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Digital Economy and Economic Transformation: A Bibliometric Analysis of Research Trends and Future Directions.

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ABSTRACT

The digital economy has become an increasingly important driver of economic transformation, reshaping production systems, business models, market structures, employment patterns, and economic interactions. The rapid development of digital technologies, including artificial intelligence, big data, cloud computing, and digital platforms, has created new opportunities for innovation, productivity improvement, and economic growth. However, the relationship between digital economic development and broader economic transformation remains a multidimensional research area requiring systematic examination. This study aims to analyze the development of scientific publications concerning the digital economy and economic transformation, identify dominant research themes, and explore potential directions for future research. A bibliometric approach is employed to examine the intellectual and thematic development of this research field. Bibliographic data are collected from the Crossref database and analyzed using VOSviewer and Bibliometrix through RStudio. The analysis focuses on annual publication trends, influential authors, institutional and country contributions, citation patterns, keyword co-occurrence, and thematic development. Network, overlay, and density visualizations are used to identify relationships among research topics and examine the evolution of scholarly attention over time. The analytical framework is expected to provide an overview of the intellectual structure and thematic evolution of digital economy and economic transformation research. Furthermore, the study seeks to identify emerging topics, underexplored research areas, and opportunities for interdisciplinary investigation. By mapping the development of scholarly knowledge, this research is expected to contribute to a better understanding of how digital technologies influence economic restructuring and development. The findings may also provide useful insights for researchers and policymakers in formulating future research agendas and strategies for inclusive and sustainable digital economic transformation.

Keywords: Digital Economy; Economic Transformation; Digitalization;; Economic Development.

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A. INTRODUCTION

The development of digital technologies has fundamentally transformed the global economic landscape by changing how economic activities are organized, conducted, and distributed. The increasing integration of information and communication technologies, digital infrastructure, data, and online platforms has created new opportunities for economic growth and innovation. The digital economy has emerged as an important component of contemporary economic development, influencing production systems, consumption patterns, business operations, and market structures. Its development extends beyond the information technology sector because digital inputs are increasingly incorporated into traditional economic activities. Bukht and Heeks (2017) explain that the digital economy encompasses economic activities that depend on digital technologies and digital networks, although its conceptual boundaries and measurement remain challenging. Digital transformation has also encouraged organizations to reconsider their business models, operational strategies, and relationships with consumers. Verhoef et al. (2021) emphasize that digital transformation involves significant changes in business models, organizational capabilities, and competitive strategies. Therefore, understanding the relationship between the digital economy and economic transformation is essential for explaining contemporary changes in economic structures and development processes.

At the global level, digital transformation has become a major driver of economic restructuring and changes in international competitiveness. The expansion of internet connectivity, artificial intelligence, cloud computing, big data, financial technology, and digital platforms has accelerated the emergence of new economic activities across countries and industries. These developments have enabled businesses to improve operational efficiency, expand market access, develop innovative products, and establish new forms of economic interaction. However, the benefits of digitalization are not distributed equally because differences in infrastructure, technological capabilities, digital skills, and institutional readiness continue to influence economic opportunities. The World Bank (2016) highlights that digital technologies can promote growth, expand opportunities, and improve service delivery, but their benefits depend on complementary institutional and regulatory conditions. Similarly, the OECD (2020) identifies digital access, effective technology use, innovation, employment, inclusion, trust, and market openness as interconnected dimensions of digital transformation. UNCTAD (2024) further emphasizes that the

development of the digital economy must consider environmental sustainability, resource efficiency, and inclusive participation. These global developments demonstrate that digital economic transformation is a multidimensional process involving technological, economic, institutional, social, and environmental changes.

In developing countries, including Indonesia, the digital economy has become increasingly important in supporting economic modernization and strengthening national competitiveness. The expansion of e-commerce, digital financial services, online transportation, digital payments, and technology-based business platforms has created new opportunities for businesses and consumers. Indonesia has experienced significant growth in digital economic activities, particularly through the increasing adoption of digital platforms and the expansion of online commercial transactions. Google, Temasek, and Bain & Company (2023) identify Indonesia as an important contributor to the growth of the Southeast Asian digital economy, particularly in areas such as e-commerce, digital financial services, and online transportation. These developments indicate that digitalization has the potential to strengthen business productivity, expand market participation, and support the transformation of conventional economic activities. Nevertheless, differences in digital infrastructure, human resource capabilities, business readiness, and access to technology may influence how economic actors benefit from these opportunities. At the local level, digital economic transformation is also relevant to small and medium-sized enterprises, local industries, entrepreneurship, and regional economic development. Consequently, understanding the development of the digital economy requires attention not only to global technological progress but also to its implications for national and regional economic transformation.

