



Exploring the Influence Factors of Digital Entrepreneurship in Improving the Digitization of Small and Medium Enterprises in Yemen

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ABSTRACT

This research provides valuable insights into the impact of digital entrepreneurship on the digitalization of small and medium-sized enterprises (SMEs) in Yemen. By integrating the Technology Acceptance Model (TAM) and the Technology-Organization-Environment (TOE) framework, the research examines the role of various factors-technological, organizational, environmental, and individual, affecting technology adoption and utilization in SMEs. The study primarily explores the direct and indirect influences of these factors on actual system use, with a particular focus on the mediating roles of perceived usefulness and perceived ease of use in shaping attitudes toward technology adoption. Data were collected through a survey of 392 respondents, and the results were analyzed using partial least squares structural equation modelling (PLS-SEM). The measurement model was validated for reliability and accuracy, followed by an evaluation of the structural model to test the proposed hypotheses. The findings highlight the critical role of information and communication technology (ICT) adoption in enhancing both perceived ease of use and perceived usefulness. Additionally, the knowledge of IT entrepreneurs and government support were found to uniquely influence perceived ease of use and perceived usefulness, respectively. Both of these perceptions, in turn, positively impacted attitudes toward and the actual use of digital tools within SMEs. To address the challenges faced by Yemeni SMEs, it is recommended to enhance digitalization through ICT adoption and promote a pro-technology culture. Policymakers should create a supportive environment via targeted policies, subsidies, and public-private partnerships to foster sustainable growth and competitiveness.

Keywords: Technology Acceptance Model, Technology-Organization-Environment Framework, Attitude Toward Using, Actual System Use, SMEs.

INTRODUCTION

Digitalization has become an essential factor in the growth and sustainability of small and medium enterprises (SMEs) worldwide [1-4]. Furthermore, technology, entrepreneurship, and SMEs significantly contribute to the encouragement of economic and social development

processes influenced by technology, organizational structures, environmental, and individual factors [1, 5, 6].

On the other hand, the digital transformation of entrepreneurship and SMEs is increasingly recognized as a fundamental component in the long-term economic development of both developed and developing countries [6]. This recognition was through the advantages of adopting digital entrepreneurship on SME digitalization by increasing the GDP value, rate of workforce participation, and diversification of the economic and production structure of the countries by stimulating the process of economic and social development in SMEs [7-9]. On the subject of global developing countries, SMEs are considered a significant economic force, representing at least 90% of firms, contributing 40-60% to GDP, 40% of global industrial production, and 35% of world exports [10]. However, in Yemen, SMEs contribute a substantial around 97% to the country's GDP and 90 % of the workforce [2, 11, 12]. Due to that, SMEs play a central role in the Yemen business environment since they are essential in job creation, which contributes to the country's well-being and development as it makes the most significant contribution to GDP [7, 13, 14].

The digitalization of entrepreneurship, SMEs in Yemen presents a complex landscape marked by both significant challenges and emerging opportunities [8, 10]. In a country where SMEs are the backbone of the economy, contributing significantly to GDP and employment, the integration of digital technologies is not just a trend but a necessity for the economic growth and development of Yemen [9, 15, 16]. Moreover, the absence of a digital economic strategy and vision within the Yemeni government has delayed the development of a positive environment for digital SMEs and entrepreneurship [10]. Compared to neighboring countries like Saudi Arabia, Oman, and the UAE, Yemen has delays in digital infrastructure and e-government services, which are crucial for supporting digital businesses [17].

Yemen's digital landscape remains underdeveloped, with a persistent digital divide significantly affecting SMEs and entrepreneurial activities. The term "digital divide" refers to the gap between technology adopters and non-adopters [17, 18], and this gap has been consistently highlighted in research [19, 20]. The ongoing conflict has further exacerbated this divide, stalling ICT advancements and damaging critical infrastructure, leaving Yemeni businesses at a disadvantage compared to neighboring countries like Saudi Arabia, Oman, and the UAE, which have progressed significantly through government support and national digital strategies [18, 21].

Yemeni entrepreneurs face critical challenges, including limited access to electricity, a weak telecommunications infrastructure, and the high cost of internet services [18, 19, 21]. In comparison, neighboring countries benefit from robust infrastructure and supportive policies that enhance their digital economies [17]. Yemen's lack of a comprehensive national digital strategy and inadequate institutional support further widen the gap, with insufficient funding for digital business development posing a major barrier [22, 23]. Additionally, while neighboring countries have successfully transitioned to advanced network technologies like 4G and 5G, Yemen lags behind, hampering the potential for SME digitalization and entrepreneurship [18-20]. And with current innocent of SpaceX company in 2024, Yemen became the first country the Arabic region access to the internet as it's already been activated with highly speed.

Moreover, the lack of technology skills and education, compounded by insufficient government investment in developing a digital knowledge base, creates further obstacles [2, 24]. High unemployment among university graduates, due to inadequate digital skills, highlights the need for strategic initiatives from the Yemeni government to foster digital readiness [7, 25]. These infrastructural and skill gaps hinder the ability of Yemeni SMEs to compete in the growing digital economy, leaving them ill-prepared to capitalize on emerging opportunities. Addressing these issues requires a strategic vision for digital infrastructure development, along with targeted investments in ICT, digital skills, and policies that foster a pro-technology environment. Hence, this study aims to explore factors to offer solutions for overcoming these barriers and developing a robust digital entrepreneurship ecosystem in Yemen, drawing comparisons to the successful digital transformations seen in neighboring countries. By leveraging findings from this research, Yemeni SMEs can enhance their competitiveness and foster sustainable growth in an increasingly digital global economy.

THEORETICAL FOUNDATION

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), proposed by Davis [26], has been widely applied in numerous studies to explore users' adoption of new technologies. TAM is grounded in the Theory of Reasoned Action (TRA) [27] and the Theory of Planned Behaviour (TPB) [28]. It identifies perceived usefulness (PU) and perceived ease of use (PEOU) as critical determinants of user intentions and technology adoption behaviour [26, 29].

Perceived Usefulness (PU) refers to the extent to which individuals believe that using new technology will enhance their performance, while Perceived Ease of Use (PEOU) relates to the degree to which users find technology easy to adopt with minimal physical effort [26]. According to TAM, PU directly impacts users' behavioural intention to use technology, while PEOU influences their attitudes toward using it indirectly by enhancing the perception of its usefulness [30]. This relationship reflects the assumption that when technology is perceived as easy to use, individuals are more likely to see its utility, leading to greater adoption [31].

The core dimensions of TAM include (i) Perceived Ease of Use (PEOU), (ii) Perceived Usefulness (PU), (iii) Attitude Toward Use (ATU), (iv) Behavioural Intention to Use (BI), and (v) Actual System Use (ASU) [32] (Parreira et al., 1987;). External variables, such as individual characteristics, organizational factors, and environmental conditions, can also influence these perceptions, making TAM a flexible and widely applicable model [33].

Research has consistently highlighted that PU exerts a more significant influence on user behaviour than PEOU, with PU being the strongest predictor of technology acceptance [34]. Moreover, users' perceptions of technology's effortlessness and its contribution to their performance positively shape their attitudes and behaviour towards adoption [35]. In this study, TAM's application helps to assess Yemeni entrepreneurs' attitudes toward digitalization, using PU, PEOU, ATU, and BI as primary variables for understanding technology acceptance.

