

Technology Transformation, Innovation, and Digital Economy Development in Developing Countries

A Systematic Literature Review

Dekeng Setyo Budiarto

Universitas PGRI Yogyakarta, Indonesia

Norraini Nordin

Management & Science University, Selangor, Malaysia

Abstract: The COVID-19 pandemic is a gateway for businesses to develop technology and embrace digitalization to remain competitive. Various results stated the important role of innovation and technology transformation as potent weapons for survival in this evolving landscape. This research analyzes the role of technology and innovation, especially in developing countries, with few articles researching this field. A systematic literature review that examined 84 articles from reputable international journals was used, with a particular emphasis on developing countries. This research aimed to conduct a comprehensive analysis of existing literature by using the keywords “technology”, “innovation”, and “digital economy” to identify gaps and generate fresh insights. The articles were collected from ProQuest, Google Scholar, and Scopus search engines and imported into Mendeley software for analysis using VOSviewer. The visualization results showed that SMEs were the most frequently mentioned keyword with 41 occurrences. This research contributed by providing opportunities in the form of new paths and variables rarely used for further analysis. There were also implications for organizational management, both in profit and non-profit organizations, to enhance technological capabilities, thereby improving business efficiency and sustainability.

Keywords: Digital Economy, Innovation, Technology, VOSviewer

Introduction

The COVID-19 pandemic is having negative impacts across various sectors, including society, the economy, education, healthcare, and the way of life of the global community ([Akkad & Mouselli, 2023](#); [Al-Mannaei et al., 2023](#); [Bouzakhem et al., 2023](#); [Carlos et al., 2022](#); [Uleanya,](#)

[2023](#); [Grigorescu et al., 2023](#); [Nan & Park, 2022](#)). Several research papers have reported technology implementation in business development as a solution to environmental uncertainty and intense competition in profit-oriented organizations, government, and the education sector ([Almatrodi & Skoumpopoulou, 2023](#); [Amoah et al., 2023](#); [Chemma, 2021](#); [Shao et al., 2022](#); [Ssemugenyi & Nuru Seje, 2021](#)). This implementation is also a primary strategy for many companies when facing pandemic, serving as a tool to formulate strategies for navigating turbulence and fulfilling consumer preferences ([Alawamleh et al., 2023](#); [Almunawar & Anshari, 2022](#); [Lontchi et al., 2023](#); [Pasciaroni et al., 2022](#); [Rodchenko et al., 2021](#)). Furthermore, it expedites communication with stakeholders, streamlines asset management, reduces costs, and increases revenue ([Othman et al., 2023](#); [Pierre et al., 2022](#); [Polas et al., 2022](#)). From an employee perspective, digital implementation in Small and Medium Enterprises (SMEs) increases motivation when the technology is beneficial and user-friendly, resulting in improved performance ([Uzkurt et al., 2023](#)). Therefore, a company strives to respond and adapt to changes in business plans to stay in line with the evolving times and goals ([Faasolo & Sumarliah, 2022](#)). The technology implementation will facilitate organizations to adopt strategies, including innovation to enhance productivity and meet market demands ([Pea-Assounga & Yao, 2021](#)).

The innovation process also serves as a driver for the advancement of manufacturing and construction companies toward a digital economy, capable of reducing disparities as well as enhancing productivity and international competitiveness ([Guang-lin & Tao, 2022](#); [Shkabatur et al., 2022](#); [Stojanovska-Georgievska et al., 2022](#)). The concept is a fundamental force that facilitates the production transformation processes and economic systems within a country ([Carvache-Franco et al., 2022](#); [Casadella & Tahi, 2021](#); [Mahmutaj et al., 2021](#)). In addition, innovation plays a crucial role during and after the COVID-19 pandemic, because the infection poses challenges to creating new business models and creative ideas in line with market needs and customer expectations ([Bouzakhem et al., 2023](#); [Nguyen et al., 2022](#); [Valdez-Juárez et al., 2022](#)). Open innovation becomes increasingly relevant in disseminating information to address digital disparities in a region. Even though traditional businesses rely on internal resources, this concept leans on openness to welcome ideas from external experts ([Kurmanov et al., 2022](#); [Osorno-Hinojosa et al., 2022](#)), enhancing company performance ([Valdez-Juárez et al., 2022](#)).

Therefore, this research identifies gaps and opportunities for future analyses related to technology implementation, innovation, and the digital economy in developing countries to answer the following questions:

1. How can research on technology, innovation, and digital economy be clustered?
2. What are the most published research trends?

3. What topics provide opportunities for future research?

Technology and innovation remain key factors in addressing competition and environmental changes in SMEs. Many previous research studies explored the concept of innovation with various supporting variables, such as Internet banking ([Pea-Assounga & Yao, 2021](#)); knowledge diffusion ([Al-Mannaai et al., 2023](#)); company size ([Carvache-Franco et al., 2022](#)) and e-commerce ([Valdez-Juárez et al., 2022](#)), which enhances performance ([Ureña-Espaillet et al., 2022](#)). Several research papers attempt to connect technology implementation with employee competence, financial resources ([Amoah et al., 2023](#)) project success ([Kamdjoug, 2023](#)) or entrepreneurial orientation ([Al-Hakimi et al., 2021](#)). Furthermore, none of the research has used digital economy as a variable. The development of digital economy is a condition where organizations or governments begin to shift their strategies to digital technology to improve efficiency ([Guang-lin & Tao, 2022](#)). This research will summarize a literature review to identify new novelties.

The development of technology, innovation, and the digital economy in developing countries was analyzed because: 1) the ability to exploit technology was significantly different from developed countries ([Pea-Assounga & Yao, 2021](#)); 2) the COVID-19 pandemic prompted small businesses in developing countries to use technology and innovate significantly ([Lontchi et al., 2023](#)); 3) developing countries faced barriers in the innovation process due to limited resources and information, and an inability to bear the risk of failure ([Carvache-Franco et al., 2022](#); [Hart et al., 2022](#); [Kamdjoug, 2023](#)); 4) the literature development in this field is slow, due to low technology adoption rates ([Amoah et al., 2023](#)); 5) many variables did not have a significant impact on technology implementation, such as risk-taking ([Polas et al., 2022](#)), complexity and relative advantage ([Amoah et al., 2023](#)), compatibility ([Alshaher et al., 2023](#)), and competitive pressure ([Justino et al., 2022](#); [Nguyen et al., 2022](#)).