Despite the growing importance of the digital economy, several conceptual and practical challenges remain in understanding its relationship with broader economic transformation. One major issue concerns the diversity of definitions and analytical approaches used to explain the digital economy across different academic disciplines. The measurement of digital economic activities also remains challenging because conventional economic indicators may not fully capture the value generated by digital platforms, data, and technology-enabled services. Mesenbourg (2001) highlights the importance of developing appropriate measurement frameworks to identify and assess economic activities associated with digital technologies and electronic business. Another issue concerns the uneven distribution of digital transformation

benefits across countries, sectors, businesses, and social groups. Differences in technological infrastructure, digital capabilities, institutional arrangements, and regulatory environments may produce different economic outcomes. Kraus et al. (2021) demonstrate that digital transformation has implications extending beyond individual organizations to broader environmental, social, and institutional contexts. These conditions indicate the need for a comprehensive understanding of how digital economy research has developed and how its major themes relate to economic transformation.

Previous studies have examined the digital economy from various perspectives, including technological development, economic growth, business innovation, digital transformation, and research mapping. Early conceptual work by Bukht and Heeks (2017) contributed to the understanding of the digital economy by discussing its definitions, conceptual boundaries, and measurement challenges. Verhoef et al. (2021) examined digital transformation as a multidisciplinary process involving changes in business models, organizational capabilities, and competitive strategies. Kraus et al. (2021) reviewed the development of digital transformation research and highlighted its implications for organizations, society, and institutions. In the bibliometric field, Xia et al. (2023) analyzed the evolution of digital economy research and identified changes in publication patterns, research themes, and emerging directions. Wang et al. (2023) also examined the development of global digital economy research through bibliometric analysis, identifying research evolution and major thematic areas. In addition, Donthu et al. (2021) established methodological guidance for conducting bibliometric analysis to identify influential publications, intellectual structures, and emerging research themes. These studies provide important foundations for understanding the digital economy, but they also indicate the continuing need for broader analysis of its relationship with economic transformation.

Although previous studies have examined digital economy development and digital transformation, several research gaps remain relevant to the present study. First, existing research often focuses on particular dimensions, such as technological innovation, digital business, organizational transformation, or the evolution of digital economy publications. Second, the relationship between digital economy development and broader economic transformation requires further examination through an integrated perspective that connects technological changes with economic restructuring. Third, the evolution of research themes, intellectual connections, and

emerging research directions needs to be mapped systematically to understand how scholarly attention has developed over time. Aria and Cuccurullo (2017) demonstrate that bibliometric analysis using the Bibliometrix package can support comprehensive science mapping and the identification of intellectual structures within research fields. However, a focused bibliometric examination that positions the digital economy and economic transformation as interconnected research domains can provide additional insights into their conceptual relationships and thematic development. The novelty of this study lies in examining publication trends, influential research contributions, keyword relationships, thematic clusters, and emerging research directions within the combined context of the digital economy and economic transformation. Accordingly, this study seeks to provide an integrated knowledge map that can clarify the intellectual development of the field and identify opportunities for future research.

Based on the identified research problems and gaps, this study aims to analyze the development of scientific publications concerning the digital economy and economic transformation through a bibliometric approach. Specifically, it seeks to identify annual publication trends and examine the growth of scholarly attention toward these interconnected research areas. The study also aims to identify influential authors, academic institutions, countries, journals, and publications contributing to the development of the field, subject to the availability of bibliographic metadata. Furthermore, it examines the intellectual structure of the research domain through citation relationships, co-authorship networks, and keyword co-occurrence patterns. Another objective is to identify the dominant research themes and their evolution over different publication periods. The analysis also seeks to recognize emerging topics and underexplored areas that may become important directions for future investigation. Through these objectives, the study is expected to provide a systematic understanding of how academic research has addressed the relationship between digital economic development and broader economic transformation. Ultimately, the research aims to establish an evidence-based foundation for identifying future scholarly priorities in this interdisciplinary field.

