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Research Article

Utilization Of Eco-Friendly Technologies in Micro, Small, And Medium Enterprises (MSME) Focused on Entrepreneurship

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ABSTRACT

In the pursuit of sustainability and competitiveness, the adoption of eco-friendly technologies has emerged as a critical agenda for Micro, Small, and Medium Enterprises (MSMEs). Despite their economic significance, MSMEs face disproportionate barriers to integrating advanced innovations such as High-Performance Computing (HPC), owing to resource constraints, limited digital readiness, and variable entrepreneurial capacity. The study examines the configurational conditions under which MSMEs adopt eco-technologies, emphasizing the interplay between structural, behavioral, and contextual factors. Grounded in the Technology-Organization-Environment (TOE) framework, Technology Acceptance Model (TAM), and entrepreneurial mindset theory, the research employs fuzzy-set Qualitative Comparative Analysis (fsQCA) to evaluate data from 66 MSMEs across IT, electronics, and automotive sectors in the Danube region. The methodological design incorporates both theoretical constructs and field insights to uncover pathways that lead to successful HPC adoption. Three dominant configurations emerged: strong entrepreneurial cognition supported by favorable environmental conditions; opportunity recognition in combination with agile organizational structures; and full-spectrum alignment across cognitive, organizational, technological, and external domains. The perception of usefulness and ease of use—key elements of TAM—also played a pivotal role in shaping adoption behavior. Medium-sized firms demonstrated a higher propensity for adoption, while micro-enterprises encountered greater challenges. The study concludes that eco-technology adoption in MSMEs is not driven by singular factors but by dynamic combinations of internal mindset and ecosystem readiness. These findings inform targeted strategies for policymakers, support agencies, and entrepreneurs seeking to accelerate sustainable innovation at the grassroots level.

Keywords: MSMEs, Eco-friendly technology, Entrepreneurial cognition, HPC adoption, fsQCA, TOE framework

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) are widely acknowledged as the backbone of economic development across both developed and developing nations. They have a major impact on regional development, innovation, and job creation. In a world where sustainability has become not a choice but a necessity, MSMEs are under growing pressure to adjust their activities to environmentally friendly and sustainable practices (Cuerva et al., 2014; Audretsch et al., 2019). Among the existing paths to reaching sustainability, the integration of friendly and digital technologies is one of the powerful levers of environmental performance and business competitiveness (Belitski et al., 2021).
Eco-friendly technologies are commonly defined as innovation that reduces the effect on the environment, improve the use of resources, and develop a sustainable production process. MSMEs have a chance to

implement them strategically to foster profitability and ecological responsibility simultaneously. High-Performance Computing (HPC) and other innovative digital technologies are gaining more popularity as a means of change for small businesses that are willing to modernize their operations and improve their value propositions (Cunningham et al., 2023).

Although they have such potential, the distribution of such technologies is not even across the MSME sector, primarily due to structural constraints, such as the unavailability of financial resources or the absence of technological infrastructure and an enabling ecosystem. The presence of such barriers is often supported by the fact that MSMEs are extremely diverse in terms of scale, sector, management capacity, and innovation orientation (OECD, 2017; Khurana et al., 2019). Due to this variety, a more differentiated picture of what determines the environmentally friendly technologies adoption of these companies is required.

In the new orientations of thinking in the discipline, the role of an entrepreneurial attitude in the behaviour of technology adoption is pinpointed. Entrepreneurial mindset refers to a combination of abilities that an individual has that allow them to identify opportunities, tolerate ambiguity, and be able to lead innovation through taking proactive steps (Kuratko et al., 2021; Cunningham et al., 2023). Among the sub-dimensions of this mindset is entrepreneurial cognition, which is the role of noticing and appraising innovation opportunities, including those pertaining to eco-friendly technologies (Daspit et al., 2021). The effects of prior knowledge and mental constructs do not make entrepreneurs indifferent to the usefulness, viability, and worth of new technologies adoption (Mitchell et al., 2002; Hajizadeh & Zali, 2016; Ardichvili et al., 2003). This psycho-social factor thus complements the more structural and organizational facilitators that have been gathered in the traditional adoption models.

