FACTORS INFLUENCING INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION IN SMALL AND MEDIUM ENTERPRISES IN JIJEL, ALGERIA

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Abstract: *The adoption of ICT can provide small and medium enterprises (SMEs) with a competitive advantage by enhancing quality, reducing costs, and increasing information flow. This study aims to identify the factors that influence the adoption of various information and communication technologies in Small and Medium Enterprises (SMEs) located in Jijel province in Algeria. A research model based on the Technological-Organizational-Environmental (TOE) framework extended to Individual context was proposed. Seven independent variables were selected (relative advantage, compatibility, top management support, competitive pressure, government support, owner/manager innovativeness and owner/manager ICT knowledge). The dependent variable, adoption of information and communication technology, was measured as the degree of adoption of six information and communication technologies by SMEs. Ordered logistic regression was utilized to analyze the collected data. The results showed that owner/manager ICT knowledge and government support are the primary factors that substantially influence most IC technologies. Relative advantage, compatibility and competitive pressure have all been found to affect one ICT. The remaining two factors, top management support and owner/manager innovativeness had no impact on any ICT. The study has significant consequences for scholars, practitioners and policymakers.*

Keywords: ICT, Adoption, SMEs, TOE framework, Ordered Logistic Regression, Algeria.

JEL classification: L25, M15, O33

1. Introduction

The introduction of information and communication technology (ICT) has completely changed how business is conducted (Jaganathan et al., 2018; Tan et al., 2009; Taylor, 2005). Research indicates that ICT has an impact on economic growth, productivity, employment, competitiveness and company performance (Kossaï et al., 2020; Tarutė and Gatautis, 2014; Al Busaidi et al., 2019; Giotopoulos et al., 2017). It has been demonstrated that ICT improves firm performance in terms of productivity, profitability, market value and market share, as well as intermediate performance measures like customer satisfaction, cost savings, organizational and process flexibility and process efficiency (Bayo-Moriones and

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Lera-Lopez, 2007). Moreover, ICT is a crucial tool for enhancing information generation and processing and effectively managing and transmitting information (Jere and Ngidi, 2020).
The adoption of ICT can give small and medium enterprises (SMEs) a competitive edge by improving quality, lowering operating costs and increasing information flow (Shahadat et al., 2023). However, SMEs adopt ICT more slowly than large companies (AlBar and Hoque, 2015; Consoli, 2012) because SMEs have fewer resources, competencies and technology (Consoli, 2012). SMEs still face several obstacles in implementing ICT, because of their small size, lack of supply chain support, inadequate infrastructure, lack of resources and training, lack of vision and ongoing weak security measures (Olatokun and Bankole, 2011).
In Algeria, the adoption of ICT in SMEs remains modest. According to 2009 research conducted by the Centre for Applied Economic Research for Development (CREAD), 44.66% of SMEs incorporated ICT, with ICT product investments at 6.72%. Another study conducted in 2011 found that just 46.33% of surveyed entrepreneurs employed ICT, with only 53.1% aware of it. However, research of National Agency for SME Development (ANDPME) conducted in 2011 discovered that only 15% of Algerian SMEs adopted ICT (Djelti, 2016). Furthermore, according to Sidlo et al. (2020), the majority of Southern and Eastern Mediterranean (SEMED) countries have low adoption of digital applications for core business management functions, with fewer firms using ERP and CRM software.
Despite the abundance of research on factors influencing ICT adoption in SMEs, there have been few studies undertaken in Algeria (Atik and Ramdani, 2018; Diouani et al., 2023; Houache et al., 2020; Houari and Medjedel, 2009; Mezaour and Chadli, 2022; Sedkaoui and Khelfaoui, 2024). These studies did not account for individual aspects of SMEs' owner/ manager such as owner/manager ICT knowledge and owner/manager innovativeness, which have been shown in previous research to be important in ICT adoption decisions in SMEs, particularly in developing countries (AlBar and Hoque, 2017; Alroussan et al., 2020; Elbaltagi et al., 2013; Thong and Yap, 1995). This study aims to address this highlighted gap by studying the factors of ICT adoption in SMEs in a province of Algeria based on the technology-organization-environment (TOE) framework by focusing on individual factors aspects such as owner/manager ICT knowledge and owner/manager innovativeness.

