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RESEARCH ARTICLE

Exploring high growth emerging market SMEs' engagement with digitalization: Analysis of the literature from Malaysia and Poland

[version 1; peer review: 2 approved with reservations]

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Abstract

Background

This analysis compares SME digitalization research in Malaysia and Poland, providing a comprehensive comparative overview of research trends and contributions in both countries. The study emphasizes how digital technologies drive innovation and improve organizational performance, urging SMEs to seize strategic opportunities for sustainable growth through digitalization.

Methods

A bibliometric analysis was employed by leveraging the open-source Lens.org database yielding 162 entries for Malaysia and 42 for Poland, employing specific terminologies associated with digitalization and SMEs. The analysis was enhanced through the utilization of VOSviewer, a software tool available at VOSviewer.com, alongside Lens.org. Both tools facilitated an in-depth exploration of the selected studies.

Result

Results indicate a marked difference in publication volumes between Malaysia and Poland, suggesting underlying factors contributing to these disparities. Malaysia's leading position in publishing can be

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attributed to its expansive and diverse research community, potentially indicating increased research funding facilitating a greater volume of studies. Additionally, Malaysia's extensive research interests highlight a robust academic and scientific environment across various fields of study.

Conclusions

These findings furnish valuable insights for policymakers, researchers, and industry practitioners in designing strategies and initiatives to fortify SMEs in their digitalization campaigns, with a keen awareness of the regional variations. Understanding these investigation patterns is of crucial importance for fostering sustained growth and innovation in SMEs and facilitating cross-border knowledge exchange and collaboration.

Plain Language Summary

In today’s digital age, small and medium-sized enterprises (SMEs) are essential for economic growth. This study looks at how SMEs in Malaysia and Poland are adapting to digital technologies, which can help them innovate and perform better. We analyzed research trends in both countries, highlighting their unique challenges and opportunities related to digitalization.

Using a detailed analysis of academic publications, we found that Malaysia has significantly more research on this topic than Poland. This difference may be due to Malaysia having a larger and more diverse research community, along with better funding for studies. Our research shows that understanding these trends can help policymakers and business leaders create effective strategies to support SMEs in going digital. By recognizing the distinct needs of each country, we can foster innovation and collaboration, helping SMEs thrive in the digital landscape. This information is valuable not just for researchers, but for anyone interested in strengthening small businesses and driving economic growth.

Keywords

digitalization, SMEs, Malaysia, Poland, bibliometric analysis, VOSviewer



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Introduction

The digitalization of small and medium sized enterprises (SMEs) has been recognized as a crucial tool towards their economic growth and competitiveness in the global market (Thrassou *et al.*, 2020). SMEs are recognized as the backbone of economies, contributing significantly to employment, innovation, and overall economic stability. The acceptance and integration of digital technologies, known as digitalization, have the potential to transform SMEs operations and enable them to effectively compete globally (Priyono *et al.*, 2020). For emerging market countries, and especially those categorized as rapidly growing such as Malaysia and Poland, digitalization represents a powerful tool for SMEs; however, the argument for SME digitalization has faced significant challenges such as slow urbanization, limited internet accessibility (Kuczewska *et al.*, 2023).

Despite the significant opportunity evidenced for SMES, the link evidenced between academic research and research impact through varied platforms (Jordan, 2023; Penfield *et al.*, 2014), and the need for research on digitalization being highlighted in both countries (Klein & Todesco, 2021), there is a clear discrepancy in the research outputs of both countries (Kuczewska *et al.*, 2023; Mieszajkina & Mysliwiecka, 2022).

By conducting a bibliometric analysis, researchers aim to establish a solid foundation for policymakers, industry practitioners, and researchers interested in SMEs digitalization in Malaysia and Poland (Khalil *et al.*, 2022). The analysis also aims to raise awareness of the challenges and opportunities in the dynamic landscapes of SMEs digital transformation in these countries, stimulating future initiatives.

The structure of the paper is as follows. First, the literature is reviewed. Then, we present the research method and materials used in the paper. In the next section the results are drawn both for Malaysia and Poland. At the end of the paper, we deliver the discussion and conclusions of our research.

Research and theoretical background

Research on digitalization of SMEs

Digitalization is recognized as one of the most critical trends impacting both society and business. It involves the adaptation or expansion of digital technology across organizations, industries and countries. In addition, digitalization has become the hallmark of the modern era, influencing economy, environment and culture (Shpak *et al.*, 2019). Digitalization represents shifts related to the use of digital technology in all aspects of human society (Parviainen *et al.*, 2017). Digitalization also entails transforming existing products or services into digital formats, thereby offering benefits over tangible products (Henr Henriette *et al.*, 2015).

The digitalization of SMEs has gained noteworthy attention in recent years due to its potential for economic growth and competitiveness (Thrassou *et al.*, 2020). SMEs play a crucial role in driving employment, innovation, and overall economic stability (Stouraitis, 2017; Thrassou *et al.*, 2020). The COVID-19 pandemic has further emphasized the significance of digital transformation for SMEs resilience and survival. SMEs that were able to adapt and leverage digital technologies were better prepared to circumnavigate the challenges posed by the crisis (Rahim *et al.*, 2022). Understanding the role of digital transformation in enhancing SME resilience in Malaysia and Poland can provide valuable insights for future crisis preparedness (Bollweg *et al.*, 2020; Kuczewska *et al.*, 2023). Moreover, aligning SMEs with megatrends and global market demands is crucial for their long-term sustainability and growth. Malaysian SMEs, for example, need to align their policies and strategies with megatrends to provide value-added services, innovative products, and high-quality offerings (Tsanis & Stouraitis, 2022).

Research context

Malaysia and Poland are both emerging economies with a growing SME sector. STATS Understanding the digitalization efforts in these countries can provide insights into the challenges and opportunities faced by SMEs in similar contexts (Kumar *et al.*, 2020).