This study is expected to contribute to the development of academic knowledge by providing a comprehensive overview of research trends concerning the digital economy and economic transformation. From a theoretical perspective, the findings may clarify the conceptual relationships between digital technologies, economic restructuring, innovation, productivity, and

inclusive development. From a methodological perspective, the bibliometric approach provides a systematic means of identifying influential contributions, intellectual connections, thematic structures, and emerging research directions. The results may also assist researchers in identifying knowledge gaps and developing more focused research agendas concerning digital economic development. From a practical perspective, the study may provide useful insights for policymakers, business actors, and development institutions in understanding the broader implications of digital transformation. In particular, the identification of emerging themes may support discussions concerning digital infrastructure, technological innovation, economic inclusion, digital capabilities, and sustainable development. By mapping the evolution of scholarly knowledge, this study seeks to connect existing research contributions with opportunities for further theoretical and empirical investigation. Therefore, it is expected to strengthen the academic understanding of digital economy development and its role in shaping contemporary economic transformation.

B.RESEARCH METHODS

This study employs a **bibliometric analysis approach** to examine the development of scientific publications concerning the digital economy and economic transformation. Bibliometric analysis is used to systematically identify publication trends, influential research contributions, intellectual structures, and emerging themes within a particular research field. The data are collected from the Crossref database, which provides bibliographic metadata, including publication titles, authors, publication years, journals, abstracts, and digital object identifiers (DOIs), depending on data availability. The literature search focuses on keywords related to *digital economy*, *economic transformation*, *digital transformation*, *digitalization*, and *economic development*. The selection of these keywords is intended to capture relevant scholarly publications that discuss the relationship between digital technological development and changes in economic structures.

The bibliographic data are processed and analyzed using **VOSviewer** and **Bibliometrix** through RStudio**.** VOSviewer is employed to construct and visualize bibliometric networks, particularly keyword co-occurrence, co-authorship, and citation relationships, depending on the completeness of the available metadata. Meanwhile, Bibliometrix is used to conduct descriptive bibliometric analysis, including annual scientific production, publication distribution, author contributions, source productivity, and thematic development. The analysis also incorporates network visualization, overlay visualization, and density visualization to identify relationships among research topics, distinguish dominant themes, and examine the development of scholarly attention over different publication periods. These techniques provide complementary perspectives for understanding the intellectual structure and evolution of research on the digital economy and economic transformation.

The analysis is conducted through several stages, beginning with the identification of relevant keywords and the retrieval of bibliographic records from Crossref, followed by data screening, cleaning, and preparation. Duplicate records and publications that do not correspond to the research focus are excluded to improve the relevance of the dataset. Subsequently, the selected records are analyzed to identify publication growth, influential contributions, keyword relationships, research clusters, and emerging thematic areas. The results are interpreted to explain the development of the research field, identify underexplored topics, and formulate potential directions for future investigation. The study also recognizes that the completeness of Crossref metadata may vary across publications, particularly regarding citation information and author affiliations. Therefore, the findings are interpreted based on the available bibliographic records and do not automatically represent the entire global body of research on the digital economy and economic transformation.

