Circular and Digital Systems in SMEs: An Assessment of the Past and Present Literature for Future Research Directions

Abstract

Small and medium-sized enterprises (SMEs) are the backbone of every economy since they fuel economic expansion. As a result of the global demand for products that are both innovative and sustainable, SMEs are being put under pressure to integrate digital and circular systems. In order to analyse the roles that SMEs play in digital and circular systems, the current study conducts a bibliometric and content analysis of 92 publications. The current study concludes, after conducting an exhaustive literature review, that SMEs are making haste to integrate digital and circular systems in an effort to create innovations that are more profitable and that will survive longer. The study also goes into the seminal articles in the discipline to have a more in-depth understanding of the pioneering experiments that were conducted. The findings indicate that SMEs are more interested in digital systems than circular systems. This makes sense, given that digitalisation is utilised more frequently than the practices of the circular economy.

Keywords: Circular system, digital system, circularity, digitalisation, environmental sustainability, information and communication technologies

JEL classification: O44

1. Introduction

Small and medium-sized enterprises (SMEs) are widely acknowledged to contribute significantly to the international economy and culminate in several social gains. Since recognising the vital role SMEs play in the economy and society, national governments are actively working to foster their growth. In order to foster financial growth, they have established policies and accompanying initiatives (Dey et al., 2019). While it's generally agreed that SMEs are vital to financial growth, many people overlook the fact that they also have a major impact on the ecology (Dey et al., 2019). Amidst this, the environmental initiatives that have been implemented by SMEs to this day have not delivered particularly outstanding outcomes, particularly when contrasted with those of big businesses (Jansson et al., 2017). It is critical for SMEs to make the shift from linear to circular business models as quickly as possible because these businesses are accountable for a significant portion of the world's emissions, consumption of resources, and production of waste (Prieto-Sandoval et al., 2019).

People, enterprises, and governments are being forced to reevaluate their associations with the natural ecosystem as a result of the extreme environmental, social, and monetary repercussions that have been posed by the stress of decimating natural assets, climate change, and ecological pollution (Prieto-Sandoval et al., 2018). Additionally, numerous nations have adopted the idea of the Circular Economy (CE) concept as a result of these problems (Singh et al., 2018), which has resulted in the development of new markets, the creation of new jobs, the decrease in material prices, and the improvement of the safety and reliability of supply chains (Kalmykova et al., 2018). One study by Organization for Economic Co-operation and Development (OECD, 2017) indicates that SMEs are “central to the efforts to achieve environmental sustainability

and more inclusive growth." Similarly, the CE presents a range of prospects for SMEs, including elevated status, decreased expenditures and increased profits, revitalisation of the local ecosystem, and sustainability (Del Río et al., 2016). Multi-National Companies (MNCs), who rely on SMEs as their tier I and tier II suppliers, should implement a CE model that has a direct impact on these enterprises (Mishra et al., 2022). However, SMEs often have inadequate scientific and monetary resources, and it is possible that they do not perceive CE as one of their preferences since they are unaware of the advantages that may be obtained via CE (Prieto-Sandoval et al., 2019). Many businesses are encountering difficulties in their day-to-day operations as a result of the rising trend for natural resources (Kumar et al., 2021). Products have limited lasting power on the market because of rising input costs caused by a lack of available resources (Preston and Herron, 2011). The advent of digital technology has made way for new possibilities for SMEs to innovate and thrive (OECD, 2019). Consequently, in order to facilitate their participation in CE-related projects, SMEs are embracing a variety of new technologies, such as blockchain and 3D printing (Chaudhuri et al., 2022). There is a wide range of how quickly SMEs are embracing digitisation (Eller et al., 2020). Due to the "ubiquity of non-proprietary technologies and open-access platforms" (Morgan-Thomas, 2016), SMEs now have an unprecedented opportunity to build up their technological infrastructure (Audretsch, 2015). Further, the use of digitalisation may be beneficial to CE enterprise paradigms because it can help to shut the loop, it can delay the material loop, and can narrow the loop with enhanced resource efficiency (Antikainen, 2018). Sustainable circular goods may be developed with the aid of digitalisation, and the participation of consumers is essential to the success of this strategy (Agrawal et al., 2021). Therefore, SMEs may begin the process of digitalising some of their business operations by using digital technology to alter their value proposition, value generation, and value capture methods, all while determining the appropriate scope and degree of digitalisation (Bouncken et al., 2019). However, studies have shown that SMEs have a harder time embracing new technology because they lack the resources, skills, dedication, and adequate knowledge of digital potential (Giotopoulos et al., 2017). To overcome these challenges, SMEs will need to develop a wide range of skills (Matarazzo et al., 2021).

In this sense, the previous discussion reveals that SMEs are in dire need of implementing CE practices due to the influence that their normal routine has on the environment. Additionally, CE helps SMEs obtain several advantages, and digitalisation has been recognised as a significant enabler for adopting CE practices in SMEs in recent years. Despite this, many SMEs have been unable to successfully implement and accept these efforts due to a lack of resources, expertise, and other possible obstacles. As a result, there is an urgent need to have an understanding of why SMEs are obliged to implement CE practices, as well as the potential elements that support and hinder the process of adoption. In addition, there is a significant topic that needs to be covered, and that is the role that digitization plays in all of this. There is no previous research that the authors are aware of that provides a discussion on this subject, to the best of their knowledge. Therefore, to propose a central focus of this article, the present study proposes the following research questions:

RQ1: How are SMEs acting towards CE practices and digitalisation?

RQ2: How is digitalisation involved in the association of SMEs and CE?

In order to respond to the aforementioned research concerns, the current investigation provides a comprehensive literature analysis of 92 papers that were taken from the Scopus database at some point between 2013 and 2022. The information was sent to 65 different reputable international journals. After that, a bibliometric and content analysis is carried out in order to extract the specific and particular information flow that is associated with the actions of SMEs in circular and digital contexts. The findings present a number of different themes for the behaviour of SMEs in digital and circular business models, together with the numerous factors that have an influence in this context. In conclusion, we have formulated a few research questions in order to further the field of discovery in this area.

2. Methodology

A systematic literature review (SLR) is supported by a rigorous and repeatable discovery and selection approach for the relevant literature, allowing users to engage in the sample development and assessment process themselves (Glock and Grosse, 2021). Over the course of the last few years, a number of different proposed approaches to SLR research have been published (Tranfield et al., 2003; Brocke et al., 2009; Durach et al., 2017). The SLR methodology for this research is based on the approach that was provided by Durach et al. (2017). According to Durach et al. (2017), the SLR should be conducted as follows:

- The research questions should be established based on their findings.
- After that, a sample of possibly related literature is identified.
- Then the necessary features of primary research are established.
- In accordance with predetermined criteria, only relevant articles are included in the review process.
- In the end, a summary of relevant literature is presented together with the associated findings.