Malaysia and SMEs

The definition for SMEs approved by the National SME Development Council (NSDC) has been adopted across ministries, financial institutions and regulatory agencies engaged in SME development efforts since 2013. According to the 11th Malaysia Plan 2016, SMEs in Malaysia have historically comprised 98.5% of all establishments, primarily within the Services Industry (89.2%), Manufacturing Industry (5.3%) and Construction Industry (4.3%). In addition, Malaysia's National E-Commerce Strategic Roadmap seeks to enhance SMEs contribution to the GDP, with a target of reaching RM211 billion by 2020. The roadmap focuses on accelerating e-commerce adoption among sellers promoting national brands to boost more exports.

In Malaysia, the government has recognized the importance of digitalization for SMEs and has implemented initiatives such as the Digital Free Trade Zone (DFTZ) to facilitate SMEs' global expansion (Chin *et al.*, 2023). Malaysia is classified as an "emerging" economy by most analysts — from the IMF to the Dow Jones index ranking 21st in Nominal GDP with an expected incremental GDP on the rise (Amoah *et al.*, 2022). The perceived importance of SMEs to the growth of Malaysia's economy is evidenced by the sheer amount of supporting mechanisms and policies that exist for entrepreneurs, including funding, physical infrastructure, and business advisory services (Ariff & Abubakar, 2003; United Nations Development Programme, 2020).

Poland and SMEs

Poland is classified both as an "emerging" economy by most analysts — from the IMF to the Dow Jones index ranking 21st in Nominal GDP with an expected incremental GDP on the rise (Amoah *et al.*, 2022) but also an "Emerged" economy by others recently (Lee *et al.*, 2023). SMEs represents the largest business segment in both Poland and the European Union. Furthermore, their number has been progressively rising in recent years. In Poland, their recent share in the entire number of enterprises is 99.8%, in line with the EU average. However, the structure of this sector in Poland shows a greater prevalence of smaller, micro-level firms compared to the EU average, with

94.9%of Polish firms falling into this category versus 93.0% across the EU. In contrast, Poland has slightly lower proportion of small (4.2% compared to 5.9%) and medium-sized firms (0.7% versus 0.9%) (PARP, 2022).

This can show that numerous SMEs do not grow and fail to convert into medium and large enterprises (Fundacja Warsaw Enterprise Institute, 2017). This is particularly true of small businesses employing 10 to 49 staff. These firms, marked by low innovations, contribute the least to GDP generation and job creation among all enterprise categories. The transition of enterprises from the small to medium scale is obstructed by multiple obstacles of an exogenous and endogenous nature (Mieszajkina, 2020).

Digital activity in Malaysia

The 2017/2018 annual report by SME Corp Malaysia (2018) acknowledges the critical role of digitalization in enhancing the business landscape. SMEs specifically fosters opportunities for skill development, expanding employment prospects, and accelerating innovation.

Digital activity in Poland

Polish SME demonstrate relatively low levels of digital engagement. While it is evident that the use of ICT is essential, their application predominantly involves basic operational and business tools that do not necessitate advanced digital. Overall local digital competences are at a low level and in need of enhancement. Similar to SMEs worldwide, there is a clear lack of funding among Polish SMEs for investments in ICT and computer equipment, employee training, recruitment of highly qualified IT specialists, and engagement with IT and consulting services. SMEs recognize that they stand to gain significant benefits through digitalization, have no major concerns and comprehend that this is an unavoidable process (Mieszajkina & Mysliwiecka, 2022).

Exploring the digitalization efforts in Malaysia and Poland can provide insights into how SMEs can align with these megatrends and enhance their competitiveness. The role of leadership, entrepreneurial orientation and organizational alignment in driving digital transformation in SMEs is another important aspect to consider (Stouraitis *et al.*, 2022). E-leadership and strategic alignment have been identified as critical factors for successful digital transformation in SMEs. Understanding the role of leadership and organizational alignment in the digitalization efforts of SMEs in Malaysia and Poland can provide guidance for effective implementation strategies.

Furthermore, studying the impact of digitalization on the sustainability and performance of SMEs in Malaysia and Poland is crucial (Broccardo *et al.*, 2023; Dana *et al.*, 2022). The COVID-19 pandemic has had a significant impact on SMEs, with many facing challenges and discontinuing their operations (Jaish *et al.*, 2023). Exploring the relationship between digitalization and sustainability can provide insights into how SMEs can adapt and thrive in the face of disruptions. Additionally, understanding the factors influencing the adoption and implementation of digital technologies in SMEs is essential. Critical success factors, such as managerial competencies, organizational culture, and technological readiness, play a crucial role in the successful implementation of digitalization initiatives. Examining these factors in the context of SMEs in Malaysia and Poland can provide insights into the barriers and enablers of digitalization. The digitalization of SMEs also has implications for market orientation (Shaltoni *et al.*, 2018), stakeholder engagement, and supply chain collaboration (Liu *et al.*, 2022). SMEs need to leverage digital technologies to enhance their market orientation, engage stakeholders effectively, and collaborate with supply chain partners. Exploring these aspects in the context of SMEs in Malaysia and Poland can provide insights into the strategies and practices that can drive digitalization and improve business performance (Yuen, 2023).

In conclusion, studying the digitalization of SMEs in Malaysia and Poland is important due to the unique challenges and opportunities faced by SMEs in these countries. Understanding the impact of digitalization on SMEs resilience, sustainability, performance, and internationalization can provide valuable insights for policymakers, researchers, and practitioners.

Furthermore, examining the factors that influence the adoption and implementation of digital technologies can inform the development of effective strategies and initiatives to support SMEs in their digital transformation efforts.

Research questions

- RQ1: How has the literature on Malaysia and Poland developed in terms of publication volume, methodologies, and leading journals, and where are the research gaps that warrant further exploration?
- RQ2: What are recurring themes within SMEs digitalization that are considered significant for Polish and Malaysian research?
- RQ3: What can we theorize from the themes in terms of the state of the Polish and Malaysian digital SME ecosystem?