Technology-Organization-Environment-Individual (TOE-I) Framework

The Technology-Organization-Environment (TOE) framework, introduced by Tornatzky and Fleischer [36], extends the understanding of technology adoption beyond individual attitudes, incorporating organizational and environmental factors. TOE posits that the decision to adopt

new technology is influenced by three key contexts: technological, organizational, and environmental [36]. This study extends the TOE framework by including individual factors, thus adapting it into the TOE-I framework.

The technological context refers to the characteristics of the technology itself, including its availability, complexity, and relative advantages. The organizational context includes factors such as the size, structure, and resources of the enterprise, which can either facilitate or hinder technology adoption. The environmental context involves external influences, including market conditions, competition, and regulatory frameworks, all of which impact an organization's decision to adopt new technologies [1, 37].

The addition of individual factors to the TOE framework highlights the importance of personal characteristics, such as the entrepreneurs' experiences and attitudes toward technology, in influencing their technology adoption decisions. Previous research suggests that users' attitudes and experiences with technology play a pivotal role in shaping adoption behaviour, particularly in environments with underdeveloped infrastructure [33, 38]. The inclusion of these individual factors enhances the model's applicability to digital entrepreneurship and SME digitalization management in Yemen, where personal and organizational challenges are heightened due to the lack of supportive infrastructure [1, 37].

By integrating TAM and TOE-I, this study captures both the individual and contextual factors influencing technology adoption. While TAM emphasizes perceived usefulness and ease of use as critical drivers of individual acceptance of technology, the TOE-I framework provides a broader organizational and environmental perspective, capturing the external forces that influence technology adoption decisions in SMEs [39]. This combined approach offers a comprehensive lens for examining how Yemeni entrepreneurs navigate the challenges of digitalization, particularly in an environment characterized by economic instability and infrastructural deficits. By adopting this integrated model, the study seeks to explore how individual perceptions of technology's usefulness and ease of use, shaped by organizational and environmental conditions, drive the digitalization of SMEs in Yemen. Through this theoretical foundation, the study aims to provide actionable insights into overcoming barriers to digital entrepreneurship in developing economies.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Technology (ICT Adoption), Perceived Usefulness, and Perceived Ease of Use

The adoption of Information and Communication Technology ICT plays the main role in developing the perceived usefulness of technology [21, 40]. Additionally, this perception significantly influences the attitude toward using technology and actual system use among Yemeni entrepreneurs [34]. Moreover, adopting ICT with perceived usefulness is considered a key driver in improving SME technology [40].

Besides, when Yemeni entrepreneurs recognize the tangible benefits of ICT in improving efficiency, expanding customer base, and facilitating competitive advantages, their attitude toward using these technologies becomes more positive [41, 42]. Additionally, this positive attitude is a central part of the actual implementation and use of ICT among SMEs in Yemen [42]. So, there is a correlation between usefulness and attitude toward using, which is essential for the successful digitalization and management of Yemeni SMEs and Entrepreneurs [33].

Therefore, the practical benefits and applicability of ICT with perceived usefulness among Yemeni entrepreneurs and SMEs are the key to the development of a digital environment that supports the growth and sustainability of digital entrepreneurship and SME digitalization management among Yemeni Entrepreneurs [33, 40]. Therefore, this study posits the following hypothesis:

- H1a: Technology (ICT adoption) has a positive influence on perceived usefulness.

The Technology factor, particularly ICT adoption, significantly influences the perceived ease of use of technology, which in turn affects the attitude towards using technology and actual system use among the Yemeni SME sectors [20]. Besides, adopting ICT is a critical determinant in shaping how Yemeni entrepreneurs perceive the ease of integrating these technologies into their SME business operations [43]. Also, when ICT solutions are used among Yemeni entrepreneurs, the perceived ease of use will be highly recommended, leading to more favourable conditions for actual system use [15, 16, 44].

Moreover, this positive attitude is the key to determining how technologies can be employed in daily practices among Yemeni entrepreneurs [45]. On the other hand, digital transformation in Yemen is increasingly important for SMEs' competitiveness and growth as the ease of use of ICT solutions significantly can lower the difficulties for the benefits of SMEs' digitalization sectors [44]. Therefore, the positive attitude toward ICT adoption encourages entrepreneurs' use by enhancing different aspects of SMEs' business operations, from efficiency to market reach [17, 19]. Therefore, this study posits the following hypothesis:

- H1b: Technology (ICT adoption) has a positive influence on perceived ease of use.

Organization (IT Entrepreneur's Knowledge), Perceived Usefulness, and Perceived Ease of Use

The correlation between organizational factors, specifically employee, managers, and owners' IT capability, and knowledge with their influence on the perceived usefulness of technology, attitude towards using technology, and actual system use are one of the fundamental factors of digital entrepreneurship and SME digitalization management among Yemeni entrepreneurs [7, 46]. Additionally, when Yemeni employees, managers, and owners have good IT capability and knowledge, they will be more attentive to perceiving technology as a good solution for the gap regarding lack of technology skills, which, in turn, adopts a positive attitude toward its adoption [17, 47]. This positive attitude translates into actual system use and enables Yemeni entrepreneurs to integrate digital tools and strategies into their business operations effectively [48].

Moreover, the alignment of Yemeni employees, managers, and owners' IT capability with perceived usefulness, attitude toward using, and actual system use plays an essential role in enhancing the digital entrepreneurship competencies of SMEs in Yemen [17, 47]. It also empowers them to connect technology for innovation, operational efficiency, and adaptability, which is vital in adopting SME digitalization management in Yemen [21]. Therefore, this cooperative relationship emphasizes investing in employee IT education and skills development to drive economic growth and sustainability within the Yemeni SMEs [23]. Therefore, this study posits the following hypothesis:

- H2a: Organization (IT Entrepreneur's Knowledge) has a positive influence on perceived usefulness.

The technological knowledge possessed by managers, owners, and employees within an organization plays a crucial role in shaping the perceived ease of use of digital technologies in SME digitalization management. This perception significantly influences their attitude toward technology and the actual system use among Yemeni SMEs [17, 47]. The IT knowledge and capabilities of Yemeni entrepreneurs, including managers and owners, directly impact the perceived ease of using digital entrepreneurship tools and SME digitalization management systems [49]. For example, employees with higher levels of IT proficiency are more likely to perceive digital tools as easy to use, which enhances their willingness to engage with these technologies for improving SME digitalization management in Yemen [1, 37]. This ease of use fosters a positive attitude toward using technology, as Yemeni managers, owners, and employees become more confident and motivated to adopt digital entrepreneurship practices within their SMEs [7, 10].

In the context of Yemeni SMEs, where digital transformation is becoming increasingly critical, empowering employees with IT skills and knowledge is essential [50-52]. This empowerment facilitates technology adoption and ensures its effective application in business operations, thereby driving digital innovation and growth for Yemeni SMEs [10].

Investing in IT training and development for employees is a strategic approach for Yemeni entrepreneurs to enhance digital capabilities within their organizations, ultimately contributing to SMEs' successful digitalization and management [7]. The perceived ease of use and understanding of how technology can improve digital entrepreneurship and SME digitalization management processes positively influence attitudes toward using among Yemenis [25, 32, 53]. Furthermore, when Yemeni entrepreneurs observe that the community perceives technology as beneficial and easy to use, their willingness to integrate these tools into their business practices increases, leading to a higher likelihood of actual system use [7, 10]. Therefore, this study posits the following hypothesis:

- H2b: Organization (IT Entrepreneur's Knowledge) has a positive influence on perceived ease of use.