In a bid to situate these cognitive drivers within the broader MSME ecosystem, however, researchers have of late been using integrative frameworks such as the Technology-Organization-Environment (TOE) framework (Arpaci et al., 2012; Gangwar et al., 2014). Under this framework, three dimensions take preeminence in technology adoption, and these are technological readiness, organizational capacity, and environmental pressure. These dimensions are dynamically related to the entrepreneurial cognition regarding MSMEs and affect the decision-making regarding eco-friendly innovations (Nam et al., 2019; Kuan & Chau, 2001; Ifinedo, 2011).

Technological readiness involves the presence and conformity of the new technologies with the existing systems. In the case of MSMEs, inadequate digital infrastructure may seriously slow down or even prevent the process of adoption (Ifinedo, 2011). The fast pace of development of digital technologies usually means that technical skills and knowledge have to be constantly updated. Here, a general-purpose technology that can assist MSMEs includes High-Performance Computing (HPC) in data analytics, supply chain optimization, and simulation-based product development (Lee & Lee, 2021; Modic & Damij, 2021).

The organizational preparedness relates to internal capabilities, including managerial skills, human capital, and strategic focus. Researchers have discovered that companies that have effectively organized internal operations and management that is devoted to innovation tend to be more inclined to implement any emerging technology (Gilbert et al., 2004; Love & Roper, 2015). Smaller companies with less hierarchical structure and quicker decision-making might be more capable of adapting green technologies within a short time, given that they have the supporting infrastructure to do so (George et al., 2016).

Environmental factors consist of the external pressures that are in the form of regulatory frameworks, market competition, and industry association influence. The governmental support of green entrepreneurship, digitalization, and sustainability can serve as potent factors that stimulate the uptake of technology (Belitski et al., 2021). On the other hand, the lack of these enablers may serve as a discouraging factor, particularly to MSMEs that are located in underdeveloped territories with underdeveloped infrastructures and institutions (Audretsch et al., 2019).

The Technology Acceptance Model (TAM) is also useful to reveal useful insights about user-level adoption behavior with a focus on the perceptions of usefulness and ease of use (Davis, 1985; Davis et al., 1989; Fishbein & Ajzen, 1975). Together with TOE, TAM can be used to explain how entrepreneurs make decisions concerning the relevance and consequences of green technologies to their business goals. As an illustration, when a technology is viewed as being complicated or hazardous, then it could be discarded even before its advantages can be realized. The adoption will take place more readily when the perceived value of the innovation fits into the cognitive schema of the entrepreneur.

The other applicable theoretical model is the HOT-fit model, which incorporates the human element in the equation of technology adoption. In contrast to TOE, which puts more emphasis on structural aspects, HOT-fit pays more attention to user satisfaction, technological potential, and organizational fit (Yusof et al., 2008; Katsinis et al., 2023). In the case of MSMEs, where the entrepreneur may have to undertake several roles, the behavioral and affective factors become important contributions to the understanding of adoption decisions.

Remarkably, fsQCA is a powerful methodological framework to study complex causality (Woodside, 2013). In contrast to the traditional regression models, where the variables are isolated, fsQCA allows finding the combinations of circumstances that are sufficient or necessary to generate a specific outcome, in this case, the successful adoption of eco-friendly technologies. The approach recognizes the fact that MSMEs are heterogeneous and allows their varied journey to sustainability.

The InnoHPC project in the European Danube region has reported a wide variance in the HPC adoption among the different countries, including Germany, Austria, and Bulgaria. The latter is explained by the influence of contextual elements, structural, and cognitive, on adoption patterns (InnoHPC, 2020). Through the incorporation of knowledge of entrepreneurial cognition, TOE, and TAM frameworks, as well as the use of fsQCA, the study would generate a mapping of the highly complex nature of eco-friendly technology adoption among MSMEs. Sustainable shift of MSMEs to the use of eco-friendly technology is a multidimensional process that is determined by both internal and external factors. Although the current model, such as TOE and TAM, offers background knowledge, the entrepreneurship mindset gives critical psychological insight that enhances our knowledge of adoption behaviors. The paper is based on the existing literature that attempts to determine how MSMEs can use technologies such as HPC to not only enhance their operational performance but also make a significant contribution to global sustainability targets. By so doing, it also aims at filling the gap between theory and practice by contributing empirical evidence and strategic advice to policy-makers, but also entrepreneurs and development agencies.

