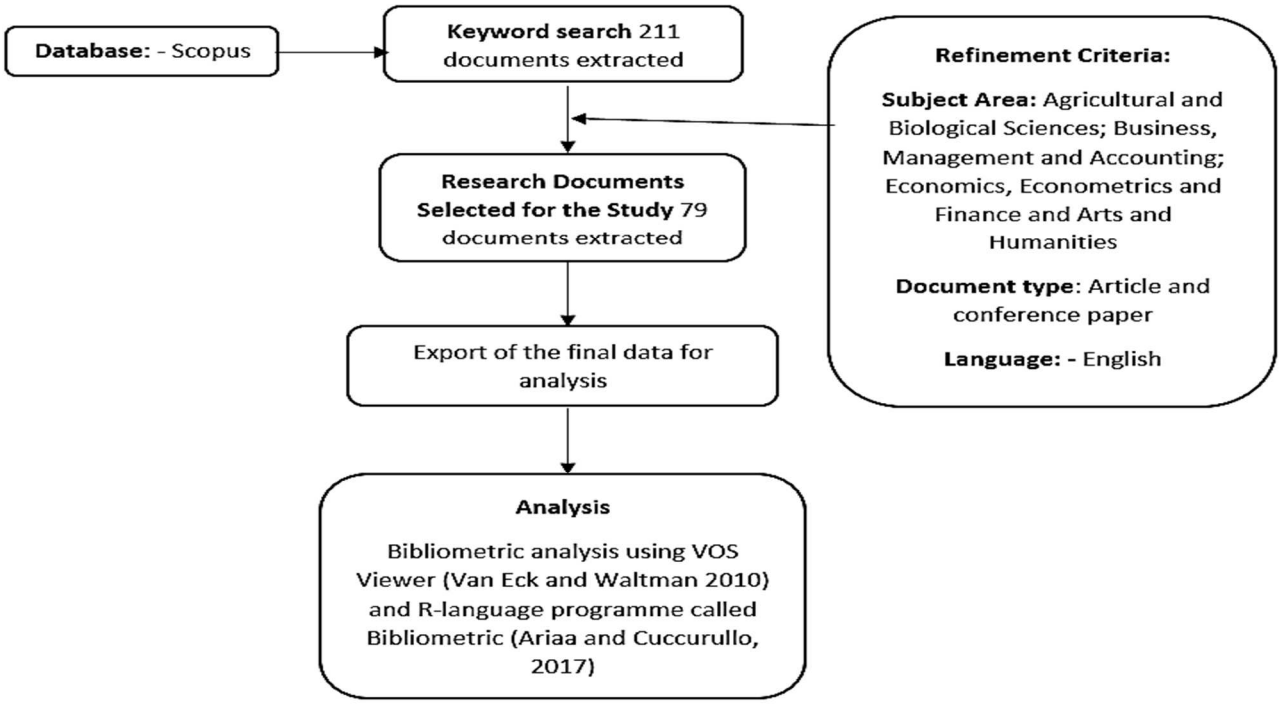


**Figure 1. Process map illustrating document selection for the study.**

To eliminate researcher bias, a key-term search of previous papers was done. The papers selected are from peer reviewed Scopus journals. The terms used for the search are "e OR online OR electronic OR "digital platforms" OR "market access" AND commerce AND farmer OR farmers AND income OR revenue OR "income inequality".

The search subfield was limited to citation information, bibliographic information, an abstract, keywords, and references to recognise the research domain specific articles addressing this topic. The first result included 178 articles. Later, the selection was screened to have only papers published in journals and conference papers in the English language and omitted others like book chapters, reviews, etc. to achieve objectivity. The time period of search was up to 3rd March 2025. The final selection consisted of 79 articles. These 79 articles were subjected to bibliometric analysis. An R-language programme called Bibliometrix (Aria and Cuccurullo, 2017) was used to investigate the publication pattern of works by nation, institution, journal, and author. Bibliometric analysis using VOS Viewer (Van Eck and Waltman, 2010) was used to visualise the citation network of journals, and conduct co-word examination. The author's word frequency was also estimated using VosViewer.

Rationale for selecting Scopus database due to its comprehensive coverage of high-quality, peer-reviewed literature across disciplines, rigorous journal selection process that ensures inclusion of reputable sources, and superior indexing of social sciences and agricultural economics research compared to alternative databases. For bibliometric analysis, we employed two complementary tools: VOSviewer was selected for its superior capabilities in visualizing complex network relationships (including author/institution/country collaborations and keyword co-occurrences) and identifying research clusters through advanced mapping algorithms. Bibliometrix was chosen for its comprehensive analytical features, including temporal trend analysis, citation metrics, and thematic evolution mapping - capabilities particularly suited for tracking the development of research fields over time. This dual-tool approach enabled both quantitative analysis of publication patterns and qualitative interpretation of intellectual structures within the literature.

These tools enabled the exploration of the conceptual, intellectual, and social dimensions of the field, aligning with the Innovation Diffusion Theory (IDT) framework. The historical evolution of publications was analyzed using the S-shaped diffusion curve of IDT, reflecting the stages of introduction, early adoption, growth, and the ongoing trajectory toward maturity, thereby contextualizing the diffusion of rural e-commerce innovations. Observability was emphasized through the use of network maps and visualizations, such as Sankey diagrams and co-word analysis, which revealed observable patterns in author contributions, keyword usage, and source affiliations, thereby enhancing the visibility of e-commerce innovations and their impact on scholarly discourse. Additionally, the identification of prominent papers provided measurable

and visible evidence of e-commerce's transformative effects on farmers' income, further emphasizing observability. Relative advantage was examined through the bibliometric analysis of top scholarly contributions, which demonstrated how rural e-commerce outperforms traditional methods in improving farmers' income.

