A Systematic Review of Factors Influencing Digital Transformation of SMEs

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Abstract: With the development of Information and communication technology in recent years, digital transformation and technology adoption have become crucial factors for small and medium business sustainability (SMEs). Though large multinational companies are well advanced in the early adoption of digital technologies, SMEs are relatively slow in adopting new technologies for various reasons. However, they are either in the early majority or in the late majority stage of the technology adoption life cycle. Such digital transformation of SMEs is significantly different from the large multinational enterprises due to various internal-external, micro-macro, and socio-economic factors. The researcher's view also broadly differs. Hence, understanding the factors influencing the SMEs' digital transformation is crucial in strategic decision making of digital companies, developing digital policies, and free trade agreements of International trade in services by Nations. Therefore, this study presents a systematic review of research conducted in the past 20 years and identifies the factors influencing SMEs' digital transformation. One hundred seventy-eight research articles published in academic databases of SCOPUS and Web of Science were identified and reviewed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach. Managerial implications and further research directions in this domain were recommended from the research findings.

Keywords: Digital Transformation; SMEs; Systematic Review; Technology Adoption.

1. Introduction

Digital transformation is one of the critical drivers of economic growth (Hanafizadeh & Bohlin, 2020). Hence, the adoption of Information & communication technology and digital transformation of businesses have been comprehensively studied in academia. However, one core question of "what are the factors that influence the digital transformation of small and medium-sized enterprises?" remains unanswered in academic research. It is because of the complexity in defining small and medium-sized enterprises (SMEs). There is no global standard criteria and definition for SME. Though ideologically it differentiates micro, small, and medium sized enterprises from large enterprises, the criteria for classification is reached through several factors such as the number of employees, type of industry, investment, sales turnover and varies based on countries and regions (Ardic, Mylenko, & Saltane, 2011). However, small and medium-sized enterprises hold a substantial market share and play a crucial role in developing and developing nations' economic growth. For example, 99.6% of companies in the People's Republic of China and 99.8% of non-financial companies in the European Union are SMEs (SMEs in China: Policy Environment Report, 2019).

Hence, this research aims to

1. Analyze the evolution and growth of SME specific digital transformation research in business and management domains.
2. Classify the perspectives of researchers in assessing the digital transformation of SMEs. and;
3. Synthesis of the factors influencing the digital transformation of SMEs.

2. Research Method and Data Collection

This SME specific research is a subset of digital transformation research. A simple keyword search for "digital transformation" shows thousands of results in Scopus and Web of Science databases. However, the challenge of filtering out the SME specific research was first addressed. Upon various keyword combination searches and consulting with academic experts, the keywords "digital transformation" along with any one of the words "SME" or "Small and Medium Enterprises" were used to select the articles from both Scopus and web of science databases. However, this keyword search did not filter the articles based on industries or sectors. Because such generalization can help the researchers to identify the theme-specific evolution and synthesize the outcomes (Sharafuddin et al, 2020). Hence, this research adopts the keyword-based document selection for thematic evolution (Sharafuddin et al., 2020) and the PRISMA approach (Liberati et al; Moher et al, 2009) for reporting the document selection for the systematic review. The keyword search in the SCOPUS and Web Of Science databases for the past 20 years from 2001 to 2020 has revealed 210 and 54 research articles published, respectively. The database was downloaded in Bibtex format and further merged and processed using the Bibliometrix package (Aria et al, 2017) in R programming language (R Core Team, 2020) to identify and remove

the duplicate files. Thirty-two articles found both in Scopus and the web of science databases were identified and removed. Further, 19 documents, which were book chapters, book reviews, and news items, were filtered out, and the remaining 213 articles were taken for the preliminary study and bibliometric analysis of the research area. The Keywords for article selection were given below.

Table 1. Keywords used in Database Search.

Database	
1. SCOPUS	**(TITLE-ABS-KEY ("SME" OR "SMEs" OR "Small and Medium Enterprise") AND ("Digital transformation")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007) OR LIMIT-TO (PUBYEAR , 2006) OR LIMIT-TO (PUBYEAR , 2005) OR LIMIT-TO (PUBYEAR , 2004) OR LIMIT-TO (PUBYEAR , 2003) OR LIMIT-TO (PUBYEAR , 2002) OR LIMIT-TO (PUBYEAR , 2001)) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (PUBSTAGE , "final"))**
2. Web of Knowledge	TOPIC: (("SME" OR "SMEs" OR "Small and Medium Enterprise") AND ("Digital transformation")) Refined by: LANGUAGES: (ENGLISH) AND DOCUMENT TYPES: (ARTICLE) Timespan: 2001-2020. Indexes: SCI-EXPANDED, SSCI, A&HCI, ESCI.