Methods

To examine the distribution patterns of research publications in specific themes and time periods, this investigation employed bibliometric, quantitative, and statistical as in by Lim and Kumar (2023), Caputo *et al.* (2021) and Bužavaitė *et al.* (2019). This investigation applied bibliometric, quantitative, and statistical analyses to assess the distribution patterns of research publications across specific themes and time periods. Following methodologies adapted from Lim and Kumar (2023), Caputo *et al.* (2021), and Bužavaitė *et al.* (2019), the study involved citation analysis and keyword grouping, with careful attention to controlling bias through data validation and timeframe selection. Bibliometric techniques, including citation analysis and keyword grouping, can provide a comprehensive overview of the scholarly literature on the digitalization of SMEs in Malaysia and Poland (Lim & Kumar, 2023). These techniques can identify prevailing research themes and trends over time, as well as influential authors, institutions, and publications in the field. Clustering techniques can also be employed to identify closely related terms, offering a nuanced understanding of the multifaceted nature of SMEs digitalization in these countries. Citation analysis can assess the impact of seminal

publications and identify the most influential papers that have shaped subsequent research in the field. Bibliometric analysis has been extensively employed in various business studies, encompassing business strategy, electronic commerce, finance, human resources, management, and marketing, to evaluate the intellectual structure of a specific subject, track trends in article and journal performance, and scrutinize research attributes (Goyal & Kumar, 2020). The data utilized in this study was sourced from the open-source database Lens.org, which consolidates information from multiple primary sources and includes persistent identifiers from the original data sources to ensure transparency and facilitate integration and amalgamation with other data. This approach guarantees the dependability and accessibility of the data employed in the analysis (van Eck & Waltman, 2010).

Used databases and search engines

The selected studies were subsequently analyzed using open-access software programs such as VOSviewer (https://www.vosviewer.com/) and Lens.org (https://www.lens.org/) as in similar work on SMEs (e.g., Bužavaitė *et al.*, 2019). VOSviewer is a valuable instrument for visualizing bibliometric networks and assessing their interconnectedness (van Eck & Waltman, 2017). The adoption of bibliometric analysis and quantitative methodologies permits a methodical and objective exploration of the distribution patterns of research publications within the specified themes and time periods. By utilizing these methodologies, this investigation guarantees a comprehensive and rigorous analysis of the literature on digitalization in SMEs in Malaysia and Poland.

Data analysis

On September 14, 2023, an exhaustive search was conducted, resulting in 162 entries with the phrase "(digitalization OR digitalisation) AND (SME OR small firm) AND Malaysia" and 42 entries with the phrase "(digitalization OR digitalisation) AND (SME OR small firm) AND Poland".

Descriptive results: mapping the state of the literature

Number of publications

When making a comparison between the total number of publications (Table 1), it is evident that Malaysia greatly surpasses Poland. Specifically, Malaysia has a substantial total of 162 publications, indicating a strong output in research. On the other hand, Poland only has 42 publications. This notable difference suggests that Malaysia possesses a significantly larger volume of research publications, which may be indicative of a more extensive and diverse research community, higher levels of research funding, or broader research interests. Gaining an understanding of this contrast in the total number of publications can offer valuable insights into the research landscapes and priorities of these two countries. In terms of journal articles, both Malaysia and Poland exhibit a noteworthy commitment to academic research. Specifically, Malaysia contributes 91 articles, accounting for 56% of its total publications, while Poland offers 24 articles, representing 57% of its total publications. These figures underscore the significance of journal articles in the scholarly endeavors of both nations.

Table 1. Number of publications in Malaysia and Poland (by document and source type).

	Malaysia	Poland
Journal Article	91(56%)	24 (57%)
Book Chapter	26 (16%)	6 (14%)
Conference Proceedings	4 (2%)	1 (2%)
Others	41 (24%)	11 (27%)
Total Publications (TP)	162	42

Distribution of publications overtime

In the examination of the table illustrating the total number of publications in Malaysia and Poland from 2000 to 2023 (Table 2), a multitude of noteworthy patterns and disparities come to light. Firstly, it is evident that both countries have experienced a consistent upward trajectory in the quantity of publications, indicating the presence of active research communities in these regions. However, a notable discrepancy becomes apparent when comparing the total number of publications, as Malaysia consistently surpasses Poland.

Malaysia's research output, though relatively modest in the earlier years (with only 11 publications from 2000 to 2010), has demonstrated significant growth starting from 2011, with

Table 2. Total number of publications in Malaysia and Poland by year.

Year	Malaysia Total Publication (TP)	Poland (Total Publication)
2000 -2010	11	5
2011	3	0
2012	3	0
2013	2	5
2014	4	1
2015	2	0
2016	4	1
2017	8	4
2018	7	3
2019	21	2
2020	18	2
2021	24	5
2022	24	9
2023	30	5

particularly remarkable increases observed from 2017 onwards. By the year 2023, Malaysia has recorded a substantial 30 publications, which serves as an indication of a flourishing research environment and potentially heightened investment in research and development. On the contrary, Poland's publication trends display sporadic variations. The country exhibited relatively few publications in the earlier years, with no contributions observed in 2011 and 2012. Despite some slight increments in the subsequent years, Poland continued to experience periods with limited or no publications. However, a noticeable surge occurred in 2022, with a total of nine publications, suggesting the possibility of improvements in research output.

Distribution in main journals

Table 3 highlights the most active publishing sources in Malaysia and Poland. In Malaysia, the "Asian Journal of Accounting and Governance," "Digitalization and Development," "International Journal of Academic Research in Business and Social Sciences," and "Journal of Petroleum Technology" each have three publications. On the other hand, in Poland, "Emerald Publishing Limited eBooks," "OECD Economics Department Working Papers," and "SSRN Electronic Journal" each contribute two publications. This data showcases the sources that have been particularly productive in terms of publications in both countries.

Citation analysis

In the field of citation analysis, we find the top highly cited articles from Malaysia (Table 4) and Poland (Table 5). In Malaysia, the most influential publications include "Digital technology, digital capability and organizational performance" by Sabai Khin and Theresa Cf Ho with 224 citations, "Bridging the Digital Divide in Southeast Asia" by Frank B Tipton with 44 citations, and other notable works. On the other hand, in Poland, top citations are associated with articles like "The digitalization in EMAS-registered organizations" by Rossella Canestrino and others with 8 citations, "Do clusters matter for foreign subsidiaries in the Era of industry 4.0?" by Barbara Jankowska and colleagues, and several more. These highly cited articles showcase the significant impact

Table 3. Top active publishing.