**Table 1. Research trends and output**

| Description | Results |
|---|---|
| **MAIN INFORMATION ABOUT DATA** | |
| Timespan | 2008:2025 |
| Sources | 66 |
| Documents | 79 |
| Annual Growth Rate % | 8.5 |
| Document Average Age | 5.52 |
| Average citations per doc | 10.9 |
| References | 2845 |
| **DOCUMENT CONTENTS** | |
| Keywords Plus (ID) | 675 |
| Author's Keywords (DE) | 312 |
| DOCUMENT TYPES | |
| Article | 60 |
| Conference paper | 19 |

## RESULTS

This section presents the bibliometric analysis findings, detailing the historical evolution of publications, influential entities, and thematic structures within the field of e-commerce and farmers' income.

**Historical Evolution:** Figure 2 presents the historical evolution of publications on e-commerce and farmers' revenue. The S-shaped curve of the Innovation Diffusion Theory (IDT) was applied to analyze trends in this domain. Early contributions, reflect an introductory stage marked by limited academic interest. Between 2009 and 2018, research activity remained sporadic, representing the early adoption stage.

The initial phase (2008–2014) saw minimal academic engagement, coinciding with the experimental rollout of rural e-commerce platforms in developing economies and the gradual expansion of mobile internet infrastructure. The subsequent period (2015–2018) witnessed modest growth, aligning with policy initiatives such as China's "Internet Plus Agriculture" strategy and India's Digital India program, which formalized digital agriculture frameworks. A significant growth phase emerged from 2019 onward, with publication numbers rising steadily and peaking in 2024 (n=18).

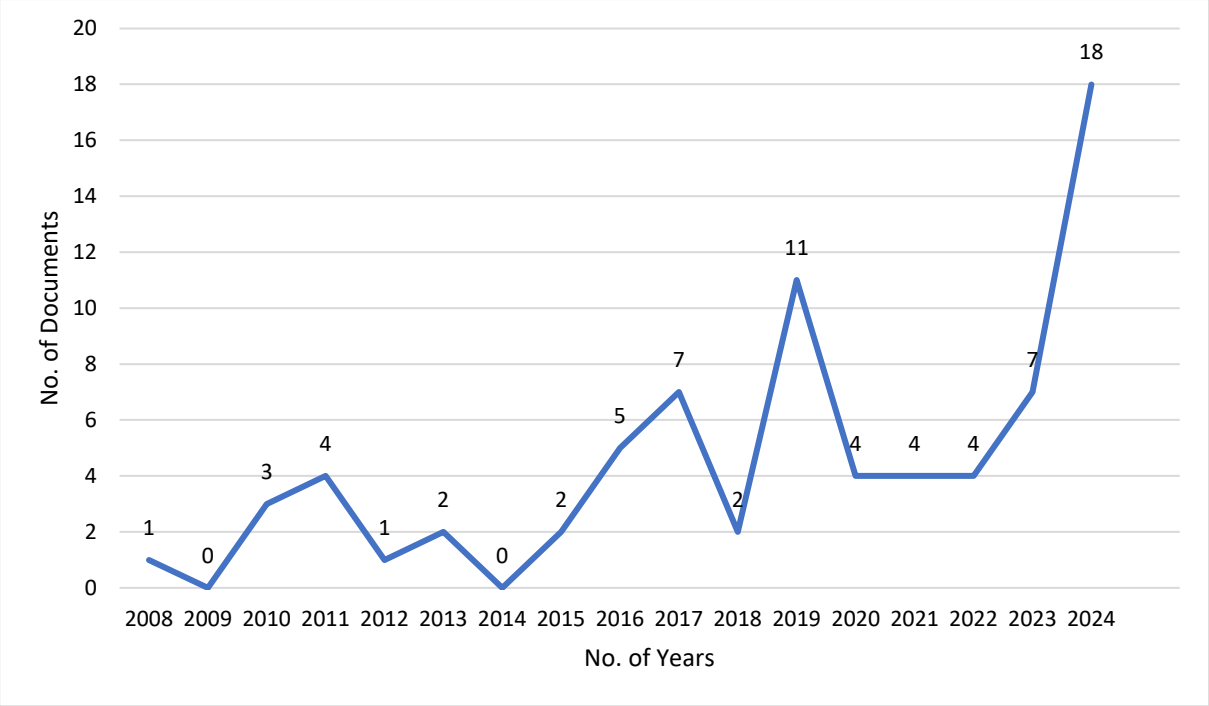


**Figure 2. Evolutionary history of Scopus publications about e commerce and farmers revenue**

**Top authors, country and institution:** Table 2 indicates the top five sources, countries, institutions and authors. China is the top nation followed by India, Japan, New Zealand and USA. Top authors in this research domain are Caballero AR, Chen C, Cordano HZ, Li L, and Ma W. Top sources in this research domain are Electronic Commerce Research, 2011 International Conference on E-Business and E-Government, ICEE2011 –

Proceedings, Economic Analysis and Policy, Agriculture (Switzerland), and Agro Food Industry Hi-Tech. Top five institutions contributing to this research domain are Fudan University, Northwest A&f University, Hangzhou Normal University, Sichuan Tourism University, and Zhejiang University. The bibliometric analysis reveals a striking regional concentration of research, with Asian countries—particularly China—dominating scholarly output on e-commerce and farmers' income.

**Table 2. Most relevant sources, countries, institutions and authors**

| S. No | Sources | N | % | Country | N | % | Affiliations | N | % | Authors | N | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Electronic Commerce Research | 4 | 28.57 | China | 26 | 78.57 | Fudan University | 6 | 22.22 | Caballero AR | 2 | 20.00 |
| 2. | 2011 International Conference on E-Business and E-Government, ICEE2011 – Proceedings | 3 | 21.43 | India | 2 | 7.14 | Northwest A & f University | 6 | 22.22 | Chen C The bibliometric analysis reveals a striking regional | 2 | 20.00 |
| 3. | Economic Analysis and Policy | 3 | 21.43 | Japan | 2 | 4.76 | Hangzhou Normal University | 5 | 18.52 | Cordano HZ | 2 | 20.00 |
| 4. | Agriculture (Switzerland) | 2 | 14.29 | New Zealand | 2 | 4.76 | Sichuan Tourism University | 5 | 18.52 | Li L | 2 | 20.00 |
| 5. | Agro Food Industry Hi-Tech | 2 | 14.29 | USA | 2 | 4.76 | Zhejiang University | 5 | 18.52 | Ma W | 2 | 20.00 |

**Three field plots:** Sankey diagrams are employed in this analysis to connect three fields—authors, keywords, and sources—with the size of each node representing its proportional value (Riehmann *et al*., 2005). In this study, authors are positioned on the left, author keywords in the center, and sources on the right. These diagrams, as illustrated in Figure 3, reveal the observable patterns of innovation diffusion within the research domain. Key terms such as "rural e-commerce," "e-commerce," "supply chain," "China," and "farmers' income" dominate the center node, reflecting their prominence in driving academic discourse. Interestingly, while four of the top five authors (excluding Li L) frequently utilized the term "e-commerce," the term "rural e-commerce" was predominantly associated with Li L.