2. Literature review

Various theories and models have been employed to study the adoption and use of ICT in SMEs, including the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB) and Unified Theory of Acceptance and Use of Technology (UTAUT). At the firm level, the Diffusion of Innovation (DOI) theory and the Technological, Organisational and Environmental (TOE) framework are commonly used, with some research incorporating multiple theories.
Among these theories and models, the TOE framework offers a comprehensive theoretical framework for analyzing ICT adoption at the firm level. It has been extensively tested and validated in various studies (Albar and Hoque, 2019; Al-Qirim, 2007; Anjum, 2019; Hassan and Ogundipe, 2017; Huda and Lestari, 2018; Ifinedo, 2011; Jere and Ngidi, 2020; Kuan and Chau, 2001; Nawaz and Gunapalan, 2015; Premkumar and Roberts, 1999; Rahayu and Day, 2015; Ramdani and Kawalek, 2009; Shahadat et al., 2023; Skafi et al., 2020).
According to the literature, SMEs' adoption and usage of ICT are influenced by several factors. According to Juniarti and Omar's (2021) review of the literature on technology adoption in SMEs, which is based on the TOE framework, prior studies have divided the factors that influence technology adoption into four groups: individual, organizational, environmental, and technological contexts

• **Technological Context:** includes relative advantage, compatibility, complexity, trialability, and observability.

• **Environmental Context**: contains government/regulatory assistance, competitive pressure, external support, image, pollution, and industry.
• **Organisational Context**: involves top management support, financial resources, ICT knowledge, organizational scale, information, competitive advantage, organizational innovation culture.
• **Individual/Management Context**: covers owner/manager innovativeness, ICT expertise, attitude, innovation, age, gender, and education.

3. Framework and hypotheses development

This research will use the TOE framework to develop a model, which is shown in Figure 1, that can predict the determinants of the decision to adopt ICT in SMEs located in the province of Jijel in Algeria. The model is based on earlier research that used the TOE framework extended to individual factors (AlBar et al., 2017; Alroussan et al., 2020; Thong and Yap, 1995).