The purpose of this article is to investigate the elements that influence the acceptance rate of CE practises among SMEs, as well as the causes that lead to its adoption, to better understand how these factors are related. In addition, it is intended to investigate the function that digital transformation plays in the context of SMEs and CE associations. In order to accomplish this goal, an SLR was carried out to investigate earlier studies. An exhaustive search and screening process, comprised of four stages as indicated in Figure 1, was utilised in order to guarantee that the research paper only incorporated the articles that were the most pertinent to the topic under investigation. Because it has a more wide collection of articles and provides more possibilities for searching for certain keywords, SCOPUS was selected as the database to perform the study because it was the most comprehensive alternative available. Also, Scopus combines machine learning with manual editors to produce complete author profiles. In doing so, Scopus is able to provide over 17 million profiles that facilitate author-level searches in the same manner that article-level searches do. Our SLR primarily focuses on English-language journal papers published between 2013 and 2022. Books, book chapters, conferences, and technical reports were excluded to keep the sample size modest. The keywords strings used for this research are *"circular" OR "circular supply chain"* OR *"circular economy"* OR *"digital*

technology" OR *"digital"* OR *"digital economy"* OR *"digital transformation"* AND *"small and medium enterprise"* OR *"SME".*

The results of this preliminary search brought up a total of 2473 documents. We were able to reject articles that did not pertain to the primary purpose of our research by employing a screening process that consisted of two stages, as shown in Figure 1. The research issue of this article review, which is centred on SMEs, required that studies addressing CE and digitalisation be taken into consideration as they are pertinent to the question. A total of 92 publications were taken into consideration for this research study after the application of criteria for inclusion and exclusion, as well as the reading of abstracts and titles of individual articles. The next section provides a description of the findings that were acquired throughout the process of reviewing 92 selected papers. These findings are presented in chronological order. Although a well-established methodology for doing research was utilised in this investigation, it is essential to highlight the fact that there are nevertheless some limitations. The search strings and search databases were used to compile the search results, which were then used to generate the findings of this inquiry. Because of this, the outcomes may turn out differently depending on the particular mix of search databases and keywords that are utilised. Second, the scope of this research was restricted to only include journal articles that were published between the years 2013 and 2022. If other sources of relevant literature or a larger time range had been taken into consideration, it is possible that the articles that were discovered might have been different.

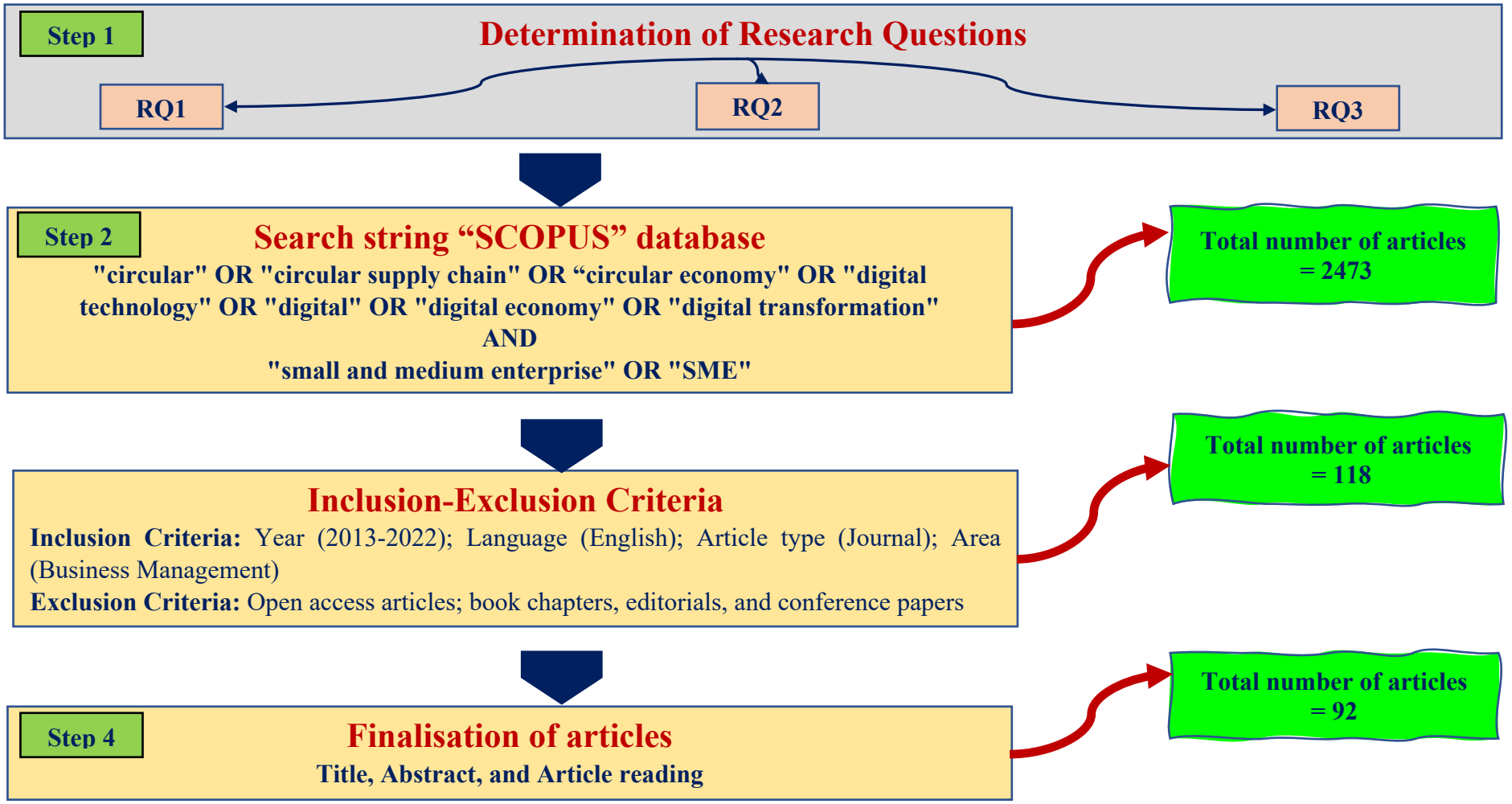

Figure 1: Methodology used to conduct a systematic literature review

3. Bibliometric results

The bibliometric findings are shown in this section in terms of the publishing origin, the publication time, the location of the first author, the most notable author (or authors), countries, and geographic area.

3.1 Publications fashion within the timespan

We have shown the year-wise publication relevant to CE and digitalisation focused on SMEs in figure 2. The number of overall articles published from 2013 to 2022 is 92. The fashion of published articles could be understood in two phases of timespan. The two-phase span is divided into a 50/50 ratio (50% timespan in the first phase and 50% timespan in the second phase as per the trend line). The first phase of the timespan includes the publications in the years between 2013 to 2017. In this phase, the trends of publications suggest that the authors were not very focused or aware of this relevance. Also, the trend indicates the low flame of publications in the concerned area. The total number of articles published in this timespan is 6 (6.52% of the overall publications).