In terms of sources, Electronic Commerce Research prominently features keywords such as "rural e-commerce," "e-commerce," "China," and "farmers' income," illustrating its role as a key platform for disseminating innovations. Similarly, Economic Analysis and Policy frequently highlights "rural e-commerce," "e-commerce," and "rural China," indicating its contribution to the diffusion of insights on rural markets. On the other hand, Agro Food Industry and Hi-Tech focuses on terms like "rural e-commerce," "supply chain," and "agricultural products,"

**Authors and their contributions:** Authors and collaborations in this field of study are shown in Table 3. The 79 articles analyzed were authored by 239 distinct authors. A striking 96.24% of authors (230/239) have contributed a single publication. Meanwhile, 3.76% of authors (9/239) have authored two articles. Of the 79 documents, 10 are single-authored. On average, there are 3.14 co-authors per document. Furthermore, 18.99% of the documents involve international co-authorship.

**Prominent papers:** Table 5 highlights the most frequently cited articles in the domain of e-commerce and its influence on farmers' income, ranked by the total number of citations per year.

The paper by (Li *et al*., 2021), "Do farmers gain internet dividends from E-commerce adoption? Evidence from China", is the most prominent with 99 total citations and 19.80 citations per year, published in *Food Policy*. (Gu and Wang, 2020), "Impacts of the COVID-19 pandemic on vegetable production and countermeasures from an agricultural insurance perspective", ranks second with 74 total citations and 12.33 citations per year, published in the *Journal of Integrative Agriculture*. The third-ranked paper, by (Ma *et al*., 2024), "Linking farmers to markets: Barriers, solutions, and policy options", published in *Economic Analysis and Policy*, has 18 total citations and 9.00 citations per year. The paper by (Li and He, 2024), "Revenue-increasing effect of rural e-commerce: A perspective of farmers' market integration and employment growth", ranks fourth with 17 total citations and 8.50 citations per year, also published in *Economic Analysis and Policy*. In fifth place is (Zheng *et al*., 2024), "Has Rural E-Commerce Increased Potato Farmers' Income? Evidence from the Potato Home of China", published in *Potato Research*,

with 16 total citations and 8.00 citations per year. Sixth on the list is (Haggar *et al*., 2017), "Environmental-economic benefits and trade-offs on sustainably certified coffee farms", published in *Ecological Indicators*, with 64 total citations and an annual citation rate of 7.11. The seventh-ranked paper, by (Chintapalli *et al*., 2021), "The Value and Cost of Crop Minimum Support Price: Farmer and Consumer Welfare and Implementation Cost", published in *Management Sciences*, has 32 total citations and 6.40 citations per year. Eighth on the list is (Berg *et al*., 2017), "Willingness to pay for local food?: Consumer preferences and shopping behavior at Otago Farmers Market", published in *Transportation Research Part A*, with 47 total citations and 5.22 citations per year. The ninth-ranked paper, by (Yang *et al*., 2021), "The Nexus between Formal Credit and E-Commerce Utilization of Entrepreneurial Farmers in Rural China: A Mediation Analysis", published in the *Journal of Theoretical and Applied Electronic Commerce Research*, has 22 total citations and 4.40 citations per year. Finally, the paper by (Khanal *et al*., 2016), "Financial performance of small farm business households: the role of internet", published in the *China Agricultural Economic Review*, has 35 total citations and 3.50 citations per year.

**Thematic organisation of research domain:** A deeper inspection of the key themes in the word cloud of keywords (Figure 5) and keyword analysis (Figure 4) reflects the dominant themes and focus areas of this bibliometric study. The co-word analysis of keywords (Figures 4-6) reveals the dominant themes and conceptual structure of research on e-commerce and farmers' income. The keyword "e-commerce" (17 occurrences) emerges as the central theme. "Rural e-commerce" (10 occurrences) signifies a critical subfield. The integration of "China" (4 occurrences) as a focal point.