Research Objectives

- To identify key factors influencing eco-friendly technology adoption in MSMEs
- To assess the role of an entrepreneurial mindset in driving HPC adoption
- To analyze adoption patterns using fsQCA across MSME contexts

METHODOLOGY

The study uses an exploratory and integrative research design to examine the use of green technologies, specifically High-Performance Computing (HPC), in the Micro, Small, and Medium Enterprises (MSMEs). Finding out how cognitive, organizational, and environmental factors affect the adoption of these technologies in entrepreneurial decision-making is the main goal.

Theoretical Framework

The study is designed with the help of a composite theoretical framework comprising three main models, namely the TOE framework, the entrepreneurial mindset approach, and the TAM. The TOE framework allows using a prism to evaluate the structural and contextual conditions that influence the technology adoption, such as technological readiness, the internal organizational potential, and the role of the pressure of the external environment. This is because the entrepreneurial mindset framework brings into the picture the cognitive dimensions of opportunity recognition and strategic behavior that play an important role in making decisions under uncertainty. The TAM framework offers a behavioral research contribution, namely the user's impression of a technology's utility and usability. These theoretical frameworks are combined to provide an in-depth perception of how MSMEs undertake the environmentally friendly digital transformation.

Data Source and Context

The InnoHPC project serves as the foundation for the empirical portion of the study, which explored the integration of digital and computational technologies in the Danube region. It is a region that has both developed economies and those that are still developing, making it a diverse ground to carry out the analysis. The research focuses on MSMEs operating within the IT, electronics, and automotive sectors, chosen for their increasing reliance on digital systems and their potential to benefit from eco-friendly and high-performance technologies.

A total of 66 MSMEs participated in the study. Purposive sampling was used to choose these businesses in order to guarantee size diversity, sector, and geographical location. The firms surveyed vary in their digital maturity and strategic approaches to innovation, making them ideal for examining the configurations of adoption behaviors.

Data Collection

Primary data were collected through a structured survey instrument designed to capture perceptions, organizational characteristics, technological readiness, and environmental influences. The survey items were informed by validated constructs from previous studies in technology adoption, entrepreneurial behavior, and digital transformation. Topics included organizational resources, leadership orientation, market dynamics, digital infrastructure, and cognitive traits such as alertness to opportunity and proactive strategic planning.

The respondents were founders, executives, or senior managers who participated directly in strategic decision-making. The survey was conducted using both direct outreach and a digital platform to ensure that it had a wide coverage within the Danube macroregion. The answers were made anonymous so that no identifying information was left in them, and the data would be more reliable.

Analytical Method: fsQCA

In light of the configurational research question, the data analysis rests on fuzzy-set Qualitative Comparative Analysis (fsQCA). FsQCA is particularly well suited in the context of investigating a large number (non-linear) causal relations, and/or where one is concerned about the discovery of sets of conditions that are either sufficient or necessary to bring about a particular outcome. It is best suited for the examination of the behavior of heterogeneous units, such as MSMEs, whereby multiple internal and external variables interplay to influence decision-making.

The direct calibration method was adopted to calibrate all survey variables into fuzzy sets. Anchor points were set to indicate full membership, full non-membership, and crossover points, which were done on theoretical grounds and consideration of the data distribution. This methodology enabled the research to pick up minute differences in company behavior and situational variables.

Reliability and Validity

To achieve methodological rigor, the survey questionnaire was pilot-tested and also subjected to the experts in the field, both in academia and industry. It was done by refining the constructs according to the expert comments to make them clearer and relevant. The reliability of data was checked with the help of internal consistency measures, and the logic of equifinality and causal asymmetry provided by fsQCA was used to identify unique adoption pathways among firms.

Within the framework of this methodological approach, the research will serve to shed light on the manner in which the entrepreneurial cognition, structural preparedness, and environmental setting collectively contribute to the uptake of green technologies in MSMEs. Such a methodological choice gives a solid foundation to the study of such a complex reality as the digital transformation of the small enterprise ecosystem.

RESULTS

The section provides the result of the fsQCA conducted on 66 MSMEs in the Danube region. The configurations of conditions analyzed are entrepreneurial mindset, technological readiness, organizational capability, and environmental context that result in the adoption of eco-friendly technologies, specifically High-Performance Computing (HPC).