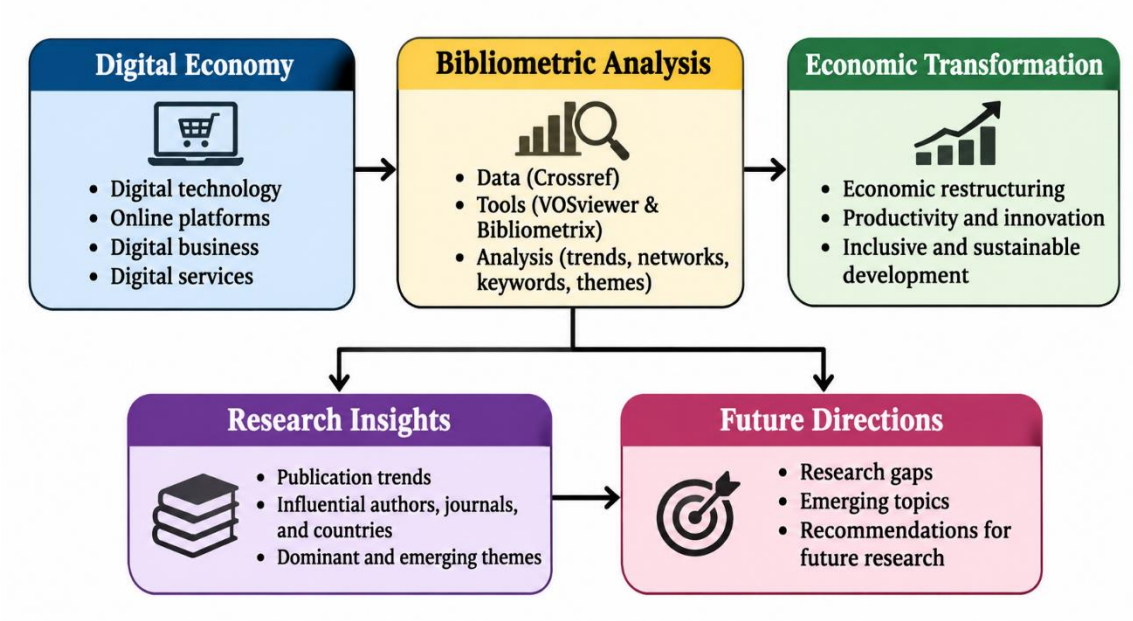

Figure 1. Conceptual Framework of Digital Economy and Economic Transformation: A Bibliometric Analysis of Research Trends and Future Directions.

The figure illustrates the conceptual framework of this study, which examines the relationship between the digital economy and economic transformation through a bibliometric approach. The first component, *Digital Economy*, represents the main research domain, covering digital technology, online platforms, digital business, and digital services. The second component, *Bibliometric Analysis*, describes the research process using bibliographic data obtained from Crossref and analyzed through VOSviewer and Bibliometrix, focusing on publication trends, citation networks, keyword relationships, and thematic developments. The third component, *Economic Transformation*, represents the broader economic dimensions associated with digitalization, including economic restructuring, productivity, innovation, and inclusive and sustainable development. These components provide the foundation for identifying *Research Insights*, such as publication trends, influential authors, journals, countries, and dominant or emerging themes. Finally, the *Future Directions* component highlights research gaps, emerging topics, and recommendations for further academic investigation. Overall, the framework provides a systematic overview of the intellectual development of digital economy research and its implications for understanding contemporary economic transformation.

C.RESEARCH RESULTS AND DISCUSSION

- Results

The bibliometric analysis of research on the digital economy and economic transformation is further supported by visualization techniques using VOSviewer. This software is employed to map and visualize bibliographic networks, allowing researchers to identify relationships among keywords, authors, and scientific publications. Through these visualizations, the study examines the intellectual structure and thematic development of scholarly publications related to the digital economy, digital transformation, and economic development. The bibliographic data retrieved from the Crossref database are processed to identify relevant relationships and patterns within the selected research dataset.

VOSviewer provides three main visualization approaches used in this study: network visualization, overlay visualization, and density visualization. Network visualization illustrates the relationships among frequently occurring keywords and identifies clusters representing interconnected research themes. Overlay visualization presents the temporal development of research topics based on their average publication years, helping distinguish established themes from emerging areas of scholarly interest. Meanwhile, density visualization highlights the concentration of research topics based on keyword occurrence and the strength of their relationships within the bibliographic dataset.

The application of these three visualization techniques provides a comprehensive perspective on the development of academic research concerning the digital economy and economic transformation. By examining the connections, temporal patterns, and concentration of research themes, this study seeks to identify dominant topics, emerging issues, and potential knowledge gaps. These visualizations also support the interpretation of how scholarly attention has evolved in discussing digital technologies, digital platforms, economic restructuring, productivity, innovation, digital business, and sustainable economic development. The following figures present the results of the VOSviewer analysis, which serve as the basis for further interpretation and discussion of research trends, developments, and future directions.