Environment (Government Support), Perceived Usefulness, and Perceived Ease of Use

In the context of Yemeni SMEs and entrepreneurship, government support exerts a powerful influence on digital transformation [5]. By providing initiatives and resources that address key infrastructure, skills, and financial constraints, the government can significantly impact Yemeni business owners' perceptions of the perceived usefulness of SME digitalization management [1, 5]. When Yemeni entrepreneurs observe a supportive government environment promoting digital adoption, they are more likely to believe that technology offers tangible benefits and can contribute to their business success [53]. This perception of usefulness enhances a positive attitude toward using technology, encouraging entrepreneurs to embrace technology and actively engage with the possibilities of SME digitalization management [10].

Furthermore, this engagement translates into actual system use, where technology becomes a foundation for digital entrepreneurship, enabling Yemeni SMEs to reorganize operations, enhance customer service, and access new markets [46, 54]. Consequently, practical government support emerges as a dynamic force in Yemeni entrepreneurship and digitalization, fostering a more sustainable and prosperous future for SME digitalization [5]. Therefore, this study posits the following hypothesis:

- H3a: Environment (Government Support) has a positive influence on perceived usefulness.

There exists a relationship between environmental factors, such as Yemeni government support and its impact on Yemeni entrepreneurs' perceived ease of use, attitude toward using technology, and actual system use in influencing digital entrepreneurship and SME digitalization management. This support is a key factor for Yemeni SMEs [1, 36]. Government support, including funding, policy roles, and enterprise backing, is essential in shaping the perception of technology as easy to use among Yemeni entrepreneurs [10, 46]. When the government actively aids and supports SMEs in technology adoption, it fosters a positive attitude toward operational changes within Yemeni SME management [10, 55]. This favorable attitude translates into actual system use of technology, enabling Yemeni entrepreneurs to effectively embrace digital tools and strategies [53, 56].

The compatibility of government support with perceived ease of use, attitude toward using technology, and actual system use is crucial in enhancing the digital entrepreneurship capabilities of SMEs in Yemen [10]. This support empowers SMEs to access necessary resources, promoting success in the digital landscape and contributing to economic growth and resilience within the Yemeni SMEs [53]. Therefore, this cooperative relationship highlights the significant role of government policies and enterprises in driving SME digitalization and entrepreneurship among Yemeni entrepreneurs [1, 57]. Hence, this study posits the following hypothesis:

- H3b: Environment (Government Support) has a positive influence on perceived ease of use.

Individual (Managers and Owners), Perceived Usefulness, and Perceived Ease of Use

The relationship between individual factors, specifically Yemeni business managers and owners, and their impact on perceived usefulness, attitude toward using technology, and actual system use is a crucial element in exploring the influencing factors in digital entrepreneurship and SME digitalization management among Yemeni entrepreneurs [1, 38, 50, 53]. As key decision-makers, Yemeni business managers and owners play a significant role in shaping the perception of digital entrepreneurship and SME digitalization management within their organizations [54].

When these managers and owners recognize the usefulness of technology in improving digitalization operations for Yemeni SMEs, it fosters a positive attitude toward its adoption among entrepreneurs [58]. This positive attitude is instrumental in actual system use, enabling individual Yemeni entrepreneurs to effectively integrate digital tools and strategies into their SMEs' digitalization processes [45, 46].

The alignment of individual factors, represented by business managers and owners, empowers SMEs in Yemen to enhance their digital entrepreneurship capabilities [5, 6, 20, 49]. Therefore, developing individual factors and fostering a culture that recognizes the value of technology among Yemeni managers and owners is fundamental to the successful implementation of SME digitalization and entrepreneurship development in Yemen [2, 46]. Therefore, this study posits the following hypothesis:

- H4a: Individual (Managers and Owners) has a positive influence on perceived usefulness.

The successful integration of digital technology into Yemeni SMEs depends on individual factors influencing business leaders' perceptions and behaviours [1, 38, 53]. When Yemeni business managers and owners find technology easy to use and believe in its ability to enhance their SME business and customer service, they develop a positive attitude toward using it [46]. This positive attitude, grounded in the belief in technology's value, leads to actual system use (ASU), making technology an essential element of daily SME business functions for Yemenis [46, 58].

Moreover, active engagement with technology allows Yemeni entrepreneurs to leverage its benefits for strategic decision-making, streamlining operations, and exploring new market opportunities [1, 5]. As a result, technology adoption driven by the perceptions of Yemeni business managers and owners becomes a crucial element for the sustainable growth and successful digitalization of Yemeni SMEs [53].

The alignment of individual factors, represented by Yemeni business managers and owners, with perceived ease of use plays a fundamental role in improving the digital entrepreneurship capabilities of SMEs in Yemen [10]. This alignment empowers them to face the challenges of digitalization and maintain competitiveness, thereby contributing to economic growth and sustainability within the Yemeni SMEs [46, 57, 59]. Encouraging Yemeni leaders (managers/owners) to adopt digital skills and a digital mindset is essential for the successful implementation of digitalization initiatives and entrepreneurship development in Yemen [1, 38, 50, 53, 54]. Hence, this study posits the following hypothesis:

- H4b: Individual (Managers and Owners) has a positive influence on perceived ease of use.

Perceived Ease of Use and Perceived Usefulness

The interrelationship between perceived ease of use, perceived usefulness, attitude towards using technology, and actual system use forms a foundational framework with a reflective impact on digital entrepreneurship and SME digitalization management among Yemeni entrepreneurs [5, 26, 34]. Moreover, when Yemeni entrepreneurs perceive SME digitalization management as easy to use, it encourages them with a positive attitude toward its adoption [41, 58]. Also, recognizing the usefulness of technology supports this suitable attitude toward SME digitalization among Yemenis [46, 60]. This factor collectively influences actual system use, enabling Yemeni entrepreneurs to effectively integrate digital tools and strategies into their business operations [42, 53]. On the other hand, this collaboration is the essential key to enhancing digital entrepreneurship capabilities, developing innovation, reorganizing operations, and enhancing competitiveness within the SMEs in Yemen [1, 5, 61, 62]. Therefore, this interrelationship of perceived ease of use and perceived usefulness emphasizes their important role in driving economic growth and sustainability of Yemen SMEs through digitalization, making them more dynamic components of the entrepreneurial environment in Yemen [53, 57]. Consequently, this study posits the following hypothesis:

- H5: Perceived ease of use of technology acceptance has a positive influence on perceived usefulness.

Perceived Usefulness and Attitude Towards Using

Perceived usefulness is the degree to which an individual believes technology will enhance a Yemeni entrepreneur's performance by driving digital entrepreneurship and digitalization management among Yemeni SMEs [5, 37, 63]. Moreover, research suggests that when entrepreneurs perceive technology as valuable and relevant to their business goals, it becomes good support with a positive attitude toward using technology and leads to actual system use among Yemeni entrepreneurs [64-66]. Also, this increase in system use directly impacts digitalization management by enabling efficient operations with improved decision-making of SMEs and enhanced business operations in Yemen [1, 41]. Therefore, addressing these challenges through targeted involvement and a capacity-building strategy program is central to unlocking the full potential of digital entrepreneurship and empowering Yemeni SMEs in the globalized economy [1, 5]. Consequently, this study posits its third hypothesis:

- H6: Perceived usefulness of technology acceptance has a positive influence on attitude towards using.