3. The Scientometrics of Digital Transformation Research

3.1. Annual Scientific Production

The results' scientometrics shows that the annual scientific production in this domain grows at 80.53% and has seen a sharp rise since 2016. The concept itself started shaping in 2012 and started growing sharply since then. A remarkable volume of 53 articles in 2019 and 125 articles in 2020 was published. Thus, just these two years account for 178 articles out of 213 articles, which accounts for 83.5% of scientific production in the research area of the digital transformation of SME in the 21st century.
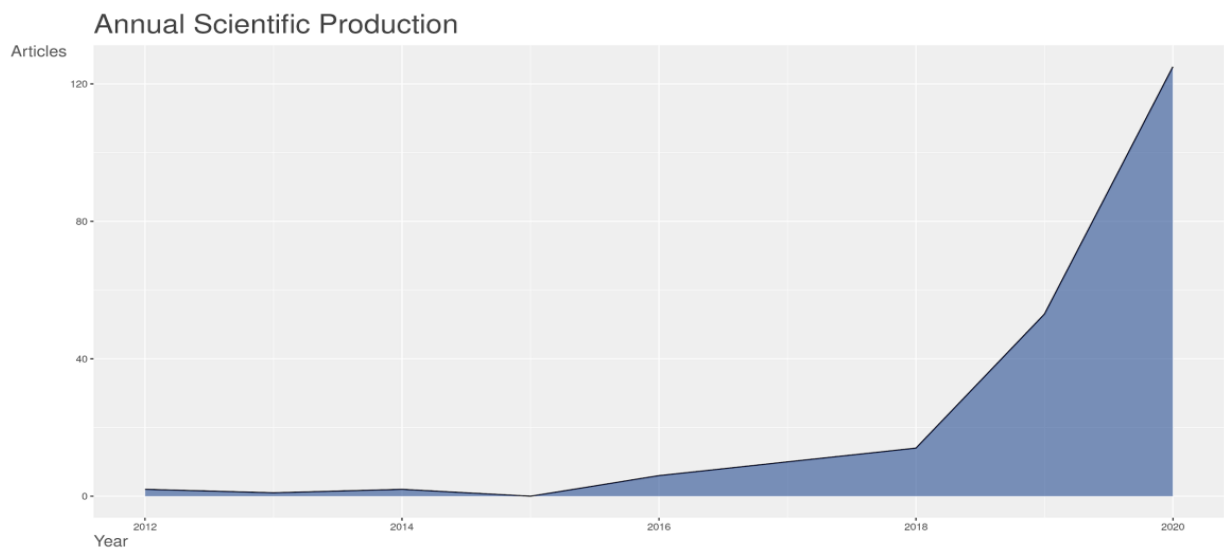

Figure 1. Annual Scientific Production in Digital Transformation Research

3.2. Most relevant Sources

The top 5 most relevant sources (Figure 2) in this research domain are Sustainability (Switzerland), International Journal of Information Management, Technology Innovation Management Review, Sustainability, and Applied Sciences - BASEL with 15, 6, 5, 4 & 3 articles, respectively. However, the total journal sources were 148, contributing to all 213 articles. Hence, Bradford's law (Bradford, 1934) of information scattering (Miller, 2015) was applied to identify the core source of knowledge in this research area.
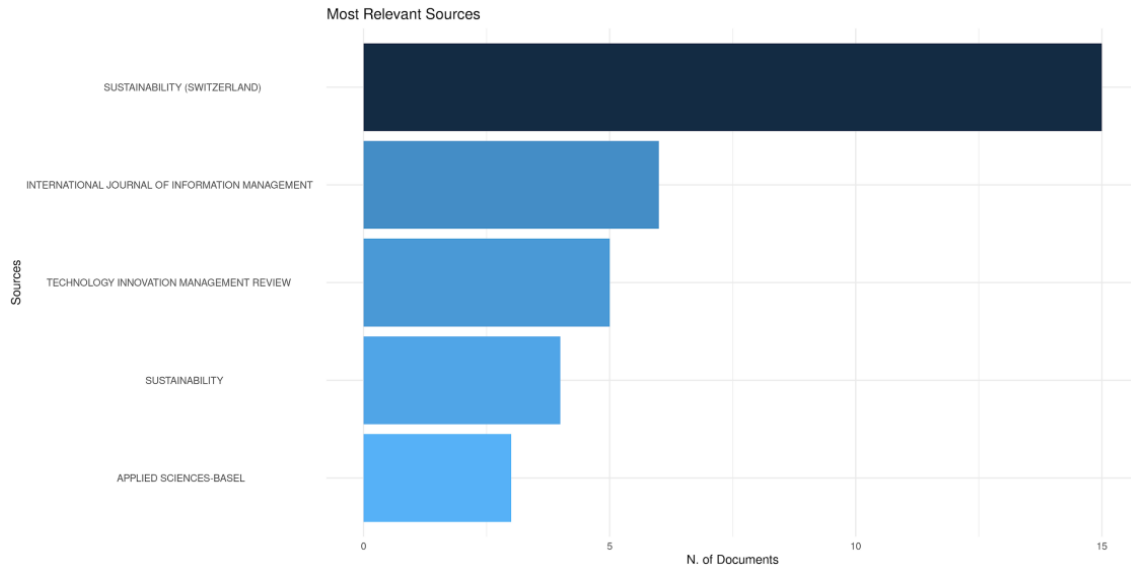

Figure 2. Most relevant sources of Digital Transformation Research

3.3. Core Source Clusters (Bradford's Law)

The results of the source clustering using Bradford's law revealed three clusters. The core source cluster consisted of 21 journals, followed by a second cluster with 57 journals and a third cluster with 70 journals. The results indicate that the information sources are highly scattered.
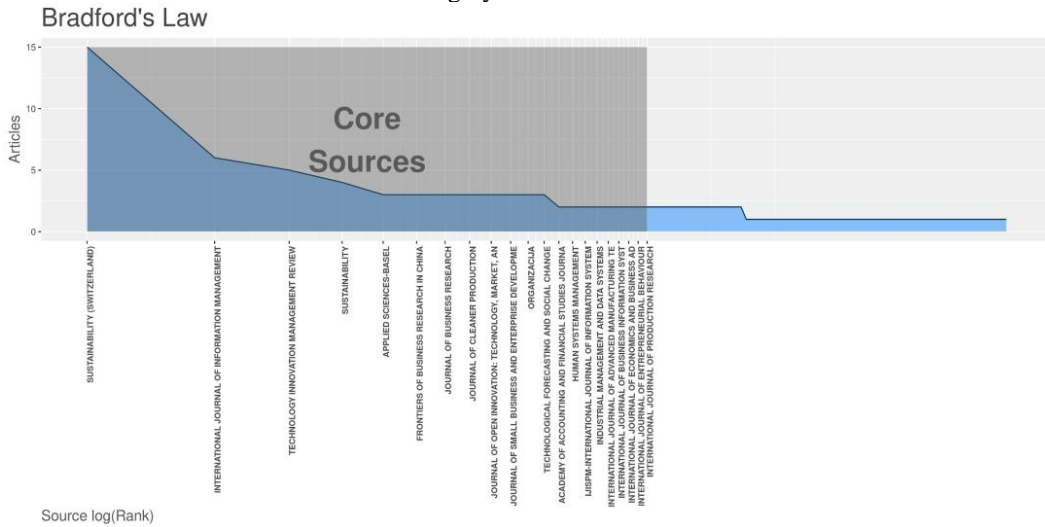