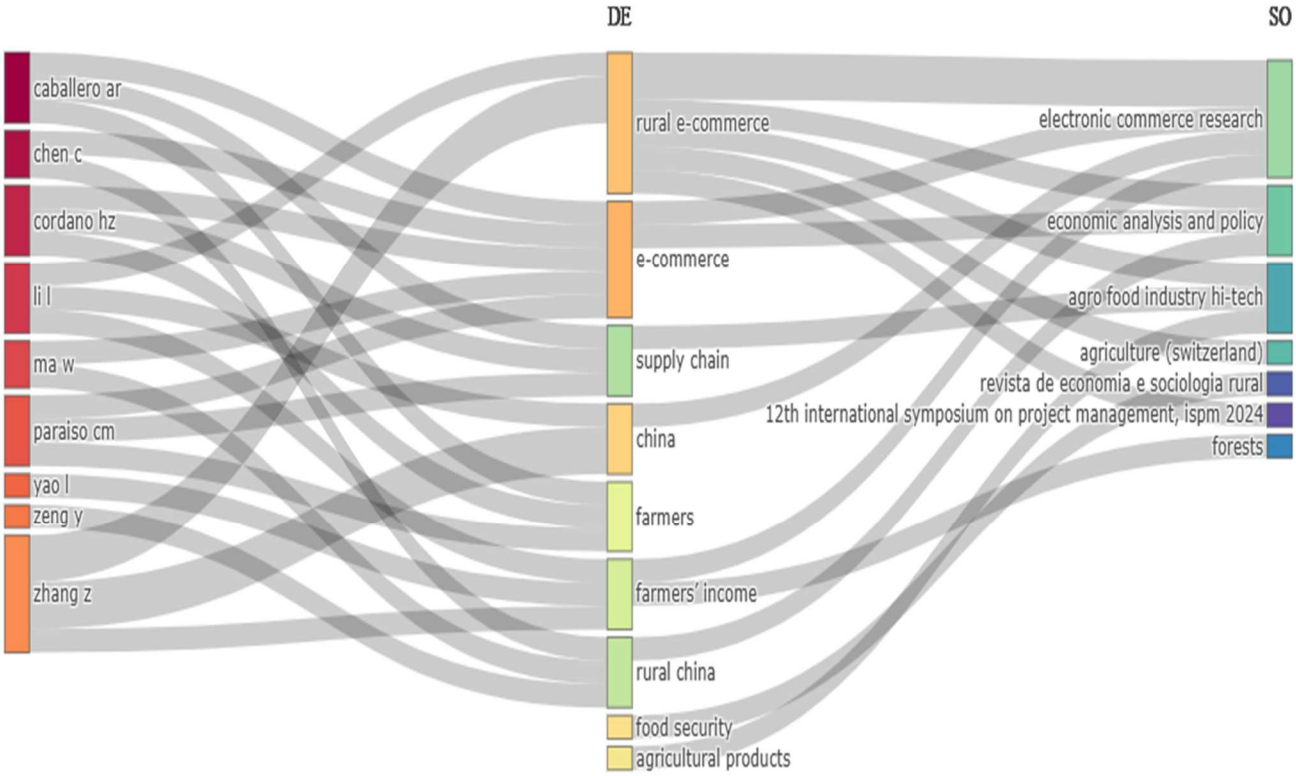


**Figure 3. Three field plots for author, author keyword, and journal**

**Table 3. Authors and collaborations**

| S. No. | Particulars | Results |
|---|---|---|
| 1. | Authors | 239 |
| 2. | Authors of single-authored docs | 10 |
| 3. | Co-Authors per Doc | 3.14 |
| 4. | International co-authorships % | 18.99% |

**Table 4 . The ten most commonly cited papers in E-commerce and farmers revenue**

| S. No | Title | Authors | Publisher | Total Citations | Citations per year |
|---|---|---|---|---|---|
| 1 | "Do farmers gain internet dividends from E-commerce adoption? Evidence from China" | (Li *et al.*, 2021) | "Food Policy" | 99 | 19.80 |
| 2 | "Impacts of the COVID-19 pandemic on vegetable production and countermeasures from an agricultural insurance perspective" | (Gu and Wang, 2020) | "Journal of Integrative Agriculture" | 74 | 12.33 |
| 3. | "Linking farmers to markets: Barriers, solutions, and policy options" | (Ma *et al.*, 2024) | "Economic Analysis and Policy" | 18 | 9.00 |
| 4. | "Revenue-increasing effect of rural e-commerce: A perspective of farmers' market integration and employment growth" | (Li and He, 2024) | "Economic Analysis and Policy" | 17 | 8.50 |
| 5. | Has Rural E-Commerce Increased Potato Farmers' Income? Evidence from the Potato Home of China | Zheng *et al.,* 2024 | "Potato Research" | 16 | 8.00 |
| 6. | "Environmental-economic benefits and trade-offs on sustainably certified coffee farms" | (Haggar *et al.*, 2017) | "Ecological Indicators" | 64 | 7.11 |
| 7. | "The Value and Cost of Crop Minimum Support Price: Farmer and Consumer Welfare and Implementation Cost" | (Chintapalli *et al.*, 2021) | "Management sciences" | 32 | 6.40 |
| 8. | "Willingness to pay for local food?: Consumer preferences and shopping behavior at Otago Farmers Market" | (Berg *et al.*, 2017) | "Transportation Research Part A" | 47 | 5.22 |
| 9. | "The Nexus between Formal Credit and E-Commerce Utilization of Entrepreneurial Farmers in Rural China: A Mediation Analysis" | (Yang *et al.*, 2021) | "Journal of theoretical and applied electronic commerce research" | 22 | 4.40 |
| 10. | "Financial performance of small farm business households: the role of internet" | (Khanal *et al.*, 2016) | "China Agricultural Economic Review" | 35 | 3.50 |