Malaysia		Poland	
Source title	**Total Publication (TP)**	**Source title**	**Total Publication (TP)**
Asian Journal of Accounting and Governance	3	Emerald Publishing Limited eBooks	2
Digitalization and Development	3	OECD Economics Department Working Papers	2
International Journal of Academic Research in Business and Social Sciences	3	SSRN Electronic Journal	2
Journal of Petroleum Technology	3		
Social Science Research Network	3		

Table 4. Top highly cited articles (Malaysia).

No.	Authors (Year)	Title Source	Source	TC
1.	Sabai Khin, Theresa Cf Ho (2019)	Digital technology, digital capability and organizational performance	International Journal of Innovation Science,	224
2.	Frank B Tipton (2002)	Bridging the Digital Divide in Southeast Asia Pilot Agencies and Policy Implementation in Thailand, Malaysia, Vietnam, and the Philippines	ASEAN Economic Bulletin	44
3.	Sabai Khin, Daisy Mui Hung Kee	Factors influencing Industry 4.0 adoption	Journal of Manufacturing Technology Management	29
4.	Yan Yin Lee, Mohammad Falahat, Bik Kai Sia	Drivers of digital adoption: a multiple case analysis among low and high-tech industries in Malaysia	Asia-Pacific Journal of Business Administration	22
5.	Farzana Parveen Tajudeen, Noor Ismawati Jaafar, Ainin Sulaiman	External Technology Acquisition and External Technology Exploitation: The Difference of Open Innovation Effects	Journal of Open Innovation: Technology, Market, and Complexity,	20

Table 5. Top highly cited articles (Poland).

No.	Authors (Year)	Title Source	Source	TC
1.	Rossella Canestrino, Marek Ćwiklicki, Piotr Kafel, Magdalena Wojnarowska, Pierpaolo Magliocca (2020)	The digitalization in EMAS-registered organizations: evidences from Italy and Poland	The TQM Journal,,	8
2.	Barbara Jankowska, Eleonora Di Maria, Joanna Cygler (2021)	Do clusters matter for foreign subsidiaries in the Era of industry 4.0? The case of the aviation valley in Poland	European Research on Management and Business Economics,	8
3.	Rahim Sadigov Rahim Sadigov (2022)	Impact of Digitalization on Entrepreneurship Development in the Context of Business Innovation Management	Marketing and Management of Innovations	5
4.	Marcin Suder, Joanna Duda, Rafał Kusa, Alexandra Mora-Cruz (2022)	At the crossroad of digital and tourism entrepreneurship: mediating effect of digitalization in hospitality industry	European Journal of Innovation Management,	3
5.	Wojciech Dyba, Valentina De Marchi (2022)	On the road to Industry 4.0 in manufacturing clusters: the role of business support organisations	Competitiveness Review: An International Business Journal,	2

of research in the digitalization and innovation domains in both countries.

Most active authorship

When examining active authorship in Malaysia (Table 6), several researchers have emerged as notable contributors. Mohammad Falahat, Daisy Mui Hung Kee, MFI Mohd Nor, and Sabai Khin have all made significant contributions, with four and three publications, respectively. These authors have demonstrated their active involvement in research within their respective fields, indicating their expertise and dedication to advancing knowledge in the area of digitalization in SMEs. In contrast, in the context of Poland, no single researcher has published more than two papers in the area. This suggests that there is no dominant author or a single researcher who has significantly contributed to the research on digitalization in SMEs in Poland. This may indicate a more distributed research landscape in Poland, with multiple researchers making valuable contributions to the field. Understanding the active authorship patterns in Malaysia and Poland provides insights into the research community's engagement and expertise in the area of digitalization in SMEs. It highlights the presence of prolific researchers in Malaysia and the need for further exploration and collaboration among researchers in Poland to enhance the research output in this field.

Research publication: co-occurrence analysis

Method

Following from the previous section, co-occurrence analysis was then performed. It focuses on analyzing counts of co-occurring entities within a collection of unit (Zhou *et al.*, 2022). In bibliometrics, co-occurrence analysis is employed to investigate the potential relationship between two bibliographic items that are found within the same dissertation (Lim & Kumar, 2023).

Table 6. Most active authorship in Malaysia.

Author	Total Publication (TP)
Mohammad Falahat	4
Daisy Mui Hung Kee	3
MFI Mohd Nor	3
Sabai Khin	3
Yan Yin Lee	3

Malaysia Co-occurrence analysis

The bibliometric co-occurrence analysis for Malaysia identifies three major thematic clusters: *Digital Transformation and Technology, Digitalization and Business in Emerging Technologies,* and *Digital Economy and Online Business* (Figure 1). These clusters illustrate key areas of focus within Malaysia's SME digitalization landscape.

Cluster 1: Digital Transformation and Technology (red)

Cluster 1 encompasses research on the broad theme of digital transformation and technology. Scholars within this cluster explore various aspects related to the digital era, digital innovation, digital marketing, digitalization, and information, communication technology and ICT. In the realm of digital transformation, researchers investigate the applications, advancements, and societal impacts of Artificial Intelligence (AI). They explore how AI is transforming industries, shaping society, and influencing culture. The Digital Era is another area of interest, examining the pervasive influence of digital technologies on different sectors, including business, education, healthcare, and governance. Scholars delve into the implications of the digital