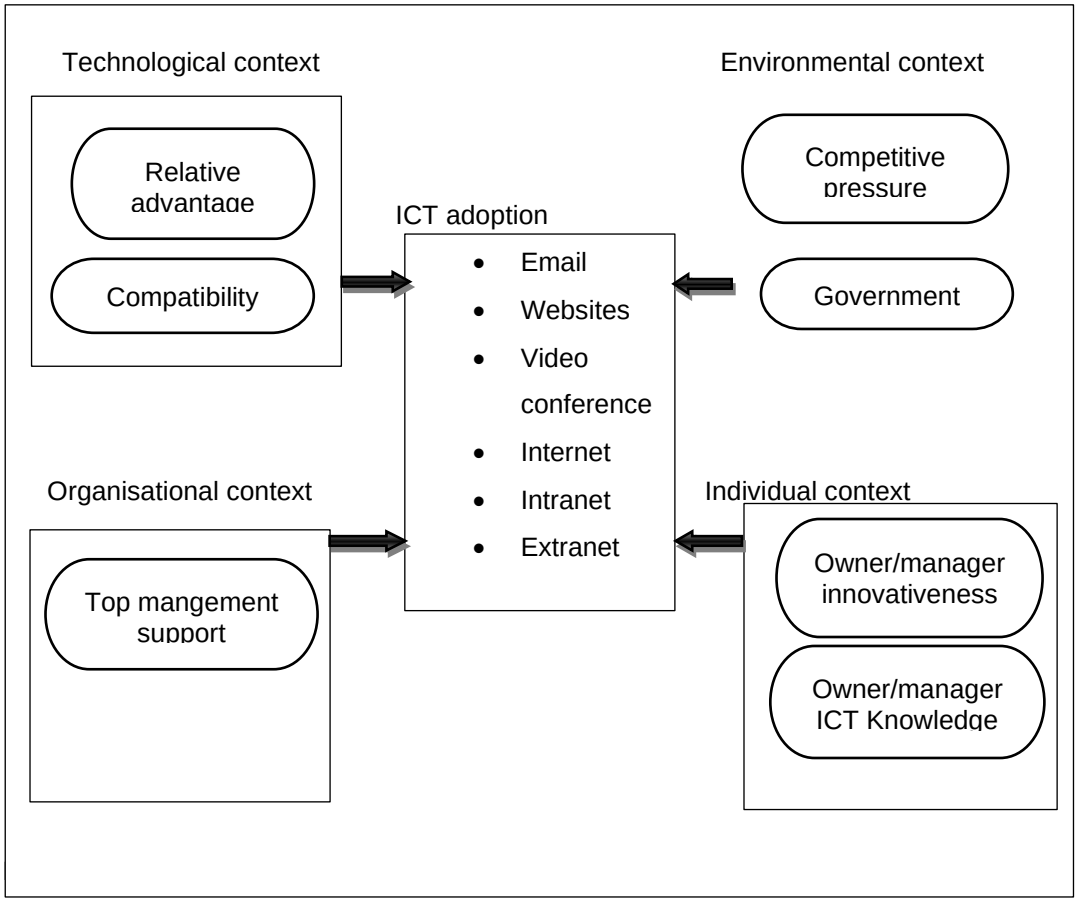

Figure 1: Research framework
Source: Authors' analysis /processing based on own data

Relative Advantage

Relative advantage, as defined by Roger (1983), refers to the perceived superiority of an innovation over its predecessor. It is a crucial factor in determining innovation uptake,

distinguishing adopters from non-adopters (Shahadat et al., 2023). Studies have demonstrated that relative advantage significantly influences the adoption of ICT in SMEs (Albar and Hoque, 2019; Alroussan et al., 2020; Huda and Lestari, 2018; Ifinedo, 2011; Nawaz and Gunapalan, 2015; Premkumar and Robers, 1999; Ramdani and Kawalek, 2009; Shahadat et al., 2023; Tan et al, 2009). Therefore, this hypothesis is formulated :
H1: Relative advantage has a positive influence on ICT adoption in SMEs.

Compatibility

Compatibility refers to how well an invention aligns with potential users' values and needs (Roger, 1983). High compatibility reduces resistance to new technology adoption in firms (Nawaz and Gunapalan, 2015). Studies have shown that compatibility affects positively the adoption of ICT in SMEs (Nawaz and Gunapalan, 2015; Prekumar and Roberts, 1999; Tan et al., 2009). Hence, the following hypothesis is suggested :
H2: Compatibility has a positive influence on ICT adoption in SMEs.

Top management support

Top management support in SMEs is crucial for the adoption of ICT. It involves understanding the nature and functions of ICT and supporting its adoption through communication and reinforcement of ideas (Nawaz and Gunapalan, 2015). Top management plays a direct role in the ICT adoption process, making decisions for operations and investments (Ghobakhloo et al., 2011; Jere and Ngidi, 2020). Previous studies have shown that top management support influences ICT adoption in SMEs (AlBar and Hoque, 2017; Alroussan et al., 2020; Jere and Ngidi, 2020; Nawaz and Gunapalan, 2015; Premkumar and Roberts, 1999; Ramdani and Kawalak, 2009; Shahadat et al., 2023; Skafi et al., 2020). Thus, the following hypothesis is proposed:
H3: Top management support has a positive influence on ICT adoption in the SMEs.

Competitive pressure

The adoption of technology by a company can be influenced by its business partners and competitors (Kuan and Chau, 2001). Competitive pressure has been found a significant factor in determining ICT adoption in SMEs in various studies (Ifinedo, 2010; Kuan and Chau, 2001; Nawaz and Gunapalan, 2015; Premkumar and Roberts, 1999; Shahadat et al., 2023; Zhu et al., 2003). Therefore, the following hypothesis is suggested :
H4: competitive pressure has a positive influence on ICT adoption in the SMEs.

Government support

Government support is crucial in promoting the adoption of ICT in businesses, particularly for SMEs. Governments play a significant role in SMEs' growth, as they are often resource-constrained and require government assistance (Jere and Ngidi, 2020). Government-funded training programs can help SMEs adopt technology and establish the necessary technological infrastructure (Shaikh et al., 2021). Shahadat et al. (2023) indicate that government assistance for ICT adoption is vital for preparing the country for fundamental changes in facilities, including technical infrastructure, trained human resources, legal and policy support and financial infrastructure. Studies have shown that government support positively impacts the adoption of ICT in SMEs and this relationship is supported by various studies (Anjum, 2019; Ifinedo, 2010; Kuan and Chaud, 2001; Premkumar and Roberts, 1999; Shahadat, 2023). Hence, it is proposed the following hypothesis :
H5: Government support has a positive influence on ICT adoption in the SMEs.

