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TECHNOLOGY-BASED SMES DEVELOPMENT: BIG OPPORTUNITIES OR NEW RISKS?

Mutia Nurul Makhfirah[1)], Nur Puji Lestari[2)]
[1, 2)] Master of Tourism Studies, Gadjah Mada University, Indonesia
Corresponding author: mutiamakhfirah@gmail.com

Abstract

This study analyzes the opportunities and risks in the development of technology-based SMEs through bibliometric analysis, focusing on trends, challenges, and their impact on the growth and competitiveness of SMEs. Using VOSviewer software, data from 934 papers published between 2014 and 2024 were analyzed to map relationships between relevant research themes, including SME technology transformation, digital adoption, and e-commerce. The mapping results indicate that most studies highlight opportunities, such as the adoption of Fintech, IoT, Enterprise Resource Planning (ERP), and e-commerce solutions, which significantly enhance operational efficiency and business value creation. However, challenges such as technological implementation and limited resources in SMEs have also been identified. Emerging research topics include the role of smart technologies, machine learning applications for business optimization, and the impact of technological entrepreneurship on sustainable development. The findings suggest that the development of technology-based SMEs offers more opportunities than risks. This research contributes to identifying potential future research directions and offers insights into the factors influencing technological innovation adoption in small businesses. The results are expected to guide researchers and stakeholders in designing effective strategies to support the sustainable digital transformation of SMEs.

Keywords: *Technology, SMEs, Opportunities, Risks*

Introduction

The development of technology-based small and medium enterprises (SMEs) has become a significant focus of discussions on economic growth and sustainability. In an increasingly connected global context, SMEs face significant challenges and opportunities, especially in achieving the Sustainable Development Goals (SDGs). This study aims to analyze the potential and challenges faced by SMEs in the context of technology-based development using a bibliometric analysis approach. Utilizing data from papers published between 2014 and 2024, this study seeks to map the trends, challenges, and impacts of digital transformation on SME growth and competitiveness. SMEs play a critical role in the global economy, contributing to job creation and innovation. According to a report by the Organisation for Economic Co-operation and Development (OECD), SMEs account for more than 60% of total employment in many member countries (El-Haddadeh, 2019). However, despite this contribution, many SMEs still struggle to adapt to rapid technological change. Research by Zahoor et al. shows that collaboration and internationalization can provide SMEs with access to the technological knowledge needed for international growth (Klein & Todesco, 2021). This suggests that SMEs that are able to utilize technology well can expand their market reach and increase their competitiveness.

One of the most significant opportunities for SMEs is the adoption of digital technologies, which include the use of e-commerce platforms, enterprise resource management (ERP) systems, and digital financial solutions (Fintech). Research shows that the adoption of these technologies can improve operational efficiency and create significant business value (Rupeika-Apoga et al., 2022). For example, the use of e-commerce allows SMEs to reach a wider customer base without geographical limitations, while ERP systems help in more efficient resource management. However, despite the many advantages, challenges such as resource constraints and lack of technical knowledge often prevent SMEs from adopting these technologies effectively (Cheng et al., 2023).

The risks faced by SMEs in technology-based development cannot be ignored either. Many SMEs need more resources to invest in new technologies, and they are often trapped in a cycle of uncertainty caused by rapid technological change (Cheng et al., 2022). In addition, the dynamic business environment and intense competition can add pressure on SMEs to innovate and adapt continuously. Research by Taghizadeh et al. shows that technological capabilities and open innovation can play an essential role in improving the

operational performance of SMEs. However, many SMEs still struggle to implement these strategies effectively (Wang, 2023).