Figure 3. Core Source Clusters (Bradford's Law)

3.4. Author's Productivity (Lotka's Law)

Further, author productivity using Lotka's Law (Lotka, 1926) was analyzed to identify the authors' publication frequency in digital transformation research. The results (Figure 4, The Frequency Distribution of Scientific Productivity) conferred that 594 authors contributed one document each, 39 authors contributed two documents each, which is similar to the results as Bradford's law. The knowledge structure is also highly scattered. Only six authors were highly productive in this research area publishing three articles each.
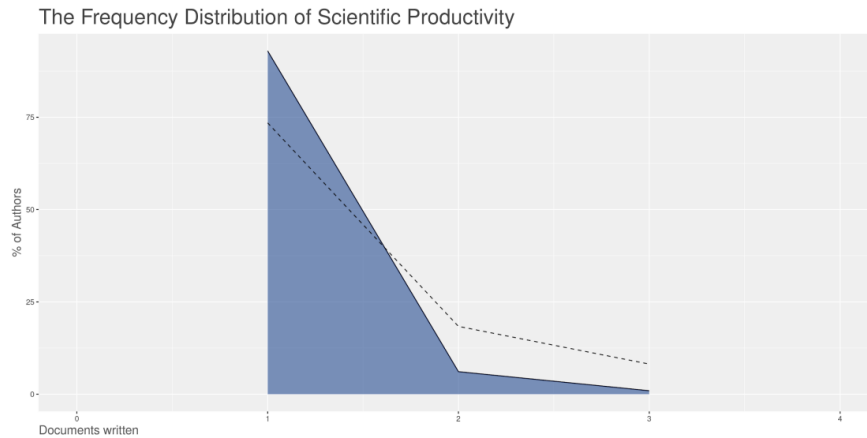
Figure 4. The Frequency Distribution of Scientific Productivity (Lotka's Law)

3.5. Country Specific Production

Country-wise classification of scientific production can give us precise cognizance of regional hotspots of SME specific digital transformation research. Hence country-specific scientific production was analyzed. The results affirmed that digital transformation research was published in 54 countries worldwide. However, (Table 2. Scientific Production by country) Italy, China, Spain, Malaysia, Germany, India, Indonesia, Portugal, Finland, and the United Kingdom were the top 10 hotspots of SME Specific digital transformation research as of 2020.

Table 2. Scientific Production by country (Top 10)

Rank	Country	Freq	Rank	Country	Freq
1	Italy	34	6	India	14
2	China	23	7	Indonesia	13
3	Spain	17	8	Portugal	13
4	Malaysia	16	9	Finland	12
5	Germany	15	10	UK	11

4. Thematic Evolution of Digital Transformation Research

The conceptual structure of research knowledge in a particular domain can be assessed using either the network approach or factor analysis. We applied the network approach with article titles as the field, 250 words with a minimum cluster frequency of 1-5 words per thousand documents, and inclusion index with a minimum weighted index of 0.1 as parameters. The network approach was adopted due to its strength in revealing the thematic evolution of research in this domain. The time slice's cutting points were carefully selected after considering the growth rate of annual scientific production in the field of digital transformation (Figure 5). We applied 2016, 2018, and 2019 as three cutting years, which revealed the thematic evolution in four durations, since 2012-2016, 2017-2018, 2019, and 2020.
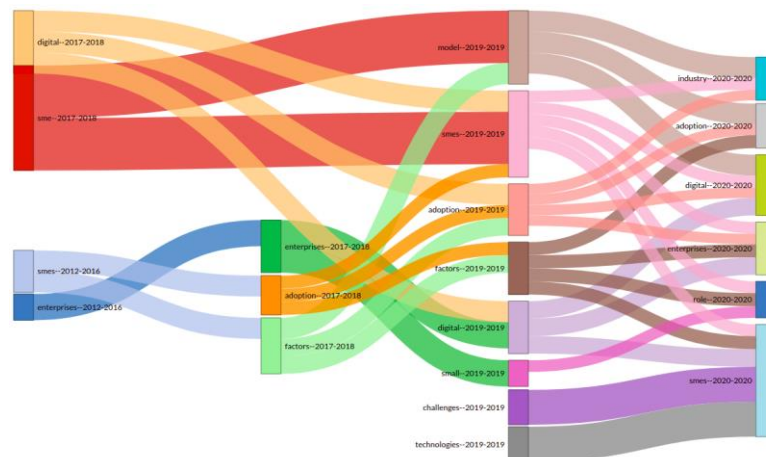

Figure 5. Thematic Evolution Map of Digital Transformation Research

The thematic evolution map revealed that the keywords "SME/SMEs," "digital," "enterprises" were the three different clusters in the 2002-2016 timeslice. Further, new themes such as "adoption" and "factors" emerged in the 2017-2018 timeslice. The core of the recent two years of digital transformation research remained the same as the previous years, but new keywords such as "model," "technology," "opportunities," and "challenges" emerged in the timeslice of 2019-2020. Thus, the new themes evolved in a brief period.