Perceived Ease of Use and Attitude Towards Using

Perceived ease of use is the degree to which an individual (managers/Owners) believes technology is easy to use, and adapt to serve as a dynamic window to technology acceptance for Yemeni entrepreneurs [5]. Additionally, when entrepreneurs perceive technology, they are more likely to develop a positive attitude toward using digital entrepreneurship [1, 37, 53]. Moreover, this positive attitude toward actual system use will lead to the successful utilization of digital tools in SMEs' operations [67, 68]. Consequently, improved efficiency, enhanced decision-making, and expanded market reach contribute to the growth of digital entrepreneurship and SME digitalization management in Yemen [5, 63]. Therefore, addressing the challenges of limited digital literacy and technical expertise through training initiatives and user-centred design can significantly increase the perceived ease of use for digital adoption among Yemeni entrepreneurs in the competitive global landscape [2, 5]. Hence, this study posits the following hypothesis:

- H7: Perceived ease of use of technology acceptance has a positive influence on attitude towards using.

Attitude Towards Using and Actual System Use

The relationship between the attitude towards using technology and actual system use plays a central role in the use of SME digitalization management among Yemeni entrepreneurs [1, 53]. Moreover, this relationship is supported by the technology acceptance model that assumes a good attitude toward technology significantly drives the actual deployment of SME digitalization among Yemeni businesses [47, 53, 64]. Due to that, when Yemeni entrepreneurs translate this vision into reality, the result will be positive perceptions, and the attitudes towards digital tools will directly influence their practical adoption of digitalization in business operations [17, 67, 69].

Additionally, this attitude is formed by TAM factors such as perceived benefits, ease of use, and the compatibility of technology with business strategy in Yemeni SMEs [46, 57]. Moreover, the actual use of technology is a central step in the digitalization of Yemeni SME management. It illustrates Yemeni entrepreneurs' development from theoretical acceptance to practical implementation [2, 70]. This development is significant for Yemeni SMEs as it enables them to influence digital technologies to develop the operational efficiency of digitalization

management [47]. Accordingly, this approach is essential for the development of the Yemeni digital economy, where technology is not only available but also actively used for SME business growth and development [46, 54, 69]. Hence, this study posits the following hypothesis:

- H8: The attitude toward using technology has a positive influence on the actual system use.

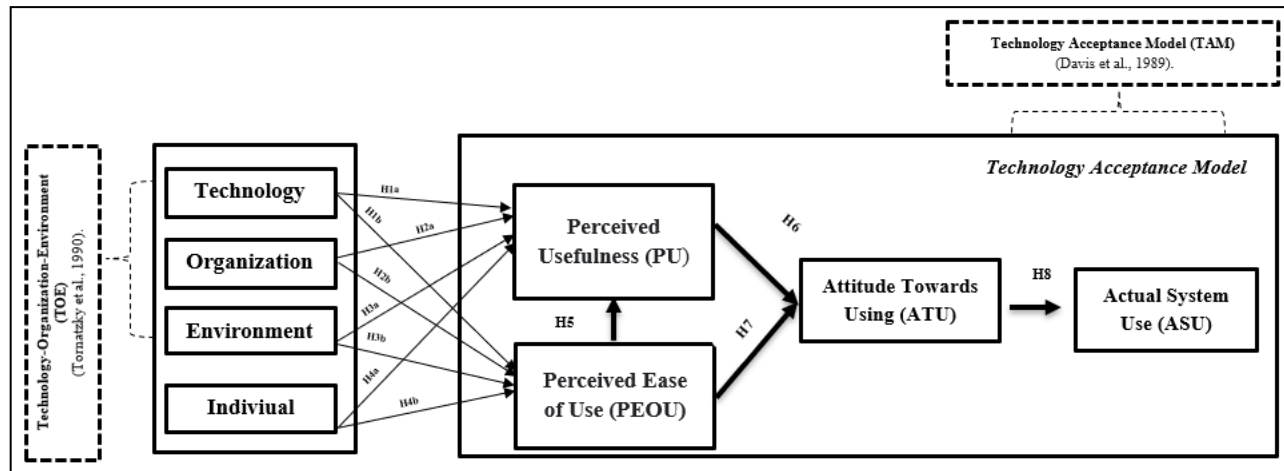


Figure 1: Framework

RESEARCH METHODOLOGY AND DATA COLLECTION

This study explored the relationship between the Technology-Organizational-Environmental-Individual (TOE-I) framework [1, 17, 36, 38, 54, 71], and the Technology Acceptance Model (TAM) [72]. It aims to evaluate the factors influencing digitalization in Yemeni SMEs by adapting measurement indicators from prior research, focusing on reflective, multi-item constructs.

This quantitative research employed a survey method, distributing a questionnaire to gather information on factors influencing digital entrepreneurship and SME digitalization among Yemeni entrepreneurs. The questionnaire used a five-point Likert scale, ranging from 'Strongly Disagree' to 'Strongly Agree,' to collect quantitative data on Yemeni entrepreneurs' perceptions and opinions. Constructs like Technology-ICT Adoption (TICTA) and Environment-Government Support (EGVS) were measured with five indicators each, based on Shahadat, Nekmahmud [73], while Organization-IT Entrepreneurs Knowledge (OIEK) drew on Jafari-Sadeghi, Amoozad Mahdiraji [74], Rababah, Bilal Ali [75]. Additional constructs, including perceived usefulness, perceived ease of use, attitude towards use, and actual system use, each utilized five indicators adapted from various studies [72, 76-78].

A random sample sampling was used. Additionally, the measurement scales were adapted from previous studies to suit this research better. As the target population speaks only Arabic, the researcher prepared the questionnaire in English and created an Arabic version. Two bilingual experts in digital entrepreneurship and SME digitalization reviewed both versions to ensure clarity, relevance, and accurate back-translation. This process, which helped to validate that both versions convey the same meaning and measure the intended constructs, has been applied in several studies [3, 4, 13, 24, 25].

A pilot study was conducted by distributing the questionnaire to 50 Yemeni entrepreneurs, the target population, to test the validity and reliability of the study. Cronbach's alpha for all variables exceeded 0.70, indicating reliability. Specifically, Cronbach's alpha ranged between 0.935 (Technological - ICT Adoption) and 0.847 (Environmental - Government Support), surpassing the recommended threshold of 0.70 [79, 80]. In conclusion, the variables demonstrated internal consistency, with no items omitted.

During the main data collection stage, 392 questionnaires were distributed, and 380 responses were received. Data were then analysed using SPSS and SmartPLS to evaluate model fit and test the study hypotheses within the research context. For the main analysis, PLS-SEM was chosen due to its suitability for complex, underexplored models, particularly where latent variables are involved [61, 62, 79]. The PLS-SEM technique was conducted in two steps: assessing the measurement model's reliability, convergent, and discriminant validity, followed by analysing the structural model to test hypothesized relationships. PLS-SEM's robustness against non-normal data [14, 51, 52, 81], and effectiveness in handling small to medium sample sizes made it a fitting choice for this study.