Related Works

This research is carried out by reviewing various results, specifically in developing countries, facing different resource limitations in technology implementation ([Amoah et al., 2023](#)). In this section, the results from various developing countries will be analyzed based on keywords to obtain a general overview of opportunities for further research.

Technology transformation

Technology transformation and organizational capacity pose serious challenges in many developing countries ([Almatrodi & Skoumpopoulou, 2023](#); [Oubrahim et al., 2023](#)). Furthermore, e-commerce and artificial intelligence have altered the behaviour of entrepreneurs in India, SMEs in Libya ([Chatterjee et al., 2021](#); [Omar & Elmansori, 2021](#)), as

well as the perspectives of the public sector in Tanzania and traditional companies in Azerbaijan, compelling companies to innovate in marketing, specifically during the pandemic ([Shao et al., 2022](#)). The concept offers new hope for SMEs in Mexico to compete both locally and globally ([Valdez-Juárez et al., 2022](#)), enhances efficiency, addresses environmental uncertainty, increases competitiveness, and ensures the survival of several SMEs in Russia, Serbia, El Salvador, and Uzbekistan ([Akberdina et al., 2023](#); [Cvijić Čović et al., 2023](#); [Flores-Hernández et al., 2022](#); [Tuychiev, 2022](#)), and performance in Tunisia ([Bellakhal & Mouelhi, 2023](#)). Meanwhile, financial technology, as part of technological advancement, has greatly assisted new entrepreneurs in Cameroon and Zambia in entering the market due to its flexibility and efficiency ([Lontchi et al., 2023](#); [Nan & Park, 2022](#)). The concept also provides many benefits for assessing risk in financial companies in South Sudan ([Kshetri, 2021](#)).

In the current era of globalization, retail companies in Thailand and SMEs in Ghana are increasingly adopting modern technology to significantly increase business growth. Social media is one form of technology used to bridge the gap between businesses and consumers in Angola and banking customers in Zimbabwe ([Amoah et al., 2023](#); [Justino et al., 2022](#); [Kaondera et al., 2023](#); [Nguyen et al., 2022](#)). Moreover, the digital transformation conducted in Pakistan and Rwanda provides new directions and pathways for further digital innovation, enhances the competitiveness and sustainability of SMEs in Indonesia ([Budiarto et al., 2023](#); [Naicker & Nsengimana, 2023](#); [Sarfraz et al., 2022](#)), and improves the digital agriculture value chain of South Africa ([Smidt & Jokonya, 2022](#)). In Tonga, sustainability is influenced by the attitude within a company, and this is affected by external factors ([Faasolo & Sumarliah, 2022](#)). As a developing country, rapid technological changes pose a challenge in the Democratic Republic of Congo. Therefore, a change in management with a focus on improving human resources is the best solution ([Kamdjoug, 2023](#)). Different results are shown in Oman, where technology transformation, digitalisation and the use of e-commerce influence SMEs' operational efficiency on performance. The performance of a company is better when SMEs use technology, specifically when facing the COVID-19 pandemic ([Mishrif & Khan, 2022](#)).

Several results use the term “technology”, as exemplified by research in the Democratic Republic of Congo conducted by Kamdjoug ([2023](#)). This research adopted a quantitative method with 229 managers from SMEs to examine the impact of management changes and IT strategy on project success and company performance. The results showed that project objective, team expertise, and IT strategy impact project success. Meanwhile, three other variables, namely communication, management support, and stakeholder acceptance, did not affect project success. The results from this research in the Democratic Republic of Congo were intriguing because most SMEs were less than 5 years old, making the digital transformation

process challenging. To achieve success, SMEs need high-quality resources and the ability to translate the company strategy and objectives.

Innovation

Innovation is a company tendency to discover new ideas that lead to the development of new products or services to enhance customer satisfaction. The development of new technology poses challenges for businesses in Trinidad and Tobago and Uganda ([Eton et al., 2021](#); [Mohan et al., 2021](#)), as well as for small businesses due to limited resources. However, it is the best solution as a powerful weapon to compete in the market ([Chemma, 2021](#)). Research conducted in Kuwait, Mauritius, and Somalia stated that collaboration between academia, the company and the government was crucial for developing innovation as a future challenge ([Daka & Siad, 2021](#)). Academics design programs for a company, while the government provides effective policies and a conducive business environment ([Arman & Al-Qudsi, 2022](#); [Roopchund, 2023](#)). These results are supported by research in Malaysia and Moldova, where digital capability and government support enhance SMEs' innovation and competitiveness ([Larisa et al., 2022](#); [Teoh et al., 2023](#)). Results in Argentina explained that innovation is key for the hotel sector to survive during the COVID-19 pandemic ([Pasciaroni et al., 2022](#)) and improve the performance of textile companies in Pakistan and Liberia, as well as SMEs in the Republic of Congo, Ecuador and Kosovo ([Mahmutaj et al., 2021](#); [Sarfraz et al., 2022](#); [Sumo et al., 2022](#)).

The research conducted in Madagascar, Bahrain, and the Philippines showed that innovation is crucial for companies. Therefore, managers must create an environment where new knowledge is continually developed, and infrastructure is available to facilitate the development of new ideas ([Al-Mannaei et al., 2023](#); [Bayudan-Dacuycuy & Dacuycuy, 2022](#); [Hart et al., 2022](#)). SMEs should compete vigorously to survive in Bangladesh, due to the rapidly changing environment ([Polas et al., 2022](#)). Results in Brazil, Bolivia, Chile and Nigeria explained that limited resources hindered innovation ([Shamaki et al., 2022](#); [Vila, 2022](#); [Zapata & Orellana, 2022](#)). Consequently, government support is needed to enable the production of new products, processes and innovative marketing methods, enhancing productivity and creating jobs ([Castella et al., 2022](#); [Shkabatur et al., 2022](#)). Lack of knowledge, financial resources, and market information have driven many companies in Ecuador and Nepal to innovate significantly ([Carvache-Franco et al., 2022](#); [Rajbhandari et al., 2022](#)).