Each time slice's themes were clustered based on centrality and density using co-word analysis and mapped in two-dimensional diagrams. This approach will help to identify the (1) niche/specialized; (2) emerging; (3) basic; and (4) motor themes (Cobo et al., 2011). This approach can also help the researchers reconfirm the themes of articles selected for the study.
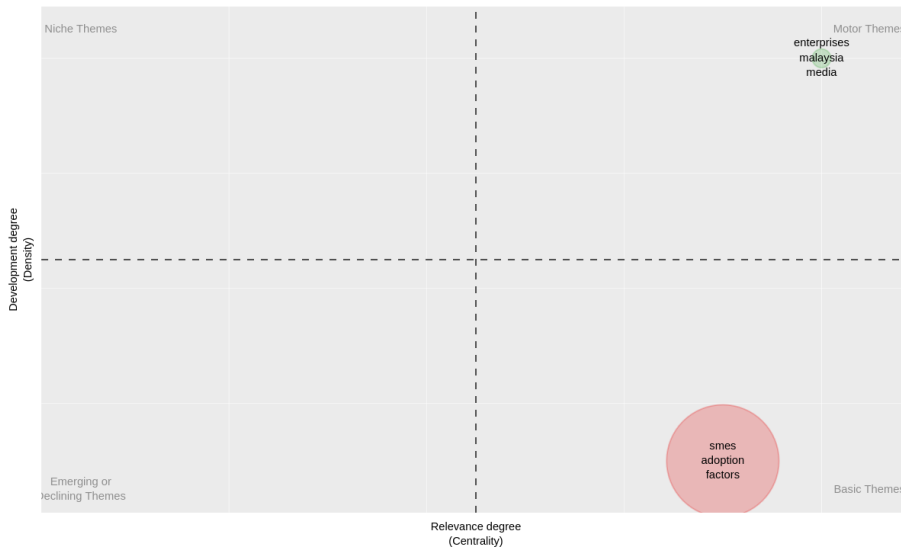

Figure 6. Thematic map of 2012-2016 Research in Digital Transformation of SMEs

In the first time slice of 2012 - 2016 (Figure 6), "factors" determining the "adoption" and related research were the basic themes. Whereas "social media" adoption was the motor theme. In the second time slice of 2016-2018(Figure 6), "SME" "adoption" of "Cloud computing" and "models," "frameworks," and "approaches" for assessing the factors have emerged into mortar themes. "Digitalization," of "SMEs," their "performance" during digital transformation and "industry," "capabilities," remained as basic themes during this time slice. This result is evident because the numbers in research outputs started increasing during this time slice. On the other hand, "internationalization," "opportunities," and "challenges" of "modern" "technologies" were niche themes. Furthermore, "social media marketing" and "blockchain" adoption-related research remained as emerging themes.
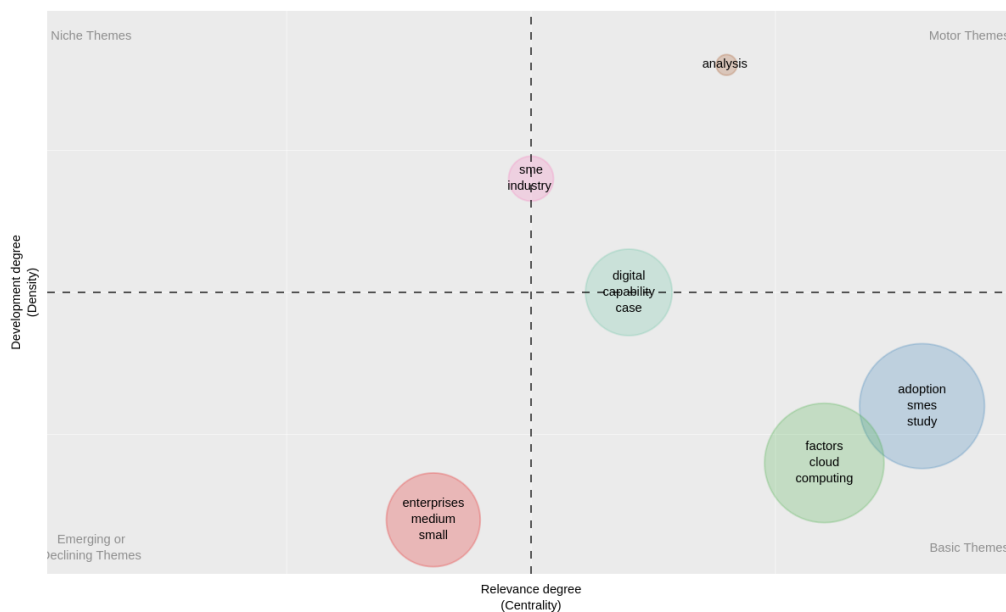

Figure 7. Thematic map of 2016-2018 Research in Digital Transformation of SMEs

In the third time slice of 2019 (Figure 7), "adoption" of "cloud computing" and "digital transformation models of SMEs in manufacturing sectors" were the two motor themes. The result means two different research clusters,

one for the digital transformation of the service sector and another one for the manufacturing sector, have emerged as mortar themes in this time slice. However, small and medium-sized enterprises' digital transformation capabilities, their perspectives, and business performance-related research were basic themes during this time slice. Whereas "International," "modern," "opportunities," and "challenges," related research remained as niche themes. "technologies," and related "experience" related research remained as emerging themes.
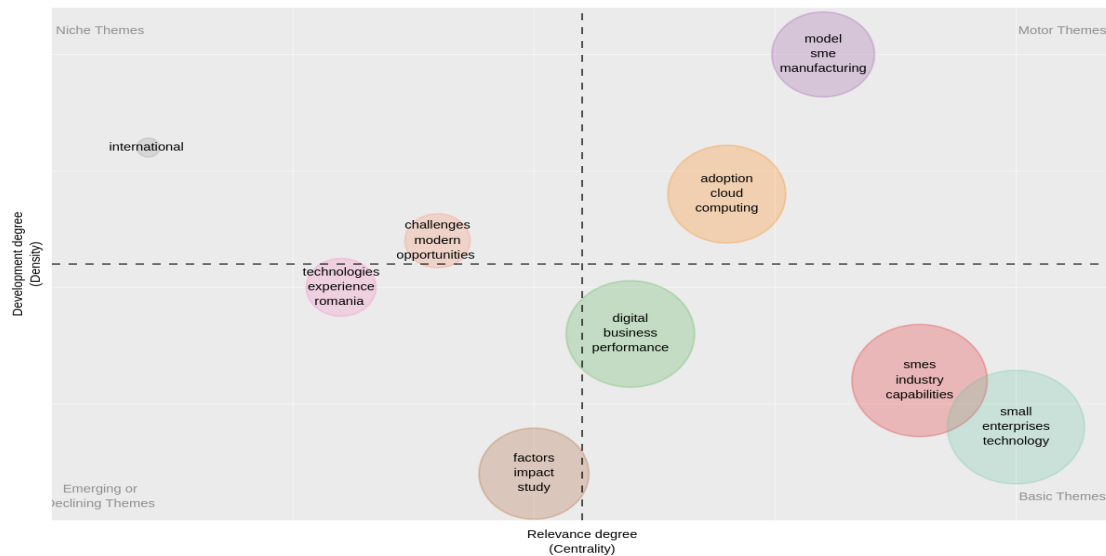

