

Study of Digitalization and Industry 4.0 Implementation in SME's

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Abstract: Industry 4.0 and Digitalization implementation in SME's is a very critical topic since the SME's are the economically important for Countries across the World. A search on google scholar yielded nearly 25000 papers from different parts of the globe on the Keywords such as "Digitalization, SME's and Industry 4.0". In this paper latest papers have been reviewed for Literature so as to identify the dominant barriers for the implementation of digitalization and Industry 4.0 in the SME's. The success factors are also identified so that it can lead to a reasonable conclusion for the SME's to implement Digitalization and Industry 4.0 particularly in developing nations. The present work is an attempt to review the available Literature as to how Fourth Industrial Revolution and Digitalization can revolutionize the SME's which are the Major Contributors to the economy of any Developing Nation.

Keywords: Digitization, Digitalization, Small and Medium Enterprise, Industry 4.0.

1. Introduction

The uncertain events in the year 2021 has created turbulence in the SME sector and survival of businesses became the biggest challenge (Ahmed & Sur, 2021). According to (Alraja et. al., 2021) the technological and the organizational factors mainly contributed to the adoption of digitalization by the SME's of Oman. Digitalization automates both the process and product which increases the demand and quality in SME's (Angadi et. al., 2023).

Industry 4.0 can customize the digital strategy of SME's thereby achieving growth and property as per the views of (Jagadeesh Babu, 2022). As stated by (Anindita Basu, 2022) digitization is a tool to improve profitability, innovation, efficiency, productivity and sales. The Digitalization of SME's is necessary for survival in the today's modern economy by the analysis of Developed and Developing Countries (Bogavac et. al., 2021).

(Ciurea et. al., 2021) has reasonably concluded that SME's must be central to the digitalization so as increase their goods and services thereby promoting a green economy. Organizational and Technical Barriers are the main type of barriers for digitization of SME's in developing and developed countries (Elhousseiny & Crispim, 2021). The Digital Transformation of Vietnamese SME's showed different influence on different SME's on the business development and the sustainability (Xuan Hoa & Thanh Tuyen, 2021). The use of IoT can be very useful for SME's and can be used to achieve higher productivity, traceability and documentation (Maria Huller et. al., 2022)

(Huria et. al., 2022), have reasonably concluded that SME's can be export efficient by digitalization when compared to the conventional SME's. The digitalization of the consumers is majorly driving the digitalization of SME's (Jha & Mittal, 2021). The SME's of Malaysia faced difficulty of finances, intense competition and cybersecurity issues. The Malaysian SME's lacks decision making and knowledge to promote digitization (Zhi Ji et. al., 2023).

The efficient use of the resources of SME's can happened due to digitalization. Digitalization of SME's can help them achieve improved performance and customer satisfaction (Kampoowale et. al., 2023). Greek SME's study has concluded that digital maturity, transformation to digital and digital business models are interconnected and are the success factors for digitalization, while shortage of finances, cultural issues and management will be the main barriers in the digitalization. (Kargas et. al., 2023)

The productivity improvement of an SME is achieved by using collaborative technology of IoT, block chain and Artificial Intelligence (Khan et. al., 2023). Information Communication Technology (ICT) and due to adaptation to Web Based Technology by Indian SME's has made it more competitive in the Global scenario (Khan & Trzcielinski, 2018). The policies of Government play an important role in enabling the digitalization of handicraft SME's which can affect the exports on a very large basis (Khatri & Kothari, 2020).

(Madhav Kulkarni, 2020) has identified Skill Gap, Technological Gap, Finance Gap and Structural Gap as some of the barriers for the digitalization of the SME's in India. Digital India, Digital MSME and Start-up India are the success factors to make the digitalization of SME's a success in India (Madhav Kulkarni, 2020).

The SME's nearly contribute approximately to 8% of the GDP of India but out of the 51 million SME's only 5-6% SME's in India have internet presence. SMEs in India have also been instrumental in providing employment opportunities in both rural and urban areas. The Indian government's initiatives like Make in India, Startup India, and Digital India

have been instrumental in providing various benefits like financial aid, technology, and infrastructure, which has led to their growth and expansion (Venkatesh & Lavanya Kumari, 2018).