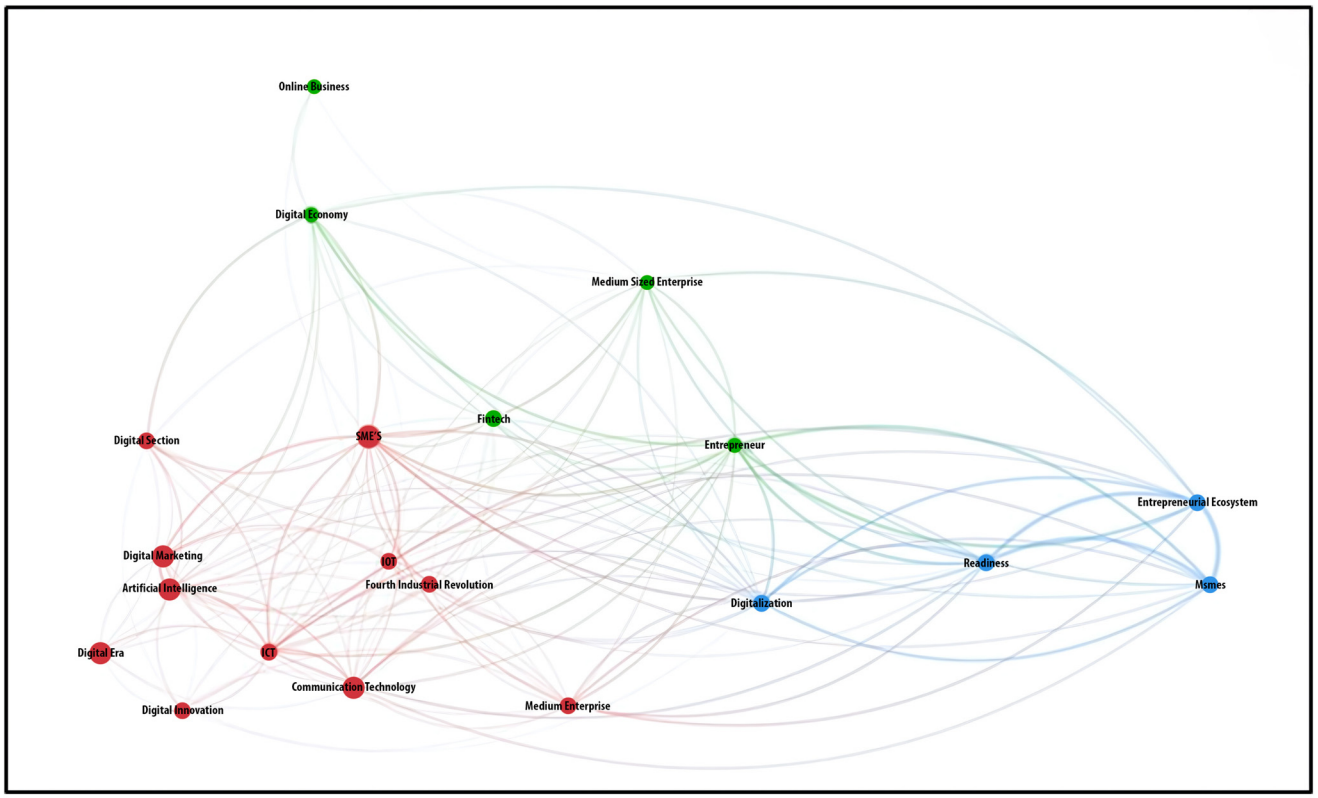

Figure 1. Co-occurrence Analysis for Malaysia.

era and how organizations and individuals adapt to this rapidly changing landscape. Digital innovation research focuses on how technology drives innovative practices across industries. Scholars explore how organizations leverage digital technologies to foster creativity, develop new products and services, and enhance operational efficiency. Digital marketing is another key area within this cluster, where researchers examine how businesses utilize digital platforms and strategies to connect with and engage customers. They explore topics such as social media marketing, online advertising, and customer relationship management in the digital context. Digitalization, as a central concept, is scrutinized to understand the process of converting analog information into digital form and its implications for various sectors. Researchers investigate the benefits, challenges, and strategies associated with digitalization efforts in organizations. Additionally, ICT research explores the role of information and communication technology in modern society. Scholars examine topics such as digital infrastructure, communication networks, and ICT services, analyzing their impact on individuals, organizations, and society as a whole.

Cluster 2: Digitalization and Business in Emerging Technologies (green)

Cluster 2 focuses on the intersection of digitalization and business, particularly in the context of emerging technologies. Scholars within this cluster investigate digital transformation across industries, with a specific emphasis on the adoption and integration of digital technologies in organizations. They explore the challenges, opportunities, and strategies associated with digitalization efforts. Fintech, or Financial Technology, is a significant area of exploration within this cluster. Researchers examine innovations in the financial sector, such as digital payment systems, blockchain technology, and online banking. They investigate the impact of fintech on traditional financial institutions, consumer behavior, and regulatory frameworks. The Fourth Industrial Revolution is another key theme within this cluster. Scholars explore the implications of emerging technologies, including AI, Internet of Things (IoT), and automation, on industries and societies. They analyze the transformative effects of these technologies on business models, workforce dynamics, and economic systems. Internet of Things (IoT) research focuses on the applications and implications of IoT devices and networks. Scholars investigate how IoT technologies are being utilized in various sectors, such as healthcare, transportation, and manufacturing. They explore the challenges and opportunities associated with the widespread adoption of IoT. Medium-sized Enterprises (MSEs) receive attention within this cluster, with researchers examining their role in the digital economy. They explore how MSEs adapt to digital technologies, compete in the digital age, and contribute to economic growth and innovation. Scholars investigate the unique challenges and opportunities faced by MSEs in the digital era.

Cluster 3: Digital Economy and Online Business (blue)

Cluster 3 revolves around the digital economy and its interactions with medium-sized enterprises and online business. Scholars within this cluster focus on the multifaceted economic

aspects of digital transformation, including e-commerce, online services, and the digital labor market. E-commerce research explores the dynamics of online marketplaces, consumer behavior in online shopping, and the strategies employed by businesses to succeed in the digital marketplace. Scholars investigate topics such as online retailing, digital payment systems, and the impact of e-commerce on traditional brick-and-mortar businesses. Online services research examines the growth and impact of digital platforms that provide various services, such as ride-sharing, food delivery, and accommodation booking. Scholars analyze the economic implications of these platforms, including their effects on traditional service industries and employment patterns. The digital labor market is another area of interest within this cluster. Researchers investigate the gig economy, remote work, and the role of digital platforms in connecting workers with job opportunities. They explore the benefits and challenges of the digital labor market, including issues related to job security, income inequality, and worker rights. Medium-sized enterprises (MSEs) receive attention within this cluster, with scholars examining their contributions to the digital economy. They investigate how MSEs navigate the digital landscape, leverage digital technologies, and adapt their business models to remain competitive. Researchers explore the strategies employed by MSEs to succeed in the online business environment.