Figure 8. Thematic map of 2019 Research in Digital Transformation of SMEs

In the fourth time slice of 2020(Figure 8), digital transformation has become the motor theme. Studies related to adoption in the manufacturing sector and the role of technology in business sustainability has emerged as niche themes. Impact of Covid 19 pandemic on small and medium-sized enterprises, sustainability, digitalization, and management implications were the emerging themes. However, digital transformation-related process-implementation and performance challenges-related themes remained as basic themes.
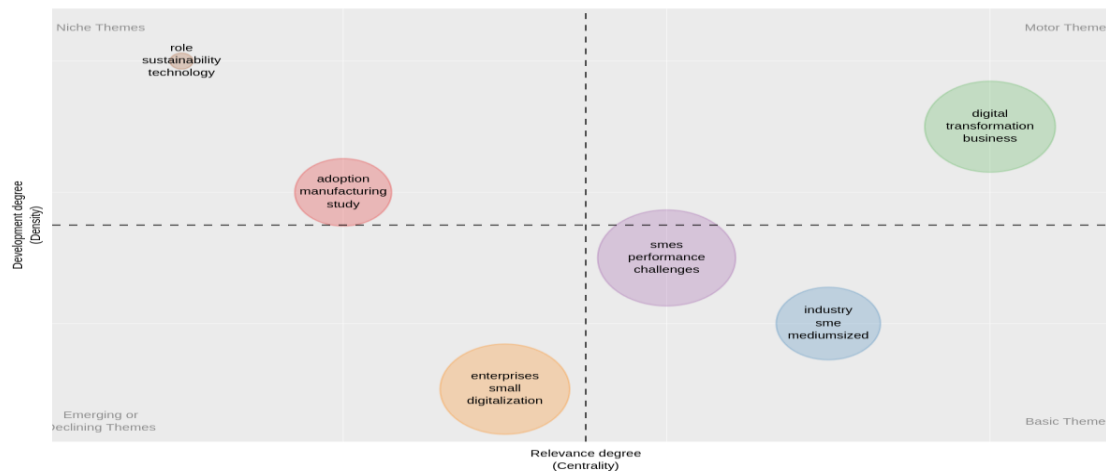

Figure 9. Thematic map of 2020 Research in Digital Transformation of SMEs

From all the above results, it is clear that research on digital transformation SMEs has gained momentum in academia since 2012 and become the motor research theme in 2020. Thus, we systematically reviewed the most influential articles with more than five citations contributing to this literature body.

5. Factors Influencing Digital Transformation of SMEs

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) is the most transparent method for reporting systematic reviews. We used articles with more than five citations as eligibility criteria to synthesize the knowledge structure of SMEs' digital transformation research. A total of 59 articles from the database were cited more than five times. Of those, 21 articles for which the full text is not accessible were excluded in the first round. The full text of the remaining 46 articles was thoroughly analyzed. 13 articles with "SMEs & large organizations," "medium & large organizations" as their study population was carefully excluded from the study, and the remaining 25 articles which focused only on the digital transformation of SMEs were

included in the final study (Figure 10). The following section presents the PRISMA model for the article selection and the results of the review.
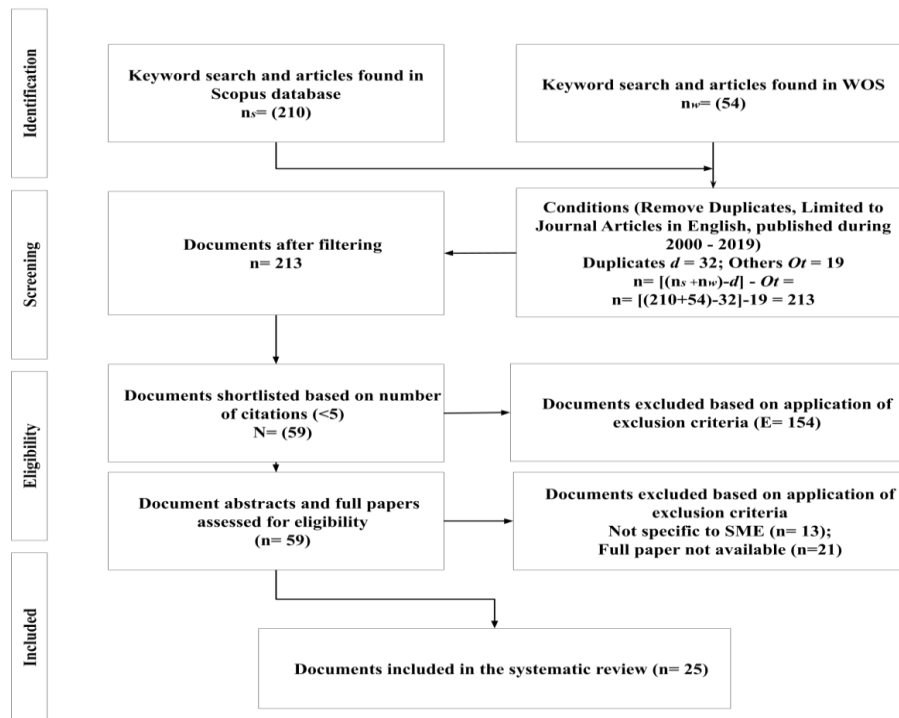
Digital Transformation - PRISMA Flow Diagram for Article Selection