(Maiti & Kayal, 2017) have reasonably concluded that the service sector and MSME's have improved largely due to IT and ITES which has digitized the operations. SME's must work for smart industry, smart innovation, smart supply chain and smart solution to achieve sustainability along with smart manufacturing (Sumon Roy, 2022). Malaysian SME's are short of finances, skilled manpower, absence of innovation and limited resources are the challenges for the adoption of Industry 4.0 and digitization of these SME's (Muhamad et. al., 2020).

Increased investment in modern technology, R & D, Digital Technology usage, human resource development, reduction in infrastructural gaps, eased business regulations and technology transfer are some of the success factors for the SME's digitalization (Sonia Mukherjee, 2018).

Publications on Industry 4.0 have increased largely since 2013 and in Europe the SME sector needs to be upgraded to Industry 4.0 so as to make it a competitive global market (Nowotarski & Paslawski, 2017). Digitalization offers global markets, efficiency gains and technology advancements. In the changing global scenario adaptability, innovation and strategic planning are the key requirements of the SME's (Panda & Panda, 2018).

The investments on German SME's to achieve their digitalization are highly fruitful as concluded by the case studies on 8 German SME's. The benefits revealed are revenue increase, customer satisfaction improvement, employee satisfaction, productivity and efficiency (Pfister & Lehmann, 2023). The Publications on the Digital Transformation of SME's continuously increased and the peak was in 2020 with nearly 119 published documents and maximum publications of 56 documents Germany happens to lead as per the published work on Digital Transformation of SME's (Pratama et. al., 2021).

Topic Modelling Approach was able to select 40 papers and using them it was possible to conclude that Digital Transformation enables Lean and Lean-Green and both of them improve the competitiveness of the SME's. Digitization has far reaching impacts on the base of pyramid segment of the people and the economic development has taken place after 2015 due to Digital India initiatives (Raj & Aithal 2018). A comparative study between SME's of Latin America and Europe has revealed that although the automation of European SME's is higher than Latin America but the employment ratio in Europe : Latin America is 12:5. This study reasonably contradicts the thinking that automation of SME's

will cause unemployment and for Industry 4.0 ready SME's the universities must change curriculum according to the requirement of the Digital SME's (Molina et. al., 2020).

Digital Transformation in developed nations is way ahead in the emerging economies and it is attributed to the key enablers both internal and external (Rassool & Dissanayake, 2019). Digitalization integrates the SME's and Firms of Low Technology into the Global Value Chains (Reddy & Sasidharan, 2023). The study of the Digitalization in the SME's of least developed countries like Yemen has concluded that the barriers like the lack of qualified staff, high internet costs, weak telecommunication infrastructure, limited financial, software and hardware resources, lacking of online payments and electricity deter the Automation of SME's (Saleh & Manjunath, 2020).

Digital Transformation of Indian MSME's have resulted in enhancing the operational efficiency whereas the challenges in adoption of automation like skill gaps, cybersecurity and infrastructure exist (Shah et. al., 2024). Digitalization has increased the growth rate of economy, increased employment and provides business opportunities for the SME's of Nigeria as conclude by the study done by (Shettima & Sharma, 2020). Industry 4.0 implementation by the SME's involves risks like readiness for technology, innovation and IT risks (Vytautas et. al., 2020). Indian SME's face many obstacles in adopting digitalization such as finance, cybersecurity, human resource, data privacy and regulatory restrictions. (Srivastava and Srivastava, 2023). There is a relatively low level of readiness among SME's for the adoption of Industry 4.0 which indicates that the manufacturing SME's potential can be tapped for innovating business models (Stentoft et. al., 2019). Workshops by R & D team for SME's have been instrumental for easy transition to Digitalization of SME's (Telukdarie et. al., 2023).The factors such as top management objective, IT security, human resource, infrastructure and technology are some of the factors for Malaysian SME's which determine the readiness for Digitalization (Wen & Atan, 2021). SME's must be ICT enabled and must be provided with financial support for ICT adoption to achieve digitalization (Tripathi & Ali, 2023). A comparative study between Value Stream Mapping and Digital Twin shows the benefits of digitalization of the production systems. Realization of Cyber Physical Production System in SME's creates an image of the production and aids data acquisition (Uhlemann et. al., 2017). German SME's are not aware of the Artificial Intelligence technologies and have not explored the relevance and potential of this upcoming technology (Ulrich et. al., 2021).S

Social Value and economic sustainability of the SME's got enhanced as concluded by a theoretical model after a detailed literature review of the Digital Technology of Indian

SME's (Vrontis et. al., 2022). Smart technologies happen to be important for the digitization of the supply chain of the SME's of Pakistan (Yasin et. al., 2022).

