

The Role of Digital Transformation in Increasing the Competitiveness of MSMEs Using Bibliometric Analysis

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ABSTRACT: This paper explores the impact of digital transformation on the competitiveness of Micro, Small, and Medium Enterprises (MSMEs) through a comprehensive bibliometric analysis. As digital technologies reshape the global economy, MSMEs face increasing pressure to adapt in order to remain relevant and competitive. Using data from 4,374 scientific articles published between 2014 and 2023 and retrieved from the Scopus database, this study applies the Bibliometrix and Biblioshiny tools in R to identify prevailing research trends, influential keywords, and key thematic areas. The results highlight that topics such as innovation, sustainability, and technology adoption are central to the academic discussion, particularly in response to challenges posed by events like the COVID-19 pandemic. Thematic mapping also indicates that digital transformation is not only a technical shift but a strategic one—enabling MSMEs to enhance efficiency, enter new markets, and increase resilience. This study concludes that digital transformation plays a crucial role in the long-term competitiveness of MSMEs and calls for continued research and policy support in this evolving field.

KEYWORDS: The Role, Digital Transformation, Increasing, Competitiveness, MSMEs, Bibliometric Analysis

1. INTRODUCTION

The rapid advancement of digital technology has significantly reshaped the global business landscape, requiring companies of all sizes to adapt swiftly. Micro, Small, and Medium Enterprises (MSMEs), which form the backbone of many national economies, especially in developing countries, face unique challenges and opportunities in this digital age. MSMEs are often constrained by limited financial resources, insufficient digital infrastructure, and low technological literacy, making it difficult for them to compete with larger enterprises [1].

Digital transformation offers a strategic avenue for MSMEs to overcome these limitations. By integrating digital tools such as cloud computing, e-commerce platforms, digital marketing, and data analytics MSMEs can enhance operational efficiency, broaden market reach, and improve customer experience [2]. Furthermore, digital adoption has the potential to foster innovation, streamline processes, and build resilience against economic disruptions [3].

However, the process of digital transformation is not without obstacles. MSMEs often encounter barriers such as high initial investment, lack of skilled workforce, and uncertain return on investment [4]. Understanding these challenges, and how they impact the competitiveness of MSMEs, is essential for creating targeted support policies and sustainable digital ecosystems.

This research aims to analyze the role of digital transformation in increasing the competitiveness of MSMEs.

The focus will be on identifying key drivers, challenges, and strategic approaches that can support MSMEs in successfully adopting digital technologies and strengthening their position in both local and global markets.

RQ1: What are the key themes and trends in academic research related to digital transformation and its impact on the competitiveness of Micro, Small, and Medium Enterprises (MSMEs) from 2014 to 2023?

RQ2: How do bibliometric indicators (such as publication volume, citation patterns, keyword relevance, and thematic clusters) reflect the strategic role of digital transformation in enhancing MSME competitiveness globally?

2. METHODS

2.1 Planning

The planning stage begins with determining a theme, where the theme in this research is related to Digital Transformation. This research uses data from 2014-2023. This data was obtained from the SCOPUS database which contains various quotes regarding keyword searches used for bibliometric analysis. This database is often used to retrieve data in systematic reviews [5] and bibliometric analysis [6] because it contains the highest quality scientific publications. In this case, the procedure produced a data document containing 4,374 articles. The metadata is then extracted in bib style format.

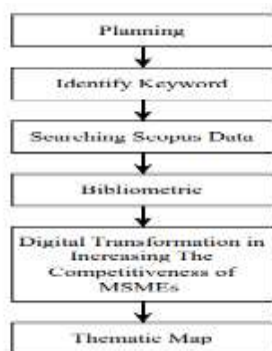


Figure 1 Methodology

2.2 Identify Keyword

Keyword identification is a step taken by researchers to find the keywords to be used. Keyword identification was carried out by collecting various articles and journals related to The Role, Digital Transformation, Increasing, The Competitiveness, and MSMEs [7]. In bibliometric analysis, the use of keywords allows researchers to better measure the trends, quantity, and impact of research related to a particular topic. Apart from that, keywords are also used to facilitate searching and understanding relevant scientific literature in a knowledge domain. Researchers use Boolean logic operators such as AND/OR in determining keywords [8].