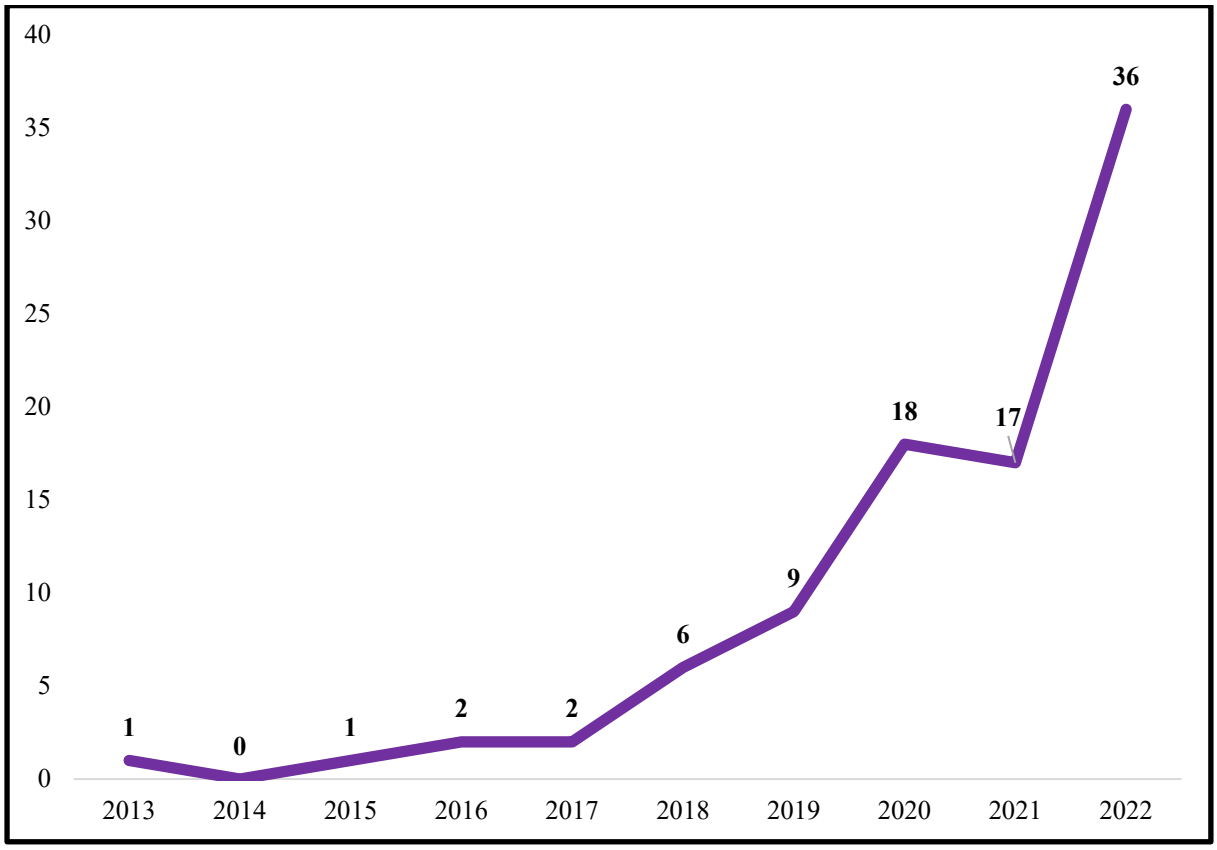

Figure 2: Year-wise publication trend

In the second phase (between the year 2018-2022), we have observed an outstanding growth in the publications of relevance area. The total number of articles published in this timespan is 86 (94.48% of the overall publication). The sudden growth of publishing articles indicates the huge awareness and need for academic research in this area. The nature of the trend line in this phase is an inclined curve, which indicates that there is a dire need to adopt the CE in SMEs with the cause of adoption. Further, it also indicates that the emergence of digitalisation is catalysing the whole phenomenon.

3.2 Journals and publishers' contribution within the timespan

Figure 3 illustrates the top academic journals where most of the articles of relevant study are published. There is a total of 48 leading journals which have published academic research on SMEs, CE, and digitalisation. We have shown only those journals in figure 3, which have published a minimum of 2 articles in the current setting. From figure 3, "Journal of Business Research" has been seen as the top journal with 26 papers published in the current search string. Apart from that, the "Academy of Strategic Management Journal", "Industrial Marketing Management", "International Journal of Recent Technology and Engineering", and "Quality - Access to Success" have been seen as pioneering journals in the relevant context.

Figure 3: Journals with two or more articles published

It is important to understand that, for any academic research, the publisher plays a crucial role in supporting and opposing. Therefore, we have presented the data treasure of published articles with respect to current research in various publishers' spaces. There is a total of 20 publishers have been identified while conducting the present research where the relevant articles are published. Figure 4 shows two giants (major contributors) of this publishing pool, such as "Elsevier" (30 articles) and "Emerald" (24 articles) are the topmost publishers for this research. Some other pioneering publishers in this area are "Routledge" (5 articles), and "Inderscience" (4 articles).

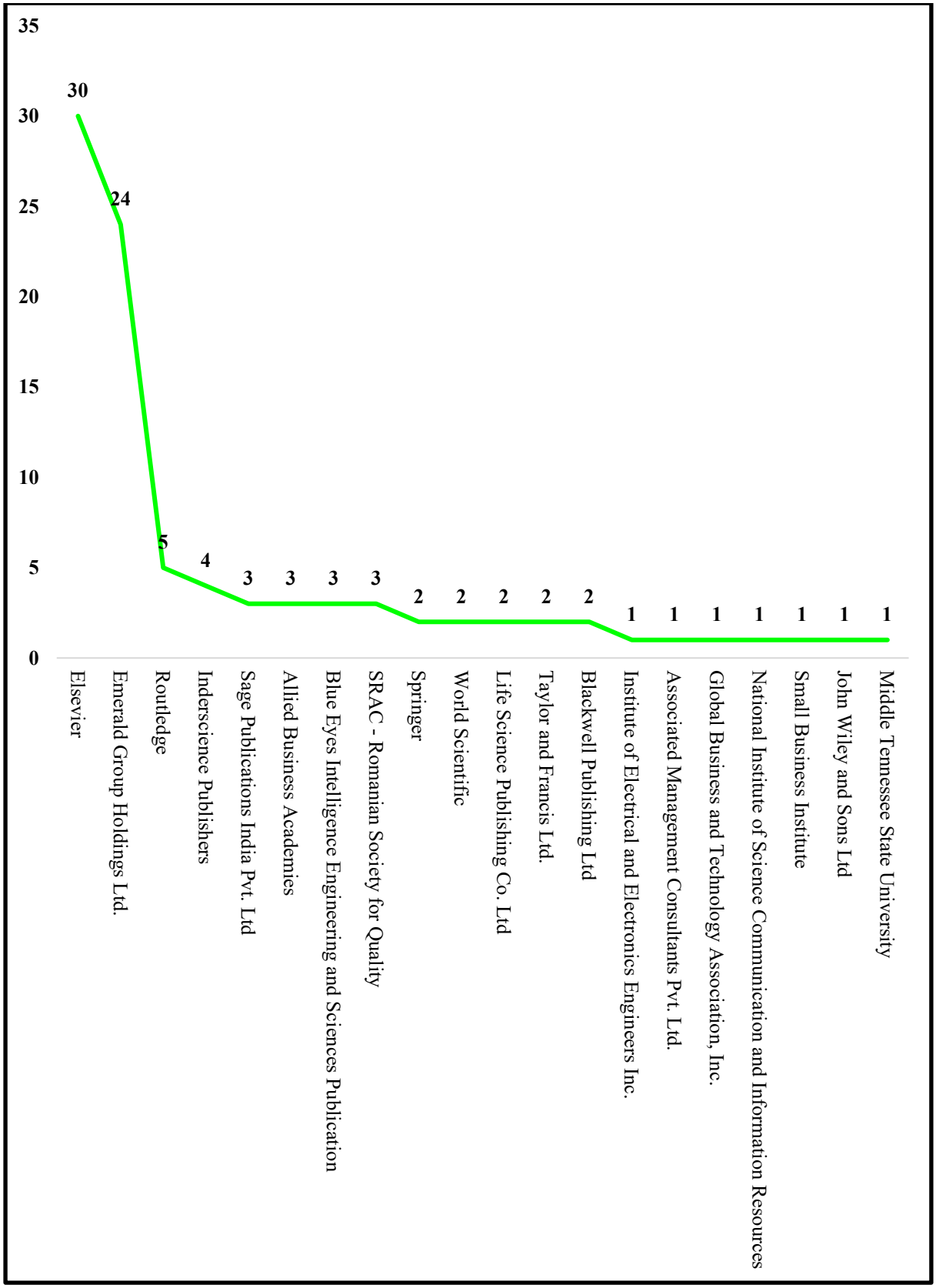

Figure 4: Publisher with number of articles

3.3 Prominent studies

After that, we have identified some of the top research in this area, which is presented in table 1. As the data are shown in table 1, the research of Scutto et al. (2017) has been found the most prominent study in this area with the highest citation of 193. Using structural equation modelling (SEM), Scutto et al. (2017) look into whether or not information and communication technologies (ICTs) with an eye on intra and inter-organisational processes lead to better innovation outcomes for SMEs. The study of Matarazzo et al. (2021) with 90 citations has also been identified as another prominent work in this area. The purpose of Matarazzo et al. (2021) research was to investigate how dynamic capabilities, as facilitating strategies, may encourage digital transformation by looking at their effect on customer value generation in the setting of Italian SMEs using a multi-case study approach. The work of Papa et al. (2018) with 75 citations has been identified as another promising study in the present search setting. The findings of Papa et al. (2018) suggest that social media might have a constructive effect on the knowledge generation operations of SMEs and perhaps aid in nurturing the innovation process. Another good work is done by Eller et al. (2020) with 63 citations, which explores the impact of digitalisation on SMEs' performance. The next prominent work has been done by Pergelova et al. (2019) with 59 citations, who look at how female-led SMEs use digital technology to grow internationally.