Figure 10. PRISMA Flow Diagram for Article Selection

The population area of the SMEs is from Australia, Brazil, Central, and Eastern European (CEE) countries, Chile, China, Czech, Europe, France, India, Japan, Jordan, Malaysia, Pakistan, Poland, Romania, Saudi Arabia, Sweden, Taiwan, Turkey, UAE, UK, & USA. This result shows the rich diversity of research conducted worldwide in the digital transformation of SMEs. Moreover, the population size and research methods also differ vastly. From two SMEs (15 employees) with focus group interviews (Li et al., 2019) to a macro vision of 158,000 SMEs (Trașcă et al., 2019). Fourteen research articles focused on the manufacturing sector, and the remaining 11 research articles focused on both the manufacturing and service sector. The digital transformation of SMEs was seen from twelve different angles by the researchers. Hence digital transformation of SMEs can be achieved through either one or a mix of the following approaches: (1) cloud computing, (2) sterilization, (3) social media adoption, (4) social commerce, (5) E-commerce, (6) Block Chain, (7) Digital Platforms (CRM/SCM), (8) RFID, (9) Industry 4.0, (10) Portals (websites), (11) Accounting Information System & (12) Smart Manufacturing. Even though most of the technologies were under the industry 4.0 paradigm, it is impossible to look at them under one umbrella from a SMEs' perspective. Because Industry 4.0 is defined as "the digital integration of the production system with the company's business functions using self-regulatory sensor-actor networks (CPS) in combination with information and communication technologies" (Prause, 2019). On the other hand, the European Union identified using of (1) ERP (enterprise resource planning) software, (2) CRM (customer relationship management) software, (3) SCM (Supply chain management) software, and (4) RFID (Radio-frequency identification) technology, as four pillars of digitalization within SMEs. However, from the Asian perspective, SMEs' digital transformation may even be limited to adopting fundamental tools such as emails and social media pages. Still, SMEs are late adopters of digital transformation (Prause, 2019). This pattern is due to capital involved, limited human resources, and market uncertainty. In certain cases, the transformation was due to external pressure also known as bandwagon pressure.

5.1. Digital Transformation through Cloud Computing

In SMEs' Cloud computing transformation research, the modified three-dimensional (Technological, Organisational, and Environmental) TOE model adopted by Alshamaila et al. (2013) is one of the most influential articles and approaches testing the digital transformation of small and medium enterprises. The researchers found that the technological variables of "relative advantage", "uncertainty", "geo-restrictions", "compatibility", "trialability"; organisational variables of "organisational size", "top management support", "prior experience",

"innovativeness"; environmental variables of "industry", "market scope", "supplier efforts", and "external computing support" were the influential factors of digital transformation of small and medium enterprises through cloud computing. Hassan et al. (2017) also adopted the TOE model and found that only organizational (IT resources) and environmental (external pressure) were the significant factors for cloud computing adoption. However, the cloud computing variables were limited to only three variables: email, cloud storage, and web services for raw computing such as Amazon Ec2. This limitation of variables is evident because of the nature of the respondents. Most of the respondents were from the service sector. This research is one of the very few studies that focused on both manufacturing and service (65%) SMEs. Pathan et al. (2017) tested the TOE framework for SMEs' cloud computing adoption and found that international environmental pressure and top management strategic decisions were the critical factors determining SMEs' digital transformation.

5.2. Digital Transformation through Servitization

The second most cited approach is the servitization approach. This servitization approach is a broader approach accounting for the whole business process and is a dynamic resource-based view. Coreynen et al. (2017) developed a three-dimensional servitization model with industrial servitization, commercial servitization, and value servitization. The researchers assessed the capability requirements of small and medium manufacturing enterprises. The authors proposed back-end digitization and front-end digitization and classified the digital transformation levels into three: Process support services, process delegation services, and hybrid services.

5.3. Digital Transformation through Social Media

The third approach is the social media approach. Wamba et al. (2016) developed a parsimonious model with firm characteristics (Innovativeness & Size), manager demographics (Age, Gender, and Education), and Geographic location of small and medium enterprises. The research adopted a Global perspective and collected data from 453 Small and medium-sized enterprises from four different countries Australia (114), the United States of America (117), the United Kingdom (111), and India (111). The research found that Geographic location does not impact the digital transformation of small and medium enterprises through social media adoption. Also, at the firm level, the organizational size, innovativeness, and individual level, the manager's age were the most significant factors influencing the digital transformation of small and medium enterprises through social media adoption. However, the research was limited to the adoption of Facebook Pages for marketing and communication of SMEs. Ahmed et al. (2019) adopted the TOE model and diffusion of innovation model to analyze the impact of social media adoption on SMEs' performance in the United Arab Emirates. They found that more than 60% of the firms' social media utilization level was minimal. They used social media platforms mainly for marketing communication, and the influencing factors were only because of the Bandwagon effect. AlSharji et al. (2018) adopted the TOE framework and tested social media adoption by SMEs in UAE. They found that both organizational and environmental factors were the significant drivers of social media adoption by SMEs in UAE. AlBar et al. (2019) hypothetically tested the TOE framework in the Saudi Arabian SMEs population and found that organizational and environmental variables were significant. Abed (2020) also adopted the TOE framework and found that organizational and environmental variables were found significant. All the research articles published in the Arab regions reflects a similar result. The Manager / Owner in organizational factor and the Business partners/sector's pressure in the environmental factor shaped the digital transformation in this region.

5.4. Digital Transformation through e-Commerce

The fourth approach is a digital e-commerce platform approach. Li et al. (2018) studied the cross-border digital e-commerce service provider (Alibaba) role in transforming the small and medium-sized enterprises in China. The results concluded that, though SMEs initiated their digital transformation, the digital e-commerce service providers play a crucial role in the business success and sustainability through training, mentoring, and facilitating the SMEs. Grandón et al. (2018) adopted the theory of planned behavior from Ajzen (1991) and tested the differences between managers and entrepreneurs of digitally transformed and non-transformed SMEs towards e-commerce. They found a significant difference in innovation between the SMEs who already adopted e-commerce and SMEs who did not.