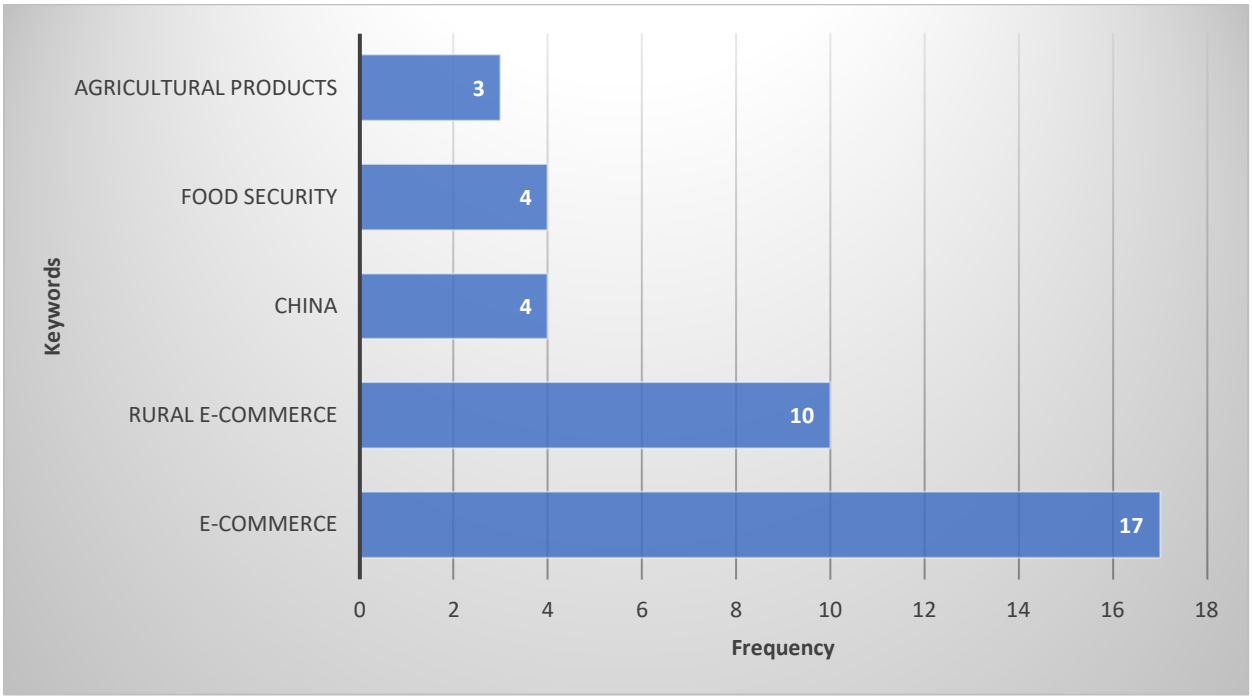


**Figure 4. Keywords and frequency**


**Figure 5. Word cloud of keywords**

E-commerce" and "rural e-commerce" emerge as dominant keywords in the literature; however, significant measurement and contextual variations exist across studies. Operational definitions of e-commerce adoption vary considerably, ranging from binary classifications (yes/no) (Li *et al*., 2021) to more nuanced intensity metrics such as sales volume or platform usage frequency (Yang *et al*., 2021). The concept of "rural e-commerce" also demonstrates regional divergences in implementation: Chinese studies typically examine government-led platforms like Taobao Villages (Guan *et al*., 2024), while African research tends to focus on informal, mobile-based systems (Little and Sylvester, 2022).

"Food security" (4 occurrences) intersects with e-commerce by addressing supply chain resilience. "Agricultural products" (3 occurrences) reflects the commercialization of farm outputs through digital channels.

The co-word analysis (Figure 6) reveals three dominant research themes. These clusters reflect the evolution of scholarly focus from foundational socio-economic studies to digital transformation in agriculture, with key papers illustrating these transitions. The red cluster is associated with socio-economic and human-related aspects, as indicated by keywords such as "economics," "commercial phenomena," "farmers," "animal," "male," "female," and "human." The blue cluster focuses on commerce and agricultural efficiency, featuring keywords such as "commerce," "efficiency," "agricultural worker," "vegetables," "marketing," and "regression analysis." The green cluster is centred on agricultural income and digital divides, with keywords such as "agriculture," "electronic commerce," "rural e-commerce," "rural areas," "China," "household income," and "agricultural product."

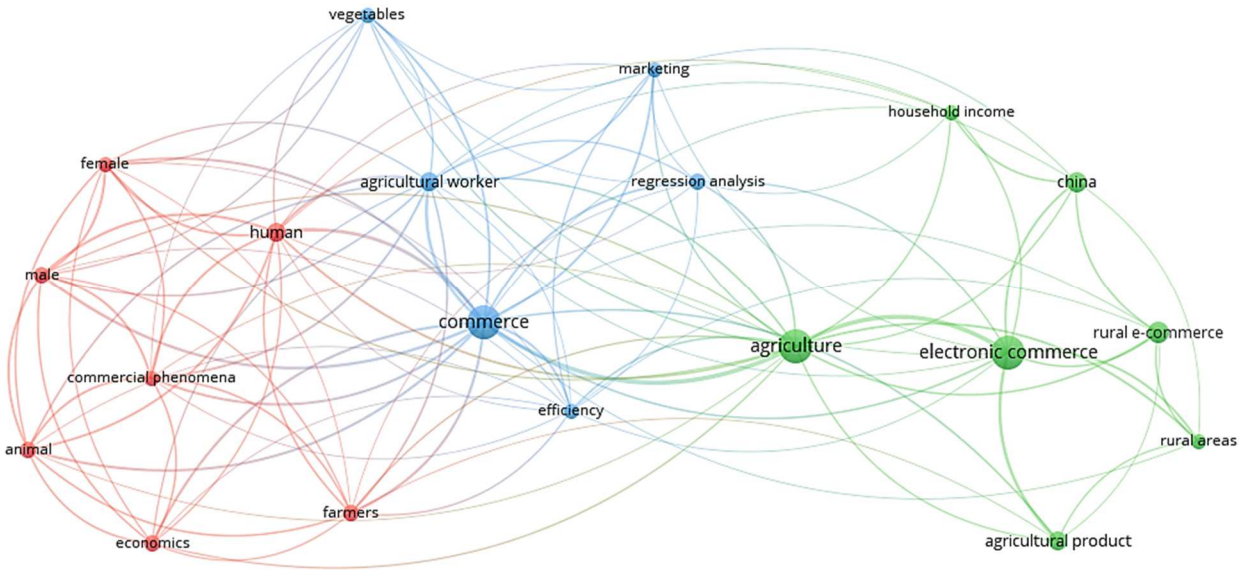


**Figure 6. Co-occurrence network of keywords**

**Recent research trends:** Investigation of the papers published between 2023 and 2024 (March 2025) was conducted to understand the recent research trends in the research (Table 5).

