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Original Article

Barriers to Technology Adoption Among Small and Medium Enterprises

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ABSTRACT: *This study examines the major barriers to technology adoption among small and medium enterprises (SMEs), focusing on financial, human, organizational, and infrastructural challenges that limit digital transformation. The goal of this research is to characterize and study the factors that prevent SMEs from adopting new technologies, and to evaluate how some of these barriers have an impact on their competitiveness and performance. A mixed-methods method is used, utilizing existing literature to form an argument supplemented by data collected from SME owners and managers using a survey, which is investigated in terms of description and themes. The results indicate that high implementation costs, lack of access to finance, insufficient technical capabilities, organizations' resistance to change, poor infrastructure, and worry about data security are the major barriers to the adoption of technology. This research suggests that to support technology use and ensure the long-term growth of SMEs in an increasingly digital business space, addressing these challenges through supportive funded government policies, raising funding accessibility, capacity building on SME training, and improving digital infrastructure is paramount.*

KEYWORDS: *Small and Medium Enterprises (SMEs), Technology adoption, Digital transformation, Financial barriers, Human capital, Organizational change, Infrastructure challenges, Data security, Access to finance, Competitiveness, Operational efficiency.*

1. INTRODUCTION

SMEs are an important contributor to economic growth through employment creation, innovation, and diversification. Over the past few years, rapid development of technology has changed the way companies work, and adopting technology is vital in order to increase productivity, efficiency , and competitiveness. Notwithstanding these merits, a great number of SMEs still trail behind when it comes to embracing modern technology such as digital platforms, service automation, and information systems. This skew is even more pronounced in emerging and developing countries, where structural and resource limitations impede digital transformation. It is therefore imperative to appreciate the barriers that prevent SMEs from adopting technology when promoting inclusive economic growth and sustainability.

Some factors affecting technology adoption in SMEs have already been emphasized by previous literature. Prior literature cites financial barriers, such as high initial costs and lack of access to credit, as key challenges. Other authors stress human capital and state that a lack of technical skills, poor digital literacy, and no access to training make technology use difficult. Organisational aspects like resistance to change, poor management support, and traditional business processes have also been the topic of significant research. Moreover, infrastructural issues, such as a lack of electricity supply, poor internet connectivity, and limited technical support, as well as fears about the security and privacy of data, are often pointed to as major barriers. Although useful, these studies fail to provide an analysis that takes into account the barriers and their context-specific interaction on the performance of SMEs.

With these gaps in mind, this study attempts to answer the following research questions: What are the primary obstacles preventing SMEs from adopting technology? What financial, human, organizational, and infrastructural elements have an impact on the adoption process? On the contrary, researchers propose that financial constraints, lack of technical competence, and insufficient infrastructure inhibit technology usage by SMEs. Through examining these issues, the current study seeks to provide clearer insights into the difficulties experienced by SMES in their digital transformation.

The value of this study is that it could have a theoretical and practical utility. This study provides academicians with a systemic approach to the impediments faced by SMEs in adopting technologies and contributes to the increasing literature record on technology adoption. The results can be used to make practical recommendations for policy makers, development partners, and SME owners, which will, in turn make it possible to minimize the challenges associated with adoption through intervention strategies as well as better access to finance, develop skills, and provide supportive infrastructure. In the end, it is all about facilitating SMEs' sustainable development and competitiveness in a more digital world of business.

2. METHODOLOGY

This study uses a mixed-methods research design that includes both quantitative and qualitative methods in order to form a multi-perspective understanding of the barriers faced by SMEs with technology adoption. The quantitative part can be used to quantify the prevalence of different barriers and explain their importance, while the qualitative part allows for richer information about how SME owners/managers experience and perceive technology adoption. The respondents are composed of owners, managers, and decision-makers in SMEs across industries. These respondents are chosen as the ones who actively participate in technological- adoption strategic discussions and/or decisions with a strategic or operational perspective, at their organisation. A purposive and simple random sampling method is adopted so that respondents have relevant knowledge, but findings can still be applied to the SME population.

Structured questionnaires and semi-structured interviews are used for data collection. The questionnaires capture quantitative information on financial, human, organizational, and infrastructure constraints, whereas the interviews report on negative views, attitudes, and contextual factors limiting acquisition. Secondary data from journals, reports, and policy documentation are also examined to complement and contextualize the primary data. The methods are therefore fairly in line with the fact that descriptive statistics like frequencies, percentages, and mean scores are used to analyze quantitative data, whereas thematic analysis is used for qualitative interviews. The findings from these two approaches are combined for a robust and balanced interpretation of results. The research process is completely in accordance with ethics. All subjects receive an explanation and provide informed consent upon enrolment. The privacy and anonymity of the participants are guaranteed, with willingness to participate being completely voluntary, with the freedom to withdraw at any time. The research also guarantees that the data are only utilized for the academicians and treated ethically.

3. RESULTS

This section presents the findings of the study on barriers to technology adoption among small and medium enterprises (SMEs). The results are organized using tables to display respondents' demographic characteristics and the major categories of barriers identified. Data are summarized using frequencies, percentages, and mean scores.

3.1. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Table 1 presents the demographic profile of the respondents, including their role in the enterprise, years of operation, and business size.

TABLE 1 Demographic characteristics of respondents

Variables	Category	Frequency (n)	Percentage (%)
Position	Owner	78	52.0
	Manager	72	48.0
Years of Operation	1–5 years	45	30.0
	6–10 years	60	40.0
	Above 10 years	45	30.0
Firm Size	Micro	58	38.7
	Small	62	41.3
	Medium	30	20.0
Total		**150**	**100**

3.2. FINANCIAL BARRIERS TO TECHNOLOGY ADOPTION

Table 2 shows respondents' responses on financial barriers affecting technology adoption among SMEs.