Based on the keyword "innovation" used in several previous studies, various diverse conclusions have been drawn: for example, the results in Ecuador on 6,275 companies in various sectors using a quantitative method ([Carvache-Franco et al., 2022](#)). The research aimed to analyze 10 factors that potentially hinder companies from innovating in process and

product. The results indicate that there are between 6 and 8 factors hindering product and process innovation. The research is interesting because demand uncertainty does not affect innovation, meaning that company strategies still focus on internal factors, such as finances and knowledge. Meanwhile, external factors, such as market barriers, are not the main target for companies.

Digital economy

Digital economy is a concept that integrates production methods with information technology, including digital platforms. Therefore, it requires technology (digital technology and digital innovation) to break the constraints of space and time, accelerating business processes in companies ([Błaszczuk et al., 2023](#); [Guang-lin & Tao, 2022](#)). Companies are making extensive use of technology because the concept can transform business strategies and processes, products and services, and the capabilities of the digital economy environment ([Błaszczuk et al., 2023](#); [Pierre et al., 2022](#)). Compared to traditional management, a digital economy can stimulate company growth, expand markets, enhance competitiveness, and change economic structure ([Rodchenko et al., 2021](#)). As an integration of information technology, the concept offers new strategic options for company transformation in China. This is because the digital economy can break spatial and temporal limitations, contributing to growth ([Guang-lin & Tao, 2022](#)). Furthermore, the development of technology integrated with business operations in Morocco and Iran facilitates the flow of supply chain information, reducing waste, improving flexibility, and speeding up decision-making ([Khodaparasti & Garabollah, 2023](#); [Oubrahim et al., 2023](#)).

Several new startups (98% SMEs) in Jordan have made significant use of technology and are considered agents of change, because they effectively generate new products and services, absorb labour, and stimulate digital economy growth ([Alawamleh et al., 2023](#)). Technology advancement, such as cloud technology, will continue to accelerate, because it is easily accessible from anywhere. Therefore, its role in the development of the digital economy in Kazakhstan, Thailand and Iraq is highly significant ([Alshaher et al., 2023](#); [Kurmanov et al., 2022](#); [Sastararuji et al., 2022](#)). In line with several examinations in Romania for education institutions, Sri Lanka for SMEs, and Cambodia for the government prove that human resource capabilities and technology expedite the transformation process towards a digital economy ([Grigorescu et al., 2023](#); [Savuth & Sothea, 2023](#); [Thathsarani & Jianguo, 2022](#)).

The results related to digital economy research show that the concept is very important for development. Therefore, the government should intervene in the form of policies in this direction ([Grigorescu et al., 2023](#); [Thathsarani & Jianguo, 2022](#)). Based on the results of various previous analyses, there are no articles that specifically use digital economy as a

variable to be tested. However, the importance of the concept was explained to support progress in developing countries.

Data and Methodology

This research uses a qualitative method with a Systematic Literature Review (SLR) to find answers to the three questions mentioned in the previous section. In the pre-analysis, only one article that used the SLR method focused on agriculture in South Africa ([Smidt & Jokonya, 2022](#)). The keywords are 'digital development', 'Small-scale farmer', 'Agriculture value chains', 'framework', 'institution', and 'innovation'. This research was divided into five stages: 1) formulating the problem; 2) collecting data and literature; 3) evaluating the quality of articles; 4) conducting analysis; 5) presenting and interpreting the results of the analysis. The same steps were followed, starting with problem formulation in the introduction section, and then gathering articles using keywords, presented in the method.

Step 1: This research was conducted by using the keywords 'technology', 'innovation' and 'digital economy', followed by the inclusion of the names of developing countries. According to the IMF (International Monetary Fund), there were 152 developing countries worldwide, resulting in 152 times searches using the ProQuest search engine. This research was restricted to scholarly journals indexed in Scopus with the document type being articles within the timeframe of 2021–2023 during the COVID-19 pandemic. Based on the ProQuest search engine, 39 articles from 39 countries were found, but 4 were not indexed in Scopus, leaving 35 usable.

Step 2 included searching for the remaining 117 countries on Google Scholar and Scopus with 117 times searches, yielding 49 articles from 49 developing countries. The total number of articles obtained from ProQuest and Scopus search engines was 84 from 84 developing countries. In cases where multiple articles pertained to the same subject (the same countries), one was selected based on the criteria of the latest year, the highest quartile, and the most keywords. Several results were not used as subjects of analysis since more than one country was discussed. The final step included processing the 84 articles in the Mendeley software and then exporting the data into an RIS file.

The analysis using VOSviewer only considered keywords that appear a minimum of two times or are used in at least two papers. The total number of keywords based on the analysis is 292, which VOSviewer then categorizes into 33 items, as shown in Table 4. The final result of the analysis includes the number of clusters and a visualization of the results, showing the relationships between keywords or variables used. The results showed that there were 60% SMEs and 40% non-SMEs (industries, government institutions, education institutions) among the types of businesses. For the method used, 64% were quantitative, while 36% were

qualitative (Table 1). Table 2 provides categorization based on journal publication year and quartiles according to Scopus.

Table 1. Analysis results using Crosstab

Types	Quantitative	Qualitative
SMEs	35	16
Non-SMEs	17	16
Total	52	32

Table 2. Journal quartiles by year

Quartile	2021	2022	2023
<25%	-	3	2
25-50%	3	6	2
50-75%	7	12	11
>75%	3	22	13
Total	13	43	28

Results & Discussion

Figure 1 is the result of clustering using VOSviewer to answer research question number 1, namely clustering research on technology, innovation, and digital economy. The results show that there are 8 clusters (the size of the dot in the Figure is directly proportional to the number of keywords used). The main keywords of clusters 1, 2, 3, 4, 5, 6, 7, and 8, with red, green, blue, yellow, purple, light blue, orange, and brown colours are ‘digital transformation’, ‘SMEs’, ‘circular economy’, ‘Covid-19,’ ‘developing countries’, ‘open innovation’, ‘innovation’, and ‘technology’, respectively.