Table 1: Top cited articles

Author (s)	Title	Journal	Citation
Scuotto et al. (2017)	"Shifting intra- and inter-organizational innovation processes towards digital business: An empirical analysis of SMEs"	Creativity and Innovation Management	193
Matarazzo et al. (2021)	"Digital transformation and customer value creation in Made in Italy SMEs: A dynamic capabilities perspective"	Journal of Business Research	90
Papa et al. (2018)	"Social media as a tool for facilitating knowledge creation and innovation in small and medium enterprises"	Baltic Journal of Management	75
Eller et al. (2020)	“Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization”	Journal of Business Research	63
Pergelova et al. (2019)	“Democratizing Entrepreneurship? Digital Technologies and the Internationalization of Female-Led SMEs”	Journal of Small Business Management	59

3.3 Prominent countries and continents

Figures 5 and 6 depict the contributions in publications by worldwide countries and continents. As shown in figure 5, the topmost contribution has been offered by Italy and India with 35% and 23% of articles to the total articles within the period of 2013 to 2022.

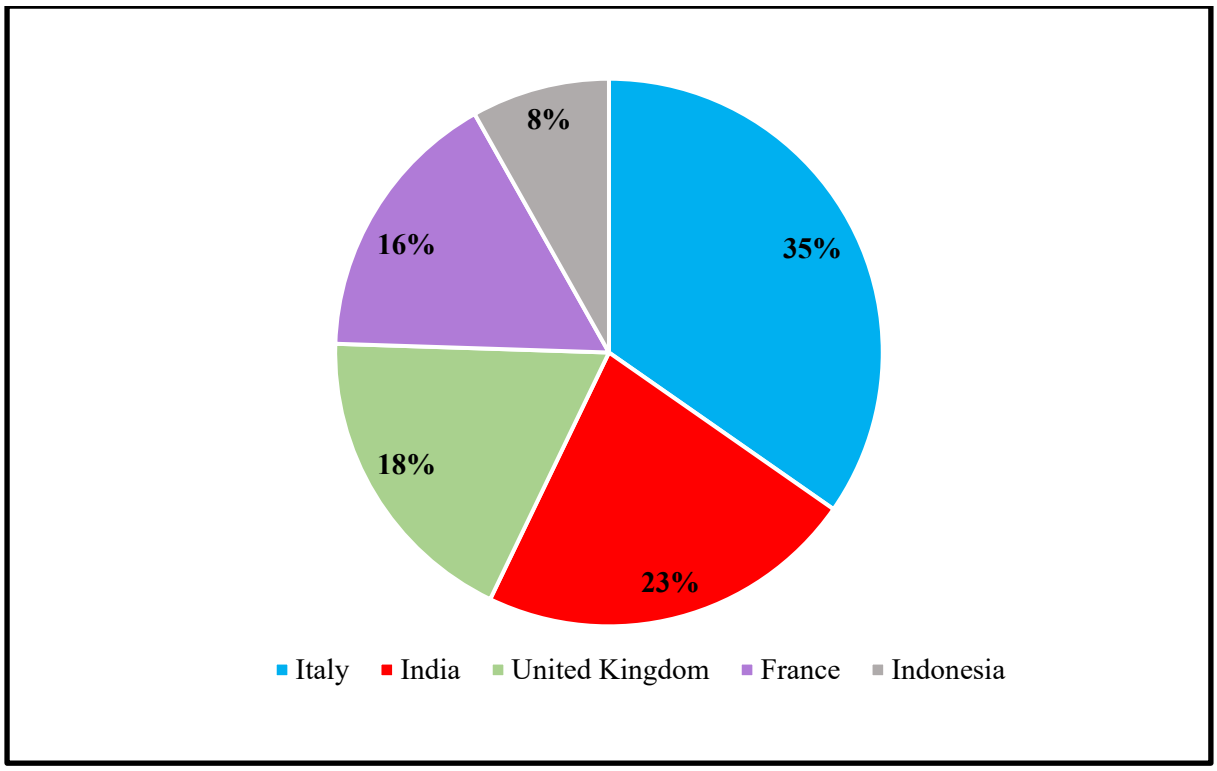

Figure 5: Contribution of top countries in articles publication

The other prominent countries that have contributed to the current study settings are the United Kingdom (18%), France (16%), Indonesia (8%), and Indonesia (8%).

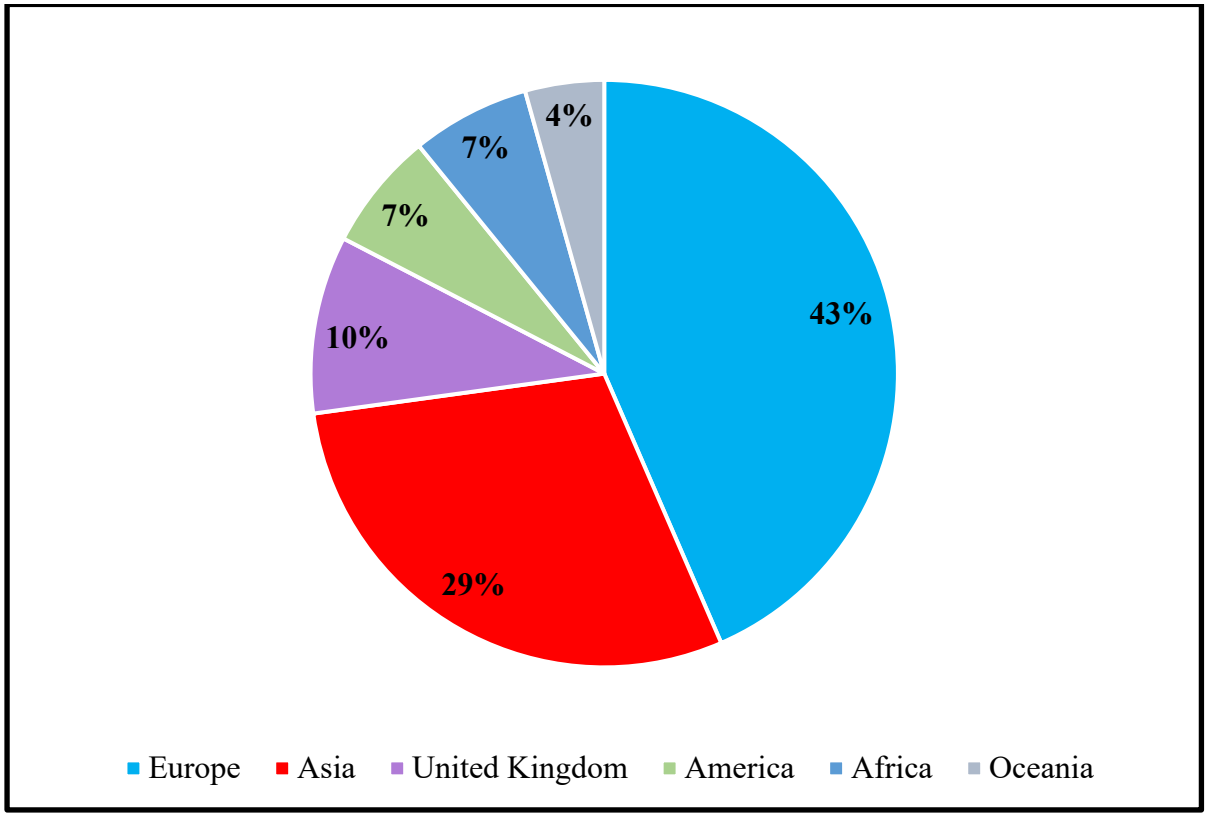

Figure 6: Contribution of different continents throughout the world in articles publication

Further, we have identified the continent-wise contributor in the publication of articles relevant to SMEs, CE, and digitalization. Figure 6 suggests Europe as the top publication contributor with 43% articles of the total published articles. The Asia continent has been identified as the second largest publication contributor in the current settings, with 29% of articles in the total articles. The other prominent continents that have contributed to the present keywords string are the United Kingdom (10%), America (7%), Africa (7%), and Oceania (4%).