Descriptive Overview of Respondents

Table 1 shows a descriptive summary of the 66 MSMEs that participated in the survey of the study. The automotive industry had the highest turnout with 37.9 percent of the respondents, followed by IT (33.3 percent) and electronics (28.8 percent). Regarding the size of the firm, the majority were small enterprises (11, 50 employees) at 42.4%, micro enterprises (1- 10 employees) were 27.3%, and medium-sized firms (51 250 employees) were 30.3%. Regarding the adoption of High-Performance Computing (HPC) or similar eco-friendly digital technologies, 44% of the firms reported either current or past usage, whereas 56% had not adopted these technologies. Among non-users, many expressed varying degrees of interest in future implementation, indicating a potential readiness for digital transformation across different MSME categories.

Table 1: Summary of Enterprise Characteristics

Variable	Category	Frequency	Percentage
Sector	IT	22	33.3%
	Electronics	19	28.8%
	Automotive	25	37.9%
Firm Size	Micro (1–10 employees)	18	27.3%
	Small (11–50 employees)	28	42.4%
	Medium (51–250 employees)	20	30.3%
HPC Adoption Status	Users	29	44.0%
	Non-Users	37	56.0%

fsQCA Configuration Results

The fsQCA analysis identified three distinct configurations that led to the successful adoption of eco-friendly technologies among MSMEs, as shown in Table 2. Configuration A revealed that the combination of strong entrepreneurial cognition and environmental support, with organizational readiness as a peripheral factor, contributed to high adoption levels.

This configuration demonstrated a coverage of 0.68 and a consistency score of 0.84. Configuration B emphasized the role of opportunity recognition and organizational support as core conditions, with technological readiness supporting adoption outcomes; it exhibited 0.61 coverage and 0.82 consistency.

Configuration C represented a holistic alignment of all four factors—entrepreneurial, organizational, technological, and environmental—which yielded the highest coverage (0.76) and consistency (0.89). These results supported the principle of equifinality, where multiple distinct pathways led to the same desired outcome of eco-technology adoption.

Table 2: Configurations Leading to High HPC Adoption

Configuration	Core Conditions	Peripheral Conditions	Coverage	Consistency
A	Entrepreneurial Cognition + Environmental Support	Organizational Readiness	0.68	0.84
B	Opportunity Recognition + Organizational Support	Technological Readiness	0.61	0.82
C	Comprehensive Alignment (All 4 factors present)	—	0.76	0.89

- Configuration A illustrates that firms with a proactive mindset and strong external support structures tend to overcome internal limitations.
- Configuration B shows that recognizing opportunities, coupled with lean organizational structures, drives practical adoption even with limited infrastructure.
- Configuration C, the most robust, involves balanced strengths across all dimensions, maximizing strategic alignment and innovation potential.

Technology–Organization–Environment (TOE) Framework for Technology Adoption

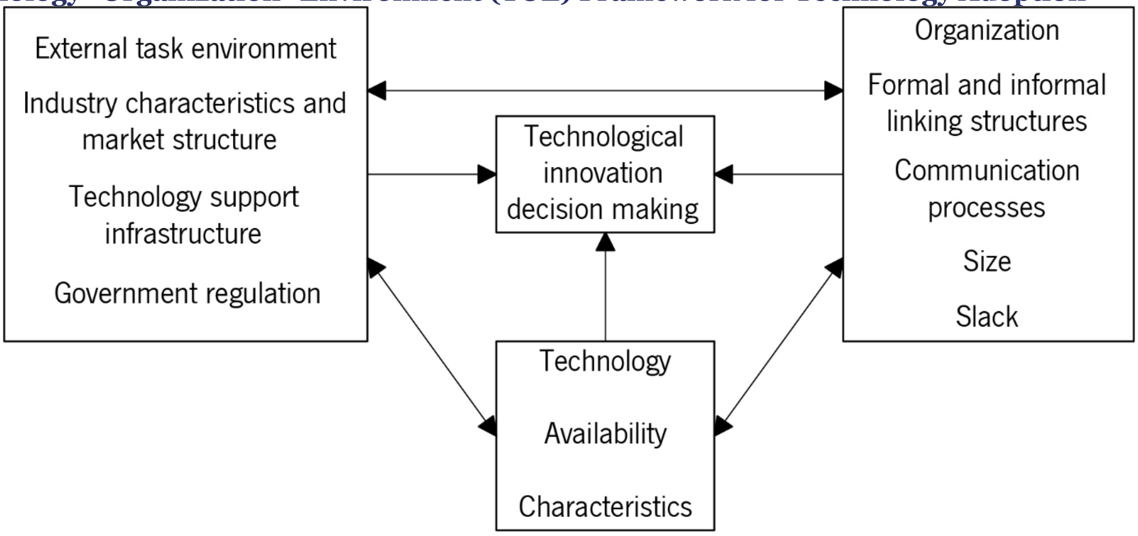

Figure 1. The Technology–Organization–Environment (TOE) Framework for Technological Innovation Decision-Making

The Technology-Organization-Environment (TOE) Framework, which highlights the three main contextual factors that influence a firm's technological innovation decision-making, is shown in Figure 1. The context of technology involves the presence and the nature of the appropriate technologies, emphasizing functionality, compatibility, and complexity.