This systematic literature review examined 84 articles discussing technology transformation and innovation in developing countries using two occurrences to obtain 33 related keywords. The frequency of keywords and link strength (Table 4) served as an entry point for future research opportunities.

The second research question about publication trends can be answered in Tables 3 and 4. In Table 4, the most used keywords are ‘SMEs’ (Cluster 2), while Table 3 shows Cluster 2 with keywords ‘SMEs’, ‘SEM’, ‘Artificial intelligence’, ‘TAM’, ‘Financial inclusion’, ‘E-commerce’, and ‘Entrepreneurial orientation’. In Cluster 2, the number of occurrences for ‘SMEs’ is 41 with a total link strength of 76, indicating that this theme has been extensively studied by previous research. In Cluster 1, the number of occurrences for ‘Human capital’ is 2 with a total link strength of 4, meaning there is an opportunity for further exploration of the human capital variable discussed in the clustering discussion.

The third question about topics is analyzed based on each cluster, serving as an opportunity for future research. To obtain new ideas, each cluster (Clusters 1-8) will be linked to others as follows.

Cluster 1: In Cluster 1, *digital transformation* is the most frequently used keyword with 11 occurrences and a link strength of 12. The results indicate that management capability enhances the digital transformation process and has an impact on technology innovation ([Guang-lin & Tao, 2022](#)), including bank customer management ([Kaondera et al., 2023](#)), leading to improved performance and sustainability ([Budiarto et al., 2023](#); [Sarfraz et al., 2022](#)). Human capital has an impact on digital transformation ([Rodchenko et al., 2021](#)), enhancing supply chain performance ([Oubrahim et al., 2023](#)). These results have potential connections to Cluster 4 ([Bouzakhem et al., 2023](#)), artificial intelligence, and acceptance model theories in Cluster 2 ([Chatterjee et al., 2021](#); [Polas et al., 2022](#)). Furthermore, the relationship between digital transformation and innovation can be tested with the role of the government, as shown in Cluster 2 ([Rajbhandari et al., 2022](#)). The description of some previous results can be explained by creating a new model that combines several previous research variables. Innovation variables are used as the first step by finding supporting factors, such as management ability and digital transformation ([Guang-lin & Tao, 2022](#)), as well as government intention ([Rajbhandari et al., 2022](#)). Furthermore, it is a challenge for future research to determine theories connecting digital transformation with government intervention to build a mediating relationship.

Cluster 2: In Cluster 2, 'SMEs' is the keyword with the highest occurrence, namely 41, and a link strength of 76. In this cluster, some research emphasizes the importance of financial inclusion, digital finance, and technology adoption in enhancing the growth and performance of SMEs ([Eton et al., 2021](#); [Thathsarani & Jianguo, 2022](#)). Other results explain the implementation of technology digitalization in increasing employee motivation and performance ([Uzkurt et al., 2023](#)). In Cluster 1, digitalization can strengthen the impact of innovation on organizational performance ([Sarfraz et al., 2022](#)). Additionally, the research by Polas et al. (2022), Rajbhandari et al. (2022) and Sharma et al. (2022) on knowledge of artificial intelligence related to technology adoption, with the role of the government as mediation, can be linked to entrepreneurship and digitalization in Cluster 5 ([Akulava & Guerrero, 2022](#); [Shkabatur et al., 2022](#)) and Cluster 1 ([Pierre et al., 2022](#)). Building a new model in this cluster can be started with the impact between technology and SMEs performance ([Thathsarani & Jianguo, 2022](#)) as well as innovation ([Sarfraz et al., 2022](#)). The new model developed is to test the mediation impact between technology implementation and innovation on performance.

Cluster 3: Cluster 3 consists of 4 keywords, namely *circular economy*, *competitive advantage*, *business strategy*, and *sustainability*, each with two occurrences. Results in this cluster show ([Amoah et al., 2023](#)) that technology influences social media implementation and enhances sustainability in SMEs. Additionally, sustainability is an outcome of circular

economy practices ([Khodaparasti & Garabollagh, 2023](#)). Different results indicate that external factors affect internal factors, enhancing sustainability ([Faasolo & Sumarliah, 2022](#)). For example, Valdez-Juárez *et al.* ([2022](#)) stated that e-commerce, business strategy and innovation improved the performance of SMEs. In Cluster 2, the application of technology is influenced by artificial intelligence knowledge ([Polas *et al.*, 2022](#)). Various results above can be related to the keyword *competitiveness* in Cluster 7 ([Teoh *et al.*, 2023](#); [Tuychiev, 2022](#)).

The overview of the results can be explained by using a model that explains the impact of business strategy and e-commerce on performance ([Valdez-Juárez *et al.*, 2022](#)). The opportunity carried out is to build a new model by connecting e-commerce, performance and sustainability using research developed by Amoah *et al.* ([2023](#)).

Cluster 4: In Cluster 4, COVID-19 is the most frequently used keyword with 12 occurrences and a link strength of 20. In this cluster, Bouzakhem *et al.* ([2023](#)) explained different factors impacting the performance of SMEs' employees. Furthermore, employee performance is related to Cluster 8, by the improvement of SMEs' performance ([Lontchi *et al.*, 2023](#); [Pea-Assounga & Yao, 2021](#)). Another research paper using a case study method found various factors affecting knowledge sharing, such as human resources, processes and organisational culture ([Carlos *et al.*, 2022](#)). However, the variable only has an impact on innovation when the company is in a low manufacturing technology environment ([Bianchi & Machado, 2021](#)). This research is further developed by conducting a more in-depth analysis based on strategy and company type, as in Cluster 6 ([Pilav-Velic & Hatidza, 2021](#)).