3.4 Collaboration between authors and countries

Collaboration between a number of authors and countries has been another interesting statistic related to this study, which is discussed in this section. Figure 7 depicts the collaboration between the number of authors throughout the world who have contributed to publishing one article. This way, we have classified the data as articles published by one author, two authors, three authors, and four or more authors. In line with the findings, the results indicate that 48% of articles are published by the collaboration of four or more authors. Further, 26% of the total publications are contributed by the collaboration of three authors. Next, 17% of the work is published by the combined efforts of two authors. Lastly, only 9% of the publications are authored by a single author. The statistics suggest that there has been a growing pattern of collaboration throughout the world. It means, the researchers are now more interested in combined knowledge creation and sharing.

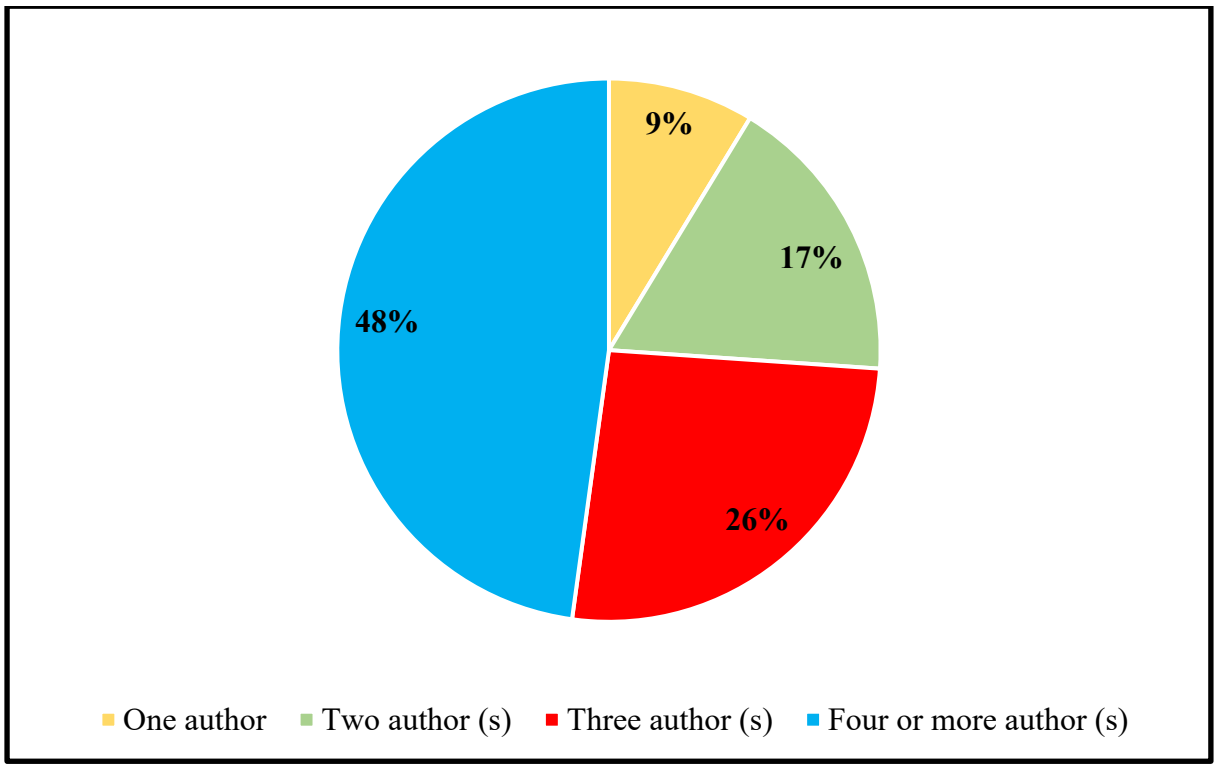

Figure 7: Author (s) collaboration worldwide

Figure 8 depicts the collaboration between different countries to publish a work. The findings of figure 8 indicate that 57% of work has been published by a single country. Further, 25% of articles are produced by the combined efforts of two countries, followed by 18% contribution by three or more countries' collaboration.

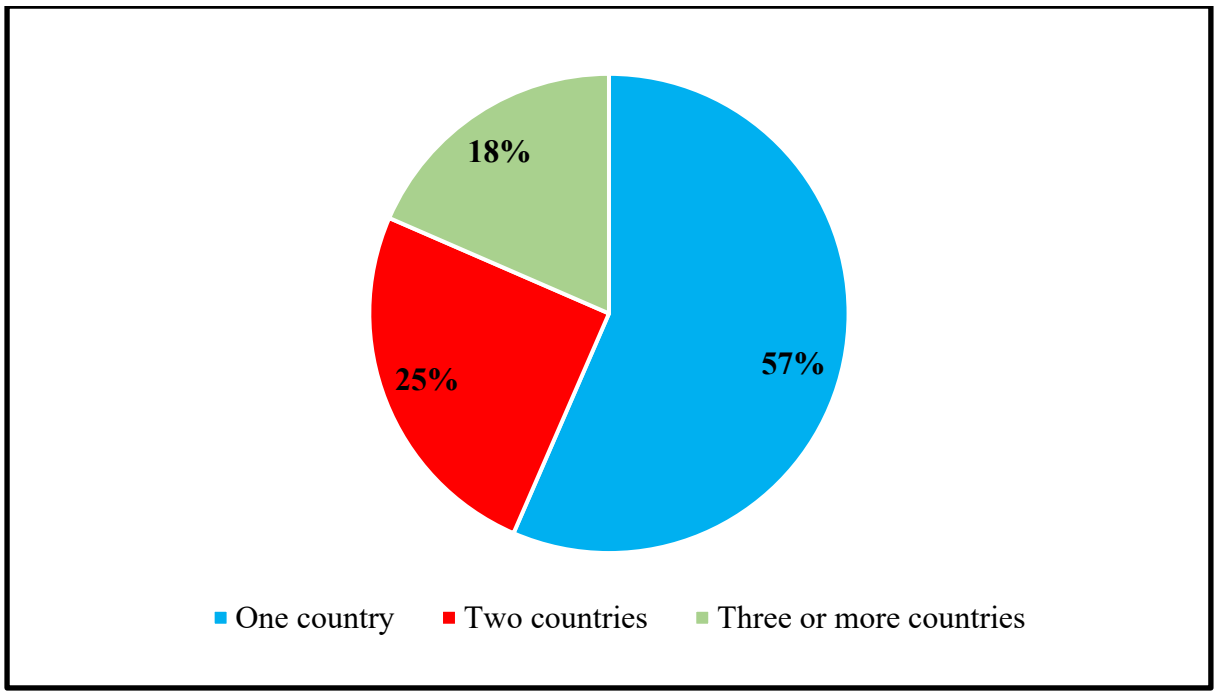

Figure 8: Nation (s) collaboration worldwide

4. Content analysis

We identified a considerable overlap in the total number of publications after conducting a thorough literature assessment of 92 sources. As a result of our analysis, we divided the articles into three clusters based on their shared characteristics. The clusters explain the relationships between the various factors that either speed up or slow down the spread of a given set of activities. In addition, the suggested study issues for future researchers in this area can be traced back to each cluster. The further sections also discuss the prominent studies of each cluster.