This research uses the search keywords “The Role”, “Digital Transformation”, “Increasing”, “Competitiveness”, and “MSMEs” with the search syntax: ALL (“The Role” OR Part OR Function OR Contribution AND “Digital Transformation” OR Digitalization OR “Digital Adoption” OR “Technology Adoption” AND Increasing OR Upgrade OR Enhancing OR Improving AND Competitiveness OR “Competitive Advantage” OR “Business Competitiveness” AND MSMEs OR SMEs OR “Micro, Small and Medium Enterprises” OR “Small and Medium Enterprises” OR “Small Businesses” OR “Micro Enterprises”). This keyword will be used by researchers in searching for data in the Scopus database regarding this topic. Searching for keywords in the Scopus database can be seen in Figure 2.



Figure 2 Keyword search in the Scopus database

2.3 Searching Scopus Data

Research on Digital Transformation can be found in various scientific publication media, whether journals, conference proceedings, or books. These media have different qualities. One thing that determines quality is the

peer review process [9]. Therefore, this research chose Scopus and Web of Science as data sources because scientific articles indexed by Scopus go through a peer review process. Scopus is a citation and abstract database supervised by experts in the field [10]. Based on information from the Scopus website (<http://www.scopus.com>) which was accessed on 07 November 2023, data was generated for 6.993 articles that were in accordance with the research theme.

Scopus is the world's largest data center covering millions of scientific literature published decades ago by Elsevier. Scopus helps researchers to search, analyze and visualize research effectively [11]. A total of 6.993 articles were filtered to prevent duplicate keywords and filters, such as (1) search in "all fields" (2) Selected Criteria 10 Years (2014-2023), (3) Filter based on Document Type, (4) Publication Stage, (5) Source Type, and (6) Language. In this case, the procedure produced a data document containing 4.374 articles whose metadata was then extracted in bib-style format. This results in the retrieval of a variety of information, including citations, bibliographic, abstract & keywords. This can be seen in the figure 2.

2.4 Bibliometrics

Bibliometrics is a package used in R software. In R, there is also biblioshiny which is an application that provides a web interface for bibliometrics [11]. To use bibliometric and biblioshiny techniques, you can install R from Rstudio. After installing, run the command “install.packages(“bibliometrix”), this is used to install the bibliometrix package. When finished, then “library(bibliometrix)” where this command is to load the bibliometrix package. The final step is to enter the command “biblioshiny()”, this command opens the interface. The metadata is extracted in the form of bibs, the data will be imported and converted to data frame collection.

The biblioshiny interface will display analysis and plot results for four different level metrics including: source, author, document, and Clustering by Coupling. Followed by an analysis of three knowledge structures (K-structures) such as: conceptual structure, intellectual structure and social structure. Of the 7 analysis menu, each contains a submenu where this supports scholars in using bibliometrix's main features easily. The biblioshiny interface can be seen in the figure 3.