RESULTS

Demographic Profile of the Respondents

Based on the data presented in Table 1, The sample comprises 380 respondents, with a predominant representation of males at 75.8% (288 respondents), while females constitute 24.2% (92 respondents). This indicates a significant gender disparity within the sample. The education levels of the respondents vary, with the largest group holding a bachelor's degree, representing 41.6% (158 respondents). Following this, 27.6% (105 respondents) possess a master's degree, 16.8% (64 respondents) have completed secondary education, 9.7% (37 respondents) hold a PhD, and 4.2% (16 respondents) have primary education. This distribution shows that a majority of the respondents have higher education qualifications, with over three-quarters having at least a bachelor's degree.

A significant majority, 95.8% (364 respondents), reported being familiar with technology and entrepreneurial practices, while only 4.2% (16 respondents) indicated otherwise. This suggests a high level of awareness and knowledge about technological and entrepreneurial activities among the participants. Similar to the previous finding, 95.8% (364 respondents) affirmed understanding what digital entrepreneurship and SMEs digitalization practices entail after being introduced to the concept. Only 4.2% (16 respondents) felt they lacked understanding. This underscores a strong grasp of digital entrepreneurship concepts among the respondents. All respondents (100%, 380 respondents) unanimously agreed that the use of technology and digital entrepreneurship practices is an effective tool for promoting high performance in SMEs digitalization and management in Yemen. This consensus highlights a shared belief in the potential of digital technologies to enhance SME operations.

The respondents acquired their knowledge about using technology to manage digitization in SMEs from various sources: 60% (228 respondents) through seminars, trainings, and workshops; 24.2% (92 respondents) via electronic media; and 15.8% (60 respondents) through their education studies. This indicates that experiential learning and media play crucial roles in disseminating knowledge about digital practices in SMEs. A significant portion, 80% (304 respondents), have attended seminars or training programs on business, technology,

entrepreneurship, and SMEs digitalization management practices, while 20% (76 respondents) have not participated in such events. This shows a high engagement rate in continuous learning and professional development activities related to digitalization. All respondents (100%, 380 respondents) expressed readiness to adopt digitization and digital transformation management practices in their companies, reflecting a strong inclination towards embracing digital innovations.

The sample is evenly split between small and medium enterprises 50.53% (192 respondents) manage small enterprises, and 49.47% (188 respondents) run medium enterprises. While there no respondents indicated in the micro and large enterprises as the target of this study as was only small and medium enterprise. The respondents' enterprises operate in various sectors: 36.1% (137 respondents) each in the manufacturing sector and the raw materials production sector, and 27.9% (106 respondents) in the sales and service provision sector. This distribution highlights a diverse representation of industries among the participants. The average age of the respondents' companies varies: 56.1% (213 respondents) are more than 10 years old, 30% (114 respondents) are between 5 to 10 years old, and 13.9% (53 respondents) are less than 5 years old. This indicates a majority of established businesses in the sample.

Additionally, the company's number of employees in Yemenis SMEs, companies with less than 4 employees the result is 0 because the target of this study was mainly with small and medium companies not the micro companies. Moreover, half of the respondents 50.53%, (192 respondents) have small companies, while other half respondents with total 188 have medium companies with 10 to 21 employees by 23.16% (88 respondents), also, some companies have from 22 to 33 employees with 16.05% (61 respondents), while other have 34 to 50 employees with 10.26% (39 respondents). This indicates that the majority of responses are from small and medium companies. Moreover, the reach of their companies, 46.8% (178 respondents) describe their businesses as local (national), 37.4% (142 respondents) as regional (neighboring countries), and 15.8% (60 respondents) as global. This shows a range of operational scopes among the enterprises. Overall, this analysis provides a comprehensive overview of the study's participants, highlighting their educational background, familiarity with technology, and the diversity in their business operations.

Table 1: Demographic Information.

Demographic	Frequencies	Percentage (%)
Gender		
Male	288	75.8
Female	92	24.2
Level of Education		
Primary	16	4.20
Secondary	64	16.8
Bachelor	158	41.6
Master	105	27.6
PhD	37	9.70
Are you familiar with technology and entrepreneurial practices?		
Yes	364	95.8
No	16	4.20

After understanding the concept of technology adoption and entrepreneurship practices in SMEs, do you realize that you know what digital entrepreneurship and SMEs digitalization practices are all about?		
Yes	364	95.8
No	16	4.2
In your opinion is the use of technology and digital entrepreneurship practices it's an effective tool to promote high performance of SMEs digitalization and management in Yemen?		
Yes	380	100
No	0	0
What is the source of your knowledge about using technology to manage digitization in SMEs?		
Seminars/Trainings/Workshops	228	60
Electronic Media	92	24.2
Education studies	60	15.8
Have you attended any seminar (s) or training programs on business, technology, entrepreneurship, SMEs digitalization management practices?		
Yes	304	80
No	76	20
After understanding the term digitization and digital transformation management for SMEs, are you ready to adopt it in your companies?		
Yes	380	100
No	0	0
What type of enterprise do you have?		
Micro	0	0
Small	192	50.5
Medium	188	49.5
Large	0	0
What type of business sector of enterprise do you have?		
Sales and service provision sector	106	27.9
Manufacturing sector	137	36.1
The raw materials production sector	137	36.1
What is the average age of your company?		
Less than 5	53	13.9
5 to 10	114	30.0
More than 10	213	56.1
Please indicate the number of employees of your company.		
Less than 4	0	0
4 to 9	192	50.53
10 to 21	88	23.16
22 to 33	61	16.05
34 to 50	39	10.26
More than 50	0	0
What best describes your company?		
Local (national)	178	46.8
Regional (neighboring countries)	42	37.4
Global	60	15.8

Common Method Bias

During the initial stage, this study employed a full collinearity test to assess the presence of CMV, following the recommendations of Kock [82]. Common method bias often arises in structural equation modelling (SEM) due to the chosen measurement technique, potentially influencing responses and leading to shared variance among indicators. To calculate the full collinearity coefficients, a random variable was generated using SPSS to serve as the dependent variable in the regression model, with all latent variables from the study acting as regressors. As shown in Table 2, the results indicate that all full collinearity variance inflation factors (VIFs) are below the threshold of 5, as established by Kock [82], Al-Refaei, Ibrahim [83]. Therefore, it can be concluded that the model is not significantly affected by CMV.

Table 2: Full Collinearity Testing.

	TICTA	OIEK	EGVS	IMO	PU	PEOU	ATU	ASU
VIF	1.825	1.355	3.005	2.008	1.995	1.364	1.875	2.140

Measurement Model

In this research, the proposed model was evaluated using the two-step approach recommended by Anderson and Gerbing [84]. The first step involved assessing the measurement model to ensure its reliability and validity, as outlined by Hair, Risher [85]. Key metrics such as loadings, Average Variance Extracted (AVE), and Composite Reliability (CR) were computed following specific thresholds: loadings needed to be at least 0.5, AVE should exceed 0.5, and CR should be greater than 0.7. The measurement model results, displayed in Table 3, show that most loading values were acceptable. All CR values exceeded 0.7, and AVEs surpassed the 0.5 benchmark. The model consisted of eight first-order constructs. Table 3 further provides the results of the validity and reliability tests for these constructs, confirming their robustness.