A more in-depth explanation of this cluster can be started by examining the factors impacting employee performance, namely resilience and empowerment ([Bouzakhem *et al.*, 2023](#)). Meanwhile, others examine the impact of Internet banking and innovativeness on employee performance ([Pea-Assounga & Yao, 2021](#)). Future research interested in this theme can establish a mediating relationship between Internet banking, empowerment and performance by using relevant theories.

Cluster 5: In Cluster 5, the keyword *developing countries* has 7 occurrences with a link strength of 16. This result ([Pierre *et al.*, 2022](#)) proves that, in developing countries, the role of digital technology is significant in improving the capabilities toward better performance. Meanwhile, other research in Cluster 1 stated that innovation bridges the relationship between technology and performance ([Sarfraz *et al.*, 2022](#)). In Cluster 3, business strategy also has a significant effect on innovation ([Valdez-Juárez *et al.*, 2022](#)). Some of the results can also be connected to Cluster 2, where women business owners in SMEs face limitations in entrepreneurship due to resource constraints, socio-cultural factors, knowledge and skills ([Lim *et al.*, 2022](#)).

Table 3. Number of authors based on cluster

Clusters	Keywords	Authors
Cluster 1	Digital transformation; Digitalization; Digital economy; Digital capability; Business; Human capital; Internationalization	Almatrodi & Skoumpopoulou, 2023 ; Alshafer et al., 2023 ; Bayudan-Dacuycuy & Dacuycuy, 2022 ; Bellakhal & Mouelhi, 2023 ; Błaszczuk et al., 2023 ; Budiarto et al., 2023 ; Chatterjee et al., 2021 ; Cvijić Čović et al., 2023 ; Grigorescu et al., 2023 ; Guanglin & Tao, 2022 ; Hart et al., 2022 ; Kaondera et al., 2023 ; Kurmanov et al., 2022 ; Naicker & Nsengimana, 2023 ; Othman et al., 2023 ; Oubrahim et al., 2023 ; Pierre et al., 2022 ; Rodchenko et al., 2021 ; Sarfraz et al., 2022 ; Savuth & Sothea, 2023 ; Shao et al., 2022 ; Stojanovska-Georgievska et al., 2022 ; Valiyev et al., 2022
Cluster 2	SMEs; SEM; Artificial intelligence; TAM; Financial inclusion; E-commerce; Entrepreneurial orientation	Akkad & Mouselli, 2023 ; Al-Hakimi et al., 2021 ; Alshafer et al., 2023 ; Bellakhal & Mouelhi, 2023 ; Budiarto et al., 2023 ; Chatterjee et al., 2021 ; Cvijić Čović et al., 2023 ; Eton et al., 2021 ; Faasolo & Sumarliah, 2022 ; Flores-Hernández et al., 2022 ; Gansonré & Ouédraogo, 2022 ; Justino et al., 2022 ; Kamdjoug, 2023 ; Kshetri, 2021 ; Larisa et al., 2022 ; Lim et al., 2022 ; Mahmutaj et al., 2021 ; Akulava & Guerrero, 2022 ; Mishrif & Khan, 2022 ; Naicker & Nsengimana, 2023 ; Nan & Park, 2022 ; Nguyen et al., 2022 ; Omar & Elmansori, 2021 ; Polas et al., 2022 ; Rajbhandari et al., 2022 ; Rodchenko et al., 2021 ; Sastararuij et al., 2022 ; Sharma et al., 2022 ; Smidt & Jokonya, 2022 ; Teoh et al., 2023 ; Thathsarani & Jianguo, 2022 ; Uzkurt et al., 2022 ; Valdez-Juárez et al., 2022 ; Vila, 2022 ; Zapata & Orellana, 2022
Cluster 3	Circular economy; Competitive advantage; Business strategy; Sustainability	Akberdina et al., 2023 ; Amoah et al., 2023 ; Budiarto et al., 2023 ; Faasolo & Sumarliah, 2022 ; Khodaparasti & Garabollagh, 2023 ; Sumo et al., 2022 ; Ureña-Espallat et al., 2022 ; Valdez-Juárez et al., 2022
Cluster 4	COVID-19; Challenges; Knowledge sharing	Akkad & Mouselli, 2023 ; Almunawar & Anshari, 2022 ; Bianchi & Machado, 2021 ; Bouzakhem et al., 2023 ; Carlos et al., 2022 ; Grigorescu et al., 2023 ; Mishrif & Khan, 2022 ; Naicker & Nsengimana, 2023 ; Nan & Park, 2022 ; Sastararuij et al., 2022 ; Shao et al., 2022 ; Teoh et al., 2023
Cluster 5	Developing countries; Entrepreneurship; Economy growth	Alawamleh et al., 2023 ; Chatterjee et al., 2021 ; Daka & Siad, 2021 ; Gansonré & Ouédraogo, 2022 ; Kshetri, 2021 ; Akulava & Guerrero, 2022 ; Mohan et al., 2021 ; Pierre et al., 2022 ; Roopchund, 2023 ; Shkabatur et al., 2022 ; Zapata & Orellana, 2022
Cluster 6	Open innovation; Hotel; Knowledge management	Kurmanov et al., 2022 ; Metawa et al., 2021 ; Osorno-Hinojosa et al., 2022 ; Pasciaroni et al., 2022 ; Pilav-Velic & Hatidza, 2021
Cluster 7	Innovation; Competitiveness; Economy development	Al-Hakimi et al., 2021 ; Al-Mannaei et al., 2023 ; Arman & Al-Qudsi, 2022 ; Bianchi & Machado, 2021 ; Carvache-Franco et al., 2022 ; Casadella & Tahli, 2021 ; Castella et al., 2022 ; Chemina, 2021 ; Daka & Siad, 2021 ; Larisa et al., 2022 ; Mahmutaj et al., 2021 ; Akulava & Guerrero, 2022 ; Mohan et al., 2021 ; Rajbhandari et al., 2022 ; Shkabatur et al., 2022 ; Sinatoko Djibo et al., 2022 ; Sumo et al., 2022 ; Teoh et al., 2023 ; Tuychiev, 2022 ; Ureña-Espallat et al., 2022 ; Valiyev et al., 2022 ; Vila, 2022
Cluster 8	Technology; Fintech; Performance	Ahmed et al., 2022 ; Bellakhal & Mouelhi, 2023 ; Dumenu et al., 2023 ; Justino et al., 2022 ; Lontchi et al., 2023 ; Mishrif & Khan, 2022 ; Mohan et al., 2021 ; Nguyen et al., 2022 ; Pea-Assounga & Yao, 2021 ; Polas et al., 2022 ; Thathsarani & Jianguo, 2022 ; Tuychiev, 2022 ; Ureña-Espallat et al., 2022