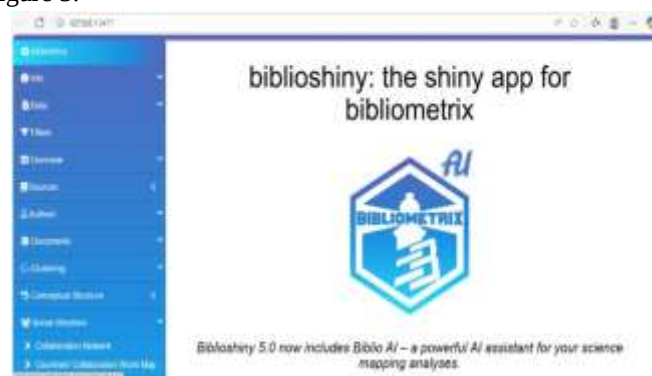


Figure 3 biblioshiny interface

2.5 Digital Transformation in Increasing The Competitiveness of MSMEs

Digital transformation refers to the process through which micro, small, and medium enterprises (MSMEs) adopt digital technologies to fundamentally change their business operations, improve efficiency, enhance customer value, and gain a competitive edge. According to [12], digital transformation involves the integration of digital technologies into all areas of business, resulting in fundamental changes to how organizations operate and deliver value to customers. In the context of MSMEs, emphasize that digital transformation is a strategic response to external challenges, particularly during times of crisis, enabling businesses to improve their resilience, adapt to market changes, and strengthen their competitiveness [13].

2.6 Thematic Map

In bibliometric analysis, a thematic map is a strategic tool used to visualize and categorize research themes based on their centrality (relevance) and density (development). This tool allows researchers to identify how well-developed and interconnected a theme is within the overall research domain. According to [14], “thematic maps are constructed based on co-word analysis and are useful for detecting the importance and development of research themes in a given field.”

The map is divided into four quadrants: motor themes (high relevance and development), niche themes (high development but low relevance), emerging or declining themes (low development and relevance), and basic themes (high relevance but low development). In the context of this study, the thematic map helps to identify the position of digital transformation and related topics in the research landscape concerning the competitiveness of MSMEs.

3. RESULTS AND DISCUSSION

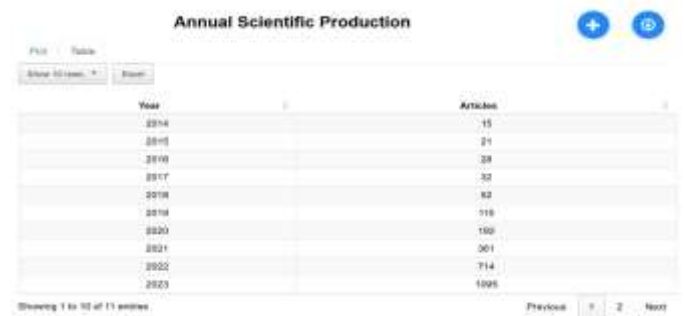
3.1 The Role of Digital Transformation in Increasing the Competitiveness of MSMEs.

The data used in this research amounted to 4.374 articles originating from the Scopus database taken from 2014-2023 which were identified based on document type, journal source type, year of research, search within "all fields" and research trends. Next, the data was processed using a bibliometric approach with R Studio software based on 4.374 existing article data. The processed data results display graphs of statistical data based on the data in the article.

3.2 Digital Transformation in Increasing the Competitiveness of MSMEs based on publications and average annual citations

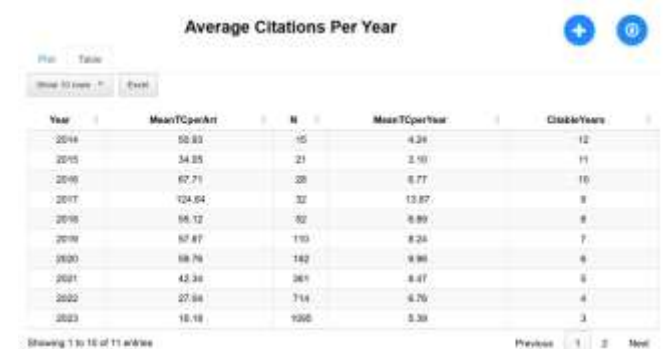
Based on the available publication results, it describes the total number of publications and article citations so that the volume of article publications can be measured. Figure 4 and Figure 5 show the development of Cybersecurity regarding human factors and time pressure from 2014 to 2023

Table 1 Research developments based on publication



Year	Articles
2014	15
2015	21
2016	28
2017	32
2018	82
2019	118
2020	180
2021	301
2022	714
2023	1095