Owner/Manager innovativeness

The innovativeness of owners and managers significantly influences ICT adoption decisions in SMEs, as they are more willing to accept innovations like technology (AlBar and Hoque,

2017; Jaganathan et al., 2018; Thong and Yap, 1995). This relationship has been confirmed by numerous studies, indicating that a more innovative owner or manager is more likely to adopt such innovations (AlBar and Hoque, 2017; Anjum, 2019; Elbeltagi et al., 2013; Rahayu and Day, 2015; Shahadat et al., 2023; Thong and Yap, 1995). Therefore, the hypothesis is the following :

H6: Owner/manager innovativeness has a positive influence on ICT adoption in the SMEs.

Owner/Manager ICT knowledge

SMEs often lack technical skills and specialised IT knowledge (Thong and Yap, 1995), but knowledgeable owners/managers are more likely to use ICT (Ghobakhloo et al., 2011, Jaganathan et al., 2018). The owner's current ICT usage abilities, knowledge, skills and experience positively impact ICT adoption (AlBar and Hoque, 2017). Previous research such as (AlBar, 2017; Alroussan, 2020; Elbeltagi et al., 2013; Rahayu and Day, 2015; Thong and Yap, 1995) has found a significant positive influence of owner/manager ICT knowledge on ICT adoption in SMEs. Thus, this hypothesis is proposed:

H7: Owner/manager ICT knowledge has a positive influence on ICT adoption in the SMEs.

4. Methodology

4.1 Instrument and Scale Development

A survey was performed to evaluate the study's presented hypotheses. An Arabic-language version of a self-administered questionnaire served as the research tool. There are three sections to the survey questionnaire. The information about the sample characteristics is covered in the first part. The second and third parts contain the items for the dependent and independents variables respectively.

The dependent variable (ICT adoption), considering the quantity and diversity of technologies concluded in ICT, was measured by the degree of adoption of each one of six information and communication technologies (email, websites, videoconference, Internet, Intranet and Extranet) (Al-Qirim, 2007; Bayo-Moriones and Lera-Lopez, 2007; Kurnia et al., 2015; Premkumar and Roberts, 1999; Osorio-Gallego et al., 2016) using a five-point Likert scale ranging from 1 (don't use) to 5 (always used). The independent variables were adopted from several studies, namely (Alrousan et al., 2020; Ifinedo, 2011; Moore and Benbasat, 1991; Premkumar and Roberts, 1999; Thong and Yap, 1995) and each item was measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

4.2 Sample and Data Collection

The population of this study consists of all private SMEs located in Jijel province, which is estimated at 7220 by the end of 2023. To collect the needed information, and given the absence of a framework for the targeted population, 84 questionnaires were distributed to a convenience sample through personal interviews, and 76 questionnaires were retrieved, of which 3 were excluded due to the missing data. The valid response rate is 86.9%.

5. Results

5.1 Sample characteristics

Table 1 shows the demographics of respondents and their firms. Most of the respondents were male (83.6%), over thirty years old (91.6%) and highly educated (72.6%). yet most of the respondents were managers and owner/managers (46.6% and 37.0%, respectively), while only 16.4% were owners. Furthermore, the data indicate that the majority of SMEs

were micro and small businesses (80.8%), operated in industry and services (82.2%) and served both local and national markets (82.2%).

Table 1: Descriptive statistics of sample characteristics

Respondent characteristics	Number of respondents (n=73)	Percentage (%)
Gender		
Male	61	83.6
Female	12	16.4
Age		
30 years and less	06	08.2
31-40	25	34.2
41-50	22	30.1
51 years and above	20	27.3
Education		
Secondary and less	08	11.0
Graduate	46	63.0
Postgraduate	7	09.6
Other	12	16.4
Occupation		
Owner	12	16.4
Manager	34	46.6
Owner/manager	27	37.0
No of Employees		
1-5	23	31.5
6-49	36	49.3
50-250	14	19.2
Activity sector		
Industry	36	49.3
Commerce	13	17.8
Services	24	32.9
Market scope		
Local	27	37.0
Regional	1	01.4
National	33	45.2
International	12	16.4

Source: Authors' analysis /processing based on own data

5.2 Validity and reliability

To assess the construct validity and reliability of the various factors, Cronbach's alpha and factor analysis were used.

