Research Article

Shaping the Future: Digital Economy and E-Commerce Policy for Innovation, Sustainability, and Inclusion

M Syafril Akhdan Arrosyady[1]*, Muhammad Andi Auliya Hakim[2]

[1-2] Universitas Negeri Semarang, Indonesia; e-mail: syafrilakhdan1213@students.unnes.ac.id
* Corresponding Author: M Syafril Akhdan Arrosyady

Abstract: The digital economy and e-commerce are rapidly transforming global markets, driving efficiency, inclusivity, and innovation. However, these developments also produce unintended consequences, particularly regarding environmental sustainability. This study aims to examine the relationship between digital transformation, the expansion of e-commerce, and their impact on carbon emissions and socio-economic outcomes. Using bibliometric analysis and VOS Viewer to map and analyze research trends from leading academic databases, this paper identifies key themes, knowledge clusters, and research gaps in the intersection of digital economy, logistics, and sustainability. The findings indicate that technological advances foster economic growth and greater accessibility but simultaneously contribute to rising energy consumption, logistics intensity, and carbon footprints. These results highlight the dual nature of digitalization as both a catalyst for inclusive development and a driver of environmental pressures. The study argues that an integrated policy framework is crucial to leverage the benefits of digital transformation while mitigating its environmental costs. It emphasizes the importance of green innovation, sustainable infrastructure investment, and inclusive e-commerce practices as key strategies for ensuring long-term socio-economic resilience. Ultimately, the paper contributes to the policy discourse by positioning innovation, inclusivity, and environmental stewardship as complementary rather than competing forces, thereby offering a pathway for future digital economy development that is both equitable and sustainable.

Keywords: Digital Economy; E-Commerce Policy; Environmental Impact; Green Innovation; Sustainable Development

1. Introduction

This study aims to map and analyze recent research trends on the digital economy and e-commerce between 2022 and 2025, focusing on their implications for innovation, sustainability, and inclusivity. The analysis was conducted through a systematic search of the Scopus database, complemented by manual screening to ensure comprehensive coverage of relevant studies. The retrieved articles were selected using predefined inclusion and exclusion criteria to maintain alignment with the research objectives. By combining bibliometric mapping with qualitative interpretation, this study provides a comprehensive overview of how digital transformation and e-commerce policies influence economic development, environmental impacts, and broader social dimensions.

The rapid development of the digital economy has profoundly reshaped global economic and social structures. As an economic model grounded in digital technologies such as big data, artificial intelligence (AI), cloud computing, and the Internet of Things the digital economy has not only driven efficiency and innovation across sectors but also transformed production and consumption patterns worldwide (Wu et al., 2025). Its contribution to global growth is evident: the digital economy now accounts for an increasingly significant share of GDP in both developed and emerging economies, providing opportunities for inclusive participation in markets, reducing transaction costs, and creating new business models.

At the same time, the expansion of the digital economy introduces complex challenges, particularly concerning environmental sustainability. On the one hand, digitalization can reduce energy consumption and carbon emissions by optimizing resource allocation, enabling cleaner production processes, and facilitating innovations in renewable energy systems (Wang & Gao, 2025). On the other hand, the rebound effect, rising electricity demand for data

centers, and the rapid growth of logistics in e-commerce may exacerbate carbon emissions (Sun et al., 2025). This duality highlights the urgency of examining the relationship between the digital economy and sustainability, particularly in the context of the global low-carbon transition.

The role of the digital economy in sustainability has been extensively debated. Scholars argue that digital platforms contribute positively by improving energy efficiency, lowering carbon intensity, and fostering the adoption of green technologies (Wu et al., 2025). For example, digital infrastructures enable real-time monitoring of emissions, while AI and automation facilitate optimization in industrial processes. Evidence also shows that the digital economy can produce spillover effects across regions, amplifying environmental benefits in neighboring area (Wu et al., 2025). However, other studies caution that the rapid expansion of digital-related industries, particularly those heavily reliant on energy-intensive infrastructure, may worsen environmental degradation if not accompanied by strong policy measures (Wang & Gao, 2025).