Table 2 Research development based on average annual citations



Year	MeanCpPerArt	N	MeanCpPerYear	CitableYears
2014	50.83	15	4.39	12
2015	34.35	21	3.10	11
2016	67.71	28	6.77	10
2017	124.64	32	13.87	8
2018	56.12	82	6.89	6
2019	57.87	118	8.24	7
2020	68.76	180	9.96	6
2021	43.36	301	8.87	6
2022	27.84	714	6.76	4
2023	18.16	1095	5.39	3

The two pictures above shed light on the patterns in scientific production and citations over time concerning the subject of digital transformation and its effects, specifically on MSMEs' (micro, small, and medium-sized enterprises') ability to compete. The number of published publications increased significantly between 2014 and 2023, according to the first table, Annual Scientific Production. With an especially notable increase in publications starting in 2020, this surge demonstrates growing scholarly interest in the topic. This may be explained by the increased need for MSMEs to adapt to digital technology during and after the COVID-19 epidemic, which served as a catalyst for digital transformation in a number of sectors.

The second table, Average Citations Per Year, complements this trend by indicating how impactful these publications have been. Earlier publications (such as those from 2016–2018) have higher citation averages, likely because they have had more time to be cited and possibly due to the foundational nature of their research. While more recent years, such as 2022 and 2023, have lower citation averages, this is expected due to the short time window for accumulation of citations. However, the growing volume of published articles and steady citation performance signal a maturing research area with robust academic engagement. Overall, the data suggests that digital transformation is an increasingly important and actively discussed topic in the academic community, particularly concerning its strategic role in enhancing MSME competitiveness.

3.3 Digital Transformation in Increasing the Competitiveness of MSMEs based on most relevant sources

The table below displays the most relevant academic sources in the field of digital transformation and its role in enhancing the competitiveness of Micro, Small, and Medium Enterprises (MSMEs). It ranks the journals based on the number of articles published on this topic. At the top of the list is Sustainability (Switzerland) with 581 articles, indicating a strong academic focus on sustainability-related themes in the context of digital transformation and MSME development. This reflects the increasing importance of sustainable practices in business innovation and competitiveness.

Following that, Heliyon and the Journal of Open Innovation: Technology, Market, and Complexity are notable sources, each contributing significantly to the body of knowledge, particularly in areas related to innovation and market-oriented transformation. Journals like Technological Forecasting and Social Change, Cogent Business and Management, and Uncertain Supply Chain Management suggest that much of the current research also investigates the future implications of technology adoption and the challenges faced by supply chains, which are critical for MSMEs operating in dynamic markets.

Other sources such as the Journal of Business Research, Journal of Infrastructure, Policy and Development, and PLOS ONE offer interdisciplinary insights, encompassing policy, infrastructure, and data-driven studies that support digital advancement in small enterprises. The presence of diverse journals in the top rankings highlights that the study of digital transformation in MSMEs is not only multidisciplinary but also globally relevant, with wide-ranging implications for policy makers, business leaders, and academic researchers.

Overall, the table reinforces the idea that digital transformation is a growing and highly researched area, with a strong link to sustainability, innovation, supply chain resilience, and economic development—core elements that define the competitiveness of MSMEs in the modern era.

Table 3 Research developments based on most relevant sources

Sources	Articles
SUSTAINABILITY (SWITZERLAND)	581
HELİYON	93
JOURNAL OF OPEN INNOVATION: TECHNOLOGY, MARKET, AND COMPLEXITY	87
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	77
COGENT BUSINESS AND MANAGEMENT	76
SUSTAINABILITY (SWITZERLAND)	76
UNCERTAIN SUPPLY CHAIN MANAGEMENT	70
JOURNAL OF BUSINESS RESEARCH	66
JOURNAL OF INFRASTRUCTURE, POLICY AND DEVELOPMENT	56
PLOS ONE	55

3.4 Digital Transformation in Increasing the Competitiveness of MSMEs based on the most relevant keywords

The two visualizations bar chart and word cloud highlight the most relevant keywords frequently used in research related to digital transformation and the competitiveness of

MSMEs. Based on the bar chart, the most dominant keywords are *innovation* (395 occurrences), *sustainability* (332), and *sustainable development* (282), indicating that these topics are central to the academic discussion. Other significant terms include *China*, *small and medium-sized enterprise*, *manufacturing*, and *technology adoption*, which reflect both geographic focus and thematic relevance to the growth and modernization of MSMEs.

