

Navigating Digitalization: AHP Insights for SMEs' Strategic Transformation

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Abstract:- The digital revolution presents Small and Medium Enterprises with potential and danger in the dynamic world of modern business. However, several substantial obstacles are in the way of digitalization, making it difficult to move forward. This study sets out to discover and remove these hurdles to fully realize the potential of digital transformation for small and medium-sized enterprises (SMEs). It looks through the Analytical Hierarchy Process (AHP) prism. Our research identifies five types of barriers, each presenting different hurdles for digitalization: organizational, technological and infrastructure, legal, social-cultural, and strategic. We investigate several options in response, such as government regulations, technology acquisition, management support, cybersecurity, and training. Using the AHP methodology, we give each alternative a normalized value and find that management support is the most critical, closely followed by cybersecurity, government regulations, training, and technology acquisition. With these discernments, SMEs can deliberately arrange their endeavours to eliminate obstacles, clearing the path for triumphant digital transformation and sustained expansion.

Keywords:- AHP, Digitalization, Barriers, Sustainability.

I. INTRODUCTION

The Indian government's 'Make in India' initiative is helping to advance the Fourth Industrial Revolution. Most of the digitalization effort has been focused on increasing productivity. The micro, small, and medium-sized enterprise (MSME) sector in India contributes significantly to the national GDP, employing 110 million people and making up 28.9% of the Indian business sector [1]. The second-highest concentration of MSMEs in the world is found on the Indian subcontinent. India's automobile industry is the sixth largest globally, accounting for 7.1 per cent of the nation's GDP.

"Digitalization" is transforming analogue data or processes into digital formats to process, store, and send digital data. It entails implementing and integrating digital tools and technology to change several service delivery areas, communication, and corporate operations.

Digital platforms, cloud computing, data analytics, artificial intelligence, Internet of Things (IoT), automation, and other technologies are all included in the broad category of digitalization. Organizations can use it to create products and services, increase productivity, improve decision-making, and streamline procedures [2]. Digitalization is essential for driving strategic transformation in the digital age because it helps organizations adapt to shifting market dynamics, compete more successfully, and experience sustainable growth [3]. The procedure is significantly streamlined by cloud computing, making it easy to access the data from these devices in real-time and almost anywhere. We can only hope that increased productivity and the wise application of automation technologies will usher in the industrial revolution, as the market is currently trending toward one. The nation's largest service providers, SMEs, face several obstacles, including high capital costs, a minimal budget for R&D, a shortage of skilled labour, growing costs for labour and raw materials, and growing marketing expenses [4]. Many benefits have been observed with the introduction of newer production techniques that use digitalization techniques, including better resource utilization, quicker manufacturing rates, more efficient machinery, reduced machine downtime and consequently lower maintenance costs, and improved product quality. The SMEs are motivated to explore opportunities for implementing digitalization-based applications with all these advantages [5]. This study aims to identify and categorize the barriers that Indian SMEs face while attempting to adopt digitalization methods. These barriers will be ranked according to the Analytical Hierarchy Process methodology [2].