In this context, China's experience provides valuable insights. As the world's largest carbon emitter, China faces the dual challenge of sustaining economic growth while pursuing ambitious targets of peaking carbon emissions by 2030 and achieving carbon neutrality by 2060. The Chinese government has actively promoted digitalization, exemplified by the "Broadband China" strategy and various regional pilot policies. These initiatives have accelerated the integration of digital technologies into the real economy, yielding both positive outcomes in carbon emission efficiency and negative externalities through higher energy demand (Wang & Gao, 2025). The lessons from China are particularly relevant for other developing economies that are simultaneously undergoing rapid digital transformation and grappling with environmental pressures.

Despite the growing body of research, several gaps remain. First, while many studies have demonstrated that the digital economy reduces carbon intensity, the mechanisms through which these effects occur are still underexplored. Indirect pathways, such as industrial restructuring, technological innovation, and changes in consumer behavior, require deeper investigation (Wu et al., 2025). Second, much of the existing literature has focused on either the environmental benefits or the risks of digitalization in isolation, with limited efforts to synthesize both perspectives within a comprehensive framework (Sun et al., 2025). Third, although spatial spillover effects have been observed, cross-regional dynamics and interdependencies remain insufficiently examined, particularly in the context of global supply chains.

Another critical dimension relates to the role of policy. Digital economy policies directly influence the scale, direction, and sustainability of digital growth. For instance, investments in green infrastructure, regulatory measures targeting carbon-intensive logistics, and incentives for adopting renewable energy in digital platforms can significantly shape environmental outcomes (Wang & Gao, 2025). Yet, many studies emphasize that policy effectiveness varies across regions, depending on governance capacity, institutional frameworks, and economic structure (Wu et al., 2025). Understanding how policy interventions interact with digital transformation to influence sustainability outcomes is thus essential.

This paper seeks to contribute to these debates by providing a bibliometric analysis of recent research on the intersections between the digital economy, e-commerce policy, innovation, and sustainability. By analyzing 2,000 documents published between 2022 and 2025, the study maps the evolution of scholarly discourse, identifies dominant themes, and highlights gaps in the literature. This approach allows for a systematic understanding of how research in this field has developed, where it currently stands, and what directions are most promising for future inquiry.

The significance of this research lies in its potential to clarify the multifaceted role of the digital economy in advancing sustainable development. On a theoretical level, it integrates fragmented insights into a coherent picture of the opportunities and risks associated with digitalization. On a practical level, it offers guidance for policymakers and business leaders seeking to balance economic expansion with environmental stewardship. Ultimately, the study argues that innovation, inclusivity, and sustainability should not be treated as competing objectives but rather as complementary pillars of a resilient digital economy.

The remainder of this paper is structured as follows. The literature review section synthesizes prior studies on the digital economy and sustainability, focusing on conceptual definitions, measurement approaches, and empirical findings. The methodology section describes the bibliometric techniques and data used. The results section presents the main findings from the bibliometric analysis, while the discussion interprets these findings in light of broader theoretical and policy debates. Finally, the conclusion highlights key insights, practical implications, and avenues for future research.

2. Literature Review

The digital economy has emerged as a transformative paradigm that reshapes the way goods and services are produced, exchanged, and consumed. Scholars conceptualize the digital economy as a system underpinned by digital technologies such as artificial intelligence, big data, cloud computing, and blockchain, which restructure economic processes and generate new forms of (Wu et al., 2025). Some studies describe the digital economy as an extension of the information economy that integrates digital infrastructure with traditional industries, while others emphasize its unique role as a new organizational mode characterized by virtualization, disintermediation, and intelligence-driven processes (Becha et al., 2025; Wang & Gao, 2025). Approaches to measuring the digital economy have also evolved. Earlier value-added methods often underestimated its actual scale, whereas index-based methods now construct composite indicators that capture infrastructure, adoption rates, innovation capacity, and human capital (Sun et al., 2025). Importantly, the digital economy has increasingly been recognized as a double-edged phenomenon. On one hand, it promotes productivity, accelerates knowledge diffusion, and drives industrial restructuring. On the other hand, it can exacerbate inequality and environmental pressures if not managed appropriately (Wu et al., 2025).