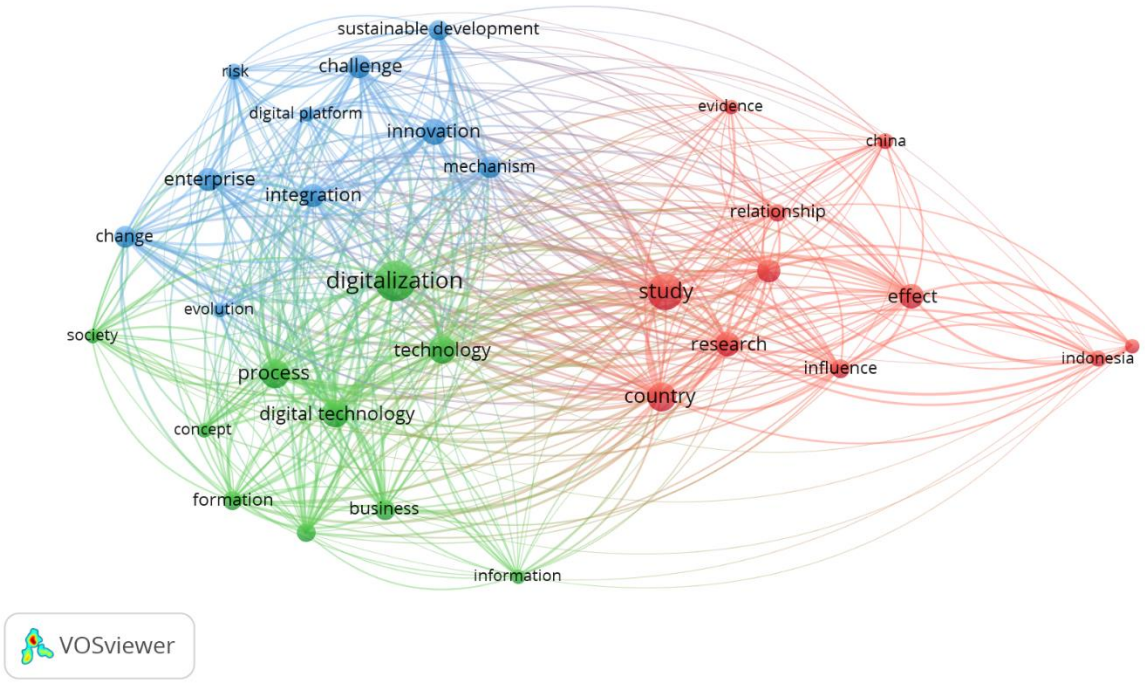

Figure 2 Network Visualization of Keyword Co-occurrence in Digital Economy and Economic Transformation Research.

The network visualization illustrates the relationships among keywords in scientific publications concerning the digital economy and economic transformation. The visualization reveals several interconnected research clusters, represented by different colors, indicating groups of related research themes. The green cluster is primarily associated with *digitalization*, *digital technology*, *technology*, *business*, *process*, and *information*, reflecting research focused on technological adoption and its integration into economic and organizational activities. The blue cluster includes keywords such as *innovation, digital platform*, *enterprise*, *integration, sustainable development*, and *challenge*, indicating scholarly attention to technological innovation, digital business platforms, organizational adaptation, and sustainability. Meanwhile, the red cluster is characterized by keywords such as *study*, *research, country*, *effect, influence*, *relationship,* and *evidence*, representing broader analytical discussions and empirical investigations of digital economic development across different national contexts.

The connections among these keywords indicate that digitalization and digital technology occupy important positions within the research network, linking technological development with business activities, innovation, and broader economic processes. The presence of keywords such as *sustainable development*, *innovation*, and *digital platform* suggests that research on the digital economy extends beyond technological adoption to include economic opportunities and long-term development challenges. Furthermore, the appearance of *Indonesia* and *China* within the red cluster indicates that country-specific perspectives are also represented in the bibliographic dataset. The relationships among these themes demonstrate the multidisciplinary character of digital economy research, connecting technology, business, innovation, and economic development. Overall, this visualization provides an overview of the intellectual structure of the research field and identifies the interconnected themes that can serve as a foundation for examining research trends, emerging topics, and future research directions.