The organization context depicts the internal features, including the size of the firm, communication mechanisms, and formal or informal arrangements supporting or restraining adoption. The environmental context involves the external forces like market structure, regulatory conditions, industry rivalry, and availability of technology support infrastructure.

A combination of these three dimensions plays a role in the process of assessing and deciding on the uptake of new technologies by the firms. The framework notes that the choices that concern innovation are not made in empty space, but they are framed within a multidimensional framework of internal capacity and external pressure combination. The model is useful, particularly in analyzing the eco-technology MSMEs' adoption.

DISCUSSION

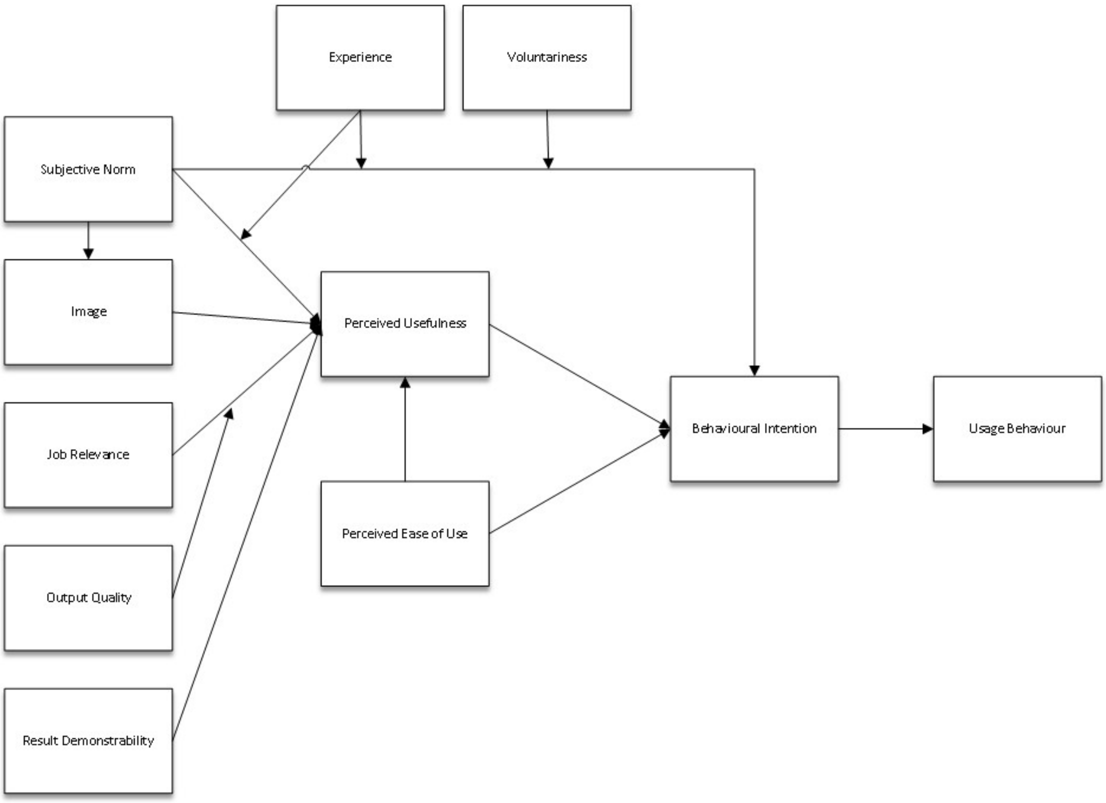

Figure 2. Extended Technology Acceptance Model (TAM) Framework

The process of green technology adoption in Micro, Small, and Medium-Sized Enterprises (MSMEs), specifically the High-Performance Computing (HPC), is complex and depends on the internal capacity, the behavioral intention, the state of the environment, and the cognitive orientation of the entrepreneur. Based on the theory of entrepreneurial mindset and the TOE framework, the multi-configurationality of the eco-technology adoption has been uncovered, where the successful outcomes are generated through different combinations of the enabling conditions (Arpaci et al., 2012; Gangwar et al., 2014).