The overview of previous research in Cluster 5 can be explained with a research model that examines the impact of technology implementation using the moderating variable of the creative industry ([Pierre et al., 2022](#)). Meanwhile, other research explains the relationship between innovation and company performance ([Sarfraz et al., 2022](#); [Valdez-Juárez et al.,](#)

[2022](#)). The results of the three research papers can be developed into a new model by testing the moderating impact of the creative industry using relevant theories.

Cluster 6: In Cluster 6, there are 3 keywords, namely *open innovation*, *hotel*, and *knowledge management*, but *open innovation* has the most occurrences and link strength. Therefore, the implementation of open innovation depends on the strategy used, company type, and collaboration with external partners ([Pilav-Velic & Hatidza, 2021](#)). Open innovation supported by human capital can create additional opportunities for acquiring new knowledge and ideas bridging digital gaps ([Kurmanov et al., 2022](#)). Other research examined the innovation process in hotels, showing that the COVID-19 pandemic was not a trigger for innovation but an inhibition ([Pasciaroni et al., 2022](#)). Some of these results connect entrepreneurship and knowledge sharing in Cluster 5 ([Akulava & Guerrero, 2022](#)) and Cluster 4 ([Carlos et al., 2022](#)). A more detailed explanation of this cluster's potential is combining the strategy impact model on innovation ([Pilav-Velic & Hatidza, 2021](#)) with gender ([Akulava & Guerrero, 2022](#)).

Cluster 7: Based on the visualization in Cluster 7, the keyword *innovation* appears with a total of 33 links, connected to keywords such as *competitiveness* and *fintech*. Results in this cluster include research on innovation in both large and small companies by Al-Mannaei et al. ([2023](#)) and Carvache-Franco et al. ([2022](#)). Other results regarding eco-innovation prove that government support enhances innovation capability, but market performance weakens the relationship ([Sinatoko Djibo et al., 2022](#)). In line with research in Malaysia, innovation is influenced by digital capability, government support, entrepreneurial orientation, and entrepreneurial leadership, supporting competitiveness and supply chain resilience ([Al-Hakimi et al., 2021](#); [Teoh et al., 2023](#)). Results in this cluster can be further developed by connecting with other keywords in Cluster 3, such as *sustainability* ([Amoah et al., 2023](#)), *business strategy* ([Valdez-Juárez et al., 2022](#)), and *competitive advantage* ([Budiarto et al., 2023](#)). Based on the results of previous research with quantitative methods, a new model can be presented by combining factors that impact innovation, such as knowledge ([Al-Mannaei et al., 2023](#)), entrepreneurial orientation ([Al-Hakimi et al., 2021](#)), and lack of information technology ([Carvache-Franco et al., 2022](#)), further connecting the concept with competitive advantage ([Teoh et al., 2023](#)) or sustainability ([Budiarto et al., 2023](#)).

Cluster 8: In Cluster 8, there are keywords such as technology, fintech and performance, but technology has 16 occurrences with a link strength of 31. In this cluster, previous results ([Lontchi et al., 2023](#)) provided evidence that using fintech could directly enhance SMEs' performance through financial literacy. Furthermore, the implementation of technology, organizational factors, and the environment improve digital transformation toward better performance ([Justino et al., 2022](#); [Nguyen et al., 2022](#)). Additional results also explain that

digitalisation can increase sales and growth for SMEs (Bellakhal & Mouelhi, 2023). These present opportunities for future research when connected to Cluster 7, which focuses on innovation (Al-Manna'ei *et al.*, 2023). The impact of technology and e-commerce on the relationship between the operations and performance of a company is also stated (Mishrif & Khan, 2022). This result offers opportunities for further development by incorporating keywords such as 'competitive advantage' and 'sustainability' in Cluster 3 (Budiarto *et al.*, 2023). The explanation of the opportunities is to start from the various antecedent factors impacting the use of m-commerce in SMEs (Justino *et al.*, 2022). This can be connected to competitive advantage and sustainability to obtain a new research model (Budiarto *et al.*, 2023).

Table 4. Number of occurrences and link strength

Clusters	Keywords	Occurrence	Total Link Strength
Cluster 1	Digital transformation	11	12
	Digitalization	6	12
	Digital economy	4	8
	Digital capability	2	5
	Business	2	4
	Human capital	2	4
	Internationalization	2	4
Cluster 2	SMEs	41	76
	SEM	6	12
	Artificial intelligent	3	7
	TAM	3	5
	Financial inclusion	3	5
	e-commerce	2	6
Cluster 3	Entrepreneurial orientation	2	4
	Circular economy	2	6
	Competitive advantage	2	6
	Business strategy	2	5
Cluster 4	Sustainability	2	5
	COVID-19	12	20
	Challenges	2	3
Cluster 5	Knowledge sharing	2	2
	Developing countries	7	16
	Entrepreneurship	6	12
Cluster 6	Economy growth	2	3
	Open innovation	5	7
	Hotel	2	4
Cluster 7	Knowledge management	2	4
	Innovation	21	33
	Competitiveness	2	5
Cluster 8	Economy development	2	1
	Technology	16	31
	Fintech	2	5
	Performance	2	4