In this context, it is crucial to understand how SMEs can manage risks and take advantage of opportunities. Previous research has shown that a better understanding of risk management and innovation capabilities can help SMEs adapt to change and improve their competitiveness (Martins, 2022). For example, research by Pellegrino and Abé shows that the use of social media can be an effective tool for creating knowledge and innovation in SMEs, which in turn can improve business performance (Gregurec et al., 2021). Thus, SMEs that are able to integrate technology and innovation into their business strategies will be better prepared to face future challenges. As part of this analysis, this study will also explore the role of collaboration in the development of technology-based SMEs. Collaboration with strategic partners, both inside and outside the industry, can provide access to the resources and knowledge needed for innovation (Mushtaq, 2024). In this context, research by Odriozola-Fernández et al. highlighted the importance of open innovation as an approach that can help SMEs improve their performance through collaboration with third parties (Dethine et al., 2020). By leveraging networks and partnerships, SMEs can reduce the risks associated with technology investments and increase their chances of success.

In order to achieve sustainable development goals (SDGs), SMEs also need to consider the social and environmental impacts of the technologies they adopt. Research by Bartolacci et al. showed that there is a positive relationship between sustainability and SME financial performance, indicating that responsible business practices can provide long-term benefits (Bican & Brem, 2020). Therefore, SMES needs to focus not only on financial benefits but also on the social and environmental impacts of its operations.

Thus, this study aims to provide deeper insights into the opportunities and risks faced by SMEs in technology-based development. Through bibliometric analysis, it is expected to identify relevant research trends and factors that influence the adoption of technological innovation in SMEs. The findings of this study are expected to guide researchers, practitioners, and stakeholders in designing effective strategies to support the sustainable digital transformation of SMEs.

Methods

This study uses bibliometric analysis to explore opportunities and risks in the development of technology-based Small and Medium Enterprises (SMEs). Data are taken from academic databases such as Scopus, focusing on relevant publications between 2014 and 2024. The article selection process involves the use of keywords such as SME technology transformation, digital adoption, and e-commerce. This resulted in 934 articles that met the criteria. The analysis was carried out using VOSviewer software to map the relationship between authors, institutions, and keywords. In addition, citation analysis was carried out to evaluate the impact of the study. This study also includes content analysis to identify key themes, including opportunities from technologies such as Fintech and IoT, as well as challenges faced by SMEs, such as resource constraints. A triangulation approach is used to ensure the validity of the data, combining bibliometric analysis with content analysis. The results of the study are expected to provide insights for researchers, practitioners, and policymakers in supporting the sustainable digital transformation of SMEs.

Discussions

This study has three general findings: network visualization (keyword network visualization), overlay visualization (latest research keyword trends), and density visualization (research keyword trends based on number) in the research topic of opportunities and risks in the development of Small and Medium Enterprises (SMEs).

The mapping of the author's development in research on opportunities and risks in the development of Small and Medium Enterprises (SMEs) was analyzed using VOSviewer.

Table 1 Analysis Based on Country Keywords

No	Country	Occurrences	Relevance
1	China	50	0,81
2	Malaysia	28	0,72
3	Indonesia	18	1,39
4	India	17	0,77
5	Europe	16	1,62
6	Germany	16	0,76

7	Italy	13	0,41
8	Vietnam	12	2,06
9	Poland	10	0,95
10	South Africa	10	0,87
11	Thailand	10	0,85

Based on the analysis conducted by the author, it was found that in the literature from 2014 to 2024, the four countries that conducted the most research on gender diversity were China with 50 findings, Malaysia in second place with 28 findings, and Indonesia in third place with 18 findings. India occupies the fourth position with 17 findings. Other countries such as Europe, Germany, Italy, Vietnam, Poland, South Africa, and Thailand also contributed to the research, although with a smaller number of findings, namely under 20 findings.