5.5. Digital Transformation through Blockchain Adoption

The fifth approach is through blockchain adoption. Wong et al. (2020) adopted the TOE model to identify the behavioral intention of Malaysian SMEs and found that the majority (73.2%) of the SMEs had either zero knowledge or just started learning about the blockchain technology and the "competitive pressure," "complexity," "cost" and "relative advantage" were the influencing factors for the behavioral intention towards the adoption of blockchain-based operations and supply chain management.

5.6. Digital Transformation through Digital Platforms

The sixth approach is through adopting industry-specific digital platforms. Cenamor et al. (2019) developed the modified platform approach to assess SMEs' financial performance and profitability through digital platforms. They divided the capabilities of SMEs into two. Platform capabilities and network capabilities and found that digital platforms transform organizational capabilities. The study also found the moderating role of exploitation and exploration orientations impacted the financial performance of SMEs.

5.7. Digital Transformation through RFID Adoption

The seventh approach can be through the adoption of RFID. Fosso Wamba et al. (2016) adopted the TOE model and tested the Radio frequency identification (RFID) technology adoption of SMEs from four different countries, India, Australia, the USA, and the Uk, with the industry sector and the country as control variables. Relative advantage, compatibility, and country were significant factors in the Radio frequency identification (RFID) technology adoption of SMEs. The authors also found that SMEs in non-metropolitan regions expressed more interest in RFID adoption than SMEs in metropolitan regions.

5.8. Digital Transformation through Adopting Industry 4.0 Technologies

The eighth approach of digital transformation of SMEs through Industry 4.0 is the most widely studied research area. Out of the 25 articles reviewed, eight articles were Industry 4.0 related research, and 1 article was near related but focused on smart manufacturing. Moeuf et al. (2020) used opportunities, risk, and critical success factors as assessing factors. They found that "low expertise," "strategy," "investment risk," "employees' fear of high surveillance" were the risk factors and "employee training," "feasibility study," and "data availability" as the critical factors for success. Türkeş et al. (2019) covered all industry 4.0 technologies, including digital technologies such as big data analytics, IoT, cybersecurity, and cloud computing and analyzed the perspectives of small and medium-sized enterprises in Romania and found that lack of understanding, knowledge and industry 4.0 standards were some of the barriers for digital transformation. Also, they found that the encouragement of implementing industry 4.0 technology is comparatively higher in micro and small enterprises than among medium-sized enterprises. Li et al. (2019) adopted the industry 4.0 maturity index of Schuh et al. (2017) and assessed SMEs' maturity level in Sweden. This article considerably differs from other articles because it focuses on human factors such as culture and organizational structure, information systems, and resources. Ingaldi et al. (2020) developed their open-ended questionnaire and used a mixed approach method to identify industry 4.0 adoption barriers in SMEs. They found that the narrow product portfolio, funding, and the turbulence state of micro and macro environments were the significant barriers of industry 4.0 adoption for Poland SMEs. Prause (2019) modified the TOE framework's technology variable into general technology and specific technology to identify the technology adoption levels based on the number of years for adoption. The author found that "relative competitive advantage" (General technological factor) and "top management support" (Organisational factor) as short-term and long-term influencing factors, respectively, for industry 4.0 adoption. He also found that "market uncertainty" (Environmental factor) was the significant barrier for adopting industry 4.0 technology in Japan's manufacturing sectors. Traşcă et al. (2019) comparatively assessed the digital transformation of Central and Eastern European (CEE) countries with Eurostat and European Union data and found that SMEs' digital transformation improves their productivity and export. However, this article's scope is limited to the technological dimension and does not include the TOE model's organizational and environmental aspects. Vrchota et al. (2019) developed a six-dimensional approach (1. Employees, 2. Process Management, 3. Know-how, 4. Machines, 5. External factors, and 6. Finance planning) for assessing the adoption of industry 4.0 in SMEs. The author's research revealed one of the crucial literature gaps missing in most of the studies. They found that the differences in digital transformation of micro, small and medium enterprises. The medium enterprises were expected to be early adopters (within the next five years), whereas the micro and small enterprises may be late adopters, or more than half of the enterprises do not plan to get digitalized. Benitez (2020) viewed the complexity of industry 4.0 and multiple players' role in offering solutions for SMEs' digital transformation. Hence, they developed a six-dimensional model based on social exchange theory with trust, commitment, reciprocity, power, value exchange, and rewards and adopted a case study approach to synthesize the role of actors in the whole ecosystem during three different phases of SMEs life cycle which are birth, expansion and leadership phases. The study stands unique from all other studies due to its broader perspective of the whole ecosystem's role in SMEs' digital transformation. The authors also insisted that each stage of digital transformation may need a complex set of players to support SMEs' digital transformation. Bouwman et al. (2019) viewed digital transformation as a process closely related to business model innovation and found that allocating more resources for new business model experimentation and strategy implementation practices can positively increase the overall firm performance.

5.9. Digital Transformation through Adopting Smart Manufacturing

The ninth approach, which is closely related to industry 4.0 is through smart manufacturing. We classified this as a separate approach because Mittal et al. (2020) adopted a process approach for the digital transformation of SMEs. They adopted a multiple case study approach and focused on the stages in the adoption of smart manufacturing by assessing different types of SMEs and found that five stages (1) Understanding the SME manufacturing data, (2) Assessing the readiness level of the SME, (3) Develop awareness, (4) vision, and finally (5) identify the suitable smart manufacturing tools and practices. Their study revealed that SMEs in developing countries like India are ready to invest in smart manufacturing tools and techniques. The cost of training the workforce and fear of losing the skilled workforce were major threats to the digital transformation.