2. Methodology

The Table 1 depicted below is an analysis of the barriers and success factors in the digitalization of SME's from the relevant research papers in this study

Table 1 : Barriers and Success Factors in adoption of Digitalization of SME's

S.No.	Author & Topic	Year	Barriers of Digitalization	Success Factors of Digitalization
1.	“Effects of Demonetization, GST & Covid-19 Pandemic in the Adoption of Digitalization by Rural MSMEs in India.” Ahmed, S., & Sur, S.	2021	Government Policies Data Security Issues	E-Commerce Facilitation Ease of technology adoption
2.	“Towards SMEs' Digitization: The Influential factors from the Perspective of SMEs' Leaders.” Alraja, M. N., Hussein, M. A., & Ahmed, H. M. S.	2018	Stakeholders not inclined for digitalization i.e. Environmental Factors	Technology inclined top management. SME's owners inclination for investment in Digitalization
3.	“What affects digitalization process in developing economies? An	2021	Lack of Digital Infrastructure in the country. SME's owner	Technology savvy manpower

	evidence from SMEs sector in Oman” Alraja, M. N., Hussein, M.A.,& Ahmed, H. M. S.		unwillingness to invest in Digital Technology.	
4.	“Study on Role of Digitalization in the Growth of MSME in the present context” Angadi, A., Jayadatta, S., & Kodaganur, P. A	2023	Low level of awareness Lack of Talented People Unable to bear technology adoption costs	Indian Government Initiatives like E-Governance, Udhयोग Aadhar, Virtual Cluster etc.
5.	“Impact of Industry 4.0 on Sme’s Digitalization in India” Babu, A. J.	2022	Lack of Practiced Labour Perception of Job Loss due to AI implementation No proper strategy	Digital Infrastructure Low cost Internet Coaching and Capability Building
6.	“The Extent of Digitization of Small and Medium Enterprises in India and its impact on Growth” Basu, A.	2022	Lack of IT Infrastructure SME’s not having required Hardware Internet Facility not popular Lack of Awareness of AI	IT manpower availability Online Sales Websites Information Management
7.	“Digitalization of SMEs In	2021	Lack of Digital	Intensified development of

	Developing & Developed Countries” Bogavac, M., & Cekerevac, Z.		Infrastructure Lack of trained manpower	IoT High Speed Internet Ex. 5G
8.	“The Influence of Digitalisation on SMEs” Ciurea, J., Dinu, L., & Dinu, G.	2021	Innovation	Competition of goods and services Digitally trained manpower
9.	“SMEs, Barriers and Opportunities on adopting Industry 4.0” Elhusseiny, H. M., & Crispim, J.	2022	Lack of capability Cyber security Skilled managers High investment costs Lack of training Lack of data integration Privacy Concerns Lack of R & D activities Lack of experience Lack of experts Lack of Management Support Fear of Change Lack of Government Support Lack of ICT infrastructure	Smart Manufacturing Cost Reduction IT integration
10.	“A model for assessing the	2021	Rejection of new technologies by the	Innovative Leadership

	digital transformation readiness for Vietnamese SMEs.” Hoa, N. T. X., & Tuyen, N. T.		workers	
11.	“How to implement IoT in an assembly line–A training module to support the digital transformation in SMEs” Hulla, M., Rüdeler, K., Herstätter, P., & Ramsauer, C.	2022	Less resources in SMEs Shortage of trained personnel	Dedicated Top Management
12.	“Digitalization and Exports: A case of Indian Manufacturing MSMEs” ‘Huria, S., Sharma, K., Jain, N., & Jose, A.	2022	SME’s lack Digital Penetration Regulatory simplification Exclusion of needy firms in Government Schemes	Embracing new technologies Enhanced Networking Greater Policy Intervention
13.	“Digitization and Industry 4.0 practices: an exploratory study on SMEs in India” Jha, P.	2021	High Cost of Online Facilities Unawareness of Manpower Towards Digital Platforms	Government Schemes like Startups, Digital India provide the required environment for the Digital Transformation
14.	“Digitalization and its Impact	2023	Financial Difficulty Cybersecurity Threats	Increasing innovation ability

