Factors of Adoption of Electronic Commerce in SMEs in Mexico

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Abstract **– E-commerce has transformed the entire process of product sales between sellers and buyers, which has been of economic benefit for both parties. The purpose of this paper is to analyze the main decisive factors of this adoption, integrating aspects of Rogers' Innovation Diffusion Theory (IDT), the Technology-Organization-Environment (TOE) model, and the Technology Acceptance Model (TAM). Through a quantitative method, data was collected and analyzed from 434 SMEs using a questionnaire. Findings highlight that the perceived ease and usefulness of e-commerce, influenced by perceived advantage and observability, are critical determinants in the decision to adopt these technologies. Additionally, it was found that management support and employees' knowledge of Information Technologies (IT) play a relevant role in this adoption. This study adds to the existing literature on technological adoption in SMEs, showing important insights for the northeastern region of Mexico and suggesting avenues for future research. The results are relevant for business decision-makers and public policy formulators, offering guidance on how to enhance e-commerce adoption in the SME context.**

Keywords **– Adoption, e-commerce, SMEs, TAM model, TOE model.**

DOI: 10.18421/TEM132-55
https://doi.org/10.18421/TEM132-55

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Received: 23 March 2024.
Revised: 22 April 2024.
Accepted: 06 May 2024.
Published: 28 May 2024.

1. Introduction

Information technologies (IT) have revolutionized the small and medium sized enterprises (SMEs) by significantly improving company processes, enhancing products and services, as well as enhancing operational efficiency [1]. One particularly relevant shift is the appropriation of electronic commerce (EC) by these SMEs, which has proven to be beneficial in terms of reducing operational costs and accelerating business processes.

E-commerce is the activity of trading services, information or products over the web [2], offers substantial advantages to SMEs, including market expansion, increased sales revenue, operational efficiency, and more effective customer relationship management [3]. These benefits have an impact on all the business activities [4].

Several models and frameworks have been designed to provide a better understanding of the degree of electronic commerce (EC) adoption. Notable among them are the innovation diffusion model [5], the technology, organization, and environment (TOE) framework by Tornatzky and Fleischer [6], and the technology acceptance model (TAM) [7]. These conceptual approaches are fundamental for comprehending EC adoption in SMEs. According to Schneider and Perry [8], electronic commerce encompasses commercial activities conducted through the transmission of electronic data, primarily over the Internet and the World Wide Web. This definition is complemented by [2], which emphasizes the exchange of goods, services, and other information via the computer. Thus, on this issue, [9] adds that e-commerce not only benefits sellers by allowing them to access broader markets but also benefits buyers, who enjoy a greater variety of products at reduced costs.

The adoption of e-commerce (EC) in SMEs has captured the attention of researchers for distinct reasons. One of them is the crucial role that SMEs play in the global economy and the transformative impact of IT on traditional business methods.

Earlier studies have explored this adoption in various regions and contexts, including Brazil, México, and the United States, in America. Also, Denmark, France, and Germany, in Europe, as well as China, Japan, Singapore, and Taiwan in Asia [10]. Related research has been conducted in developing countries such as Chile [11], Iran [12], Malaysia [13], and Vietnam [14]. Despite so much existing research, there is a persistent need to look deeper into the factors affecting the appropriation of the EC, especially in less-explored regions.

Given this scenario, this research pursues the building of knowledge on this topic, focusing specifically on the factors which influence the adoption of e-Commerce (EC) in SMEs in the state of Tamaulipas, found in northeastern Mexico. This research is aimed at showing and analyzing the fundamental elements that promote or limit the integration of e-commerce into the business practices of this area, integrating variables from Rogers' [5] innovation diffusion theory (IDT), the TOE model, as well as elements from the technology acceptance model.

This proposal stands for an interesting theoretical contribution to the field of e-commerce (EC) by combining different theoretical perspectives to enlighten with an understanding of the organizational context of e-commerce adoption in SMEs. Thus, the study will not only offer a more detailed insight into the determinant elements that influence the adoption of e-commerce in this region but also enhance the existing literature, to provide with valuable perspectives for academics, industry entrepreneurs, and creators of policies interested in the economic and technological development of the region.