Similarly, the word cloud reinforces these insights by visually emphasizing frequently recurring terms such as *sustainability*, *innovation*, *sustainable development*, *technology adoption*, and *supply chain management*. Additional keywords like *covid-19*, *digitization*, *competition*, and *industry 4.0* suggest a growing interest in how external factors and emerging technologies influence MSME resilience and competitiveness.

Overall, these visualizations reveal that the intersection of innovation, sustainability, and technological advancement plays a crucial role in current research on MSMEs, highlighting the strategic importance of digital transformation in today's dynamic business environment.

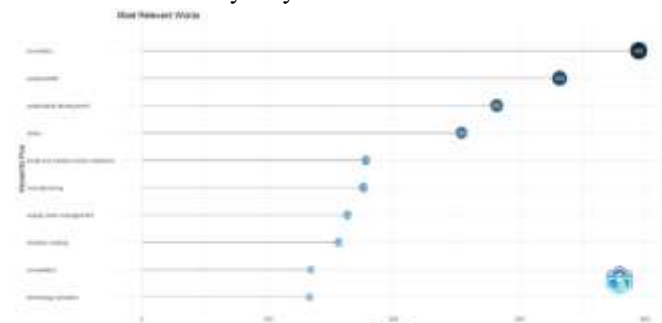


Figure 4 Research developments based on the most relevant keywords



Figure 5 World Cloud

3.5 Digital Transformation in Increasing the Competitiveness of MSMEs based on countries' collaboration world map

The image below illustrates a Countries' Collaboration World Map, which visualizes international research collaborations in the field of digital transformation and MSME competitiveness. Each line represents a co-authorship or co-publication connection between researchers from different countries. The denser and darker the lines, the more frequent and intense the collaboration. Countries shaded in darker blue, such as China, appear to be central hubs of collaboration, indicating their strong participation and

contribution in global research activities. Lighter blue countries also participate, though to a lesser extent.

The map highlights that digital transformation is a globally relevant topic and that researchers from various regions—especially Asia, Europe, North America, and Oceania—are actively engaged in collaborative work. Such global cooperation plays a crucial role in advancing knowledge, exchanging best practices, and driving innovation that can benefit MSMEs worldwide.

Tables must be numbered using uppercase Roman numerals. Table captions must be centred and in 8 pt Regular font with Small Caps. Every word in a table caption must be capitalized except for short minor words as listed in Section III-B. Captions with table numbers must be placed before their associated tables, as shown in Table



Figure 6 Research developments based on countries collaboration world map

3.5 Digital Transformation in Increasing the Competitiveness of MSMEs based on trends topic

The image below illustrates the evolution of trend topics in academic research related to digital transformation and its impact on competitiveness. Each horizontal line represents a specific term or keyword that has appeared in scholarly literature over time, while the circles indicate the frequency of each term's occurrence, with larger circles representing higher usage. Based on this visualization, it is evident that recent years, particularly from 2022 to 2024, have seen a significant increase in research focused on terms such as “digitization,” “dynamics capability,” and “technological innovation.” These terms represent emerging areas of interest in the context of digital transformation. Meanwhile, widely studied topics such as “innovation,” “sustainability,” and “sustainable development” appear prominently with larger circles, highlighting their continued importance in addressing the challenges and opportunities MSMEs face in adapting to digital change.