**Table 5. Recent trends (2023 -2025)**

| S. No. | Summary of the study | References |
|---|---|---|
| 1 | This study analyzes the impact of rural e-commerce on household consumption in China's rural areas, utilizing data from the Ali Research Institute and the China Household Finance Survey. Results of the study indicates that rural e-commerce significantly enhances consumption by increasing farmers' income and digital payment adoption. The effects are more pronounced in central and eastern regions compared to the west, and non-poor households benefit the most from the consumption boost. | (Wang *et al*., 2025) |
| 2 | This study investigates the impact of rural e-commerce policies on digital inclusive finance in China. Findings indicates that it boosts farmers' income, improves consumption, and fosters innovation. The benefits are stronger in areas with advanced infrastructure but limited in smaller or less developed regions, highlighting e-commerce's potential to bridge income gaps and support rural growth. | (Zhang and Zhao, 2025) |
| 3 | This paper explored the experiences of small farmers in agricultural e-commerce in China. The article found that while agricultural e-commerce in China benefits small farmers, it also subjects them to greater commercial control. | (Feng, 2024) |
| 4 | This paper aimed to disclose income disparities in the rural e-commerce landscape in China. The findings revealed that rural e-commerce in China primarily benefits marketing-oriented minority farmers with high access and participation, while its impact at village and county levels is limited. | (Du *et al*., 2024) |
| 5 | This research explores the impact of digital finance on farm income, revealing a significant boost to non-agricultural earnings. Utilizing panel regression, it demonstrates digital finance's potential to drive rural economic growth through enhanced market access and financial inclusion, emphasizing the importance of digital technologies in agricultural development. | (Zhou, 2024) |
| 6 | This paper explored a government-led e-commerce expansion project and rural household income and found that the e-commerce project boosted rural incomes, especially for lower-income households. | (Chen *et al.,* 2024) |
| 7 | This study investigated whether e-commerce development alleviated farm household poverty vulnerability. Research reveals that the growth of e-commerce in China has a substantial impact on lowering the vulnerability of rural households to poverty, particularly for those with lower incomes and educational attainment. | (Tang *et al.,* 2024) |
| 8 | This study examined the mechanisms to trigger and strengthen the positive impact of the internet on the income of farmers. The study found that internet access, usage, and local conditions drive income growth for rural farmers in China. | (Li *et al.,* 2024) |
| 9 | This study finds that rural e-commerce significantly increases farmers' income by enhancing market integration and creating jobs through affiliated industries. These benefits are amplified by better transportation infrastructure, with educated and healthier farmers gaining the most. It emphasizes policies supporting e-commerce, infrastructure, and industry development for rural growth. | (Li and He, 2024) |
| 10 | This study explored whether rural e-commerce increased potato farmers' income. The study found that rural e-commerce significantly boosts potato farmers' income in China, especially for those who have not yet adopted it, and is influenced by various socio-economic factors. | (Zheng *et al.,* 2024) |
| 11 | This study emphasized the importance of linking farmers to markets. The study found that market participation, especially through e-commerce, significantly improves farmers' well-being, income, and market access in low-income countries, but market power dynamics can limit benefits. | (Ma *et al.,* 2024) |
| 12 | This study examined the impact of the cost-sharing contract on capital-constrained agricultural supply chains. The study found that optimal production and pricing decisions in e-commerce-financed agricultural supply chains are influenced by financing parameters and output uncertainty, with cost-sharing contracts improving coordination. | (Bai and Jia, 2023) |
| 13 | This is a bibliometric and content analysis study of technological advancement applications in agricultural e-commerce. This study proposes a conceptual architecture for agricultural e- | (Altarturi *et al.,* 2025) |

| | | |
|---|---|---|
| | commerce using blockchain and IoT technologies to address challenges and promote sustainable development. | |
| 14 | This study investigated whether cooperative membership facilitates e-commerce adoption and income growth. The study found that cooperative membership and e-commerce adoption both increase rural household income in China, but cooperative membership can inhibit e-commerce adoption. | (Chen *et al*., 2023) |
| 15 | This study investigated whether e-commerce platforms improved organic tea farmers' income in the context of the COVID-19 epidemic. The study found that using e-commerce platforms to sell organic tea significantly increases income for farmers in northern Vietnam, especially during the COVID-19 pandemic. | (Doanh and Van, 2023) |
| 16 | This study investigated whether poverty alleviation measures play any role in land transfer farmers' well-being. The study found that poverty alleviation measures, especially e-commerce, improve land transfer farmers' well-being in China, with livelihood capital and social capital playing mediating roles. | (Su *et al.,* 2023) |
| 17 | This study investigated the relationships between e-commerce participation, digital finance, and farmers' income. The study found a non-linear association among e-commerce participation and farmers' revenue in China, with digital finance enhancing the positive effects. | (Yi *et al.,* 2023) |

## DISCUSSION

This section interprets the findings from the bibliometric analysis through the lens of Innovation Diffusion Theory (IDT), elucidating the underlying dynamics and implications of rural e-commerce adoption and its impact on farmers' income.

**Historical evolution and the s-shaped diffusion curve:** The observed historical evolution of publications on e-commerce and farmers' revenue, as depicted in Figure 2, clearly aligns with the S-shaped diffusion curve of the Innovation Diffusion Theory (IDT). The early contributions (2008-2014) reflect an introductory stage, characterized by limited academic interest coinciding with the experimental rollout of rural e-commerce platforms and gradual expansion of mobile internet infrastructure. The subsequent period (2015-2018) represents an early adoption stage, witnessing modest growth that aligns with supportive policy initiatives like China's "Internet Plus Agriculture" and India's Digital India programs. The significant growth phase from 2019 onward, peaking in 2024, indicates a rapid acceleration in research activity. This surge was notably influenced by the COVID-19 pandemic, which amplified the adoption of digital sales channels due to disruptions in traditional markets. This trend underscores a growing scholarly recognition of rural e-commerce as a critical research area and confirms that the field is progressing along a typical adoption curve, though it has yet to reach full maturity, as evidenced by the sustained upward trajectory in research contributions.

**Top entities and relative advantage:** In the context of Innovation Diffusion Theory, the prominence of specific sources, countries, institutions, and authors (Table 2) serves as evidence of the "relative advantage" of e-commerce in improving farmers' income. The scholarly contributions highlighted reflect global interest and academic exploration of these advantages, demonstrating how e-commerce significantly outperforms traditional methods in achieving beneficial outcomes for farmers. China's leading position, coupled with the strong showing of other Asian countries, directly aligns with their rapid digitalization of rural economies, propelled by government policies. This regional dominance and the global collaboration indicated by contributing institutions underscore IDT's emphasis on networks accelerating innovation diffusion, as successful implementation and visible benefits in one region encourage research and adoption elsewhere.