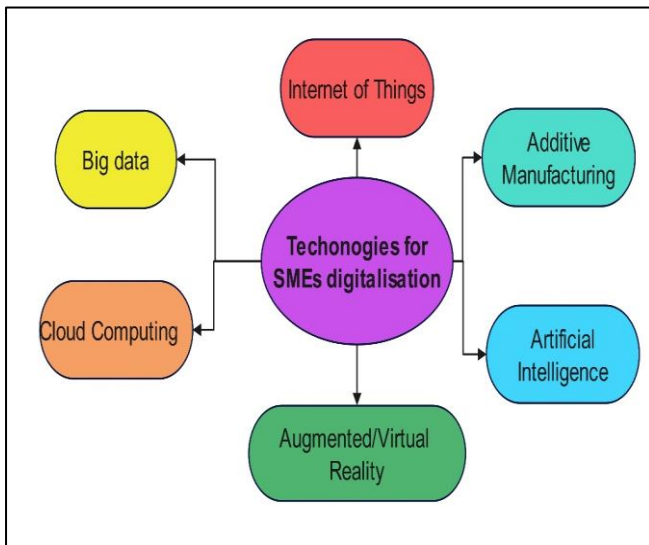


Fig 1 Technologies for SMEs

II. LITERATURE REVIEW

SMEs contribute significantly to output, exports, and employment, which significantly affects India's state economic growth. Most of India's economic activity is driven by SMEs [6]. Compared to the high cost of resources, India's small sector provides low-cost employment for many people. Because of its significance, the Indian government has included the SME sector in its objectives for five years. SMEs continue to face financial and marketing challenges and poor product quality. SMEs contribute significantly to the economic growth of Indian states by increasing output, exports, and employment [7]. SMEs account for the vast majority of economic activity in India. In contrast to the high cost of resources, India's small sector employs millions of people at a low cost. SMEs continue to face challenges with money, marketing, and poor quality. Because of its enormous potential, businesses and governments should collaborate to foster growth in the small business sector [8]. The expansion of the industrial sector is the main driver of the Indian economy's growth. The National Manufacturing Policy was introduced by the Indian government in 2011 to highlight the advantages of digitalization across several industries. Small and medium-sized enterprises (SMEs) have grown dramatically since 1947, as expected, and they have contributed to the nation's economic prosperity. The enlargement was carried out as planned. By increasing exports and creating new job opportunities, it has boosted GDP growth [9]. The SME sector has made a substantial contribution to the nation's overall socioeconomic development. Limited financial resources, rapid technological advances, permissive financing restrictions, dependable business services, a qualified staff, a lack of industry awareness, and poor infrastructure impede the sector's growth [10]. In today's globalization trend, SMEs are emerging as the economic engine. Over 95% of industrial units, 40% of industrial production, and 36% of overall exports are small and medium-sized businesses or SMEs. Over 18 million people are employed by a diverse range of SMEs. In the fiscal year 2018, MSMEs contributed 30.27 per cent of India's GDP, per the Government of India's

2021 annual report [11]. SMEs make a substantial contribution to the growth of the Indian economy. Several recent studies have been released to identify the barriers to Digitalization adoption in various industries. The constraints include stakeholders' understanding of cyber resource threats, limited industry engagement, insufficient technology infrastructure, and a scarcity of experienced labor [12]. The DEMATEL approach employs the analysis, considering high investment costs, a lack of knowledge, and insufficient technological infrastructure needs. Research has highlighted obstacles that hinder the adoption of digital supply chain management, such as dependent and independent barriers [13]. Barriers to advancement include a lack of an organizational digital vision strategy, a lack of urgency, misaligned company objectives, and senior management support. The authors cited inefficient data management and insufficient funding as the key constraints. Structured equation modelling was used in a study that identified various barriers to the deployment of digitalization technologies based on the findings of their theoretical research [14]. Their analysis revealed that the organization must address both internal and external hurdles when implementing digitalization. The obstacles include a lack of a good management system, insufficient IT infrastructure, uncertain economic benefits, and management's limited awareness of digitalization techniques. The report addressed these challenges. Barriers to integrating lean principles with digitalization in SMEs include employee opposition, insufficient top management support, insufficient information and communication technology infrastructure, and dependency on internet-based networks and service providers [15]. Legal or regulatory issues were addressed, and the ISM technique was chosen for the study, which also included the completion of the MICMAC analysis. A study looked at various barriers to digitalization readiness, including management, workforce, and standards on a global scale, as well as continuous employee education, lack of data protection, lack of qualified workforce, lack of employee readiness, and financial resources on a local scale [16]. The study used regression, correlation, and other methods to determine dependent and independent variables. The categories are separated worldwide into management, workforce, and standards, focusing on specific subjects such as the enablers, constraints, and potential of Vietnamese small and medium-sized manufacturing enterprises in the manufacturing sector [17]. The obstacles include strategic, organizational, technological, and legal or ethical issues, with the following sub-categories: digitalization economic benefits are questionable due to insufficient research and development, limited government assistance, a skilled labor scarcity, and cybersecurity dangers [18]. Inadequate government backing and policies, the absence of an organizational digital vision strategy, and a lack of senior management support are all barriers to the adoption of digital technology in India's construction sector. Using an interpretive structural modelling technique, this study investigates the barriers to implementing digitalization in the industrial sector. The study finds ten barriers, including reluctance to change, limited infrastructure, high investment costs, and data management issues, and investigates solutions for overcoming them. Another study investigated