4.1 Cluster 1: SMEs to Digital Systems

Cluster 1 is the largest cluster of this study, which stores the 61 articles of the relevant study. The name of cluster 1 indicates why and how SMEs are shifting towards digital systems. One of the most prominent research, along with the highest citation of 193 on this cluster, was conducted by Scuotto et al. (2017). Scuotto et al. (2017) deployed structure equation modeling to determine whether or not SMEs can improve their innovation performance by utilising information and communication technologies that are geared toward intra-organisational and inter-organisational processes. The second most highlighted study of this cluster is given by Matarazzo et al. (2021), with recognition in 90 articles. Focusing on SMEs in the Made in Italy industries, their research employed a multi-case study approach to investigate how dynamic capabilities might serve as facilitating strategies to promote digital transformation and its attendant benefits for SMEs and their customers. The study of Papa et al. (2018) is another important work of this cluster with a citation of 75. The primary goal of their article was to examine the impact of SME social media use on the production of new knowledge and the development of new products. Using a user-centred, co-creation-focused strategy, their research has shown the concrete effects that social media can have on knowledge management and innovation operation. Eller et al. (2020) have offered the fourth most prominent study of

this cluster with a citation of 63. They examine the effects of digitalisation on the monetary effectiveness of SMEs and look at the roles that information technology, staff skills, and digital policy play in digitalisation. They also look at how much of a role digitalisation plays in linking assets to production. Another pioneering study of this cluster is given by Pergelova et al. (2018), where they look at how the emergence of digital media has impacted the global growth of SMEs run by females. Their study was recognised by the 59 articles. This way, this cluster is more focused on the intervention of digital technologies in SMEs to improve their performance and advance their competitive advantages. Further, table 2 highlights the future research directions needed to address the findings of cluster 1.

Table 2: Challenges and future research direction for cluster 1

Focus area of cluster 1	**Challenges for cluster 1**	**Research Propositions for the Future (RPF)**
The cluster discusses the need and trend of SMEs towards digitalisation.	A) Lack of awareness towards the adoption of digital technologies. B) Incompetent capital infrastructure to implement digitalisation. C) Differences in mutual consensus towards the adoption of digitalisation. D) Lack of patience to wait for the outcomes of digital practices. E) Fear of the side effects of digitalisation hinders the process of adoption and implementation.	**RPF1:** What can be done to increase employees' familiarity with digitalisation in the context of SMEs?
		RPF2: What measures could be made to lessen the initial financial outlay required to begin digitalisation?
		RPF3: How can SMEs' understanding of the benefits of digitalisation be raised?
		RPF4: How can the adaptability of digitalisation in SMEs be increased through policy measures?
		RPF5: Is there anything that can be done to alter SMEs' perceptions of digitalisation and make them more receptive to implementing it?
		RPF6: How to highlight the back-end business process while adopting and implementing digital technologies?
		RPF7: What steps must be taken for digitalisation to link local and global trade?

4.2 Cluster 2: SMEs to Circular Systems

Cluster 2 is the second largest cluster of this research, along with 19 articles in their storage. This cluster is more about the involvement of SMEs in circular systems. The most recent and prominent study of this cluster is conducted by Bag et al. (2022) with 10 citations. Their study investigates the factors that make it possible for SMEs to participate in the CE, with a particular emphasis on the connections among institutional stresses, eco-innovation, green supply chain management activities, CE potential, big data distribution networks, and effectiveness for CE distribution networks. Another prominent study was conducted by Pereira et al. (2022), where

they used two case studies to investigate the viability of CE practises among SMEs in the Indian Ayurveda sector within the context of the country's expanding market. The study of Malik et al. (2022) is another recent and prominent study of this cluster. Their study delves into the obstacles that SMEs in India have while trying to implement CE methods in the setting of India's growing marketplaces. They use a multi-case qualitative approach by conducting in-depth interviews with the CEOs and business proprietors of Indian SMEs, as well as CE intermediates and two major corporations, to determine the character and scope of significant obstacles to and facilitators of CE adoption. The study of Pashova et al. (2018) has been seen as another pioneering work of this cluster. Edible films in food technology are a particular area of interest for their research because of their relevance to contemporary issues in the economy and society. Instructions and suggestions for improving innovative models in the CE are summarised via a plot based on data from a study of customer perceptions regarding the usage of goods, which have edible films. Another masterpiece of research from this cluster has been offered by Ganeshan and Suresh (2017), who looked at a variety of manufacturing, pollution, machine failure, transportation, storage, and company performance indicators, including sales and revenue growth, to gauge supply chain operation enhancement. Therefore, the present cluster indicates how the pressure of improving performance through waste and pollution reduction can be seen in SMEs, and now, they are more into the adoption of CE practices, which are the ultimate solution to all these efforts. Finally, table 3 highlights the challenges faced by cluster 2, along with the future research directions.

Table 3: Challenges and future research direction for cluster 2

Focus area of cluster 2	**Challenges for cluster 2**	**Research Propositions for the Future (RPF)**
The cluster discusses the emergence of SMEs towards the circular economy.	A) The interest of SMEs is more towards profitability than environmental concern. B) Future benefits must be valued against existing expenses, information requirements, and pull and push influences in the market, which might be difficult to predict. C) Challenges exist in meeting customer expectations and the accessibility of technologies needed to produce environmentally friendly goods. D) SMEs are generally limited to monitoring only the developments in the supply network of the markets in which they participate. E) Insufficient available capital to enable the company to embrace circular procedures. F) The organisation has to devote a sizable quantity of resources,	**RPF8:** How can we better engage the supply and demand networks to promote the adoption of circular practices?
		RPF9: What sorts of measures are necessary to ensure a smooth financial transition for SMEs to a circular business model?
		RPF10: How might top executives play a vital role in easing and speeding up the implementation of circular processes inside SMEs?
		RPF11: In what ways may the company's "green mindset" be fostered?
		RPF12: To what extent can information exchange and awareness-raising be improved by the establishment of a regional or local ecosystem of SMEs and their supporting multipliers?
		RPF13: How to raise people's understanding of the advantages of having a "green" brand and also

	including time and money, to the implementation of circular procedures.	being identified as a "green" vendor by consumers as well?
		RPF14: What can be done to make eco-friendly SMEs more appealing to investors?

4.3 Cluster 3: Mutual intervention of digital and circular systems in SMEs

Cluster 3 explores the interactions of digital and circular systems in the setting of SMEs. This is the smallest cluster of this research, with a collection of 12 articles. The most pioneering research on this cluster is offered by Ardito et al. (2021), with a citation of 29. Their research analyses the synergistic relationship between digitisation and ecological approaches and their impact on the propensity of SMEs to innovate their goods and operations. The results of their research show that a focus on digitised and ecological factors directly impacts the success of goods and operation innovations. The study of Basu and Bhola (2016) is another important research of this cluster, which investigate the underpinning characteristics of situational quality management methods and their real impact or correlation with performance in the setting of Indian IT-enabled SMEs. The third most highlighted work of this cluster was provided by Bucci et al. (2018) with a citation of 26. Beginning in the year 2000, their article provides a global summary of precision agriculture's growth and current state. In discussing the current level of knowledge, the study reaffirms the need for technological advances in food production for the sustainability of agricultural systems. El Hilali et al. (2020) have offered another interesting work under this cluster. They have used Partial Least Squares Structural Equation Modeling and found that organisations' efforts to achieve sustainability are significantly influenced by the three drivers of digitalisation: consumers, information, and innovation. Further, they argue that firms may increase their commitment to sustainability by focusing on consumers, information, and innovation as part of their digital transition path. The study of Pelletier and Cloutier (2019) is another pioneering research of this cluster. They looked at how different groups within an IT ecosystem—one that includes business owners, IT specialists, and those who work to bolster the economy's social fabric—conceive of and approach IT-related problems. This way, the present cluster explores how digitalisation and circular principles interact with more emphasise on the sustainable parameter's adoption in SMEs. Further, table 4 explores the challenges for cluster 3 along with the future research directions drawn.