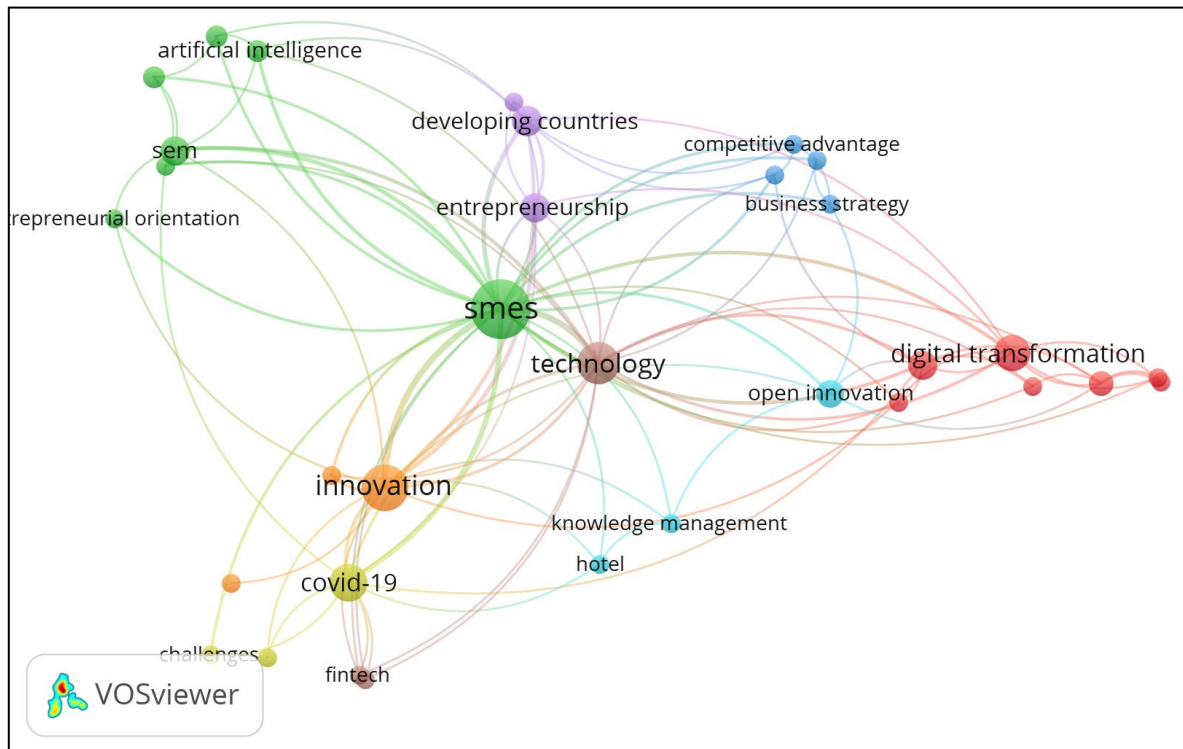


Figure 1. Analysis results with VOSviewer



Figure 2. Density display result

Conclusions/Recommendations

In conclusion, the visualization results using VOSviewer were indicative of the variable ‘SMEs’ as the most frequently observed keyword across different articles. However, attention was drawn to Clusters 7 and 4, where the keywords ‘economy development’ and ‘knowledge

sharing' had only 1 and 2 link strengths. These keywords served as entry points for the fields of technology, innovation, and digital economy. Furthermore, it is essential for researchers that innovation, technology, and digital transformation variables have become trends nowadays, so finding novelty in this area will be a difficult challenge. Finally, based on the analysis results in Figure 2, many variables still have no connection, making it an opportunity for future research, especially in developing countries.

This research also presented several limitations to be considered for future analyses. First, there were no differences between subjects in low-income, lower, upper, or high-income countries, and future research could be tested based on income categories. This limitation was consistent with previous results that investing in infrastructure strengthened creativity and promoted innovation and technology adoption, which was a barrier for low-income countries (Al-Manna'ei *et al.*, 2023; Bayudan-Dacuycuy & Dacuycuy, 2022).

Second, this research did not differentiate between the objects as small firms, large firms or government entities. This could be an opportunity for future research, because small businesses have limited resources for innovation (Dumenu *et al.*, 2023; Polas *et al.*, 2022; Thathsarani & Jianguo, 2022). Lastly, this research uses keywords with at least two occurrences, meaning keywords only used once did not appear in the analysis, such as 'e-government' (Shao *et al.*, 2022), 'start-up' (Alawamleh *et al.*, 2023) and 'digital education' (Grigorescu *et al.*, 2023).

Finally, this research only discussed the definition of digital economy, which according to practitioners is still ambiguous. Therefore, future analyses could show the definition of digital economy from various perspectives based on 5 levels of digital development (Kurmanov *et al.*, 2022).