2. Literature Review

This research focuses on three fundamental models: the technology-organization-environment (TOE) model, the innovation diffusion theory (IDT), and the technology acceptance model (TAM). These approaches have been chosen for their ability to unravel the numerous factors influencing the adoption of e-commerce in SMEs, encompassing technological, organizational, environmental, and user behavioral aspects.

A. TOE Model

The TOE model by Tornatzaky and Fleischer [6] is composed of three organizational aspects that influence the process of adoption, implementation, and use of technological innovations, as described below:

- Technological context - outlines the existing and innovative technologies important to the company, such as the use of earlier technology and the amount of computers in the enterprise, which condition the company's capacity to transition to electronic commerce and related technologies.
- Organizational context - alludes to quantitative metrics pertaining to companies, including the company's size, breadth, and managerial philosophy.
- Environmental context - emphasizes the locations where the firm carries out its business activities, giving top importance to outside variables like laws and incentives that have a big influence on the business and the industry.

Regarding organizational factors within the organization and their relationship with the adoption and acceptance of technology within organizations, it has been noted by [15] that IT knowledge is the most crucial factor affecting the intention of behavior in the use of certain technological services. Similarly, in the work conducted by [16], which integrates a conceptual framework with the theory of innovation diffusion and the TOE model, the research goal is to use a comprehensive framework to explain the adoption of electronic marketing in SMEs. Furthermore, the results revealed that relative advantages, IT experience, top management support, IT knowledge from the management teams, and external pressure have a significant impact on the adoption of electronic marketing. Additionally, some research has discovered that management support is one of the most important elements that foster the intention to adopt mobile commerce [17], [18], the adoption of blockchain [19], as well as the adoption of big data [20].

B. Innovation Diffusion Theory (IDT)

While the TOE model provides a thorough approach to understand the inner and outer dimensions that shape technology adoption, Rogers' IDT [5] offers a broader perspective on how technological innovations, such as e-commerce are issued all over and adopted across different contexts and cultures.

The innovation diffusion theory is a theoretical visor sort of speaking, used to analyze the diffusion and adoption of innovative ideas, practices, or technologies. It provides insights into how innovations are accepted and spread among diverse groups or countries. It can also extend beyond the sale of products to analyze the diffusion of thematic innovations [21]. The IDT has been applied in various contexts, including business management, where it guides stakeholders in implementing innovative practices for sustainable business growth [22].

In addition, the theory has been used to understand the effects of psychological and technological factors affecting the behavioral intentions of consumers regarding novel technologies [23].

The theory considers factors such as relative advantage, compatibility, observability, complexity, and trial ability, which have been highlighted as critical elements of the adoption process [24]. However, it is noted that earlier studies have shown that compatibility, relative advantage, and observability are critical attributes in the adoption of modern technologies [25]. Nevertheless, it is pointed out that variables such as complexity and trialability do not have a meaningful influence on the propensity to embrace technologies.

Regarding empirical contributions within the field of scientific research, studies have been conducted that integrate elements of the mentioned theories and models, such as the work by [26]. In their study, they look further into the intentions to adopt precision agriculture technologies in Iran. In their findings, they show that observability impacts both perceived easiness of use and perceived usefulness, influencing the intention to adopt precision technologies in agriculture.

Similarly, the work conducted by [27], aimed to decide the adoption of consumers of a shared economy application under the perspective of the IDT and the TAM models. In their findings, they found out that both relative advantage and observability are positively and significantly related to both perceived usefulness and perceived ease of use in the intention to use the technological application by consumers such as in these studies.

Therefore, within the framework of this research, the variables of relative advantage and observability have been specifically selected for examination, given their recognized critical impact on technological adoption and their versatility to be integrated and considered in various studies that incorporate the reference framework of the technology acceptance model [7], [28], [29], [30], [31], [32], [33].

C. TAM model

After exploring how technological innovations spread and adopted in different contexts through the theory of diffusion of innovation, it becomes essential to understand the perspective of the end user who interacts directly with these technologies. Here, the technology acceptance model (TAM) [7] becomes relevant, providing a detailed insight into technology acceptance from the user's point of view. While the TDI offers a framework for understanding the adoption of innovations at a macro level, TAM allows for a deeper investigation into individual beliefs and attitudes toward technology, crucial aspects for understanding the adoption of e-commerce in SMEs. Therefore, TAM complements the macro perspective of the theory of diffusion of innovation, focusing on the beliefs, attitudes, and individual behaviors that drive technological adoption.