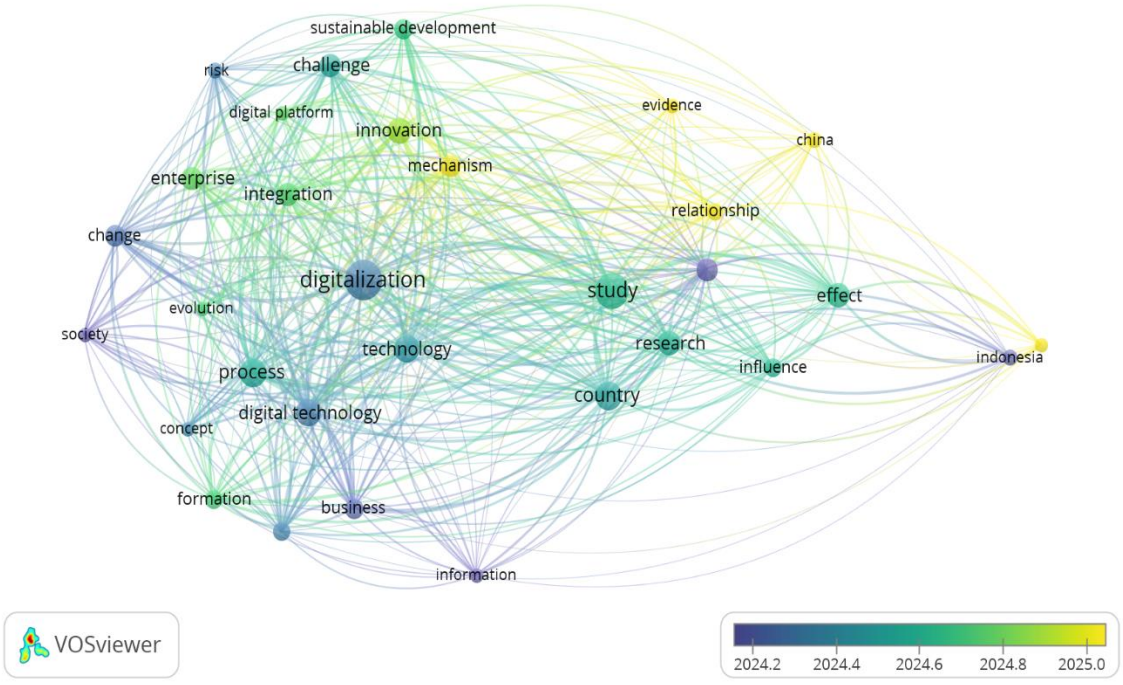

Figure 3 Overlay Visualization of Research Trends in Digital Economy and Economic Transformation (2022 - 2026).

The overlay visualization illustrates the temporal development of research themes related to the digital economy and economic transformation based on the average publication year of the keywords. The color spectrum represents the development of scholarly attention, ranging from purple and blue for relatively earlier research topics to green and yellow for more recent themes. The visualization indicates that keywords such as *digitalization, digital technology*, *process, business,* and *technology* occupy important positions within the research network, reflecting established discussions concerning the adoption and integration of digital technologies into economic activities. Meanwhile, terms such as *innovation, sustainable development, digital platform,* and *mechanism* demonstrate connections between technological advancement, business development, and broader economic transformation. The presence of these interconnected keywords suggests that digital economy research has developed across several related dimensions, including technological innovation, organizational change, and economic development.

Furthermore, the appearance of relatively recent keywords, particularly *China, Indonesia, evidence,* and *relationship,* indicates growing scholarly attention to country-specific experiences and the relationships between digitalization and economic outcomes. The yellow-colored nodes, which correspond to relatively newer average publication years, suggest areas receiving more recent research attention within the analyzed dataset. However, these colors represent the average publication year of keyword occurrences rather than proving that a particular topic is entirely new. The visualization also demonstrates that established themes, such as digitalization and technology, remain closely connected to emerging discussions on innovation, sustainability, and national economic development. Overall, the overlay visualization provides insights into the evolution of research interests and helps identify topics that may offer opportunities for further investigation, particularly the relationship between digital transformation, economic restructuring, innovation, and inclusive economic development.