Additionally, the visualization shows the use of methodological terms like “questionnaire survey,” “conceptual framework,” and “surveys,” indicating that many studies employ empirical and theoretical approaches to understand the transformation process. Contextual terms such as “marketing,” “manufacture,” and “certification” suggest that digital transformation research is also being applied in specific functional and industrial domains. Interestingly, terms like “open innovation” and “barriers” appear earlier in

the timeline but with relatively smaller frequencies, implying that while these topics were introduced earlier, their prominence has been surpassed by newer, more urgent issues. Overall, the visualization underscores the dynamic and evolving nature of research on digital transformation, and highlights how innovation, technology adoption, and sustainability have become key components in efforts to enhance the competitiveness of Micro, Small, and Medium Enterprises (MSMEs).

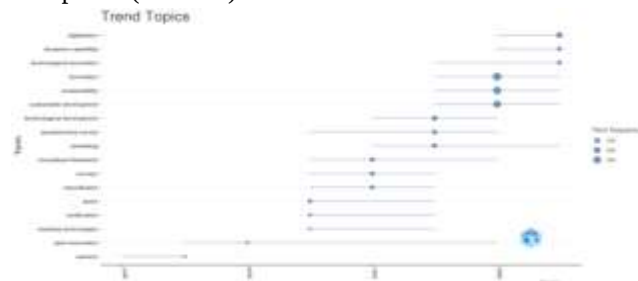


Figure 7 Research developments based on trends to trends topic

3.6 Digital Transformation in Increasing the Competitiveness of MSMEs based on the Co-occurrence Network

The image below presents a co-occurrence network map that visualizes the relationships among key research terms related to digital transformation and MSME competitiveness. Each node represents a keyword extracted from academic literature, and the size of each node reflects the frequency of its appearance. The connecting lines (edges) indicate the co-occurrence strength between terms—how often they appear together in the same context or study. The colors of the nodes represent different clusters or thematic areas.

In the center of the network, the most prominent and frequently mentioned terms are “innovation,” “sustainability,” and “small and medium-sized enterprise” (MSME), indicating these are core topics in current research on digital transformation. The blue cluster mainly revolves around MSMEs and their connection to topics like technology adoption, strategic approaches, and supply chain management, highlighting the strategic and operational dimensions of competitiveness.

The red cluster, on the left side, includes terms such as “sustainable development,” “digitalization,” “artificial intelligence,” “industry 4.0,” and “decision making.” This cluster suggests a strong emphasis on how emerging technologies and sustainable practices drive innovation and digital transformation within MSMEs. The purple cluster on the bottom right includes more conceptual and human-centric terms like “commerce,” “human,” and “article,” pointing to research involving social or behavioral aspects of transformation.

Meanwhile, the green cluster to the right connects terms like “China,” “government,” and “economic development,” possibly reflecting geographical case studies or policy-driven discussions on how nations, particularly China, support MSME transformation. The term “digital transformation,”

although slightly smaller in node size, is central and linked with various clusters, indicating its integrative role across disciplines and sectors.

Overall, the visualization reflects the interdisciplinary nature of digital transformation research and its multifaceted impact on MSME competitiveness. The convergence of technology, sustainability, innovation, and policy suggests that boosting MSME performance in the digital era requires coordinated strategies involving both internal capabilities and external support systems.



Figure 8 Research developments based on co-occurrence networks

3.7 Thematic Map

The study themes pertaining to digital transformation and MSME competitiveness are categorized in the thematic map below according to two dimensions: density (development degree) and centrality (relevance degree). Each of the four quadrants that make up the map represents a distinct topic type. Important and well-developed subjects including innovation, sustainability, and small and medium-sized business are located in the upper right quadrant (Motor Themes). These themes are essential to the literature and act as catalysts for the discipline because they are both highly relevant and structurally developed. This demonstrates how important digital transformation is for encouraging sustainability and creativity in MSMEs.

Terms like supply chains, industry 4.0, and rivalry are included in the upper left quadrant (Niche Themes). Despite being well-developed, these topics have a lower centrality, indicating that they are specialized fields of study that are less linked to the larger research network despite their importance. These themes may reflect more specialized or industry-specific conversations in the context of MSMEs.