**Three field plots and observability:** The analysis of the three-field plots using Sankey diagrams (Figure 3) provides a vivid representation of "observability"—the extent to which the outcomes of rural e-commerce are visible to others, playing a key role in its adoption. These diagrams visually highlight the relationships among authors, keywords, and sources, making the innovation's diffusion process more transparent. The dominance of terms like "rural e-commerce," "e-commerce," "supply chain," "China," and "farmers' income" in the central keyword node signifies their central role in academic discourse, making the core concepts and their impacts highly observable. The varying focuses among top authors, such as Li L's predominant association with "rural e-commerce," further demonstrates how individual contributions make specific aspects of the innovation's benefits visible. Similarly, the prominent featuring of relevant keywords in leading journals like *Electronic Commerce Research* and *Economic Analysis and Policy* illustrates their role as key platforms for disseminating observable benefits and fostering the innovation's diffusion. The alignment of *Agro Food Industry and Hi-Tech* with "agricultural products" and "supply chain" showcases its contribution to making agricultural

innovations observable. This synthesis of visual elements strongly reinforces the importance of observability in driving the diffusion of e-commerce innovations within the agricultural sector.

**Authors' contributions and observability:** From the lens of Innovation Diffusion Theory, the collective contributions of authors (Table 3) serve as a crucial element of "observability," driving the dissemination and adoption of innovative ideas in rural e-commerce and farmers' income. The visible and measurable outcomes of scholarly efforts, such as published works and collaborative ventures, make the impacts of e-commerce innovations more accessible and comprehensible. The high percentage of authors with single publications suggests a broad network constantly introducing new perspectives, while the smaller group of authors with multiple articles likely acts as key hubs for knowledge generation, enhancing the visibility and credibility of e-commerce as an effective innovation. The significant collaborative activity, evidenced by the average number of co-authors per document and international co-authorship, further facilitates the diffusion of ideas across institutions and regions. These collective scholarly efforts demonstrably contribute to strengthening the acknowledgment and adoption of rural e-commerce innovations in diverse academic and practical landscapes by making their benefits visible and measurable.

**Prominent papers: observable outcomes and relative advantage:** The most frequently cited articles (Table 4) critically illustrate how "observability" and "relative advantage" have driven the acknowledgment and adoption of e-commerce in the context of farmers' income. These papers, by showcasing measurable impacts (e.g., increased income, improved market integration, reduced volatility), emphasize the transformative benefits of e-commerce and render its positive effects highly visible and credible. For example:

The leading paper by Li *et al*. (2021) explicitly demonstrates the "internet dividends" and enhanced income from e-commerce adoption in China, offering clear, observable evidence of its relative advantage over traditional methods. Its robust methodology and comprehensive data directly contribute to making these benefits visible. Gu and Wang (2020) highlight how e-commerce (alongside agricultural insurance) mitigates supply chain challenges during crises like COVID-19, showcasing a crucial relative advantage in terms of resilience and market access when traditional channels fail. In this regard, Ma *et al*. (2024) and Li and He (2024) further underscore the relative advantage by addressing barriers to market access and demonstrating e-commerce's dual role in improving market integration and fostering employment growth. Their findings make the superiority of e-commerce solutions for rural development highly observable. The study by Zheng *et al*. (2024) provides specific, observable evidence of increased income for potato farmers due to rural e-commerce, directly demonstrating the innovation's positive impact. Haggar *et al*. (2017) and Berg *et al*. (2017) link e-commerce to premium markets and consumer preferences for local food, respectively, illustrating relative advantages in value addition and market reach that become observable through successful case studies. Nonetheless, Chintapalli *et al*., (2021) and Yang *et al*., (2021) delve into complementary factors (MSP, formal credit) that enhance e-commerce's effectiveness, making its synergistic benefits more observable. Finally, Khanal *et al*. (2016) broadly illustrates the internet's role in improving financial performance for small farm households, providing clear, observable evidence of e-commerce's foundational relative advantage.

Collectively, these prominent papers reveal how the quantifiable impacts and demonstrated superiority of e-commerce align with IDT principles, driving its diffusion among farmers and rural communities. By making its outcomes visible and consistently demonstrating its superiority, e-commerce has established itself as a pivotal innovation for enhancing farmers' income and fostering rural development. This synthesis provides a robust foundation for future studies aimed at addressing adoption barriers and optimizing the benefits of e-commerce integration.

**Thematic organization of research domain:** The co-word analysis of keywords (Figures 4-6) effectively reveals the dominant themes and conceptual structure of research on e-commerce and farmers' income, reflecting the "observability" of distinct research directions within the field. The central theme of "e-commerce" (17 occurrences) underscores its transformative role in agricultural markets, highlighting the observable interest in how digital commerce allows farmers to bypass intermediaries and improve revenue streams (Jiao & Cao, 2008; Yi, 2016). "Rural e-commerce" (10 occurrences) signifies a critical subfield, emphasizing the observable adaptation of digital platforms to rural contexts, with studies demonstrating its role in direct farmer-market linkages, reduced transaction costs, and enhanced income stability (Wei and Ruan, 2022). The prominence of "China" (4 occurrences) as a focal point reflects the observable impact of its pioneering role, driven by government initiatives and platform partnerships (Feng, 2024).

While "e-commerce" and "rural e-commerce" are dominant, observable variations exist in their measurement and contextual application across studies. The distinct clusters from the co-word analysis (Figure 6) further illustrate observable research themes:

Red Cluster (Socio-economic and Human-Related Aspects): This cluster emphasizes the observable

economic dynamics and human elements influencing farmers' livelihoods, including price fluctuations, information asymmetry (Yi, 2016), and the impact of gender on household income dynamics in e-commerce (Wei and Ruan, 2022; Demetrio, 2024). The inclusion of "animal" suggests observable research on livestock farming's role in income stability (Mwangi and Crewett, 2019).

Blue Cluster (Commerce and Agricultural Efficiency): This cluster highlights the observable commercial and operational aspects, focusing on optimizing labor and resource use through e-commerce to enhance productivity (Chintapalli and Tang, 2021) and improve profitability for vegetable growers via direct online sales (Gao and Li, 2014). The use of "regression analysis" indicates the observable methodological approaches for analyzing market trends and innovation adoption.