the constraints on ethical and sustainable behaviors. The constraints considered included insufficient IT infrastructure, fear of failure, a lack of managerial support, insufficiently qualified personnel, and considerable financial commitments. The DEMATEL technique was used the investigation to determine the relative influence of one barrier over another. To ensure the accuracy of the results, a sensitivity analysis was performed. It was discovered that ethical and sustainable practices were studied utilizing the ISM technique to analyze barriers in the apparel industry. The main impediments cited are insufficient government funding and policies, inexperienced workers, a lack of understanding and dedication from senior management, investment, and fear of failure [19]. Identifying the barriers

to the widespread acceptance of digitalization is the first step toward successfully deploying these technologies. Analysed the literature to determine the primary barriers to effectively adopting digitalization practices in the SME sector. This study focuses on the problems encountered while implementing digitalization technologies in industries, particularly SMEs. This study focuses on identifying the most significant barriers to the implementation of digitalization [20]. This is critical for the progression of industries, which in turn is critical for the success of SMEs (SMEs). A thorough literature review was undertaken on the current issues encountered by the SME sector. 16 barriers were identified and classified into five major categories, as shown in table 1.

Table 1 Categories of Barriers

Criteria	Criteria code	Sub-criteria	References
Strategic (S)	S1	Lack of clear strategic roadmap for Industry 4.0	[20-25]
	S2	Lack of top management commitment	[26-30]
	S3	Lack of stakeholder involvement and engagement	[30-35]
	S4	Lack of collaboration between academic institutions and industry.	[36-38]
Organizational (O)	O1	Resistance to change	[39-40]
	O2	High Investment	[41-44]
	O3	Lack of Knowledge	[45-47]
	O4	Lack of Technology	[48-51]
	O5	Trained Workforce	[52-54]
Technological and Infrastructure (TI)	TI1	Lack of technical standards and reference architecture	[55-57]
	TI2	Security and Privacy	[58-61]
Legal barriers (L)	L1	Cybercrime and data theft	[62-64]
	L2	labour and employment regulations	[65-68]
	L3	IPR concerns	[69-73]
Social-cultural (SC)	SC1	Job for less skilled	[74-77]
	SC2	Regional/Cultural difference	[78-82]

III. METHODOLOGY

The AHP methodology was chosen to investigate the primary barrier. This method was invented in the 1970s by Thomas L. Saaty, and in 1983, it was improved by Ernest Forman as an Expert's Choice. Over time, Thomas L. Saaty and Ernest Forman improved the technique and increased their use of AHP. The suggested method can be regarded as correct once the importance of the various difficulties, facilitators, and selection criteria has been established. The

standard procedure in AHP is to estimate weights using a two-way comparison. This is predicated on the knowledge of experts in the pertinent fields. When faced with difficult decisions, this idea is used in many areas, including manufacturing, healthcare, education, and government, to break down complex decisions into pairwise comparisons. The AHP technique, based on Saaty's foundational ideas, has been explained. Figure 2 creates and displays a hierarchical model. The criteria and sub-criteria are shown at the top, together with the primary objective.