Following the guidelines of Henseler, Ringle [86], Al-Refaei, Ali [87], discriminant validity was evaluated using the Heterotrait-Monotrait Ratio of Correlations (HTMT) criterion. Two benchmarks were used: the stricter threshold required HTMT values to be below 0.85. As shown in Table 4, all HTMT values fall under the threshold of 0.85. This suggests that respondents were generally able to differentiate between the constructs being studied. In summary, the measurement outcomes confirm the constructs' validity and reliability.

Table 3: Measurement Model.

Constructs	Items	Outer Loadings >0.5	Cronbach Alpha > 0.7	Composite Reliability >0.6	AVE > 0.5
TICTA	1	0.711	0.775	0.847	0.526
	2	0.720			
	3	0.755			
	4	0.722			
	5	0.716			
OIEK	1	0.807	0.787	0.852	0.538
	2	0.821			
	3	0.771			
	4	0.654			
	5	0.586			
EGVS	1	0.828	0.802	0.883	0.716

	4	0.853			
	5	0.856			
IMO	1	0.857	0.918	0.938	0.753
	2	0.894			
	3	0.875			
	4	0.826			
	5	0.884			
PU	1	0.868	0.924	0.943	0.768
	2	0.871			
	3	0.863			
	4	0.903			
	5	0.875			
PEOU	1	0.840	0.790	0.851	0.538
	2	0.820			
	3	0.666			
	4	0.597			
	5	0.715			
ATU	1	0.925	0.931	0.948	0.787
	2	0.895			
	3	0.790			
	4	0.895			
	5	0.923			
ASU	1	0.871	0.904	0.929	0.724
	2	0.890			
	3	0.810			
	4	0.874			
	5	0.807			

Table 4: HTMT Results.

	ASU	ATU	EGVS	IMO	OIEK	PEU	PU	TICTA
ASU	-							
ATU	0.703							
EGVS	0.120	0.076						
IMO	0.184	0.110	0.683					
OIEK	0.366	0.393	0.094	0.061				
PEU	0.401	0.380	0.148	0.152	0.362			
PU	0.634	0.506	0.353	0.293	0.308	0.513		
TICTA	0.608	0.576	0.181	0.186	0.606	0.515	0.591	

Structural Model

The structural model output from SmartPLS is given in Figure 2 below. Table 5 presents the hypothesis testing for direct effects, showcasing the relationships between various constructs and their significance. The results demonstrate a combination of significant and insignificant relationships, which contribute to understanding the overall model. The impact of TICTA on PEOU ($\beta = 0.367$, $p < 0.05$) and PU ($\beta = 0.328$, $p < 0.05$) is positive and significant. This indicates that improvements in TICTA positively influence how easily users perceive a system and are crucial in shaping users' perceptions of system usefulness. Likewise, OIEK also has a significant positive impact on PEOU ($\beta = 0.129$, $p < 0.05$). This suggests that internal knowledge

management within organizations contributes positively to the perceived ease of system use. On the other hand, the relationship between OIEK and PU is insignificant ($\beta = 0.024$, $p > 0.05$), indicating that OIEK does not significantly affect users' perceptions of the system's usefulness. EGVS significantly influences PU ($\beta = 0.182$, $p < 0.05$), implying that governmental support positively affects how useful users find the system. Whereas OIEK has an insignificant impact on PEOU ($\beta = 0.025$, $p > 0.05$), and IMO has insignificant impacts on PEOU ($\beta = 0.064$, $p > 0.05$) and PU ($\beta = 0.071$, $p > 0.05$).

Results also reveal that PEOU significantly impacts PU ($\beta = 0.282$, $p < 0.05$), demonstrating that when users find a system easy to use, they are more likely to perceive it as useful. This finding aligns with previous research in technology adoption models. Moreover, PU ($\beta = 0.392$, $p < 0.05$) and PEOU ($\beta = 0.167$, $p < 0.05$) strongly influences ATU, indicating that users' attitudes are strongly shaped by perceived usefulness and perceived ease of use. Finally, ATU has a positive and significant influence on ASU. This demonstrates that positive attitudes toward using are a key predictor of actual system usage. The R^2 value for overall model is 0.421, indicating that 42.1% of the variance in ASU is explained by the predictor variables. Overall, these findings highlight the critical roles of TICTA in influencing both perceived ease of use and usefulness, which ultimately drive users' attitudes and actual system use. The results also point to areas, such as OIEK, EGVS and IMO, where further investigation might be needed to understand their varied impact across different relationships.

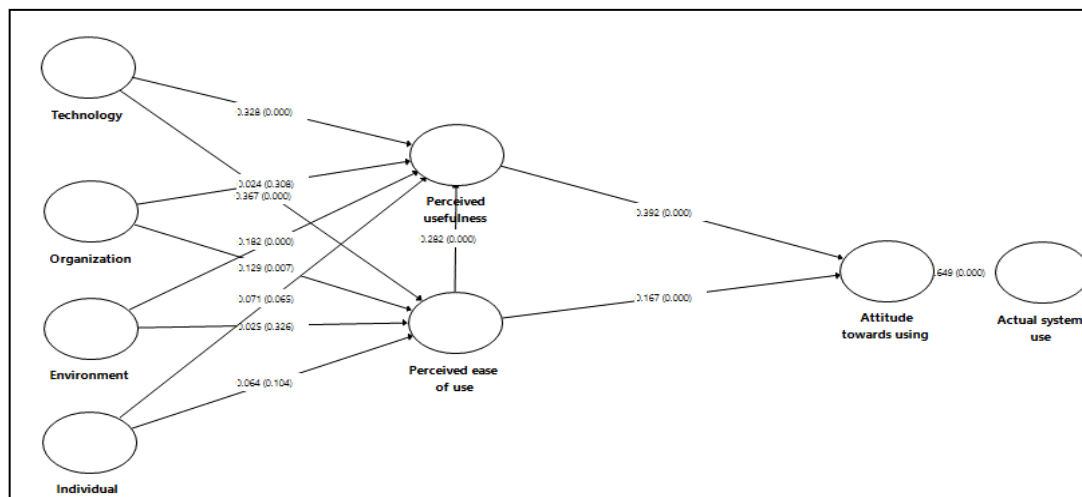


Figure 2: Structural Model.

Table 5: Hypothesis Testing of The Direct Effects.

Relationship	Beta	LL	UL	SE	T-stat	P-value	Result	R2
TICTA -> PEOU	0.367	0.273	0.451	0.054	6.76	0	Significant	
OIEK -> PEOU	0.129	0.037	0.208	0.052	2.487	0.006	Significant	
EGVS -> PEOU	0.025	-0.066	0.116	0.056	0.451	0.326	Insignificant	
IMO -> PEOU	0.064	-0.019	0.146	0.051	1.263	0.103	Insignificant	0.217
TICTA -> PU	0.328	0.228	0.416	0.056	5.851	0	Significant	
OIEK -> PU	0.024	-0.051	0.099	0.046	0.516	0.303	Insignificant	
EGVS -> PU	0.182	0.107	0.256	0.046	3.973	0	Significant	
IMO -> PU	0.071	-0.008	0.145	0.046	1.534	0.063	Insignificant	
PEOU -> PU	0.282	0.207	0.359	0.047	6.032	0	Significant	0.379

PU -> ATU	0.392	0.289	0.49	0.061	6.415	0	Significant	
PEOU -> ATU	0.167	0.087	0.247	0.048	3.451	0	Significant	0.243
ATU -> ASU	0.649	0.548	0.735	0.056	11.586	0	Significant	0.421

Mediation Analysis

Beside evaluating direct effects, the structural model is also designed to analyze mediating effects. The findings, as presented in Table 6, reveal that technology (TICTA) ($\beta = 0.026$, $p < 0.01$) and organization (OIEK) ($\beta = 0.009$, $p < 0.05$) significantly and positively influences actual system use through the serial mediation of perceived ease of use, perceived usefulness, and attitude towards using, at 1% and 5% levels, respectively. Moreover, environment (EGVS) ($\beta = 0.033$, $p < 0.05$) has positive influence on actual system use through significant mediation of perceived usefulness and attitude towards using, at 5% level. Whereas results reveal that individual (IMO) factor does not have any significant indirect effect on actual system use.