Table 4: Challenges and future research direction for cluster 3

Focus area of cluster 3	**Challenges for cluster 3**	**Research Propositions for the Future (RPF)**
The cluster discusses the mutual perception of circular and digital practices in the context of SMEs.	A) The interest of SMEs is more towards profitability than environmental concern. B) Most SMEs focus on either digitalisation or circular practices.	**RPF15:** What role might digitalisation play in making the circular business model more valuable?
		RPF16: How can SMEs maximise their gains from adopting integrated digital and circular business models?

	C) Lack of capital to adopt both practices as they demand huge investment. D) Lack of awareness towards the mutual benefits of implementing both practices. E) Don't try to envision the long-term goal of integrating digital and circular practices within the SMEs.	**RPF17:** To what extent do various company stakeholders facilitate the speedy and smooth implementation of circular and digital processes?
		RPF18: How can the adoption and deployment of various digital technologies be categorised and prioritised in accordance with the influence that they have on circular practices?
		RPF19: To what extent can digital technology be used through research and innovation to aid SMEs in implementing a circular business model?
		RPF20: How can an SME attain sustainability using digital and circular practices?

Further, Figure 9 illustrates the outcomes of various clusters identified during the content analysis of the present research. Table 5 offers the interpretation of coding used for different cluster outcomes in Figure 9.

Table 5: Coding interpretation of cluster framework

Clusters	**Cluster-wise coding**	**Cluster-wise coding interpretation**
Cluster 1	*O1*	Provide the scalability and adaptability that consumers need
	O2	Maximising the effectiveness of current operations
	O3	Expanding financial gains
	O4	Gaining exposure to a larger client segment
	O5	Improved firm management
	O6	Improvement and enrichment of existing abilities and knowledge
Cluster 2	*O1*	Long-term durability of material worth
	O2	Minimise waste to conserve materials
	O3	Reduce stress on ecosystems around the world
	O4	Lessen the need for new materials
	O5	Reduced cost of re-mortgaging
	O6	Lessen the likelihood of supply network interruptions
	O7	Minimise the pressure on SMEs to make do with ever-dwindling and costly assets
	O8	Strive for creativity and additional sources of income
Cluster 3	*O1*	Better innovative performance of products
	O2	Better loop closure
	O3	Decreasing material use and increasing material efficiency through resource conservation
	O4	More sustainable outcomes
	O5	Win based on cost, quality, and ease of use
	O6	Acceleration of the firm's circular performance
	O7	Allowing business models that are new and distinct
	O8	Improved productivity and competitiveness

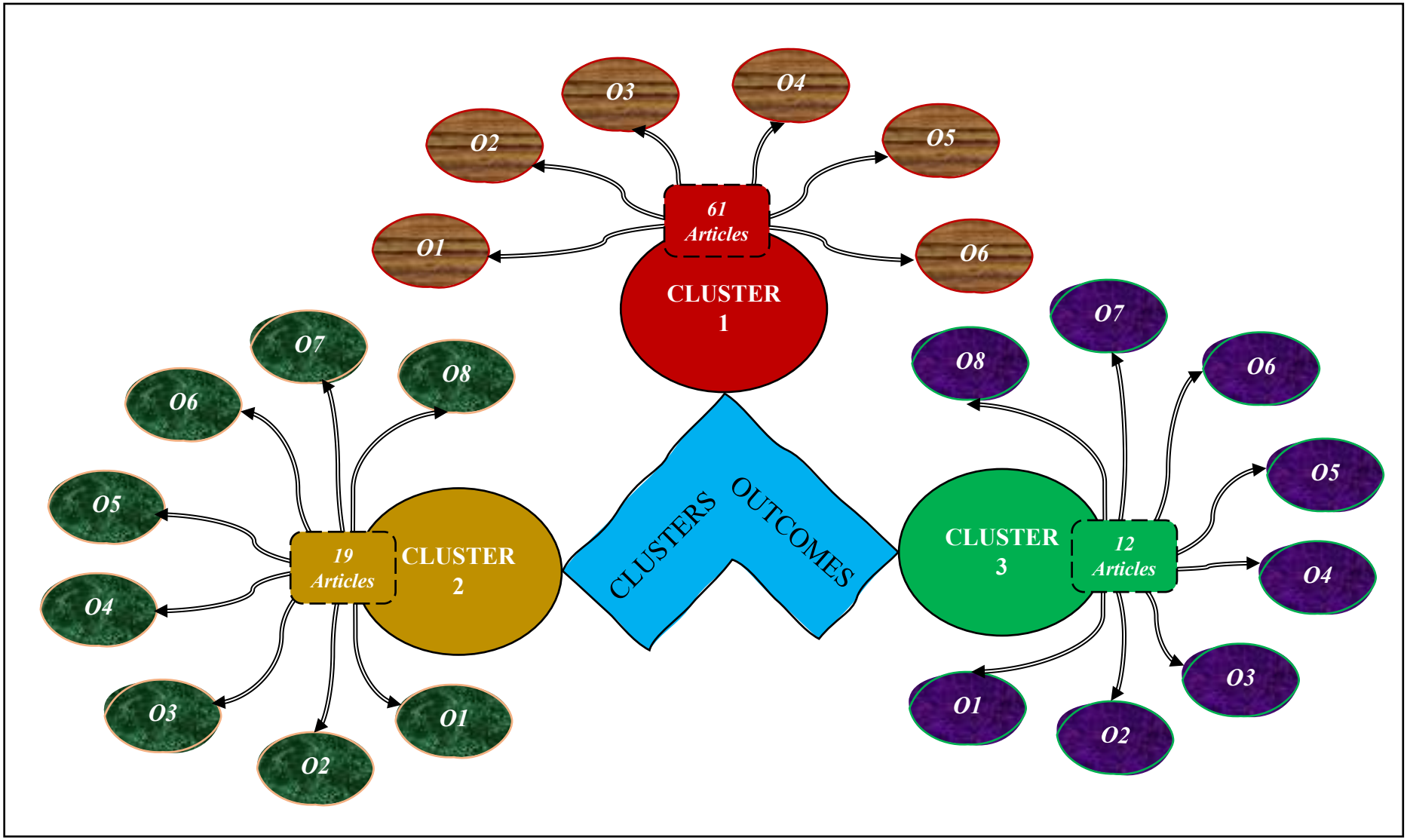

Figure 9: Cluster-based research framework

5. Discussion and implications

This article provides a comprehensive review of the literature by analysing 92 articles based on the individual and integrated influence of digital and circular business models on SMEs. There are now more ways than ever before for small and medium-sized enterprises to create and grow due to digitalisation. Since this is the case, SMEs are embracing new technologies to better participate in CE-associated activities (Chaudhuri et al., 2022). Embracing cutting-edge digital technology, digitalisation reimagines an enterprise's approach to planning, management, and growth in order to increase profits and add tangible value (Ravindran, n.d.). Further, businesses in the contemporary age of CE operate in a market that is more fluid, unpredictable, and dynamic than ever before (Singh et al., 2020). Therefore, this section offers a comprehensive overview of the emergence of CE and digital technologies to tackle the existing issues of SMEs. Also, a diagrammatic representation of this discussion is illustrated in Figure 10.

SMEs are the economic powerhouse and critical participants in steering economic growth into a truly circular model. Nevertheless, because of their small size, they confront particular hurdles in completing cycles and increasing resource efficacy. Although, SMEs are incompetent because of the many issues (enlisted in figure 10). To improve the competency and performance of SMEs, CE and digitalisation play an important role through their sole implementation or integrative efforts. During the literature assessment, we concluded that SMEs that adopt CE have a better chance of achieving several desirable outcomes, including improved brand reputation, lower operational costs, expanded business operations, increased productivity, and a restored environment as a result of decreased CO2 emissions (Prieto-Sandoval et al., 2018). SMEs can benefit from circular business models in several ways, including protection from supply chain interruptions, savings on warranties and operational expenses, and the pursuit of innovation and other revenue sources (UoB, 2021). For instance, the "Sustainable Synergies" project has enabled the sharing of unused resources, which has led to tangible gains including cheaper trash disposal and material sourcing. Innovative items, the development of fresh markets, and the cultivation of new types of customers all contributed to the increase in revenue (State of Green, 2017).