Cronbach's alpha was used to evaluate the constructs' reliability. Table 2 shows that all constructs had appropriate alpha values (>0.6).

Table 2: Result of construct reliability

No of Item	Variable	No of items	Cronbach's alpha
1	Relative advantage	4	0.883
2	Compatibility	3	0.901
3	Top management support	3	0.944
4	Competitive pressure	3	0.857
5	Government support	3	0.864

6	Owner/manager innovativeness	4	0.833
7	Owner/manager Knowledge	3	0.920

Source: Authors' analysis /processing based on own data

Factor analysis was used to determine convergent and discriminant validity. Using principal components analysis and varimax criteria to rotate the result, seven factors were discovered as explaining the phenomena under examination in the current research (with eigenvalues greater than 1). The results are summarized in Table 3.
Table 3 shows that items load strongly (>0.5) on their linked factors and each item loads more strongly on its corresponding factor than any other factor, so convergent and discriminant validity were confirmed and validated (Kuan and Chau, 2001).

Table 3. Result of factor analysis

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7
RA1		0.766					
RA2		0.889					
RA3		0.862					
RA4		0.861					
CM1				0.867			
CM2				0.928			
CM3				0.856			
TMS1			0.881				
TMS2			0.888				
TMS3			0.857				
CP1						0.847	
CP2						0.853	
CP3						0.855	
GS1					0.733		
GS2					0.904		
GS3					0.940		
OMI1							0.637
OMI2							0.933
OMI3							0.914
OMK1	0.849						
OMK2	0.878						
OMK3	0.851						
OMK4	0.811						

Source: Authors' analysis /processing based on own data

Pearson correlation matrix and Variance Inflation Factor (VIF) were calculated to assess the Multicollinearity problem.
Table 4 indicates that the maximum squared correlation among the independent variables was less than 0.8 (Al-Qirim, 2007).

Table 4. Correlation matrix of the research variables

Variable	RA	CM	TMS	CP	GS	OMI	OMK
RA	1						
CM	0.306	1					
TMS	0.353	0.390	1				

CP	0.188	0.199	0.328	1			
GS	0.050	-0.017	0.011	0.199	1		
OMI	0.104	0.123	0.256	0.127	0.089	1	
OMK	0.227	-0.048	0.369	0.337	0.357	0.331	1

Source: Authors' analysis /processing based on own data

Table 5 displays the findings from the VIF analysis. All the VIF values are below 5 (AlQirim, 2007). Consequently, no indication of a multi-collinearity issue is seen.

Table 5. Variance inflation factor (VIF) values

	RA	CM	TMS	CP	GS	OMI	OMK
RA		1.160	1.184	1.221	1.221	1.220	1.195
CM	1.284		1.194	1.329	1.384	1.338	1.235
TMS	1.528	1.392		1.534	1.533	1.559	1.419
CP	1.237	1.216	1.204		1.220	1.236	1.185
GS	1.191	1.188	1.159	1.175		1.191	1.056
OMI	1.161	1.151	1.150	1.161	1.162		1.080
OMK	1.610	1.504	1.482	1.576	1.458	1.530	

Source: Authors' analysis /processing based on own data

5.3 Hypotheses testing

The Ordered (ordinal) logistic regression was used to evaluate the hypotheses. This statistical method was used since the dependent variable was ordinal (Lal, 1999). The results are shown in Table 6.

The findings of Table 6 indicate statistical significance ($p<0.01$) across all six ordered logistic regressions. The results of Table 6 show also that owner/manager ICT knowledge and government support are the primary variables that substantially impact most IC technologies. Relative advantage, compatibility and competitive pressure have all been found to affect one ICT. The remaining two variables, top management support and owner/manager innovativeness had no impact on any ICT.