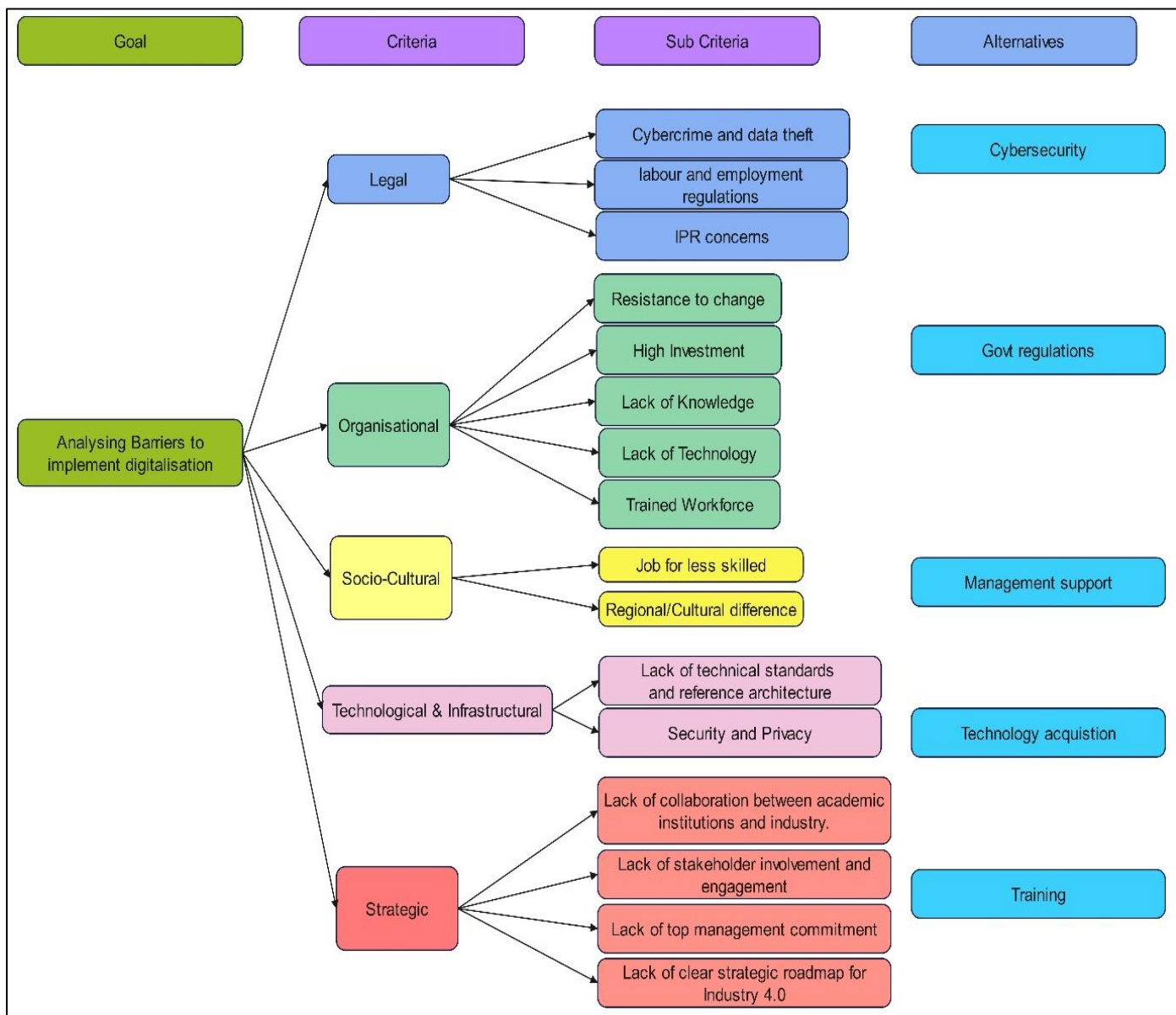


Fig 2 Criteria and Alternatives

➤ Steps to Apply AHP Methodology

- Step 1: Questionnaire for expert response.
- Step 2: Response of the experts on a scale of 1 to 9 using Table 2

Table 2 Saaty's Scale

Value	Significance	Description
1	Equal importance	Factors contributing Equally
3	Somewhat important	Judgement is favouring one over other
5	Much important	The judgment strongly favours one over other.
7	Very much important	Judgment strongly favouring one
9	The other is important	The judgement favouring one factor over others in the highest order.
2,4,6,8	Intermediate levels	Compromising judgements

• Step 3: Pairwise Comparisons

Decision-makers are asked to make pairwise comparisons between elements at each hierarchy level. These comparisons are typically done using a scale that represents one element's relative importance or preference

over another. The scale is often a numerical scale, ranging from 1 to 9, with 1 representing equal importance and 9 representing extreme importance. The normalized weights are calculated.

• *Step 4: Consistency Check*

AHP includes a consistency check mechanism to ensure the reliability of the pairwise comparisons. If inconsistency in the result is more than 0.1, decision-makers are prompted to revise their judgments until a consistent set of comparisons is obtained.

$$C.I = \frac{\lambda_{max} - n}{n - 1}$$

n=Number of Criteria

• *Step 5: Deriving Priority Weights*

The pairwise comparison data calculates priority weights for each element in the hierarchy. These weights indicate the relative importance of each criterion, sub-criterion, and alternative in the decision-making process.