Empirical research on the environmental implications of the digital economy has expanded, especially in relation to carbon emissions and energy efficiency. Evidence from China shows that the digital economy significantly improves carbon emission efficiency, which refers to the ability to generate output with fewer emissions per unit of input (Wang & Gao, 2025). Using quasi-natural experiments such as the Broadband China policy, studies demonstrate that digitalization enhances carbon emission efficiency through technological innovation, industrial restructuring, and optimization of the energy structure. Mechanisms include the capacity of digital platforms to monitor and optimize energy consumption in real time (Wu et al., 2025), the diffusion of green technologies facilitated by lower transaction costs (Sun et al., 2025), and the application of big data and artificial intelligence in corporate decision-making to strengthen green supply chains and energy-saving strategies (Becha et al., 2025). These findings highlight the potential of the digital economy to serve as a catalyst for low-carbon development.

Nevertheless, several studies point out that digitalization is accompanied by risks. Digital-related industries may increase emissions at the early stages due to the energy demand of data centers, infrastructure construction, and rebound effects from efficiency improvements (Wang & Gao, 2025). These contradictory outcomes underscore that the environmental impact of the digital economy is highly context-dependent, shaped by the level of development, regional capacity, and the effectiveness of policy frameworks. In urban contexts, the digital economy plays a vital role in green transformation. Empirical studies reveal that digitalization reduces carbon intensity by improving energy efficiency, supporting circular economy practices, and promoting industrial restructuring. However, these benefits are not linear. Find that the positive environmental effects of the digital economy are strongest at moderate levels of digitalization but tend to diminish at higher levels, suggesting potential saturation effects (Wu et al., 2025).

Spatial dynamics further complicate this relationship. The digital economy not only affects outcomes within individual regions but also generates spillover effects across neighboring areas. Demonstrate that provinces with advanced digital infrastructure exert positive influences on surrounding regions by diffusing knowledge, technologies, and green practices (Wu et al., 2025). This indicates that digitalization has the capacity to create regional networks of sustainability. However, uneven adoption also reinforces disparities, leaving lagging regions unable to fully benefit (Sun et al., 2025). These findings emphasize the need for regional cooperation and coordinated policies to maximize positive spillovers and ensure balanced outcomes.

The digital economy also affects broader patterns of production and consumption. E-commerce platforms, for instance, facilitate resource sharing, eco-labeling, and recycling practices that support sustainable consumption (Jiang et al., 2025). Smart city initiatives employ digital tools for traffic optimization, waste management, and renewable energy integration, aligning urban development more closely with sustainability objectives (Becha et al., 2025). These examples demonstrate that digitalization intersects not only with technological innovation but also with behavioral change among producers and consumers.

The role of policy and institutions is central in shaping the sustainability outcomes of digitalization. Several studies emphasize that government intervention strongly influences whether the digital economy strengthens or undermines environmental goals. Public investments in green infrastructure, subsidies for renewable energy adoption, and regulatory measures targeting carbon-intensive industries can amplify the positive effects of the digital economy (Wang & Gao, 2025). Coordinated policy efforts may also encourage interregional

collaboration, standardize green digital practices, and stimulate green innovation. Conversely, poorly designed policies may inadvertently increase emissions by accelerating the development of energy-intensive infrastructure (Sun et al., 2025). Additional challenges such as data privacy, market concentration among dominant digital platforms, and inequalities in access to digital technologies further complicate the governance of the digital economy (Becha et al., 2025). These challenges highlight the need for governance models that integrate economic, technological, and environmental objectives.

Despite rapid progress in this field, important research gaps remain. First, much of the literature isolates either the benefits or the risks of digitalization, with limited attempts to synthesize both perspectives into a comprehensive framework (Wu et al., 2025). Second, empirical studies remain disproportionately focused on China and a limited number of emerging economies, which raises questions about the generalizability of findings to other contexts (Sun et al., 2025). Third, while industrial restructuring and green innovation are often identified as primary mechanisms, other aspects such as consumer behavior, institutional capacity, and global supply chains receive comparatively little attention (Jiang et al., 2025). Finally, further research is required to understand long-term dynamics such as nonlinearities, rebound effects, and saturation points to ensure that digitalization remains aligned with sustainability objectives.

Taken together, the literature highlights the complex relationship between the digital economy and sustainability. On one hand, digitalization enhances efficiency, fosters innovation, and promotes green transformation. On the other hand, it introduces new challenges such as increased energy demand and regional inequality. The ultimate outcomes depend on the interaction between technological progress, institutional capacity, and policy effectiveness. This understanding provides both justification and a foundation for the present study, which employs bibliometric analysis to systematically examine recent research at the intersection of the digital economy, e-commerce policy, innovation, and sustainability.