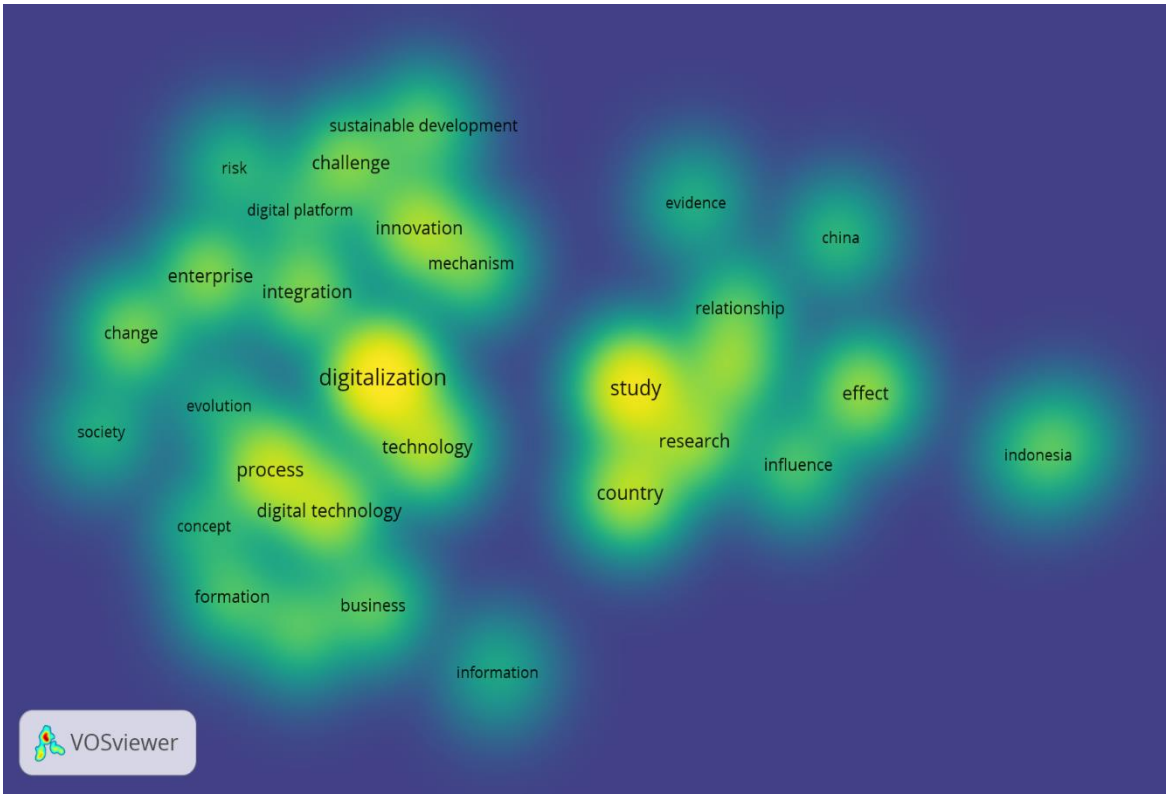

Figure 4 Density Visualization of Research Themes in Digital Economy and Economic Transformation.

The density visualization illustrates the concentration and distribution of research themes related to the digital economy and economic transformation based on keyword occurrences and their co-occurrence relationships. The color intensity represents the density of research topics, with yellow areas indicating higher concentrations of frequently occurring keywords, green areas representing moderate concentrations, and blue areas indicating relatively lower concentrations. The visualization shows that *digitalization* occupies a prominent high-density position, suggesting that it is one of the central themes in the analyzed research dataset. Other relatively concentrated topics include *study, technology, digital technology, process,* and *research*, reflecting the strong academic interest in technological adoption, digital transformation processes, and their economic implications. Meanwhile, keywords such as *innovation, business, sustainable development,* and *country* indicate the broader dimensions associated with digital economic development.

The distribution of research density also reveals several interconnected thematic areas that extend beyond the central discussion of digitalization. Topics such as *digital platforms, enterprise integration, technological innovation,* and *business* demonstrate the relationship between digital technologies and organizational or economic activities. Furthermore, the presence of *China* and *Indonesia* indicates that country-specific perspectives are represented in the analyzed publications, although their density is comparatively lower than that of the dominant themes. The visualization suggests that scholarly attention is concentrated around digitalization and technological development, while other dimensions, including sustainability, institutional change, and country-specific economic transformation, provide opportunities for further investigation. Overall, the density visualization helps identify dominant research themes and comparatively less concentrated topics, providing a basis for recognizing potential research gaps and developing future research directions in the digital economy and economic transformation.

- Discussion

The bibliometric findings demonstrate that research on the digital economy and economic transformation is strongly concentrated around the themes of *digitalization, digital technology, technology, business,* and *innovation*. The network visualization (Figure 2) indicates that digitalization occupies a central position and maintains connections with various research themes, suggesting its importance in linking technological development with economic and organizational changes. The green cluster highlights the relationship between digital technology, business activities, information, and economic processes, while the blue cluster emphasizes innovation, digital platforms, enterprise integration, and sustainable development. These patterns indicate that the digital economy is not merely associated with the adoption of technological tools but also involves changes in business practices, organizational structures, and economic activities. This interpretation is consistent with Verhoef et al. (2021), who explain that digital transformation involves changes in business models, organizational capabilities, and competitive strategies. Therefore, the network structure suggests that digitalization functions as an important connecting theme in the scholarly discussion of economic transformation.