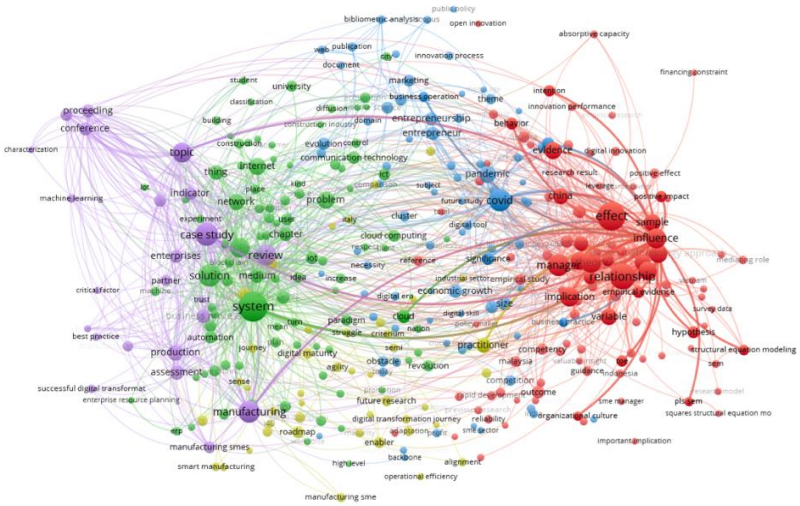

Figure 1 Networking Visualization

The first figure shows a visualization of the keyword network used in technology-based SME research. In this visualization, keywords are connected based on their frequency of occurrence in the analyzed literature. The most frequently occurring keywords, such as digital transformation, innovation, and SME productivity, reflect the main topics that are the main focus of research on technology-based SMEs. The relationships between keywords are also clearly visible, such as the relationship between cloud computing and productivity, which shows how certain technologies play a role in improving the operational efficiency of SMEs. This visualization provides a clear picture of how research focuses on the application of digital technologies to improve SME performance and competitiveness.

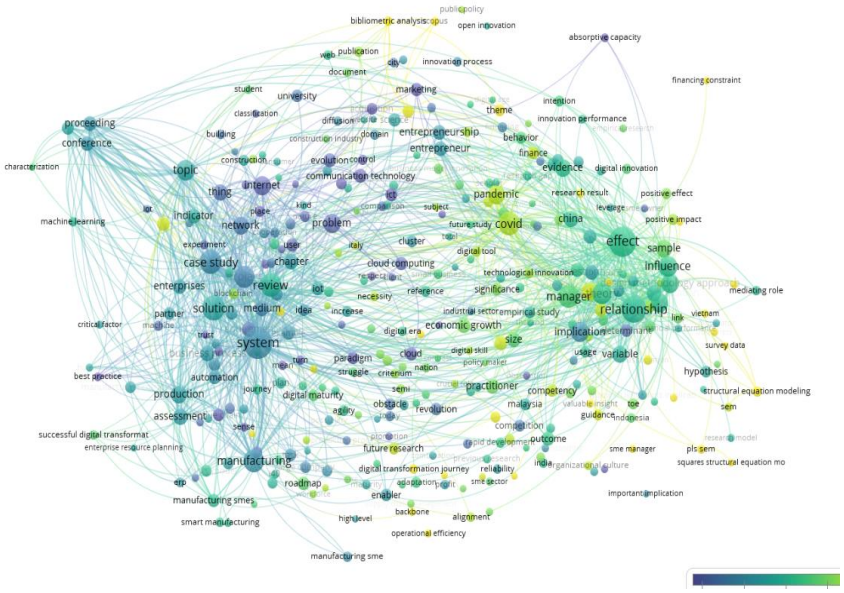

Figure 2 Overlay Visualization

The second figure shows an overlay visualization that illustrates the development of keywords appearing in technology-based SME research over time. The colours used in this visualization indicate specific periods, with lighter keywords indicating recent trends. This allows us to identify shifts in research focus, such as the increased attention to emerging technologies such as machine learning or IoT, which have become increasingly dominant in research in recent years. The visualization also shows that specific topics, such as digitalization and technology adoption, are increasingly being discussed, illustrating emerging trends in the SME sector.