3. Research Method

The research began by conducting a comprehensive search of the Scopus database, ensuring that the selected documents matched the research focus. The overall process was structured in three main stages (see Figure 1). The first stage involved defining the search criteria and refining the retrieved records to ensure relevance (data collection stage). In the second stage, the curated dataset was imported into Bibliometrix (R Studio) and VOSviewer to perform bibliometric analysis, including mapping publication trends, key authors, journals, countries, and thematic clusters (data visualization stage). Finally, in the third stage, the results of the bibliometric mapping were interpreted to identify dominant research themes, gaps in the literature, and patterns connecting digital economy, e-commerce, and sustainability issues (data interpretation stage).
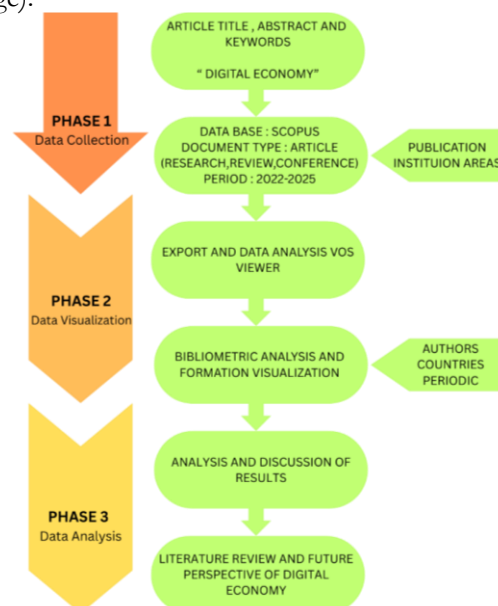

Figure 1. Phase Method Analysis

This study adopts a bibliometric approach using data extracted from the Scopus database covering the period 2022 to 2025. A total of approximately 2,000 documents sourced from 540 journals and conferences were included in the dataset. The bibliometric method was

chosen because it allows researchers to examine large volumes of scientific production systematically, identifying influential authors, journals, and countries, as well as mapping the conceptual structure of a field. The search strategy employed English keywords such as "digital economy," "e-commerce policy," "innovation," "sustainability," and "spillover effect," ensuring that the retrieved articles were closely aligned with the theme of this research. The exported records contained bibliographic information such as authors, publication year, title, source, and keywords, which were used for subsequent analysis.

Data processing and visualization were carried out using Bibliometrix in R-Studio and VOSviewer. Bibliometrix facilitated descriptive analysis of publication trends, citation counts, and co-authorship patterns, while VOSviewer enabled the construction of keyword co-occurrence maps and thematic clusters. Through these tools, annual scientific production, main information overviews, and international collaboration networks were examined. The final stage of the methodology involved interpreting the bibliometric indicators to uncover research trends, thematic interconnections, and gaps in the literature. Special emphasis was placed on exploring how digital economy and e-commerce research intersect with sustainability and innovation, and how spillover effects such as carbon emissions and industrial restructuring appear in the academic discourse. This twofold approach, combining quantitative mapping with qualitative interpretation, provided a comprehensive picture of the evolving knowledge landscape.

4. Results and Discussion

The bibliometric analysis covered research outputs from 2022 to 2025, comprising 2,000 documents published across 540 journals and conferences. The field experienced a remarkable annual growth rate of 218.63%, reflecting the rapidly increasing scholarly interest in the digital economy and e-commerce. A total of 7,477 authors contributed to this body of work, indicating a strong level of collaboration and knowledge exchange. The dataset includes 7,797 distinct author keywords and references a total of 15,023 sources, highlighting the thematic diversity and breadth of the field. On average, each document has received 7.82 citations, suggesting a growing research impact and relevance within the academic community. Collectively, these indicators illustrate the dynamic and fast-evolving nature of the literature, characterized by high publication growth, diverse research themes, and an active global research network.