Table 6: Specific Indirect Effects.

MEDIATIONS	BETA	LL	UL	SE	T	Sig
TICTA -> PU -> ATU -> ASU	0.081	0.046	0.126	0.025	3.304	0.000
TICTA -> PEU -> PU -> ATU -> ASU	0.026	0.016	0.042	0.008	3.174	0.001
TICTA -> PEU -> ATU -> ASU	0.04	0.018	0.068	0.015	2.591	0.005
OIEK -> PU -> ATU -> ASU	0.007	-0.013	0.028	0.013	0.531	0.298
OIEK -> PEU -> PU -> ATU -> ASU	0.009	0.003	0.018	0.005	1.972	0.024
OIEK -> PEU -> ATU -> ASU	0.014	0.004	0.027	0.007	1.963	0.025
IMO -> PU -> ATU -> ASU	0.001	-0.027	0.023	0.015	0.095	0.462
IMO -> PEU -> PU -> ATU -> ASU	0.005	-0.001	0.012	0.004	1.167	0.122
IMO -> PEU -> ATU -> ASU	0.007	-0.002	0.018	0.006	1.129	0.129
EGVS -> PU -> ATU -> ASU	0.033	0.013	0.062	0.015	2.259	0.012
EGVS -> PEU -> PU -> ATU -> ASU	0.002	-0.005	0.009	0.004	0.435	0.332
EGVS -> PEU -> ATU -> ASU	0.003	-0.007	0.014	0.006	0.443	0.329

DISCUSSION

In light of the ongoing digitalization, SMEs are facing persistent challenges in Yemen, this research aims to deliver valuable insights that can guide authorities and management in promoting digital entrepreneurship. The study focuses on a detailed examination of the factors influencing technology usage within the context of Yemeni SMEs. Additionally, it explores mediating factors that could significantly boost digital entrepreneurship. Within this framework, the study identifies technology (ICT adoption) as a major independent factor influencing the competitiveness of telecommunication companies. Furthermore, perceived ease of use, perceived usefulness, and attitude towards using are introduced as mediating variables, emphasizing their role in strengthening the impact of technology factors on actual system use.

By investigating the roles of these factors, the study aims to highlight their importance in promoting the digitalization of SMEs in Yemen. Through comprehensive analysis, this research aspires to provide valuable insights for decision-makers, management, and policymakers, aiding in the development of strategies and measures to improve digital entrepreneurship. To address the main objectives and aims, the study investigates twelve hypotheses presented earlier. Concerning the influence of TOE-I factors on perceived ease of use and perceived

usefulness, the study accepts four out of eight developed hypotheses. The findings from this study emphasize the differential impact of technology, organizational, and environmental factors on PU and PEOU within Yemeni SMEs. Technology plays a significant role in shaping both PU and PEU, while organizational factors influence PEOU, and environmental factors primarily drive PU.

The significant influence of the technology factor on PU and PEOU can be attributed to the inherent advantages of ICT adoption, such as increased efficiency, automation, and improved communication channels. These features not only streamline business processes but also reduce the manual workload, thus fostering a sense of enhanced usefulness. Employees and managers alike perceive the technology as instrumental in improving productivity and decision-making, reinforcing its utility. Moreover, user-friendly interfaces and functionalities offered by modern ICT solutions contribute to a higher perception of ease of use, facilitating faster adoption by employees who find the technology accessible and intuitive. Further, technology fosters improved collaboration both within the organization and with external stakeholders, offering tools such as instant messaging, video conferencing, and collaborative platforms that enhance daily operations. These factors combine to enhance both PU and PEU, reflecting technology's pivotal role in driving SMEs' operational efficiency and decision-making processes. This resonates with the findings of Nosary and Al-Asadi [18], Zide and Jokonya [88], who demonstrate the broader economic impact of ICT on SMEs, including increased competitiveness and improved communication.

On the other hand, organizational factors, particularly the knowledge and expertise of IT entrepreneurs, show a significant impact on PEU, aligning with the TOE framework. The presence of skilled IT leaders who can streamline the integration of new technologies, provide training, and address resistance to change helps reduce complexity, making the technology more accessible and easier to use for employees. This expertise also enables customization of technology to suit the specific needs of the organization, further enhancing its usability. Such findings are consistent with previous research [1] that underscores the importance of IT expertise in facilitating smoother technology adoption. In contrast, environmental factors, such as government support, predominantly influence PU. Government initiatives, including financial incentives, training programs, and favorable business environments, enhance the perceived utility of technology by reducing the financial and technical barriers associated with adoption. SMEs in Yemen, which often face resource constraints, benefit significantly from such support, as it not only lowers costs but also improves their capacity to leverage technology for growth. This aligns with the findings of Hsieh, Rai [89], Scupola [90], who emphasize the role of government policies in creating a conducive environment for technology adoption.

Notably, individual factors, such as the knowledge and attitudes of managers and owners, did not demonstrate a significant influence on PU or PEU. This can be attributed to cultural resistance to change and a lack of technological awareness, which limit the adoption of new tools in the face of traditional business practices. These challenges, compounded by resource constraints and a focus on short-term goals, hinder the perceived benefits of technology. Economic and political instability further exacerbate these issues, as immediate survival often takes precedence over long-term technological investments. This finding aligns with the works of Alkhateeb and Abdalla [91], who highlight the barriers faced by SMEs in developing economies when adopting new technologies. Overall, the study demonstrates that technology

adoption within Yemeni SMEs is primarily driven by the perceived benefits in terms of usefulness and ease of use. However, the successful implementation of these technologies is contingent upon the presence of knowledgeable IT leadership and robust government support. Addressing challenges such as resistance to change, resource constraints, and a lack of technological awareness is critical for maximizing the potential benefits of ICT in driving SMEs' performance and competitiveness [92].

Moreover, regarding the indirect impacts, this study confirms the mediating effects of PU and PEOU between technological factors and actual system use, supporting all four hypotheses presented. The findings highlight three distinct mediation pathways, showing that technological and organizational factors significantly influence both attitude towards using technology and actual system use through the serial mediation of PEOU and PU. Similarly, the environmental factor (government support) positively influences attitude and actual system use through the mediation of PU alone. The TAM provides a robust framework for understanding these mediations. The serial mediation of PEOU and PU in the relationship between ICT adoption and actual system use within Yemeni SMEs underscores TAM's core principles, where PEOU refers to the degree to which a system is perceived as effortless to use, and PU is the extent to which a system enhances job performance. The ease with which employees can use ICT tools is particularly important in resource-constrained environments like Yemen, where limited technical expertise makes usability a critical factor for adoption. When technologies are user-friendly, employees form positive attitudes towards their use, which directly translates into higher levels of system adoption.