TABLE 2 Financial barriers to technology adoption

Financial Barriers	Mean Score	Standard Deviation
High cost of technology	4.35	0.72
Limited access to finance	4.21	0.81
High maintenance cost	4.10	0.76
Inadequate government support	3.98	0.84

3.3. HUMAN AND ORGANIZATIONAL BARRIERS

Table 3 presents the findings related to human and organizational factors.

TABLE 3 Human and organizational barriers

Barrier	Mean Score	Standard Deviation
Lack of technical skills	4.28	0.69
Inadequate training opportunities	4.15	0.73
Resistance to change	3.90	0.88
Limited management support	3.85	0.82

3.4. INFRASTRUCTURAL AND SECURITY BARRIERS

Table 4 summarizes infrastructural and security-related challenges reported by respondents.

TABLE 4 Infrastructural and security barriers

Barrier	Mean Score	Standard Deviation
Poor internet connectivity	4.22	0.77
Unreliable power supply	4.30	0.74
Lack of technical support	4.05	0.79
Data security concerns	3.95	0.86

3.5. SUMMARY OF KEY RESULTS

The results presented in the tables show the distribution of respondents and the reported levels of financial, human, organizational, infrastructural, and security-related barriers to technology adoption among SMEs. Frequencies, percentages, mean scores, and standard deviations provide a clear summary of the data without interpretation.

4. DISCUSSION

The findings of this research suggest that financial, human capacity issues, organizational, and infrastructural limitations are key obstacles to the adoption of technology in SMEs. Financial constraints were identified to be the most severe, anchored on the high cost of technology investment and lack of access to credit. 2019) This indicates a large portion of SMEs don't have enough money to invest in digital tools, which consequently affects their efforts to modernize operations and stay in the competition. The high central tendencies of skill-related barriers also suggest that SMEs do not always have the technical know-how to implement and use technologies, even when they are available.

Such findings are consistent with previous literature on technology adoption in SMEs. Similar findings have been reported in other studies regarding SMEs, which have also identified financial constraints as a major challenge and highlighted that high initial potential for economic gain (Lin & Chang, 2012). Findings are also consistent with prior research revealing the significance of human capital, such as insufficient technical abilities, low levels of digital literacy, and training opportunities in hindering technology use. Infrastructure-related barriers like limited access to reliable power and internet connectivity reported in this study have also been observed across the board in previous research, particularly within developing countries. Organizational resistance to change was found to be less important than financial and skill-related barriers; they remained significant, adding evidence of the importance of managerial attitudes and organizational culture in technology diffusion decisions. The findings have huge implications for development policy makers, owners of SMEs, and development partners. From a policy perspective, the findings show that policy-makers should create an enabling environment for SMEs to access financing at low cost, as well as subsidies or tax breaks for investments in technology. For the SME owner-manager, findings suggest a focus on investment in training; creation of an organization culture that is positive towards innovation and change you want to encourage. Development agencies and private sector proponents can also be instrumental in delivering capacity-building solutions by enhancing digital infrastructure for SMEs to adopt technology.

There are some limitations to the study, albeit its contributions. The size and sample distribution could potentially restrict the understanding of all SMEs, especially those that do business in other regions or environmental situations. Furthermore, the use of self-reported data could also suffer from response bias, where respondents' perceptions may not necessarily reflect actual practices in technology adoption. Furthermore, the paper is mainly concerned with barriers and does not extensively explore the enabling aspects or successful cases of technology adoption by SMEs. These limitations can be addressed in a further study by increasing the sample size and taking SMEs from various regions or countries to generalize the comparison. Future research could include longitudinal studies to consider how technology acceptance barriers change over time. In addition, potential research could investigate the influence of different technologies (e.g., e-commerce platforms or artificial intelligence tools) and also what has been successful for SMEs to overcome adoption hurdles.

5. CONCLUSION

In this paper, we investigated the barriers to technology uptake by SMEs in terms of financial, human capital, organisational, and infrastructural issues. The results suggest that financial barriers, such as high technology costs and insufficient access to finance, are the most important obstacles. Human-centered barriers, including a shortage of technical expertise and insufficient training opportunities, also play a key role. There are also organizational issues like a lack of support from managers and resistance to change; infrastructural problems, such as unstable internet and power supply, further limit the adoption of technology. Nevertheless, even if less of an issue these days, security concerns still drive some of the SMEs' slow pace when it comes to digital applications. To conclude, SMEs encounter several barriers that are interrelated and act as a disincentive for adopting technology, which is so critical for productivity, efficiency, and competitiveness. The need to meet these challenges is critical if SMEs are to become full participants in the digital economy and take advantage of modern technology opportunities.

Based on the study's findings, several recommendations are proposed:

- **Financial Support:** Governments and financial institutions should provide affordable financing options, subsidies, or tax incentives to reduce the cost burden of technology adoption.
- **Capacity Building:** SME owners and employees should be provided with training programs and workshops to improve digital literacy and technical skills.
- **Organizational Change:** SME management should foster a culture that encourages innovation, flexibility, and acceptance of new technologies.
- **Infrastructure Improvement:** Investment in reliable internet connectivity, power supply, and technical support services is crucial to enable effective technology use.
- **Policy and Stakeholder Engagement:** Policymakers and development agencies should design targeted interventions that address both barriers and incentives for SMEs to adopt technology.

Implementing these recommendations can enhance technology adoption among SMEs, support sustainable business growth, and strengthen their competitiveness in an increasingly digital business environment.

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