Poland Co-occurrence analysis

The bibliometric co-occurrence analysis for Poland reveals two prominent thematic clusters: *The Intersection of the Digital Economy and Digital Technology* and *Technology Parks* (Figure 2).

Cluster 1: The Intersection of the Digital Economy and Digital Technology (red)

This cluster delves into the interdependent relationship between the digital economy and digital technology in Poland. Scholars within this cluster explore the multifaceted interactions and ramifications of these two fundamental components. The digital economy serves as a central theme within this cluster, where researchers examine the economic aspects of the digital transformation. Studies in this domain encompass an analysis of e-commerce, online services, and the digital labor market. Scholars research subjects such as online marketplaces, consumer behavior in online shopping, and the techniques employed by businesses to thrive in the digital marketplace. This underscores the economic influence of digital technologies on business models, consumer behavior, and employment trends. Digital technology, as the second component of this cluster, assumes a crucial role in comprehending the digitalization of SMEs in Poland. Researchers delve into the applications, advancements, and societal implications of digital technology, including Artificial Intelligence (AI). The study emphasizes the profound effect of AI and digital innovation in multiple sectors, encompassing business, education, healthcare, and governance. Scholars analyze the consequences of the digital era and how organizations and individuals adapt to this rapidly changing technological landscape.

Cluster 2: Technology Parks (green)

The second cluster in Poland's research landscape focuses on the concept of technology parks. This cluster represents a specific area of interest within the digitalization of SMEs.

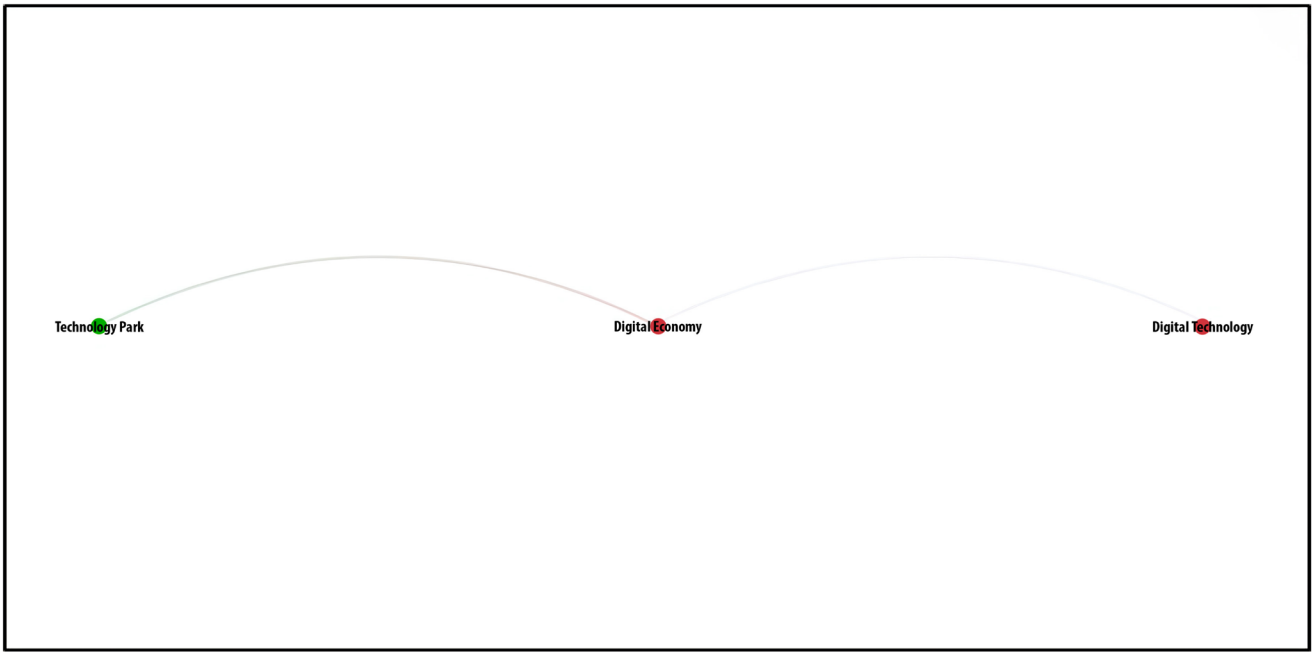

Figure 2. Co-occurrence Analysis for Poland.

Scholars within this cluster investigate the role and impact of technology parks on SMEs in Poland. Technology parks serve as critical ecosystems that provide support, resources, and infrastructure for businesses, particularly SMEs, to prosper in the digital era. Researchers explore the services offered by technology parks, including mentorship, networking opportunities, and access to funding. The emphasis lies in understanding how technology parks foster innovation and facilitate the growth of SMEs.

Thematic results of the qualitative content analysis

The findings reveal a striking disparity in the number of publications between Malaysia and Poland, implying underlying factors that contribute to these discrepancies. Malaysia's dominance in publication output can be attributed to its extensive and diverse research community, which may also indicate higher levels of research funding, enabling researchers to undertake and publish more studies. Additionally, Malaysia's broad research interests highlight a robust academic and scientific ecosystem across various fields of study. Both Malaysia and Poland demonstrate a shared commitment to academic research, particularly evident in the fact that more than half of their total publications fall into the category of journal articles. This reflects their emphasis on disseminating research findings through recognized and peer-reviewed platforms, underscoring their dedication to rigorous and scholarly research practices (Jordan, 2023).