Table 6. Results of ordered logistic regression

Variable	Email	Websites	Videoconference	Internet	Intranet	Extranet
RA	1.115*	0.476	0.267	-0.628	-0.284	-0.891
CM	0.275	1.186*	0.013	0.508	0.301	0.395
TMS	-0.089	0.417	0.596	0.581	-0.166	0.605
CP	-0.457	0.167	0.458	0.897	0.731	1.189**
GS	1.359**	1.995**	0.713**	0.313	0.908**	0.798**
OMI	-0.116	-0.161	0.016	0127	0.294	0.091
OMK	1.417**	0.844	1.099*	1.963**	1.098*	1.117*
Log-likelihood	158.038	146.252	143.584	96.196	158.481	169.567
Chi-square	51.595**	64.434**	29.336**	36.958**	38.349**	45.830**

Note. * $p<0.05$; ** $p<0.01$

Source: Authors' analysis /processing based on own data

6. Discussion

The study explores the factors influencing ICT adoption in SMEs in Algeria's Jijel province, revealing that government support and owner/manager ICT knowledge are the primary influences.

The study found that owner/manager ICT knowledge significantly influences the adoption of ICT in SMEs, impacting all IC technologies except websites. This aligns with previous research, (AlBar and Hoque, 2017; Alroussan et al., 2020; Elbaltagi et al., 2013; Thong and Yap, 1995). This can be explained by the fact that the owners and managers are more likely to undertake ICT projects if they believe it will benefit their company financially and in other non-tangible ways (Thong and Yap, 1995). AlBar and Hoque (2017) argue that most decisions in SMEs, in Arabic states, particularly in Saudi Arabia, are made by the owner-manager, including whether to implement ICT in the firm.

The study found also that government support is a crucial factor in determining ICT adoption, affecting all IC technologies except the Internet. This aligns with previous research (AlBar and Hoque, 2017; Alroussan et al., 2020; Elbaltagi et al., 2013; Thong and Yap, 1995). The no significance of the Internet technology can explain by that the respondents may believe SMEs widely use certain EC technologies such as the Internet and hence do not require government support (Alam and Noor, 2009). This result may be due to the role played by the government's financial incentives and facilities in Algeria, such as the creation of specialized technical centers, national upgrading and PME II programs, in encouraging SMEs to adopt ICT(OECD/EU/ETF, 2014).

Unfortunately, the study reveals that competitive pressure, relative advantage and compatibility significantly influence the adoption of only one IC technology. Competitive pressure affects the Extranet. This result is consistent with Al-Qirim's (2007) findings, in which he argues that competition drives the adoption of Extranet in SMEs, as fast, secure access to remote databases is crucial for market competition. Relative advantage has a significant impact on email, which is consistent with previous research such as (Ghobakhloo, Arias-Aranda and Benitez-Amado, 2011; Prekumar and Roberts, 1999) findings. Compatibility affects significantly websites, which is similar to (Al-Qirim, 2007; Ghobakhloo, Arias-Aranda and Benitez-Amado, 2011; Teo et al., 1998) findings.

Surprisingly, the study found no significant impact of top management support and owner/manager innovativeness on ICT adoption in SMEs. This contradicts previous research but aligns with some ones such as (Anjum, 2019; Hassan, 2017) for top management and (Alroussan, 2020; Jaganathan et al., 2018; Shahadat et al., 2023) for owner/manager innovativeness. This result can be explained by the fact that top management engages only when technology incurs expenses (Hassan, 2017) and Managers may lack the innovative understanding necessary to effectively adopt ICT (Shahadat et al., 2023) or traditional innovation differs from technical innovation due to the need to change an SME's entire system and decision-maker's willingness to take risks when implementing new technology (Alroussan, 2020).

7. Conclusion

This study examined the factors influencing the ICT adoption in SMEs in Algeria's Jijel Province. The TOE framework was used to identify these factors. Based on the ordered logistic regression, the results of the study have identified two important determinant factors namely, owner/manager ICT knowledge and government support. However, compatibility, top management, competitive pressure and owner/manager innovativeness were found to be not significant in influencing the adoption of most or all the IC technologies.

These findings contribute significantly to the literature on ICT adoption particularly in ICT adoption among SMEs in developing countries such as Algeria. On the other hand, the study's findings can help managers and policymakers to develop a plan for increasing ICT

adoption among SMEs. The findings suggested that the role of the owner/manager's ICT knowledge and government support is essential in developing and promoting the adoption of ICT in Algerian SMEs.

However, this study suffers from some limitations. The study was conducted in only one province and adopted the convenience sampling technique which may hinder the generalization of the findings. Therefore, further studies with a larger representative of all regions, using probability sampling technique are suggested.

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