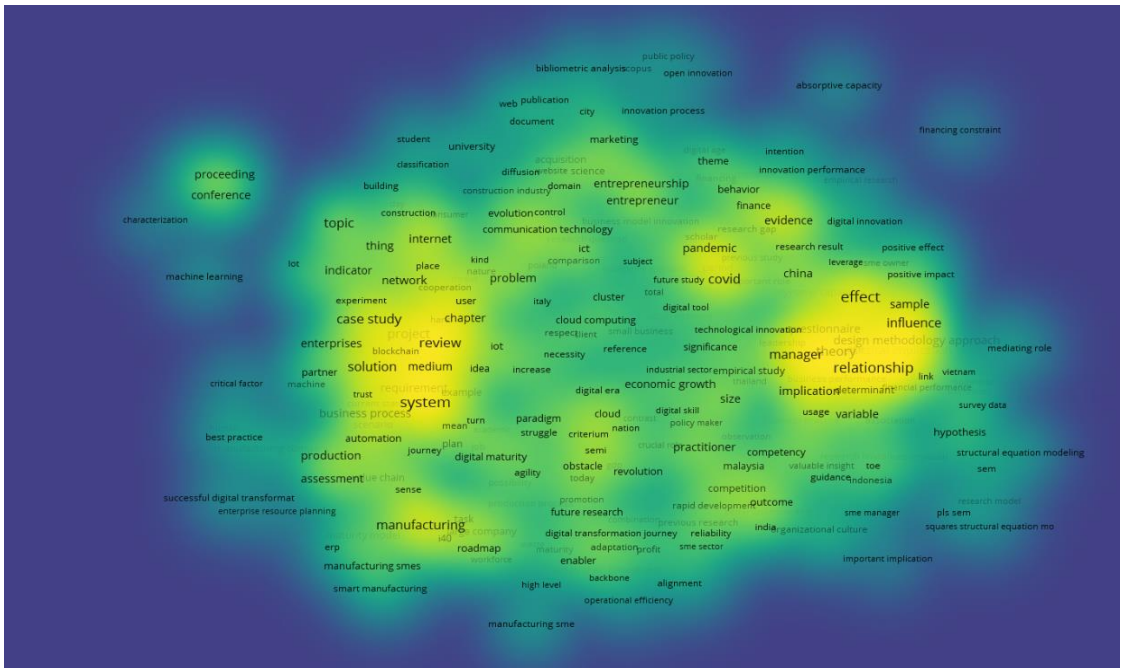

Figure 3 Density Visualization

The third figure displays a density visualization that shows the intensity or frequency of keyword occurrence in the literature on technology-based SME research. Larger or bolder keywords indicate that the topic is more dominant in existing research. From this visualization, it can be seen that innovation, digitalization, and productivity are the most dominant keywords, indicating that these topics have received

greater attention from researchers. Conversely, keywords with low density, such as barriers to adoption or technology integration, indicate that although important, these topics have yet to receive enough attention and can be areas for further research. Research related to technology-based SMEs shows several main focuses reflected in four clusters. Each cluster represents a dominant research theme that is relevant to the challenges and opportunities faced by SMEs in the technology era. The following is a description of each cluster:

Technology-based research on SMEs shows four main clusters that reveal the focus and development trends in this field. The Red Cluster highlights the relationship between digital technology, SME performance, and its contribution to economic growth. Keywords such as relationship, effect, and influence dominate this cluster, indicating that studies in this field focus on the influence of technology on the competitiveness and sustainability of SMEs. Furthermore, the Green Cluster focuses on the resilience of SMEs in facing crises, such as the COVID-19 pandemic, and their ability to adapt to new technologies. Keywords such as resilience, practitioner, and understanding indicate that technology plays an important role in helping SMEs survive and thrive amidst dynamic changes.