	on Small and Medium-sized Enterprises (SMEs): An Exploratory Study of Challenges and Proposed Solutions” Ji, G. Z., & Singh, J.		Intense Competitive Forces	Digital Economy Blueprint Digital customer experience
15.	“The Role of Digitalization on Manufacturing SME Firm Performance in India” Kampoowale, I., Singh, H., Sakka, A. A. B., Iwuchukwu, E., & Al-Shaikhli, E. A. A.	2023	Lack of Human Capital Skills	Digital Supply Chain
16.	“Digital Maturity and Digital Transformation Strategy among Greek Small and Medium Enterprises” Kargas, A., Gialeris, E., Komisopoulos, F., Lymperiou,	2023	Lack of Funding Cultural Issues Top Management Issues	Stakeholders perspective who enable the digital transformation process Digital Maturity Technology Training

	A., & Salmon, I.			
17.	“Information technology adaptation in Indian small and medium sized enterprises: opportunities and challenges ahead” Khan, I., &Trzecieliński, S.	2018	Lack of Digital Infrastructure Financial Restrictions Technology Weakness	ICT Readiness of Indian SME’s Adaptability of Web Based Technologies
18.	“Handicraft Smies And Digitalization: Results From Recent Literature” Khatri P.	2020	Low awareness of digital benefits Lack of Digital Knowledge Limited Internet Infrastructure Weak Cyber Laws Security Issues Lack of guidance and resistance Consumer psyche Investment Issues Language Barriers	Government support policies Digitalization training Management Commitment on digitalization
19.	“Research Paper on the Need for Digitalization of Smes in India” Kulkarni, M. A	2020	Skill Gap Technological Gap Finance Gap Structural Gap	Policies of Government Education Investment

20.	“Industry 4.0 and MSMEs in India: An Opportunity and Government initiatives” Roy, S.	2022	Investment Issues Shifting Business Models Data Issues Legal Issues Intellectual Property Standards Talent Gaps	Smart Innovation Smart Factory Smart Solutions Smart Supply Chain
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The study of the Barriers and Success Factor selectively from 20 papers out of the total of 59 papers from which the literary survey has clearly brought forward the challenges and success factors in the Digitalization of SME's. The selective study reveals that in the above analysis Digitalization has nearly common barriers and success factors.

To depict the analysis a graphical representation of the data is necessary and then it can be represented on the bar diagram for an easy glance. The bar charts are drawn for the Barrier-Frequency and Success Factors-Frequency tables analyzed earlier. These charts intend to bring out the critical barriers and success factors for the Digitalization of the SME's.

Table 2 – Barriers Frequency Table

Barriers In SME's Digitalization	Frequency (No. of Papers)
Lack of Infrastructure	55
Digital Ready Manpower	54
Cyber Security	42
Financial Constraint	56
Unavailability of Technology	35
Misconception of Job Loss	29
Government Policy Unsupportive	37
Lack of Innovation	28
Consumer Disinterest	24