5.10. Digital Transformation through Portals

The tenth approach is through websites and portals. Chen et al. (2016) examined the digital transformation of textile manufacturing firms in Taiwan. The approach was limited to the digital presence of the companies through websites. The authors assessed the Portal usefulness (Portal training, usage), portal interface (operational friendliness, industry benchmark information, bilingual Information), service-oriented portal function (portal maintenance and service, B2B function and cloud computing) on organizational performance (finance, customer, process, and learning) of SMEs. The authors found that B2B functionality and other service-oriented portal functions were significant digital resources supporting SMEs' digital transformation.

5.11. Digital Transformation through Accounting Information System

The final and eleventh approach is through adopting an accounting information system. Lutf et al. (2016) tested the TOE framework's applicability in understanding the factors that influence and affect the use of accounting information systems in small and medium-sized enterprises and found it useful in determining the variables.

From the above literature, the research constructs for assessing the digital transformation of SMEs research can be classified into (1) 3-dimensional T-O-E approach, (2) six-dimensional (1. Employees, 2. Process Management, 3. Know-how, 4. Machines, 5. External factors, and 6. Finance planning) Vrchota approach (Vrchota et al., 2019), (3) 6D social exchange approach (Benitez, 2020) and others. Researchers from different countries and contexts substantially tested the Technology-Organization-Environment framework. A detailed list of variables and significant variables from their results is provided in Table 3.

Table 3. T-O-E Factors influencing Digital Transformation of SMEs

Author	Technological	Environmental	Organisational	
Alshamaila et al (2013)	Relative advantage*	Competitive pressure	Size*	
	Uncertainty & Geo-restrictions*	Market scope & Industry*	Top management support*	
	Compatibility* & Complexity	Supplier Effort*	Innovativeness*	
	Trialability*	External computing support*	Prior IT experience & familiarity*	
Hassan et al. (2017)	Perceived Benefits	External Pressure*	Top Management Support	IT Resources*
	Customer Relationship	Market Influence	Investment Readiness	Hardware Compatibility
	Product and Service Improvement	Competitiveness	Competitive Advantage	Technology Infrastructure Readiness
	Reduce Operational Cost	Competitor Pressure	Implementation Readiness	
	Reduce manpower	Competitor Operations	Resource Support	
	ROI	Strategic Necessity	Clear understanding	
	Employee Productivity			
Pathan et al (2017)	Relative Advantage*	Regulatory Support*	Managerial Support*	

	Compatibility*	Competitive Pressure*	Firm Size*	
	Dynamic Complexity			
Ahmad et al (2017)	Relative advantage	Competitive industry*	Management support*	
	Compatibility	Bandwagon pressure*		
	Complexity	Competitive pressure*		
	Trialability			
	Observability			
AlSharji et al. (2018)	Relative advantage	Competitive intensity	Top Management Support	
	Compatibility	Bandwagon pressure*		
	Complexity	Competitive pressure		
	Trialability			
	Observability			
AlBar et al (2019)	Relative advantage*	Regulatory Environment*	Top Management Support*	Owner / Manager Innovativeness
	Compatibility	Competitive Environment	Organisational Culture*	Owner / Manager ICT Knowledge*
	Complexity			
Abed (2020)	Perceived Usefulness*	Consumer Pressure	Top Management Support*	
	Security concern	Trading Partner Pressure*	Organisational Readiness	
Wong et al. (2020)	Relative advantage*	Market Dynamics	Top Management Support	
	Complexity*	Regulatory support	Cost*	
		Competitive pressure*		
Fosso Wamba et al (2016)	Relative advantage*	Competitive Environment	Firm Size*	Manager Age
	Compatibility*	Firm Geographic location		Gender
	Complexity	Country*		Education
Prause (2019)	Relative advantage (Short Term)*	Market Uncertainty*	Top Management Support (Long Term)*	
			Championship	
Lutf et al (2016)	Relative advantage	Competitive Pressure*	Organisational Readiness*	
	Compatibility*	Government Support*	Owner/Manager Commitment*	
		Networking (Informal)		

* Influencing factors

6. Findings & Conclusion

Research on SMEs' digital transformation is steadily rising, and in 2020 it is a mortar theme. The Adoption of Industry 4.0 and other information and communication technology in the manufacturing and service sectors may be a global phenomenon. Nevertheless, in the case of SMEs, it is not. SMEs all around the world face different

challenges in digital transformation. On the other hand, digital transformation is becoming more and more crucial since 2020. Hence, the digital transformation of SMEs can be achieved through either one or a mix of the following technology/approaches (1) cloud computing, (2) servitization, (3) social media adoption, (4) social commerce, (5) E-commerce, (6) Block Chain, (7) Digital Platforms (CRM/SCM), (8) RFID, (9) Industry 4.0, (10) Portals (websites), (11) Accounting Information System & (12) Smart Manufacturing. The researchers widely adopt the "technology - environment - organization" framework for assessing various metrics such as intention, willingness, opportunities, and challenges of SMEs' digital transformation. However, new models for assessing the digital transformation of SMEs are also evolving.

7. Limitations

The keywords, articles from only Scopus and Web of Science were the major limitations of this research. Changing the keywords or adding articles from other journal databases may bring out different results. So, some of the conceptually crucial articles might have been missed unintentionally. However, the research objectives were accomplished with the documents shortlisted from the databases as mentioned above.

8. Research Implications and Further Research Directions

The research results are valuable for service providers, academicians, and researchers from all the mentioned 12 technologies / related services. The frameworks reviewed in this article can be adopted and modified to suit the industry-specific business cultural environments of different SME sectors and explore opportunities and challenges. As far as the T-O-E framework, it is a proven tool for exploring and identifying the underlying factors for SMEs' digital transformation. However, qualitative semi-structured interviews with the appropriate industry stakeholders must be conducted to develop/expand the dimensions/variables of the questionnaire. Further systematic reviews of differences between assessing the small, medium, and large enterprises will bring more insights into this research area.

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