An analysis of publication trends over time reveals consistent upward trajectories in the quantity of publications for both Malaysia and Poland. Malaysia's research output experiences significant growth starting from 2011, with particularly notable increases observed from 2017 onwards. The substantial number of publications in 2023, totaling 30, signifies a flourishing specific research landscape and potentially increased investments in research and development (Penfield *et al.*, 2014; Stremersch *et al.*, 2006). In contrast, Poland's publication trends exhibit sporadic variations, with fewer publications in earlier years and noticeable surges in 2022. This intermittent pattern suggests that Poland's research landscape could benefit from more consistent research activity. However, the significant surge in 2022 is promising, indicating a possible upward trend in research productivity that should be nurtured and sustained. The existence of highly active publishing sources in both countries highlights the preferred platforms researchers choose for sharing their findings (Stremersch *et al.*, 2006). These sources play a vital role in disseminating knowledge and facilitating scholarly discussions. Citation analysis serves as a crucial metric for assessing the impact of research. In Malaysia, the study "Digital technology, digital capability, and organizational performance" by Sabai Khin and Theresa Cf Ho, which has garnered a substantial 224 citations, exemplifies the profound influence of research in this area. It suggests that this particular study has made a substantial impact on the field and has received widespread recognition from other researchers.

The presence of prolific authors in Malaysia, such as Mohammad Falahat, Daisy Mui Hung Kee, MFI Mohd Nor, and Sabai Khin, underscores the critical role of individual researchers in advancing knowledge. Their contributions not only demonstrate their expertise but also their dedication to exploring the intricate domain of digitalization in SMEs. In contrast, the absence of a dominant author in Poland with more than two publications signifies a more dispersed research landscape. This can be viewed as both an opportunity and a challenge. On one hand, it indicates a diverse pool of contributors, fostering a rich and varied perspective. Conversely, it implies that additional collaboration and shared expertise might be necessary to build upon the current research output.

Gaps in existing research

Country focus of research and the problem of transferability

Most of the authors focus on their own country, both in Malaysia and Poland. It seems to be quite reasonable, however, it limits the transferability of the conclusions. Therefore, it is recommended to use the qualitative methods more often in order to generalization (Maxwell, 2021). These methods enable to answer the research questions such as why or under what circumstances we observe a relation between variables (Ton, 2012). That makes a gap in research about SMEs' engagement with digitalization.

Lax definitions of SMEs

Another gap is connected with different definitions of small and medium-sized enterprises in Malaysia and Poland. Poland as a member of the European Union implemented the definition created by the European Commission. There are three criteria: the number of employees, and turnover or balance sheet. They are shown in the Table 7 below:

Comparison of these thresholds suggests that some companies considered as medium-sized in Poland are not included into SMEs in Malaysia (Figure 3). These gap should be taken into consideration in the research.

Summary and conclusion

The concentration of articles in a small number of leading journals adversely affects the dissemination of a topic within the broader scientific discourse (Oler *et al.*, 2016). In analyzing the articles, those published in recent rears seem to hold greater significance. The present research contributes to the literature on SMEs digital tool with an all-encompassing overview of the research landscape and map of the knowledge base concerning the digitalization of SMEs in two distinct settings such as Malaysia and Poland. The findings underscore the growing interest in digital transformation and the diverse themes and trends within this realm.

The research has revealed the significance of digital technologies, in propelling innovation and augmenting organizational performance in SMEs. It has underscored the imperative for SMEs to identify strategic opportunities and capitalize on digitalization to attain sustainable firm performance. The findings have also underscored the import of digital marketing, stakeholder engagement, and the digital economy in the context of SMEs. The analysis has illuminated the role of the entrepreneurial ecosystem in fostering the growth of MSMEs. It has underscored the import of supportive environments, access

Table 7. SMEs definition in Poland.

Company category	Staff headcount	Turnover	Balance sheet total
Medium-sized	< 250	≤ € 50 m	≤ € 43 m
Small	< 50	≤ € 10 m	≤ € 10 m
Micro	< 10	≤ € 2 m	≤ € 2 m

Source: European Commission, 2016, On the other hand in Malaysia, there are only two criteria: the number of employees or turnover. Moreover, the thresholds are adjusted to two main industries: manufacturing and services and other sectors. They are presented in the figure below.

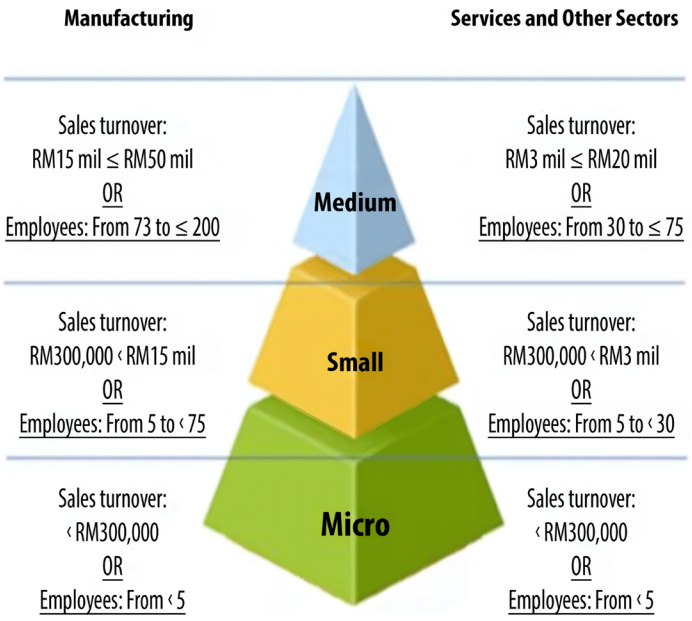

Figure 3. SMEs definition in Malaysia. Source: https://www.smecorp.gov.my, accessed: 14.10.2014.

to funding, and resources in enabling the success of MSMEs in the digital age. In both countries, digital transformation serves as a common thread, albeit with variations in the specific research areas. Malaysia's focus spans societal and economic impacts, emerging technologies, and entrepreneurial ecosystems. Meanwhile, Poland's research revolves around the digital economy and the pivotal role of technology parks in supporting SMEs. These insights offer valuable guidance for policymakers and enterprises, empowering them to align their strategies with the existing research trends and capitalize on the potential of digitalization for economic growth and innovation. Researchers can also utilize these clusters to identify collaborative opportunities within their areas of interest.