Figure 1 – Bar Diagram representing the Barriers to Digitalization

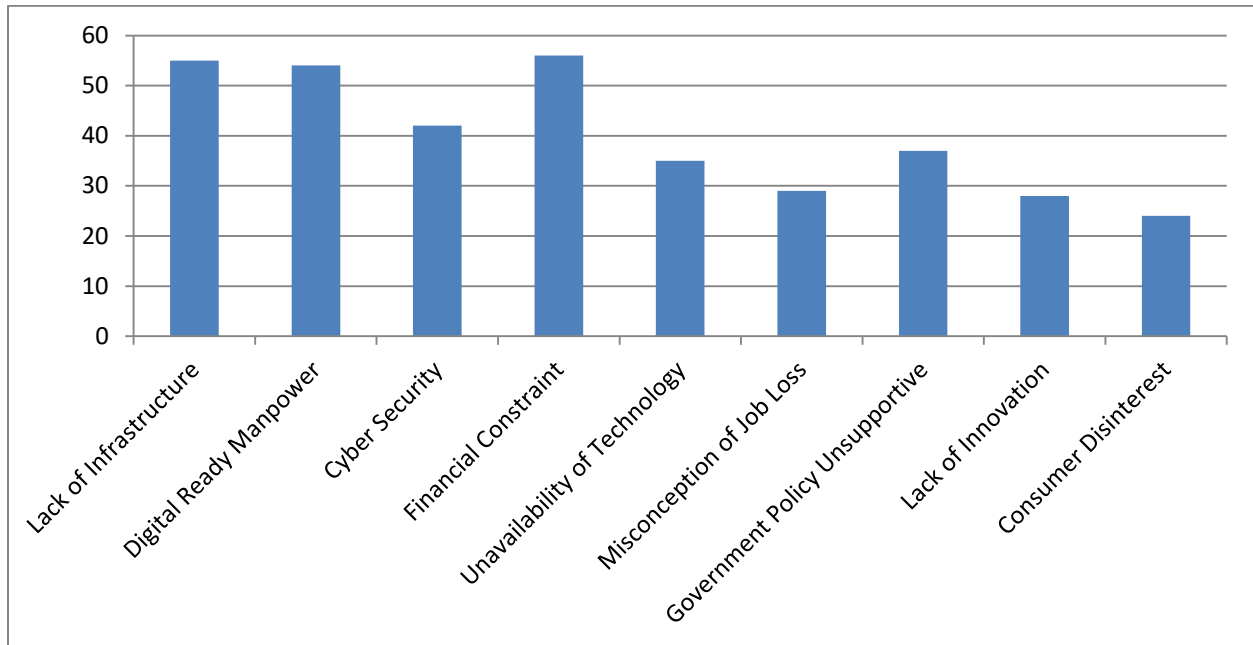
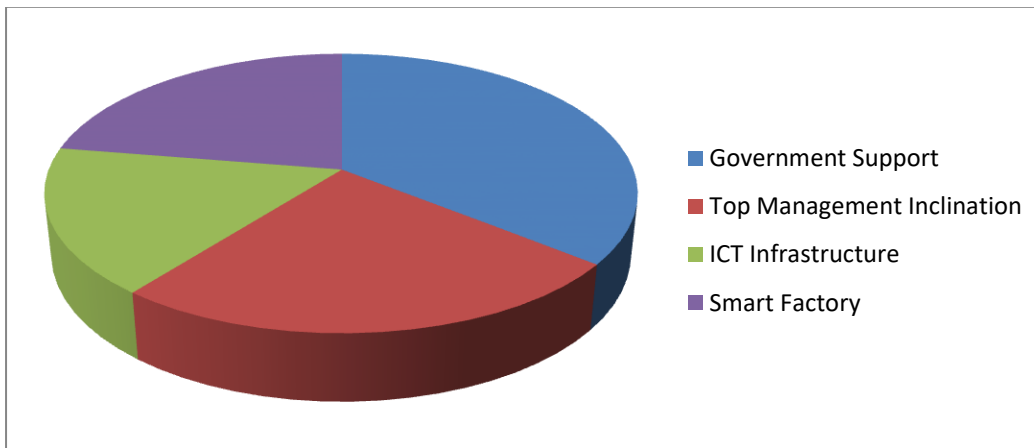


Table 3 – Success factors of Digitalization of SME’s

Success Factor	Frequency
Government Support	59
Top Management Inclination	41
ICT Infrastructure	28
Smart Factory	37

Fig 2 – Pie-Chart representing the Success Factors in Digitalization of SME’s



3. Results and Conclusions -

The present study is an attempt to study the digitalization of SME's around the globe and the study has yielded conclusive results. The Government Support emerges to be the

Critical Success factor for the achievement of Digitalization in SME's. Smart Factory is a future concept and it seems largely that Indian SME's have to go a long way to adopt 4th Industrial Revolution. Lack of Infrastructure is the major barrier for the adoption of Industry 4.0 and Digitalization of SME's. The Top Management commitment and availability of finance is a major factor in the smart industry creation. SME's in Asian continent needs Government support to become smart SME's.

4. Scope For Future Work –

This study is limited to a broader viewpoint of digitalization of the SME's and doesn't brings about the various practices of Industry 4.0. An extensive Literature survey can be done to bring out to study the practices of Industry 4.0 and Digitalization. Another aspect can be the definition of SME's around the World and this can further be extended to evaluate the status of Digitization around the World SME's.

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