The sequential mediation process begins with ICT adoption influencing PEOU, which then impacts PU. As employees in SMEs perceive technology to be easy to use, they are more likely to appreciate its functional benefits, thus improving their perception of its usefulness. This, in turn, positively affects their attitudes towards technology, making them more inclined to integrate it into their daily routines, thereby increasing actual system use. This finding is consistent with Venkatesh and Bala [93] assertion that initial perceptions of ease of use lower the barriers to entry and encourage exploration, leading to a more positive assessment of technology's utility. Organizational factors, specifically the knowledge and expertise of IT entrepreneurs within Yemeni SMEs, also play a crucial role in shaping these perceptions. IT entrepreneurs with substantial technical knowledge are more adept at selecting and implementing technologies that employees find easy to use. This expertise not only lowers resistance to adoption but also enhances the perceived usefulness of the technology as employees recognize its potential to improve their work processes. Previous research, such as that by Al-Ghaili and Al-Harethi [92], Aloulou [94], supports this argument, demonstrating that entrepreneurial knowledge and leadership positively influence employee attitudes and behaviors. In the context of Yemeni SMEs, this serial mediation process reinforces the importance of IT leadership in fostering positive attitudes towards technology, leading to its increased use.

In addition to technological and organizational factors, the environmental factor, specifically government support, has a significant indirect effect on actual system use through PU. Government initiatives, such as financial incentives, infrastructure development, and training programs, enhance the perceived utility of technology by making it more accessible and valuable to SMEs. As SMEs recognize the benefits provided by government support, their

perception of the system's usefulness improves, which fosters a positive attitude towards adoption. This finding aligns with Utama, Karmagatri [95], Febrianti and Fajri [96], who highlight the importance of external resources in shaping technology adoption in resource-limited contexts. In Yemen, where SMEs face significant challenges due to economic instability, government interventions play a critical role in facilitating the uptake of ICT systems by first enhancing PU and, subsequently, actual system use. In conclusion, this study provides compelling evidence that PEOU and PU mediate the relationship between technological factors and system use in Yemeni SMEs, with three distinct mediation pathways identified. By improving both the usability and perceived benefits of ICT, SMEs can foster positive attitudes towards technology, ultimately leading to higher levels of actual system use. The significant role of IT leadership and government support further underscores the importance of both internal and external factors in driving successful technology adoption in SMEs. For policymakers and SME managers in Yemen, focusing on improving PEOU and PU through targeted interventions can help maximize the benefits of ICT investments and enhance overall organizational performance.

CONCLUSIONS AND IMPLICATIONS

This research offers critical insights into the impact of digital entrepreneurship on the digitalization and management of SMEs in Yemen. By integrating the Technology Acceptance Model and the Technology-Organization-Environment-Individual framework, the study provides a comprehensive understanding of the factors influencing technology adoption and usage within SMEs. The research specifically examined how technological, organizational, environmental, and individual factors contribute to actual system use, emphasizing the mediating roles of perceived usefulness and perceived ease of use in shaping attitudes towards technology and actual system use. The study's results highlight the importance of ICT adoption in enhancing perceived usefulness and perceived ease of use, which in turn significantly affect attitudes towards technology and its actual use. Furthermore, IT entrepreneurs' knowledge and government support emerged as critical influencers of perceived ease of use and perceived usefulness, respectively, demonstrating how these factors shape the adoption process in SMEs. This study makes significant theoretical contributions by developing an integrated framework combining Technology Acceptance Model and the Technology-Organization-Environment-Individual framework to explore the influence of various factors on digitalization. By doing so, it extends our understanding of how digital tools and entrepreneurial strategies are adopted and utilized within SMEs, particularly in resource-constrained contexts like Yemen. The research also enhances the theoretical understanding of the mediating effects of perceived ease of use and perceived usefulness on the relationship between technological factors and system use, contributing to the literature on digital entrepreneurship and SME management. The findings emphasize the role of contextual factors, such as government support and IT entrepreneurs' knowledge, in facilitating digital transformation, particularly in developing countries. The results from the PLS-SEM analysis provide a foundation for future studies, offering valuable insights for researchers aiming to further explore the mechanisms underlying technology adoption and digital entrepreneurship.

The practical implications of this research are extensive, offering actionable guidance for Yemeni entrepreneurs, policymakers, and development agencies. For SMEs, prioritizing ICT adoption is essential, as it enhances both perceived usefulness and perceived ease of use, driving positive attitudes and actual system use. Entrepreneurs and managers should invest in

modern ICT infrastructure and training programs to ensure smooth integration and optimize the use of digital technologies. Although IT entrepreneurs' knowledge did not directly impact perceived usefulness, ongoing education and development programs remain crucial for building digital literacy, which could yield long-term benefits. Government support plays a pivotal role in enhancing the perceived usefulness of technology, underlining the need for supportive policies such as subsidies, tax incentives, and grants for ICT adoption in SMEs. Public-private partnerships can further facilitate resource access and technology integration. Policymakers should also focus on creating user-friendly digital platforms to encourage wider adoption, despite the lack of a direct influence on perceived ease of use.

Small and Medium Enterprises should also adopt intuitive, user-friendly technologies and provide comprehensive training to enhance employees' ability to utilize these tools effectively. Demonstrating the practical benefits of digital tools can foster positive attitudes towards technology, driving acceptance and usage. Furthermore, fostering a pro-technology organizational culture, where experimentation and innovation are encouraged, can enhance actual system use. In conclusion, this research highlights the importance of ICT adoption, digital entrepreneurship, and a supportive environment in fostering SME digitalization. By acting on these insights, Yemeni SMEs can enhance their digital transformation efforts, improve competitiveness, and contribute to sustainable economic growth. Government bodies and development agencies play a critical role in supporting these efforts through policy interventions that promote continuous learning, ICT adoption, and the development of positive attitudes towards technology.

LIMITATIONS AND FUTURE RESEARCH DIRECTION

While this study provides valuable insights into the digitalization of Yemeni SMEs, several limitations must be acknowledged. First, the study's focus on Yemeni SMEs limits the generalizability of the findings to other regions or contexts. Future research should extend this investigation to diverse regions and sectors to capture varying contextual factors that influence SME digitalization. Expanding the study to include larger sample sizes across multiple countries would enable cross-country and cross-regional comparisons, offering a more comprehensive understanding of digitalization trends, challenges, and best practices, particularly in developing economies.

Additionally, the study employs a quantitative research methodology, which, while effective in identifying the impact of technological, organizational, environmental, and individual factors, may overlook the nuanced experiences of SME staff and management. Future research should complement these quantitative findings with qualitative methods, such as interviews or case studies, to explore the complexities and challenges of digitalization in greater depth. A mixed-methods approach would enrich the findings, capturing both the measurable effects and the human factors that influence technology adoption. Moreover, while this study highlights the mediating roles of perceived ease of use and perceived usefulness, future research should consider expanding the scope to include a broader set of variables. Exploring additional factors, such as organizational culture, innovation capabilities, and external market pressures, could provide deeper insights into the drivers of digital adoption in SMEs. This expanded focus would offer a more holistic view of the strategies and interventions necessary to enhance technology usage and foster successful digital transformation.

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