Figure 2. Main Information Overview of Publications (Using R Studio)

The dataset reveals 2,000 documents authored by 7,477 researchers, with an average of 8.73 co-authors per document. International co-authorship accounts for 23.4%, reflecting moderate global collaboration. Annual growth in publications reached 218.63%, demonstrating the increasing relevance of digital economy research. The summary indicators show that the field is attracting growing scholarly attention, supported by the rise in the number of contributing authors and the diversification of publication sources. The fact that almost a quarter of the documents involve international collaboration indicates that digital economy and e-commerce are not only national concerns but also global academic priorities. The combination of high co-authorship rates and international collaboration suggests the field is characterized by networking and knowledge sharing across borders, which strengthens the robustness of research outputs.
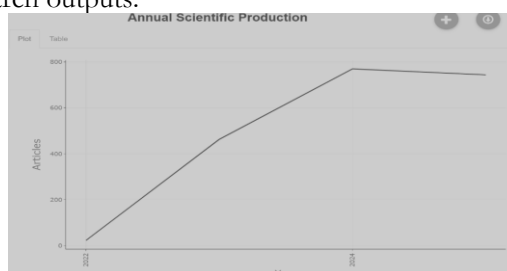

Figure 3. Annual Scientific Production of Digital Economy and E-Commerce Publications (Using R Studio)

From 2022 to 2024, the number of publications rose sharply, peaking at nearly 800 articles in 2024. While projections for 2025 show a slight decline, this is likely due to incomplete indexing for the ongoing year. The overall upward trend confirms the dynamic nature of the field. This increase after 2022 aligns with broader policy debates about digital transition and sustainability in the post-pandemic period. The acceleration in publication output suggests that issues around digital transformation, innovation, and sustainability have moved from being niche topics to central themes in economic research. The dip in 2025 is not necessarily indicative of reduced interest, but more likely reflects the indexing process and the fact that many 2025 articles are still under review or in press. The data underline how quickly the field is evolving, showing strong momentum that is likely to continue in the coming years.
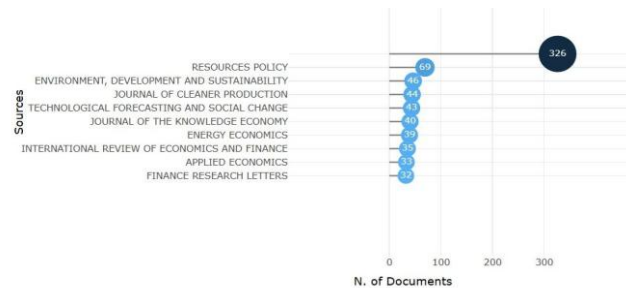

Figure 4. Resource Policy

The figure above shows that Resource Policy is the main source with 326 documents, followed by Environment, Development, and Sustainability, and Clean Production Journals. This dominance reflects the close relationship between digital economy studies and sustainability issues, particularly in resource management, environmental policy, and green innovation. The collection of publications in environment-oriented journals shows that research on the digital economy is increasingly integrating technological, economic, and ecological perspectives, reinforcing the view that digital transformation is not only about efficiency and growth, but also about addressing environmental challenges and promoting sustainable development.
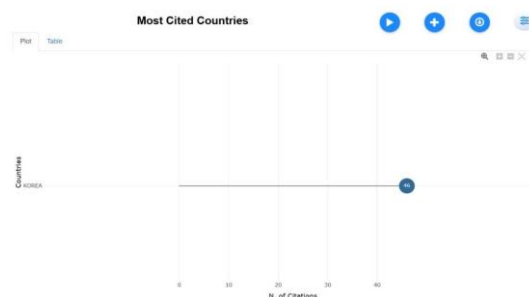

Figure 5. Most Cited Countries

The image above is an Analysis of Countries with the Most Citations, highlighting that Korea has emerged as a major contributor with the highest number of citations, reflecting its strong academic influence in the fields of digital economy and e-commerce policy. This dominance shows that research originating from Korea is not only productive but also highly relevant and impactful, often serving as a reference in subsequent studies. This highlights Korea's role in driving academic debate on digital transformation, innovation, and sustainability in the global research landscape.
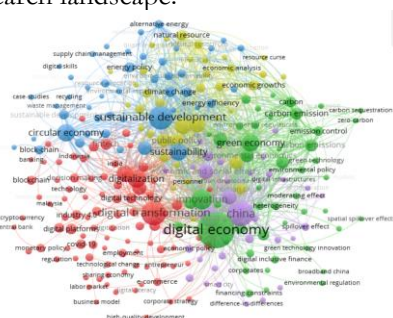