• *Step 6: Aggregation and Ranking*

The priority weights are then aggregated to derive overall scores for the alternatives. These scores rank the alternatives and provide the best solution to overcome the hurdles.

IV. RESULTS

Through in-person interviews, 52 manufacturing industry professionals provided the data. Software called Super Decision is used to analyze the responses. The geometric mean of each matrix value from several experts is assessed once the data from the questionnaire has been obtained through responses. Table 3 presents the findings of a pairwise comparison matrix completed for both main categories and sub-categories of several main categories. The findings indicate that the most significant obstacles are infrastructural and technological, involving stakeholders, lack of information, lack of worker training, and reluctance to change. Table 4 presents a ranking of the alternatives that need to be taken in order to get beyond these obstacles. Management must assist SMEs in obtaining technology to help them overcome the obstacles. Staff members must receive training on using the technology after it is purchased. To lessen the training burden on SMEs, the government must provide policies and guidelines for training that improve workforce skills. Cybersecurity measures must be implemented to reduce the chance of data leaks and privacy violations.

Table 3 Ranking of the Alternatives

Category	Detail	Normalized value	Rank
Alternatives	Technology acquisition	0.25589	1
	Management support	0.2304	2
	Training	0.21018	3
	Govt regulations	0.18157	4
	cybersecurity	0.12196	5

➤ *Sensitivity Analysis*

Table 4 summarises the comprehensive list of obstacles along with their respective ranks. Sensitivity analysis was done once the study was completed using the AHP technique to ensure the system was robust. Most constraints impeding SMEs' adoption of digitization methods fall under technological barriers.

Table 4 Priorities of Criteria and Sub-Criteria with Rank

Criteria/sub-criteria	Normal weight	Rank
Technological and Infrastructure	0.83334	1
Stakeholder involvement	0.75001	2
Lack of Knowledge	0.63699	3
Trained Workforce	0.54318	4
Resistance to change	0.5112	5
Lack of Technology	0.49541	6
Technical standards	0.30135	7
Regional/Cultural	0.25827	8
Labour and employment rules	0.25059	9
Organizational	0.24999	10
Investment	0.24152	11
Lack of clear strategy	0.16666	12
Cybercrime and data theft	0.14747	13
job for less skilled	0.12668	14
Security and Privacy	0.10541	15
Socio-cultural	0.10473	16
Management commitment	0.0808	17
IPR	0.0751	18
Strategic	0.05005	19
Lack of collaborations	0.0405	20