Green Cluster (Agricultural Income and Digital Divides): This cluster centers on the transformative role of e-commerce in rural economies, driven by the observable impact of digital platforms on reshaping rural markets and generating income gains (Li *et al*., 2021; Yang *et al*., 2021). The focus on "China" within this cluster points to the observable challenges and opportunities in its rural e-commerce landscape, including platform monopolization risks (Feng, 2024). Crucially, from an IDT perspective, the *observability* of increased household income and improved market access through rural e-commerce serves as a powerful driver for its widespread adoption, reinforcing its perceived relative advantage.

**Recent research trends: an IDT perspective:** Analysis of the recent trends (Table 5) reveals notable variations and commonalities in how rural e-commerce impacts farmers' income, consumption, and broader socio-economic outcomes. These findings can be critically analyzed through the lens of the Innovation Diffusion Theory (IDT), particularly focusing on observability and relative advantage.

**Impact on farmers' income and consumption:** Several recent studies converge on the theme that rural e-commerce has a direct positive impact on farmers' income, demonstrating its clear relative advantage over traditional methods. For instance, Wang *et al*. (2025) demonstrates that e-commerce boosts income and consumption levels, with pronounced benefits for non-poor households in central and eastern China, making these benefits highly observable. Chen *et al*. (2024) highlights the role of government-led projects in raising incomes for lower-income households, emphasizing the innovation's inclusivity and observable impact. Some researchers provide empirical evidence of e-commerce's ability to enhance income through improved market integration, job creation, and tailored opportunities for specific farmer groups, such as potato farmers, further solidifying its observable relative advantage (Zheng *et al*., 2024; Li and He, 2024). While income growth is a common observable outcome, Du *et al*. (2024) identifies disparities, suggesting that rural e-commerce primarily benefits marketing-oriented minority farmers rather than entire communities. This finding points to limitations in e-commerce reach and calls for targeted strategies to ensure broader impact, making the unevenness of its diffusion also observable.

**Alleviation of poverty and vulnerability:** E-commerce has been shown to play a significant role in reducing poverty vulnerability, underscoring its observable relative advantage. E-commerce substantially reduces poverty vulnerability, particularly for households with lower income and educational attainment, making this transformative benefit highly observable (Tang *et al*., 2024). Su *et al*. (2023) highlights the role of e-commerce as part of broader poverty alleviation measures, improving well-being through enhanced social and livelihood capital, which are tangible and thus observable outcomes. These studies collectively reinforce e-commerce's superior capability in providing farmers with pathways to escape poverty compared to traditional methods. However, Feng (2024) suggest potential drawbacks, such as increased commercial control over small farmers, which may limit their autonomy and long-term gains. This "observability" of unintended consequences is crucial for refining future e-commerce diffusion strategies.

**Role of complementary factors:** Several recent studies emphasize the interplay between e-commerce and complementary factors, showcasing how these interactions enhance the innovation's observability and relative advantage. Yi *et al*. (2023) identifies digital finance as a critical enhancer of e-commerce participation, creating a non-linear relationship with farmers' income, meaning that the synergistic benefits become more observable when digital finance is integrated. Recently, Zhou (2024) and Chen *et al*. (2023) reveal that financial inclusion and cooperative membership strengthen income growth, but may simultaneously create challenges (e.g., inhibiting e-commerce adoption for some groups). The nuanced effects of these complementary factors contribute to the complex observability of e-commerce's overall impact. (Doanh and Van, 2023) shows how e-commerce platforms were particularly effective during the COVID-19 pandemic, demonstrating their adaptability under crises. This highlights an observable and crucial relative advantage in terms of resilience and continuity, making e-commerce a more attractive option during unforeseen disruptions.

**Technological and market innovation:** Recent studies like Altarturi *et al*. (2025) and Ma *et al*. (2024) provide insights into innovations that further enhance e-commerce's effectiveness, reinforcing its relative advantage. Likewise, Altarturi *et al*. (2025) proposes the integration of blockchain and IoT technologies to address e-commerce challenges and foster sustainable agricultural practices, illustrating the observable potential for future improvements and extended relative advantages. Ma *et al*. (2024) stresses the importance of linking farmers to markets, demonstrating how e-commerce platforms can improve market participation and well-being, especially in low-income countries, offering a clear and observable relative advantage over fragmented traditional markets. Both studies emphasize how these technological and market innovations continue to push e-commerce to outperform traditional systems, offering farmers unprecedented access and revenue potential, thus continuously making its benefits more observable and desirable for adoption.

**Conclusion:** This bibliometric analysis maps the 18-year evolution of research on e-commerce and farmers' revenue through the lens of Innovation Diffusion Theory (IDT), revealing a significant post-2019 surge in scholarly interest driven by the COVID-19 pandemic and digital transformation. It finds that e-commerce adoption consistently boosts farmers' income, reduces poverty vulnerability, and enhances market integration, although disparities remain across regions and demographics. China leads in research output, and keyword trends show the field's growing interdisciplinary spanning economics, agricultural sciences, business, and humanities—with emerging themes such as gender, operational efficiency, and rural e-commerce dynamics. The S-shaped diffusion curve reflects the domain's growth trajectory, and the study offers a valuable foundation for researchers and practical insights for policymakers aiming to advance inclusive digital solutions for rural development.

**Limitations and Future Directions:** This study identifies key limitations, including reliance on the Scopus database and English-language publications, which may exclude region-specific research and non-English contributions, especially from non-Western agricultural economies. The dominance of China in the dataset offers in-depth insights but limits generalizability to regions like Latin America, Africa, and South Asia. Notably, the literature lacks macroeconomic and psychological perspectives on e-commerce's impact on farmers' income. Future research should explore these dimensions, incorporate multilingual and regional databases, and consider dynamic, inclusive frameworks to assess emerging trends such as AI-driven marketplaces, block chain-based traceability, digital payments, gender inclusion, and cooperatives particularly within developing countries.

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