On the other hand, the Purple Cluster highlights the application of technology in the production process and the development of solution systems to improve efficiency. Keywords such as manufacturing, solution system, and business process indicate a focus on the use of technologies such as automation and data-based management systems to improve SME productivity. Finally, the Blue Cluster focuses on technological innovation and digitalization, including the application of technologies such as cloud computing and IoT. This cluster emphasizes the importance of innovation and digital transformation in improving the competitiveness of SMEs in the modern era.

Based on the analysis that can be taken from Figure 1, which illustrates the keyword network and trends related to technology-based SME research, the following are the potentials and challenges presented.

Table 2 Development Potential

Development Potential	Description
Digital Innovation	Technologies such as cloud computing, IoT, and machine learning provide huge opportunities for SMEs to improve operational efficiency and competitiveness.
Market Expansion	Digital technology allows SMEs to reach a wider market through e-commerce and digital marketing platforms
Increased Productivity	Automation of business processes and the use of smart manufacturing technologies can increase the productivity of SMEs.

The development of technology-based SMEs has great potential and can have a significant impact on their competitiveness and sustainability. Digital innovations, such as the implementation of cloud computing, the Internet of Things (IoT), and machine learning, provide excellent opportunities for SMEs to improve operational efficiency and expand their ability to compete in the global market. In addition, digital technology enables broader market expansion through e-commerce platforms and digital marketing, providing better access to consumers in various locations. The implementation of smart manufacturing technology and business process automation also contribute to increased productivity, which ultimately helps SMEs to operate more effectively and efficiently.

Table 3 Obstacle

Obstacle	Description
Financial Constraints	Many SMEs face obstacles in accessing funding for new technology investments.
Lack of Digital Literacy	Low understanding of digital technology is a major obstacle to technology adoption.
Resistance to Change	Some SMEs are reluctant to adopt new technologies because they fear the risks and major changes in their operations.

However, several challenges need to be overcome to realize this potential. One of the main obstacles is financial constraints, where many SMEs need help accessing sufficient funding to invest in new

technologies. In addition, low digital literacy among SMEs is a major obstacle in adopting and optimally utilizing digital technology. Another challenge is resistance to change, where some SMEs are still reluctant to adopt new technologies because they are afraid of the risks that may arise and major changes in their operations. Therefore, a comprehensive strategy is needed, including providing digital education, funding support, and inclusive transformation programs to help SMEs overcome these challenges and maximize the potential of technology.

Conclusion

Based on the results of the analysis and discussion, it can be concluded that the most significant potential for developing technology-based SMEs is digital innovation through the application of technologies such as cloud computing, IoT, and machine learning, which provide excellent opportunities for SMEs to improve operational efficiency and competitiveness. The country that has conducted the most research on the development of technology-based SMEs is China, with 50 findings, followed by Malaysia, with 28 findings, and Indonesia, with 18 findings.

The most dominant keywords based on the analysis's results include innovation, digitalization, technology, productivity, market expansion, and automation, which indicate a primary focus on utilizing technology to improve SMEs' competitiveness. However, the main challenges that still need to be overcome are financial limitations, low digital literacy, and resistance to change, which hinder SME actors' adoption of technology.

The bibliometric analysis found 934 publications related to technology-based SMEs, reflecting significant attention to this topic in the scientific literature. Several topics that have yet to be widely studied provide opportunities for further research, such as the use of technology in international market expansion, digital literacy among SMEs, and strategies to overcome resistance to change. This shows that the development of research on technology in SMEs is still quite broad and open to further exploration.

Conclusion

This research was realized with the support and assistance of various parties. We would like to express our gratitude to the organizers of the International Student Conference on Economics and Business Excellence (ISCEBE) 2024 for providing the opportunity to present this research. Our thanks also go to everyone who has contributed to the research process, both directly and indirectly. We hope that the results of this research can provide benefits and positive contributions to the development of technology-based Small and Medium Enterprises (SMEs) and the achievement of the Sustainable Development Goals (SDGs).

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