The overlay visualization (Figure 3) provides additional insights into the temporal development of research themes, with the average publication years ranging approximately from

2024.2 to 2025.0. The distribution of colors indicates that established topics, including digitalization, digital technology, business, and technological processes, remain connected to relatively recent discussions concerning innovation, sustainable development, and country-specific economic experiences. The appearance of *China, Indonesia, evidence,* and *relationship* in the more recent color spectrum suggests growing attention to national contexts and the relationship between digital development and economic outcomes. However, these patterns should be interpreted as changes in the average publication years of keywords rather than definitive evidence that the topics are entirely new. The OECD (2020) emphasizes that digital transformation involves interconnected dimensions, including access, effective technology use, innovation, employment, inclusion, trust, and market openness. This perspective supports the interpretation that contemporary digital economy research increasingly addresses technological development alongside its broader economic and institutional implications.

The density visualization (Figure 4) further confirms the prominence of *digitalization, study, technology, digital technology, process,* and *research* within the analyzed publications. The high-density areas, represented by yellow, indicate that these keywords occur relatively frequently and have strong relationships with other topics in the dataset. Meanwhile, themes such as *innovation, sustainable development, digital platforms, business,* and *enterprise integration* appear as interconnected areas that broaden the discussion of digital economic development. The presence of *China* and *Indonesia* also reflects the inclusion of country-specific perspectives, although their lower density suggests that these topics are less concentrated than the dominant keywords. These patterns are relevant to the findings of Xia et al. (2023), whose bibliometric study identifies the evolution of digital economy research through publication characteristics, keyword changes, and emerging research directions. Thus, the density visualization helps distinguish the central research themes from topics that may require further scholarly attention.

Overall, the three VOSviewer visualizations provide complementary insights into the intellectual structure, temporal development, and thematic concentration of research on the digital economy and economic transformation. The network visualization identifies the relationships among major research themes, the overlay visualization highlights changes in scholarly attention over time, and the density visualization reveals the concentration of frequently discussed topics. Taken together, the results suggest that digitalization and technological development constitute

central themes, while innovation, sustainability, business transformation, and national economic experiences provide important interconnected research dimensions. These patterns also indicate opportunities for future studies to investigate how digital technologies influence productivity, economic restructuring, business competitiveness, employment, and inclusive development. UNCTAD (2024) emphasizes the importance of shaping a digital economy that is environmentally sustainable and inclusive, reinforcing the need to examine economic transformation beyond technological adoption alone. Therefore, future research should integrate technological, economic, social, and environmental perspectives to develop a more comprehensive understanding of digital economic transformation.

D.CONCLUSION & RECOMMENDATIONS

- Conclusion

This study concludes that research on the digital economy and economic transformation is predominantly characterized by themes related to digitalization, digital technology, technological innovation, business activities, and economic development. The network visualization reveals that digitalization occupies a central position within the research structure and is interconnected with themes such as technology, business, innovation, digital platforms, and sustainable development. The overlay visualization indicates the development of scholarly attention toward issues including innovation, sustainability, and country-specific economic experiences, while the density visualization confirms the prominence of digitalization, technology, and research-related themes. These findings demonstrate that the digital economy is an interdisciplinary research field that connects technological advancement with changes in business practices, organizational processes, and broader economic structures.

Furthermore, the bibliometric analysis provides an overview of the intellectual structure, thematic development, and emerging research interests concerning digital economic transformation. The findings indicate that digitalization and technological development remain central topics, while sustainability, economic restructuring, innovation, and national economic experiences offer opportunities for further investigation. Nevertheless, the findings are limited to the bibliographic records retrieved from Crossref and the metadata available for analysis.

Therefore, they should not be interpreted as representing the entire global body of research or as establishing causal relationships between digitalization and economic performance. Overall, this study contributes to understanding the development of scholarly research and provides a foundation for identifying future research priorities concerning the relationship between digital technologies and economic transformation.

- Recommendations

Future research should expand the bibliographic sources by integrating databases such as Scopus and Web of Science with Crossref to obtain broader publication coverage and strengthen the robustness of bibliometric findings. Researchers are also encouraged to investigate emerging themes, particularly artificial intelligence, digital financial services, digital entrepreneurship, business innovation, economic productivity, and sustainable digital development. In addition, future studies should examine the relationship between digital transformation and economic performance through empirical approaches, including comparative studies across countries, industries, and regions. Policymakers and economic development institutions should also consider the findings when formulating strategies that strengthen digital infrastructure, improve digital literacy, support business innovation, and promote inclusive participation in the digital economy. These efforts are expected to contribute to a more comprehensive understanding of digital economic transformation and support sustainable economic development.

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