Among the most significant implications of the findings, the fact that the digital and eco-friendly technology adoption is preconditioned by the entrepreneurial mindset deserves to be mentioned. The high cognitive skills and the inclinations of opportunity recognition by the entrepreneurs increased the possibility of breaking the institutional constraints and adopting an innovation such as HPC. Past studies affirm the same, noting that the entrepreneurial cognition (ability to recognize and exploit opportunities) may be viewed as a cognitive prism through which external cues are perceived and pursued (Mitchell et al., 2002; Daspit et al., 2021). The great level of opportunity recognition allows entrepreneurs to be better situated to anticipate changes, exploit disequilibrium, and embrace innovations that align with long-term sustainability goals (George et al., 2016; Ardichvili et al., 2003; Kuratko et al., 2021).

Such entrepreneurial action is consistent with the cognitive foundations of the TAM, which posits the perceived usefulness and perceived ease of use as antecedents to the adoption intent (Davis, 1985; Davis et al., 1989). The more entrepreneurs view HPC as useful and feasible, the more they consider employing it in their work. Perceived to be expensive or more complicated than it should be, it is unlikely to be adopted, even with external factors being positive. This is an example of how perceptions of behavior and not only structural capacity can influence or discourage an adoption decision (Ifinedo, 2011). The extended TAM model is depicted in this picture, wherein behavioral intention and actual usage behavior are influenced by perceived utility and perceived ease of use, which are determined by subjective norms, job relevance, output quality, and demonstrability of outcomes, among other factors. These psychological and perceptual elements, in the case of MSMEs, are crucial to the decision of an entrepreneur to implement eco-friendly technologies such as HPC, thus providing structural explanations through the TOE framework.

The fsQCA analysis brings even more clarity since it shows three salient configurations of adoption: (A) entrepreneurial cognition and environmental support, (B) opportunity recognition and organizational readiness, and (C) overall alignment of all four factors, entrepreneurial, organizational, technological, and environmental. These results emphasize the principle of equifinality, according to which different and

dissimilar combinations may have the same result (Fiss, 2011). In line with this are the past research findings that highlighted the heterogeneity of MSMEs and their adoption patterns (Cunningham et al., 2023).
Configuration A shows how, with good environmental support mechanisms, entrepreneurial cognition can make up the difference of moderate internal capacity. The external assistance can be government incentives, innovation hubs, or access to funding, which all decrease the weight of initial investment and risk. Such an observation aligns with the discussion that policy and ecosystem infrastructure can be rather influential in facilitating technology adoption among SMEs (Belitski et al., 2021).
Configuration B demonstrates that firms with flexible and adaptive internal systems can adopt HPC even without high levels of external support, as long as the entrepreneur effectively identifies strategic opportunities. This combination suggests that internal champions and lean processes can provide agility and responsiveness to technological change (Gilbert et al., 2004; Love & Roper, 2015). Configuration C, representing full alignment, showed the highest consistency, affirming the view that integration across cognitive, structural, and contextual domains yields optimal outcomes (Nam et al., 2019; Woodside, 2013).
The Technology Acceptance Model serves as a complementary framework to interpret behavioral differences in adoption. Despite having access to similar resources, some MSMEs resisted HPC adoption due to perceived complexity or uncertainty about its relevance. These barriers correlate directly with the TAM constructs, where negative perceptions of usefulness and usability hinder behavioral intent (Davis et al., 1989). Such findings are supported by previous work indicating that small firms often face challenges related to digital illiteracy, insufficient technical expertise, and the lack of strategic clarity when engaging with sophisticated technologies (Ifinedo, 2011; Atkinson, 2017).
Organizational readiness also emerged as a secondary but significant condition in both high and moderate adoption scenarios. Firms with competent leadership, dynamic human resources, and experience in managing change were better positioned to implement eco-friendly technologies. Studies have indicated that such internal preparedness—especially in MSMEs that have previously invested in R&D or digital tools—enhances their absorptive capacity for innovation (Love & Roper, 2015; Gangwar et al., 2014). Adaptive firms tend to exhibit faster decision-making cycles and are more open to experimentation, a critical feature in environments characterized by rapid technological change.