Figure 6. VOS Viewer Network Visualization

The VOSviewer network visualization image depicts the intellectual structure of this field through different thematic clusters, represented by different colors. The red cluster highlights discussions on the digital economy, digitization, and digital transformation, while the blue

cluster highlights themes of sustainable development, the circular economy, and renewable energy. The green cluster is closely related to the green economy, carbon emissions, and environmental policy, while the yellow cluster focuses on economic growth, natural resources, and energy efficiency. Together, these clusters reveal how research in this field goes beyond technological advances to encompass sustainability and environmental issues, in line with this paper's focus on the dual role of the digital economy and e-commerce policy as both drivers of innovation and sources of ecological challenges.
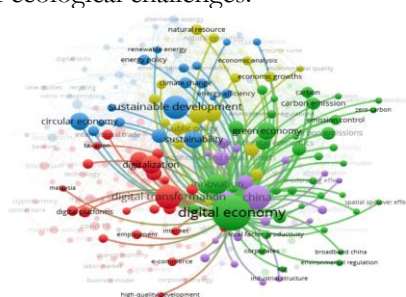

Figure 7. VOS Viewer Visualizes Co-Occurrence Network of Keywords

The image above visualizes the co-occurrence network of keywords in research on the digital economy and e-commerce. These clusters highlight key themes: the digital economy and environmental policy (green), digital transformation and platforms (red), sustainable development and the circular economy (blue), and natural resources and economic growth (yellow). These interconnected themes align with this article's focus on how digital economy and e-commerce policies simultaneously drive innovation, inclusion, and sustainability.
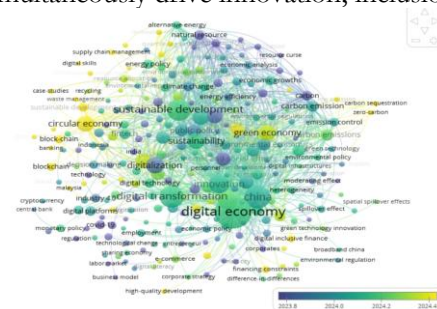

Figure 8. Keyword Co-Occurrence Network of Digital Economy and E-Commerce Research (VOSviewer)

The figure above presents an overlay visualization generated by VOSviewer, mapping the co-occurrence of keywords in the field of digital economy and e-commerce. The size of the nodes reflects the frequency of keywords, while the colors indicate the average publication year, ranging from earlier studies in blue–purple to more recent ones in green yellow. The connections between the nodes illustrate the relationships among concepts, showing how academic discussions have evolved over time. This visualization provides a clear overview of both established foundations and emerging directions in the literature.

The central node digital economy dominates the network, highlighting its role as the core theme that connects related topics such as digital transformation, digitalization, and innovation. Closely linked to these are keywords related to digital platforms, e-commerce, and inclusive finance, which indicate the expansion of the digital economy into various socio-economic aspects. On the other side, the visualization shows strong connections toward sustainability-oriented keywords such as sustainable development, green economy, carbon emissions, and environmental policy. This dual orientation demonstrates that digitalization is increasingly discussed not only in terms of technological advancement but also regarding its environmental and social implications.

From a temporal perspective, older studies (blue clusters) concentrated on broad issues like sustainable development, circular economy, and digitalization. More recent research (green yellow clusters) has shifted toward pressing challenges including carbon emission reduction, emission control, zero-carbon transition, and energy policy. The appearance of methodological terms such as spatial spillover effects, heterogeneity, and difference-in-differences indicates a growing use of advanced econometric and policy evaluation tools in the field, showing how the research community is deepening its analysis of the complex interactions between digital economy and sustainability.

This visualization directly supports the focus of this paper, "Shaping the Future: Digital Economy and E-Commerce Policy for Innovation, Sustainability, and Inclusion." It confirms that current scholarship increasingly treats the digital economy as both an engine of

innovation and inclusion, and as a source of ecological pressure that demands policy attention. By aligning with clusters related to green innovation, sustainable infrastructure, and environmental regulation, the paper emphasizes the importance of designing e-commerce policies that harness digitalization for growth while ensuring environmental sustainability and social equity.