Legal	0.03074	21
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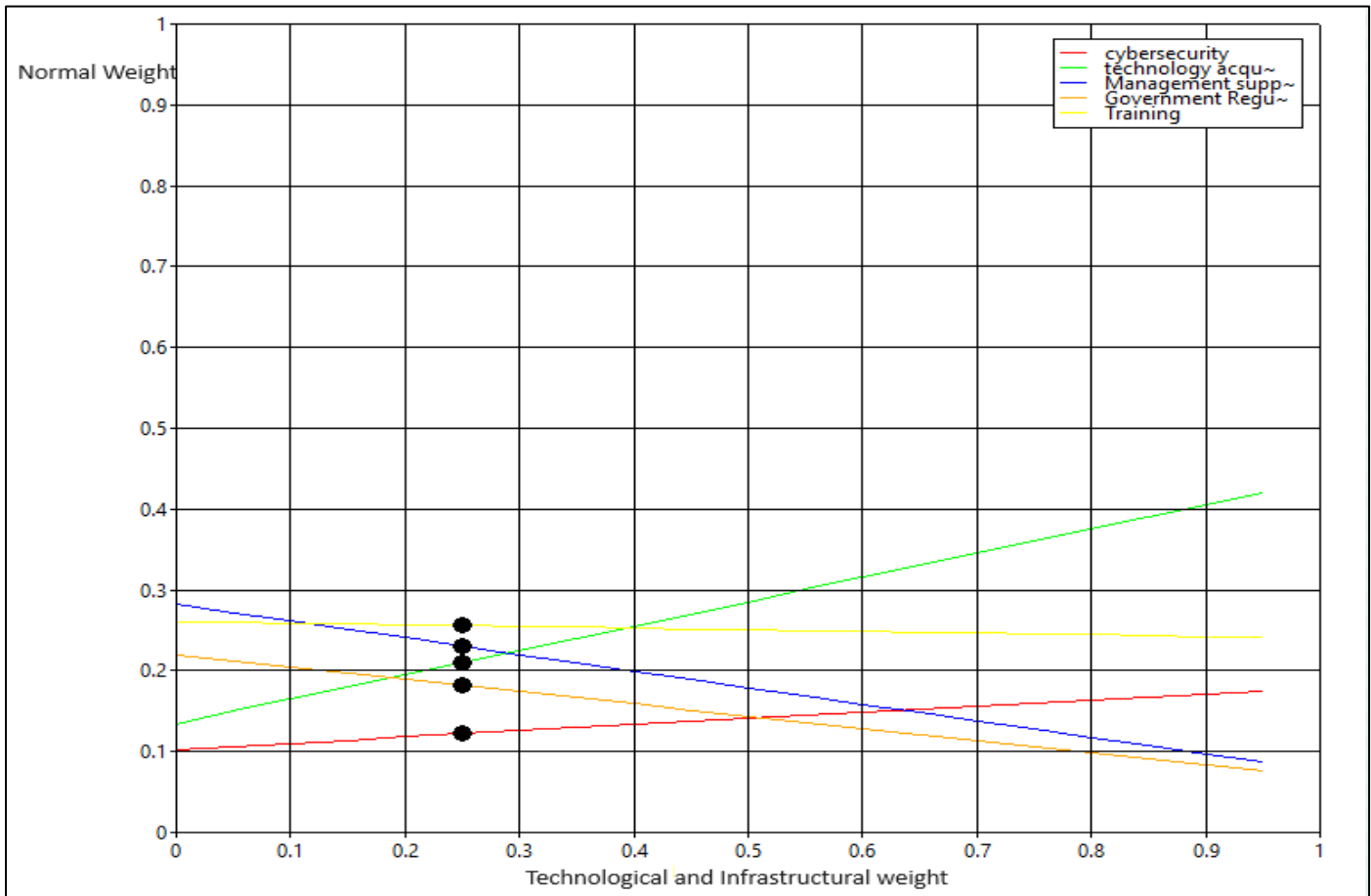


Fig 3 Sensitivity Analysis

The sensitivity analysis can be carried out by altering the technological and infrastructural barrier category weights, which range from 0.1 to 0.9. Other categories' weights also alter as a result of this. Figure 3 shows how the outcomes change. As the chart illustrates, technological hurdles significantly impact digitalization, and their removal could facilitate the seamless adoption of digitalization in small and medium-sized enterprises. Initially, the support of management/stakeholders plays an important role, and when the p-value or the weight of technological infrastructure is about 30 per cent, the stakeholders's importance decreases. It is evident from the figure that the role of government is continuously required, irrespective of the weights of other parameters, to achieve the goal of digitalization in SMEs.

V. CONCLUSION

The main obstacles to the adoption of digitalization technologies were evaluated in this study using the AHP methodology. The findings indicate that the most challenging areas are infrastructure and technology, followed by stakeholder involvement (0.83 and 0.75 weightage, respectively). The final two difficulty categories, with weights of 0.04 and 0.03, are the absence of cooperation and laws and regulations. This demonstrates the SMEs' severe lack of technology know-how and lousy management impedes their ability to embrace digitalization.

The digitization framework across the boundaries of SMEs is being hampered by a lack of technology and technical standards, according to the assessment of sub-challenges conducted using the AHP technique. The second issue that SMEs deal with is legal and regulatory compliance, which comes under the ethical area and is a significant obstacle to digitalization technology. Organizations are unwilling to adopt the technology trends of the modern world because government regulations are not stringent enough for them. The second factor impeding the adoption of digitalization beyond SME boundaries is the risk related to the ramifications of the digitalization methodology. The normalized weights are displayed in Table 3. According to the survey, small and medium-sized enterprises (SMEs) do not have the backing of upper management or exposure to government agencies to adopt digitalization approaches effectively. Since SMEs play a critical role in any country's development and because digitalization approaches positively impact performance and productivity, it is imperative that SMEs effectively promote technology-based digitalization procedures. The ramifications of digitalization applications show the SMEs' adaptability to changing market conditions and improvement in product quality. The adoption policy for digitalization in SMEs can be considered a crucial step toward gaining a competitive advantage and enhancing brand image.

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