The external environment played a vital role as well. MSMEs embedded in regions with active policy interventions, technical support programs, and innovation networks reported higher adoption rates. These findings are in line with work suggesting that collaborative ecosystems and institutional support mechanisms reduce uncertainty and enhance firm-level capabilities (Audretsch et al., 2019; Audretsch & Link, 2012). The InnoHPC initiative helped to solve the perceived financial and technical risks by regional programs that offered knowledge and access to infrastructure as a buffer. The spillover effects positively affected the firms connected to research institutions or industry clusters with faster onboarding and access to skilled labor (Belitski et al., 2021).

The analysis also gave rise to sectoral patterns. The IT companies showed the greatest digital preparedness and ability to embrace HPC. This comes as no shock, considering that they are anchored on data and software platforms. Automotive companies were next, as they require real-time simulation and modeling. Electronic companies demonstrated average behaviors of adoption that are mostly influenced by supply chains and compliance needs. Such industry-level observations are consistent with the past studies of heterogeneity in digital adoptions by industry (Lee & Lee, 2021; Modic & Damij, 2021).

Another distinction criterion was firm size. The adoption rates were highest in medium-sized enterprises, which may be explained by more developed systems, as well as by diversified revenues and easier access to capital. Micro-enterprises, on the other hand, were affected by more crucial obstacles such as human resources and technological capability. It confirms the previous findings that highlight the idea that the limitations of resources are more critical in small companies, affecting their strategic flexibility and risk tolerance (Atkinson, 2017; Kim et al., 2018; Belitski et al., 2021).

When taken together, these findings have several useful applications. The first is the establishment of cognitive abilities, in particular opportunity recognition and strategic foresight, in entrepreneurs and in particular in those who work in environments of uncertainty or constraint. Second, policy-makers are advised to do more than merely offering financial subsidies; they ought to invest in training initiatives, digital skills, as well as the establishment of inclusive innovation ecosystems. Third, support organisations need to differentiate their engagement models based on firm size, industry, and maturity, i.e., offer simplified access and more hands-on support to micro-enterprises, and advanced tools and co-development possibilities to medium-sized firms.

Infrastructure or financial capital alone does not determine the adoption of eco-friendly technologies in MSMEs. Instead, it is an outcome of the concurrence of behavioral intention, cognitive strategy, organizational competence, and environmental support. The study establishes that no particular factor ensures success, but their dynamic combination, especially in the situation of high entrepreneurial cognition, makes the likelihood of meaningful and sustainable adoption much higher. It likewise confirms the applicability of integrative models such as TOE and TAM in unravelling the adoption behavior of various and resource-limited enterprises.

CONCLUSION

Using a combined TOE, Technology Acceptance Model (TAM), and entrepreneurial mindset theory, the study looked at the variables influencing the uptake of environmentally friendly technology in MSMEs, specifically High-Performance Computing (HPC). Drawing on empirical data from 66 MSMEs across diverse sectors and geographies, the study utilized fsQCA to uncover distinct configurations of cognitive, structural, and environmental factors leading to successful adoption outcomes. The findings demonstrate that no single factor is sufficient to guarantee adoption. Rather, combinations such as entrepreneurial cognition paired with environmental support, or opportunity recognition alongside organizational readiness, significantly influence uptake. Firms with complete alignment across cognitive, organizational, technological, and external support systems exhibited the most consistent adoption behavior. Perceived usefulness and ease of use—core constructs of TAM—were shown to influence decision-making, especially in resource-constrained firms. These findings carry several important implications. For entrepreneurs, cultivating a proactive and opportunity-driven mindset is essential in identifying and acting on technological innovations. For policymakers and ecosystem builders, support mechanisms should extend beyond financial incentives to include training, access to innovation networks, and infrastructure development tailored to MSMEs. The study recommends differentiated intervention strategies based on firm size and sector. Micro-enterprises may benefit from simplified adoption pathways and direct support, whereas medium-sized firms may need advanced collaboration frameworks and funding for scaling innovations. Innovation hubs, incubators, and public-private partnerships can play a critical role in reducing perceived risks and boosting confidence among small business owners. Future research should explore longitudinal adoption behavior, sector-specific adoption barriers, and the impact of eco-technology integration on sustainability performance metrics. Expanding the geographic scope and employing mixed methods could further enrich insights into MSME innovation dynamics.

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