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Appendix

No	Country	Author	Year of publication	Methodology	Study Period
1	Algeria	Chemma	2021	Qualitative	Sept 2013 - Jun 2016.
2	Angola	Justino et al.	2022	Quantitative	NA
3	Argentina	Pasciaroni et al.	2022	Qualitative	July - Oct 2020
4	Azerbaijan	Valiev et al.	2022	Qualitative	Jan -May 2021
5	Bahrain	Al-Mannaai et al.	2023	Quantitative	Jan - Feb 2022
6	Bangladesh	Polas et al.	2022	Quantitative	Feb - March 2022
7	Belarus	Akulava & Guerrero	2022	Quantitative	2017-2018
8	Benin	Sinatoko Djibo et al.	2022	Quantitative	Jul - Sept 2021
9	Bolivia	Vila	2022	Qualitative	2021
10	Bosnia	Pilav-Velic & Hatidza	2021	Quantitative	Oct. - Dec 2019
11	Brazil	Carlos et al.	2022	Qualitative	During Covid Pandemic
12	Botswana	Uleanya	2021	Qualitative	October 2021
13	Brunei	Almunawar & Anshari	2022	Quantitative	2021
14	Burkina Faso	Gansonré & Ouédraogo	2022	Quantitative	2014
15	Cambodia	Savuth & Sothea	2023	Qualitative	NA
16	Cameroon	Lontchi et al.	2023	Quantitative	During Covid Pandemic
17	Chile	Zapata & Orellana	2022	Qualitative	2021
18	China	Guang-lin & Tao	2022	Quantitative	2008-2029
19	D. Rep. of the Congo	Kamdjoug	2023	Quantitative	Jan - March 2021
20	Ecuador	Carvache-Franco et al.	2022	Quantitative	2015
21	Dominican	Ureña-Espaillet et al.	2022	Quantitative	2020
22	Egypt	Metawa et al.	2021	Qualitative	2019 - 2020
23	El Salvador	Flores-Hernández et al.	2022	Quantitative	2018
24	Eswatini	Ahmed et al.	2022	Qualitative	2018
25	Ethiopia	Shkabatur et al.	2022	Qualitative	NA
26	Fiji	Sharma et al.	2022	Quantitative	Nov - Dec 2020
27	Gambia	Lim et al.	2022	Qualitative	NA
28	Ghana	Amoah et al.	2023	Quantitative	June - Sept 2022
29	India	Chatterjee et al.	2021	Quantitative	Dec 2019 - Jan 2021
30	Indonesia	Budiarto et al.	2023	Quantitative	Sept - Dec 2022
31	Iran	Khodaparasti & Garabollah	2023	Quantitative	April - July 2022
32	Iraq	Alshaher et al.	2023	Quantitative	Feb - Nov 2021
33	Jordan	Alawamleh et al.	2023	Qualitative	During Covid Pandemic
34	Kazakhstan	Kurmanov et al.	2022	Quantitative	2016 - 2021
35	Kosovo	Mahmutaj et al.	2021	Qualitative	2014-2016
36	Kuwait	Arman & Al-Qudsi	2022	Qualitative	2019 - 2021
37	Laos	Castella et al.	2022	Qualitative	2005-2020
38	Lebanon	Bouzakhem et al.	2023	Quantitative	Sept - Oct 2022
39	Liberia	Sumo et al.	2022	Qualitative	Nov 2021 - Feb 2022
40	Libya	Omar & Elmansori	2021	Quantitative	NA
41	Madagascar	Hart et al.	2022	Qualitative	March - April 2022
42	Malawi	Dumenu et al.	2023	Quantitative	June - August 2021
43	Malaysia	Teoh et al.	2023	Qualitative	Sept - Oct 2020
44	Mauritius	Roopchund	2023	Qualitative	NA
45	Mexico	Valdez-Juárez et al.	2022	Quantitative	Feb - Oct 2021
46	Moldova	Larisa et al.	2022	Quantitative	2015-2020
47	Morocco	Oubrahim et al.	2023	Quantitative	Aug - November 2022
48	Nepal	Rajbhandari et al.	2022	Quantitative	March - Dec 2020
49	Nicaragua	Osorno-Hinojosa et al.	2022	Qualitative	2018-2021
50	Nigeria	Shamaki et al.	2022	Quantitative	January 2021
51	North Macedonia	Stojanovska-Georgievska et al.	2022	Qualitative	2022
52	Oman	Mishrif & Khan	2022	Quantitative	During Covid Pandemic
53	Pakistan	Sarraz et al.	2022	Quantitative	March - June 2022
54	Papua New Guinea	Ssemugenyi & Nuru Seje	2021	Quantitative	During Covid Pandemic
55	Peru	Pierre et al.	2022	Quantitative	2015
56	Philippines	Bayudan-Dacuyucuy & Dacuyucuy	2022	Quantitative	2019
57	Poland	Błaszczuk et al.	2023	Quantitative	2016 - 2021
58	Qatar	Othman et al.	2023	Qualitative	2019-2021
59	Rep of the Congo	Pea-Assounga & Yao	2021	Quantitative	Oct - Dec 2019
60	Romania	Grigorescu et al.	2023	Quantitative	2008-2021
61	Russia	Akberdina et al.	2023	Quantitative	June - Nov 2022
62	Rwanda	Naicker & Nsengimana	2023	Qualitative	During Covid Pandemic

No	Country	Author	Year of publication	Methodology	Study Period
63	Saudi Arabia	Almatrodi & Skoumpopoulou	2023	Qualitative	May 2020
64	Senegal	Casadella & Tahi	2021	Qualitative	NA
65	Serbia	Cvijić Cović et al.	2023	Quantitative	Feb - April 2020
66	Somalia	Daka & Siad	2021	Qualitative	NA
67	South Africa	Smidt & Jokonya	2022	Qualitative	2021
68	South Sudan	Kshetri	2021	Qualitative	2019
69	Sri Lanka	Thathsarani & Jianguo	2022	Quantitative	Sept 2021 - Jan 2022
70	Syria	Akkad & Mouselli	2023	Qualitative	During Covid Pandemic
71	Tanzania	Shao et al.	2022	Qualitative	Feb 2020 - Feb 2021
72	Thailand	Sastararui et al.	2022	Qualitative	August 2020
73	Tonga	Faasolo & Sumarlia	2022	Quantitative	May-July 2021
74	Trinidad & Tobago	Mohan et al.	2021	Quantitative	2015
75	Tunisia	Bellakhal & Mouelhi	2023	Quantitative	March 2013 - July 2014
76	Turkey	Uzkurt et al.	2023	Quantitative	Oct - Dec 2021
77	Uganda	Eton et al.	2021	Quantitative	2018
78	Ukraine	Rodchenko et al.	2021	Quantitative	Nov 2020-Feb 2021
79	Uruguay	Bianchi & Machado	2021	Quantitative	2009 - 2015
80	Uzbekistan	Tuychiev	2022	Qualitative	During Covid Pandemic
81	Vietnam	Nguyen et al.	2022	Quantitative	NA
82	Yemen	Al-Hakimi et al.	2021	Quantitative	NA
83	Zambia	Nan & Park	2022	Quantitative	Sep 2019 - March 2020
84	Zimbabwe	Kaondera et al.	2023	Quantitative	2022

NA: We did not find the study periods