Knowledge of resource utilisation throughout the whole product lifecycle and value chain is crucial for taking advantage of the vast possibilities that the CE offers (EIT Climate-KIC, n.d.). The same is true for specifics on the materials used. The key to acquiring and making use of such data lies in its digitalization. Digital solutions can improve the efficiency and effectiveness of procedures while also providing real-time information about the position, state, and accessibility of an item. By doing this, businesses can improve the rate at which they retain value across all stages of product development, manufacturing, and customer interaction. For example, research on German companies shows that digitalisation makes it possible to measure how well resources are used and how much money can be saved (Neligan et al., 2022). With more digitalisation in efficiency measures, German companies may be more efficient with their use of resources, which can also improve the circularity of their business (Neligan et al., 2022).

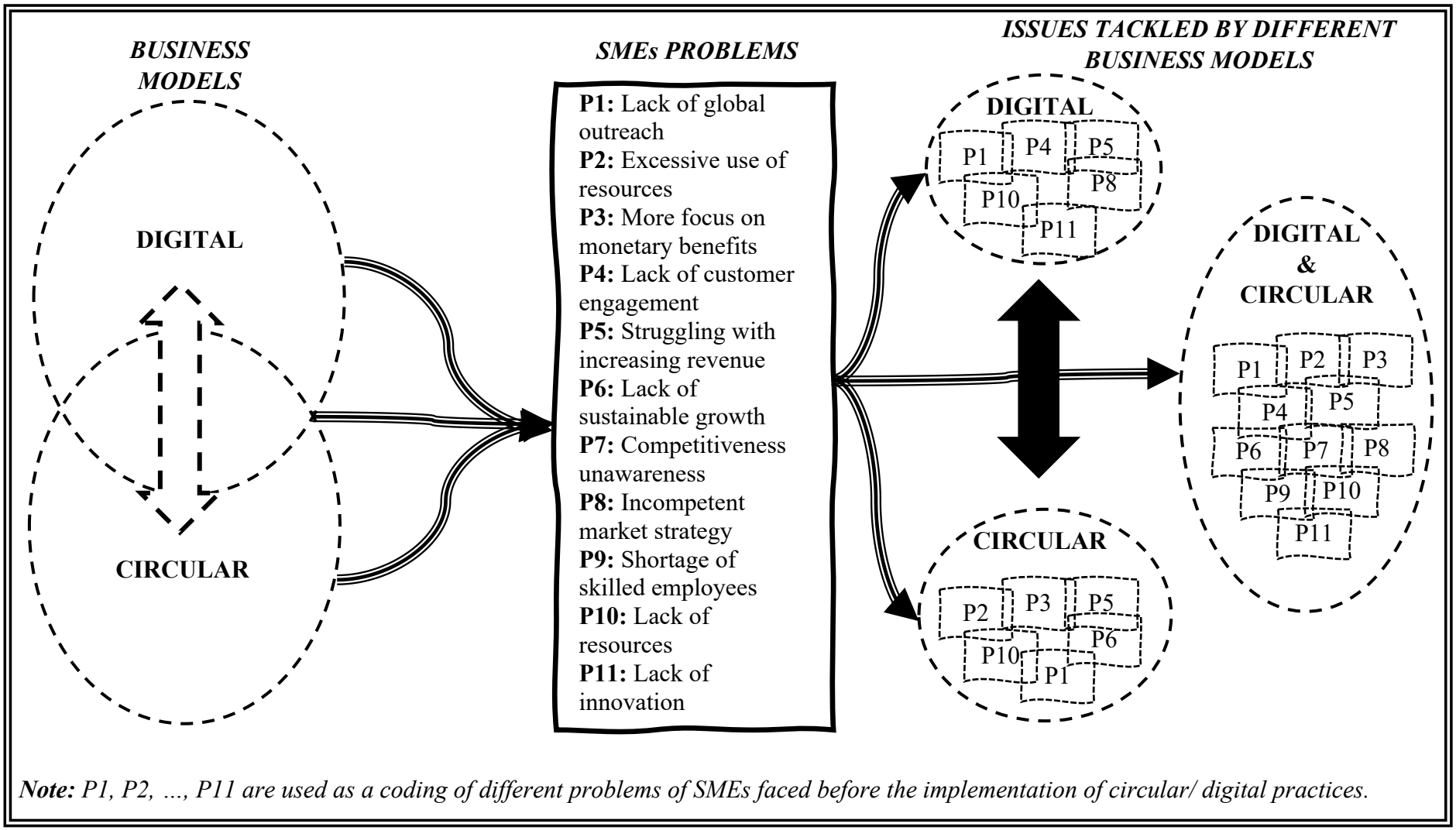

Figure 10: Research glimpse framework

In this way, the assessment of the literature indicates the greater benefits of adopting and implementing circular and digital business models together. However, there is no doubt of the fact that benefits will be obtained from individually deploying either the circular or digital business models. Nevertheless, there will always be limited advantages to adopting/ implementing a single model. Where CE enhances optimal resource consumption, digitalisation improves the performance of CE by offering actual and live information about the resources. The actual and live information of products and processes helps to improve the implementation of circular practices and deliver better outcomes. Therefore, SMEs should adopt and implement the circular and digital business models together, which will lead them to achieve more sustainable outcomes by complementing each other.

6. Conclusions

The current study is a synthesis of 92 papers that were identified and analysed to draw conclusions from the academic literature in relation to the direction of the digital and circular shift of SMEs. The current study identifies the leading authors, countries, journals, and geographic locations that have contributed to the academic literature. In addition, the study classifies the publications into one of three clusters based on the characteristics of their contributions to the field. The findings of this study cluster reveal how CE, or the characteristics of CE, are affecting the adoption of technological and managerial policies in order to maintain a competitive position in the market. In addition, the research emphasises how digitalisation is currently intervening in this process, which is simultaneously increasing the performance of SMEs along the supply chain. The benefits of implementing CE practises and digitalisation are prompting SMEs to establish policies that contribute to the promotion of CE and digitalisation inside SMEs. In the current study, we also investigate how the impact of digitalisation and CE can be seen in terms of innovation and environmental performance. According to the findings of the study, the combination of digitalisation and CE practises acts as a catalyst for the achievement of innovation and sustainability-driven results. In this manner, the current research provides an overview of digitalisation and circular systems as they pertain to SMEs. Finally, we have developed two frameworks (figure 9 and figure 10) based on the cluster outcomes and research glimpse. The use of a single database (Scopus) and the generalisation of digital technologies are two of the limitations of this study, in addition to the broad overview that is provided of the findings of this research. In subsequent studies, this obstacle might be surmounted by expanding the number of available databases while simultaneously narrowing the scope of digital technology.

Key Questions Reflecting Applicability in Real Life

1. How the collaborative and integrative efforts of digital and circular systems might deliver the competitiveness needed in SMEs of emerging countries like India?

2. Is it realistic to expect that circularity and digitalisation could help achieve some of the United Nations' sustainable development goals (SDGs), such as "responsible production and consumption," "climate action," and "sustainable cities and communities" at SMEs level?

3. What kind of technical and managerial shifts are needed in SMEs for more effective simultaneous application of circularity and digitalisation?

4. How might an improved circular-digital system in SMEs benefit from a more robust regulatory framework?

5. Is it possible to utilise this circular-digital integrated system as a template for future ecologically focused deliverables like net-zero digitisation?

Data Availability

Not applicable.

Code Availability

Not applicable.

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