In the lower right quadrant (Basic Themes), keywords such as *sustainable development*, *decision making*, and *commerce* appear. These are relevant yet underdeveloped topics. They form foundational concepts in the field and may offer opportunities for deeper exploration and integration with more advanced themes, especially in the context of policy support and strategic planning for MSMEs.

Finally, the lower left quadrant (Emerging or Declining Themes) includes *China*, *conceptual framework*, and *economic development*. These themes have low relevance and low development, possibly indicating areas that are either emerging and not yet fully integrated into the core research, or declining in scholarly attention.

In summary, the thematic map indicates that research around MSMEs is largely driven by innovation and sustainability, while areas like digital competitiveness, decision-making, and supply chain management present opportunities for deeper exploration to strengthen MSMEs in the digital era.

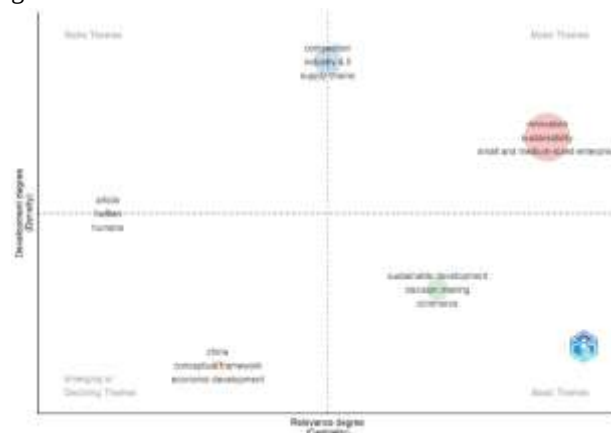


Figure 9 Thematic Map

4. CONCLUSION

RQ1: What are the key themes and trends in academic research related to digital transformation and its impact on the competitiveness of Micro, Small, and Medium Enterprises (MSMEs) from 2014 to 2023? The key themes and trends in academic research related to digital transformation and the competitiveness of Micro, Small, and Medium Enterprises (MSMEs) from 2014 to 2023 reveal a significant shift in scholarly attention towards innovation, sustainability, and technological adoption. These topics are frequently positioned as central elements (motor themes) in bibliometric thematic mapping, indicating both their high relevance and maturity within the research landscape. The trend analysis demonstrates a rapid increase in publication volume, particularly after 2020, driven in part by the global impact of the COVID-19 pandemic, which accelerated the need for digital adaptation among MSMEs. Keywords such as “innovation,” “sustainable development,” “digitalization,” and “industry 4.0” appear prominently, highlighting the academic focus on enabling competitiveness through modern technology. Furthermore, the use of conceptual frameworks and empirical methods, such as surveys, illustrates a growing sophistication in research design. Overall, the academic literature increasingly acknowledges digital transformation as a strategic necessity for MSMEs to enhance efficiency, adaptability, and market positioning in an evolving digital economy.

RQ2: How do bibliometric indicators (such as publication volume, citation patterns, keyword relevance, and thematic clusters) reflect the strategic role of digital transformation in enhancing MSME competitiveness globally? Bibliometric indicators strongly reflect the strategic role of digital transformation in enhancing MSME competitiveness on a global scale. The analysis of 4,374 articles indexed in the Scopus database over a ten-year period (2014–2023) shows a

consistent increase in the number of publications, signaling a rising academic interest in this field. Citation patterns further reinforce the importance of foundational research, with earlier publications receiving higher average citations due to their long-term influence. Keyword analysis reveals that terms like “innovation,” “sustainability,” and “technology adoption” are among the most frequently occurring, suggesting that these concepts are considered vital components of MSMEs' competitive strategies. Thematic mapping and co-occurrence network visualizations show clusters around digital transformation, strategic management, and supply chain optimization, confirming the interdisciplinary and practical nature of this research. Additionally, the international collaboration map highlights strong global participation, particularly from China, Europe, and the United States, reflecting the universal relevance of digital transformation for economic development. Collectively, these bibliometric findings underscore how digital transformation has become a key enabler of MSME growth, resilience, and competitive advantage across diverse contexts and industries.

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