The findings of this study bring several important implications from policy, managerial, social, and academic perspectives. From a policy standpoint, governments must play an active role in directing the development of the digital economy so that it does not merely pursue economic growth but also aligns with sustainability and inclusivity goals. Strengthening regulations that encourage green innovation, such as providing tax incentives for companies investing in renewable energy, low-carbon logistics, and environmentally friendly packaging, is a crucial step in this regard. Furthermore, the equitable expansion of digital infrastructure, particularly in rural and underserved regions, should be prioritized to prevent the widening of the digital divide. Another relevant policy measure is the integration of carbon accounting systems within e-commerce platforms, for instance by requiring large platforms to disclose their carbon footprint or by offering carbon emission calculators for consumers.

From a managerial perspective, the findings emphasize the importance for e-commerce companies to integrate sustainability into their business models. The adoption of green logistics practices, such as the use of electric vehicles for delivery, route optimization, and consolidated shipping systems, not only reduces carbon emissions but also enhances operational efficiency. Companies may also innovate by encouraging the use of eco-labels, recyclable packaging, and energy-efficient production methods. The use of digital technologies such as big data and artificial intelligence provides opportunities to design personalized sustainability nudges, for example by recommending low-carbon products or displaying information about the environmental impact of different consumption choices.

The social implications of this study are equally significant. The expansion of the digital economy should not be seen solely in terms of technological advancement and profit generation but also in relation to its contribution to social well-being. Digital inclusivity is essential to ensure that marginalized groups, such as small rural producers, low-income communities, and micro, small, and medium enterprises (MSMEs), can fully participate in digital transformation. This requires digital literacy programs, training, and financial inclusion initiatives to accompany infrastructure development. At the same time, consumer awareness plays a key role in shaping sustainable practices. E-commerce platforms can contribute by conducting educational campaigns that highlight environmentally responsible consumption and the ecological impact of purchasing behavior.

From an academic perspective, the findings open space for further research on the dynamics of the digital economy in broader regional contexts. To date, most research has focused on China and a few advanced economies, while empirical evidence from Southeast Asia, Africa, and Latin America remains limited. Future studies should explore how institutional capacity, cultural factors, and governance structures shape the outcomes of digital transformation. In addition, emerging topics such as blockchain for supply chain transparency, digital carbon trading, and the use of artificial intelligence in sustainability governance offer promising directions for future inquiry.

Overall, these implications demonstrate that the development of the digital economy is not a neutral process but one shaped by the interaction between technological innovation, governance capacity, and social responsibility. With well-designed policies and sustainability-oriented business practices, digital transformation can become a driver of innovation, inclusivity, and long-term sustainability.

5. Conclusion

This study examined the relationship between the digital economy, e-commerce policy, innovation, and sustainability through a bibliometric analysis of 2,000 documents published between 2022 and 2025. The results indicate that the digital economy has experienced rapid growth, reflected in an annual publication increase of more than 200%, greater international collaboration, and a wide variety of research themes. This trend confirms that digitalization is no longer a peripheral issue but has become a central driver of global economic transformation.

A key finding of this study is the dual nature of the digital economy's development. On the one hand, digitalization and the expansion of e-commerce have stimulated inclusive growth, improved efficiency, and broadened access for both individuals and businesses. On the other hand, these processes have intensified energy consumption, increased logistics intensity, and generated significant carbon footprints. The bibliometric mapping also highlights a shift in academic discourse from general topics such as sustainable development and digitalization toward more specific issues, including emission reduction, green innovation,

and the transition to a zero-carbon economy. This shift reflects a growing recognition that digital transformation must be accompanied by stronger environmental governance.

The findings further imply that e-commerce policies should not only aim to expand markets and foster innovation but also integrate sustainability and social equity into their design. Policies that promote energy efficiency, low-emission logistics, and investment in green infrastructure will be essential in ensuring that digital growth aligns with sustainable development objectives. For businesses, especially small and medium-sized enterprises (smes), digitalization should not merely be seen as a tool to expand market reach but also as an opportunity to adopt environmentally friendly practices, such as sustainable packaging or the use of renewable energy in operations.

Overall, this study provides a comprehensive overview of the evolution of digital economy research and identifies remaining gaps in the literature. More importantly, it emphasizes that innovation, inclusivity, and sustainability are not competing goals but mutually reinforcing pillars. With the right policy framework, the digital economy can function both as an engine of growth and as a foundation for more equitable, resilient, and sustainable development in the future.

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