The findings of this study can apprise policymakers, researchers, and industry practitioners in formulating strategies and initiatives to bolster SMEs in their digitalization endeavors. By comprehending the research landscape and the emerging trends, stakeholders can make well-informed decisions and implement evidence-based approaches to promote sustained growth and innovation in SMEs. Future research in this field should concentrate on addressing the challenges identified in this study and exploring the potential of digital technologies in enhancing the competitiveness and sustainability of SMEs. Further investigation into specific industries, like manufacturing, services, and retail, can provide valuable insights into industry-specific challenges and opportunities in the digitalization of SMEs.

Overall, this study contributes to the advancement of knowledge on the digitalization of SMEs in Malaysia and Poland. It provides a groundwork for further research, policy development, and industry practices to bolster SMEs in their digital transformation journeys. By rejecting digital technologies and ignoring the opportunities they offer, SMEs can hinder their competitiveness, worsen operational efficiency, and risk long-term failure in the digital era.

Ethics and consent

Ethical approval and consent were not required.

Data availability

All necessary data used in this study required for readers and reviewers can be accessed through VOSviewer.com, alongside Lens.org

Databases: VOSviewer (https://www.vosviewer.com/) and Lens.org (https://www.lens.org/)

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Author contributions

Mior Harris Mior Harun Conceptualization, Formal Analysis, Funding Acquisition, Investigation, Methodology, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing

Vasilios Stouraitis Conceptualization, Writing-Original Draft Preparation

Rafal Kusa Conceptualization, Formal Analysis

Maciej Wozniak Formal Analysis, Investigation, Writing-Review & Editing

Azlina Haniff Funding Acquisition, Methodology, Writing-Original Draft

Arlinah Abd Rashid Formal Analysis, Writing - Review & Editing

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Open Peer Review

Current Peer Review Status: ? ?

Version 1

Reviewer Report 02 September 2025

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nohman Khan
Asia Pacific University of Technology & Innovation (APU), Kuala Lumpur, Malaysia

Summary
This bibliometric analysis compares SME digitalization research between Malaysia (162 publications) and Poland (42 publications) using Lens.org and VOSviewer. The study identifies thematic clusters and publication patterns but has significant methodological and theoretical weaknesses.
Critical Issues Requiring Mandatory Revision
1. Unjustified Country Selection
- No theoretical rationale for comparing Malaysia vs. Poland beyond "emerging economies"
- Vastly different contexts (Asian vs. European, different economic structures)
- Overgeneralized conclusions about regional research patterns from two countries
- Fix: Provide specific theoretical framework justifying this comparison

2. Methodological Transparency Problems
- Database source unclear for Table 1 (Scopus? Web of Science?)
- "Others" category undefined (24-27% of data)
- Search strategy insufficient for replication
- No PRISMA guidelines followed
- Fix: Specify exact databases, define all categories, provide complete search protocol

3. Inadequate Bibliometric Standards
- Missing systematic review protocol
- No discussion of database limitations or coverage bias
- Limited quality assessment of included studies
- Fix: Adopt established bibliometric standards, acknowledge limitations

Secondary Issues
4. Shallow Analysis
- Co-occurrence clusters lack depth

- Missing temporal trend analysis
- Citation analysis limited to simple counts
- Improvement: Analyze cluster evolution over time, expand network analysis

5. SME Definition Problem
   - Authors note different SME definitions between countries but don't address impact on analysis
   - Fix: Discuss how definitional differences affect comparability

Minor Issues
- Table formatting inconsistencies
- Some incomplete references
- Figures need better resolution

Recommendation
MAJOR REVISION REQUIRED
The study addresses a relevant topic but has fundamental flaws in country selection justification and methodological rigor that undermine scientific validity. Must address critical issues #1-3 before acceptance.
Key Actions Needed:
1. Justify Malaysia-Poland comparison with theoretical framework
2. Provide complete methodological transparency
3. Adopt bibliometric analysis standards
4. Define all data categories clearly

With these revisions, this could become a valuable contribution to SME digitalization literature.

Is the work clearly and accurately presented and does it engage with the current literature?
No

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

Are all the source data and materials underlying the results available?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: My research expertise spans digital transformation and technology adoption

in small and medium enterprises (SMEs), with particular focus on bibliometric analysis and systematic literature reviews in business and management studies. I have extensive experience in evaluating digitalization strategies across emerging markets, innovation ecosystems, and entrepreneurship research methodologies. My work includes comparative studies of business digitalization patterns, research impact assessment, and the application of advanced bibliometric tools for analyzing scholarly literature in technology management and organizational innovation contexts.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 17 December 2024

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Henry Jonathan Karyamsetty
Modern College of Business and Science, Muscat, Oman

Firstly, I commend the authors for working on this research comparing the potential research output between two growing economies. It is an interesting study to understand the advancement in digitalization and contrast the amount of research studies between the two countries through a literature analysis.

Though the output from this study is very critical for future research, the authors have to offer their concrete justification (in research context) for choosing Malaysia and Poland for the study in addition to them being emerging economies or else the study outcome deduces Asian economies are slightly ahead in research over some European economies if not all countries.
Would also recommend the authors to use the PRISMA approach for performing literature review when using data analysis software like Vos viewer.
Further, the authors should include the source of their database, against table 1. either the database is taken from Scopus, web of science, or non-indexed. Finally, in table 1, add footnote if allowed to report what "others" mean as they show a significant percent of documents.

Is the work clearly and accurately presented and does it engage with the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

Are all the source data and materials underlying the results available?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Digitalization and digital technology tools in SMEs.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Comments on this article

Version 1

Reader Comment 22 Nov 2024

Shariq Sheikh, Management, Glasgow Caledonian University School of Business and Society, Glasgow, UK

The article addresses a greatly relevant topic of digital transformation and digitalisation by comparing publication output of two vastly different countries in terms of their cultures and economies. The findings demonstrate a link between digitalisation, innovation and firm performance. An interesting read.

Competing Interests: No competing interests were disclosed.