The technology-acceptance model (TAM) is a framework used to assess the acceptance and adoption of technology by users. It considers factors such as perceived usefulness, perceived ease of use, attitude toward use, behavioral intention, and actual system use. The TAM model has been applied in several settings, including virtual laboratories [34], financial technology applications [35], mobile banking applications [36], and mobile e-commerce applications [37]. These studies use the TAM model to evaluate users' beliefs, attitudes, and intentions toward the technology under investigation. The results of these studies give insights into the factors influencing the acceptance and adoption of the respective technologies by users. By understanding these factors, organizations can enhance the design and implementation of user-centered applications and technological solutions to better fulfill the requirements and preferences of users.

In summary, the integration of these models and theories in the study let us see a solid and multifaceted framework for exploring the factors influencing the adoption of e-commerce in SMEs. This integrated perspective will not only help the identification of facilitators in the adoption process but also allow us to get effective strategies for their implementation and efficient use.

So, the hypotheses to be evaluated in the development of the present research are as follows:

- H1.- The relative advantage influences the ease of use of e-commerce.
- H2.- The relative advantage influences the perceived usefulness of e-commerce.
- H3.- Observability positively and significantly influences the ease of use of e-commerce.
- H4.- Observability positively and significantly influences the perceived usefulness of using e-commerce.
- H5.- Management support positively affects the ease of use of e-commerce.
- H6.- Management support positively influences the perceived usefulness of using e-commerce.
- H7.- IT knowledge influences the perceived ease of use of e-commerce.
- H8.- IT knowledge influences the perceived usefulness of e-commerce.

- H9.- Perceived easiness of use influences the intention to adopt e-commerce.
- H10.- Perceived usefulness influences the intention to adopt e-commerce.

3. Methodology

In the dynamic context of north-eastern Mexico, particularly in the state of Tamaulipas, the evolution of e-commerce stands for a crucial area of study to understand the factors driving its adoption in SMEs. The increasing use of social networks has transformed not only how businesses interact with their customers but also how they promote and sell their products and services. This research focuses on examining the organizational factors involved in the adoption of e-commerce in SMEs, stemming from the scarcity of earlier studies in this specific region of Mexico on the rise of e-commerce, underscoring the importance and relevance of this study. To do so, the variables of the proposed theoretical model were operationalized, considering aspects such as perceived usefulness, ease of use, and social influence, thus integrating the principles of the TAM and the IDT models in the specific context of e-commerce in SMEs in Tamaulipas.

To develop the tool that would allow achieving the aims outlined in the research, the operationalization of variables to support the proposed theoretical model is done as follows:

- Personnel IT Knowledge: Internet browsing skills, ability to use a computer, ability in activities involving information technologies.
- Perceived Advantage: Efficient operations management, improvement in the quality of operations, enhanced effectiveness of operations, efficiency in operations, and better control of operations.
- Management Support: Interest in using e-commerce technologies, promotion of electronic commerce usage in company operations, and communication of the need to use e-commerce.
- Observability: Competitors in the market using e-commerce, market partners and suppliers using e-commerce, improved visibility with customers at any time, enhanced business outcomes compared to traditional methods.
- Usefulness: Enables performing specific tasks more quickly, enhances job performance, increases productivity, improves work efficiency, and eases work.
- Ease of Use. Learning to run e-commerce is easy, e-commerce is flexible for interaction, interaction with e-commerce is clear and understandable, becoming an expert in using e-commerce is easy, and e-commerce is easy to use.
- Intention to Use: Intention to use e-commerce in the future, prediction of future use of e-commerce, planning to use e-commerce in the future.

As there is no precise instrument that measures each of the dimensions comprising the proposed theoretical model collectively, the works of [38], [39], [40], [41], [42], [43], [44], [45], [46], [47], [48], [11], [49], [50] serve as a basis. These contributions are made in different contexts than the present research, and adjustments are made to the wording of each item for its application in the study region.

Upon creating the preliminary version of the instrument, it was assessed by subject-matter experts for scrutiny based on their professional experience. Feedback was obtained, and some recommendations for improvement in terms of style and form were addressed. Subsequently, a pilot study was conducted with 32 entrepreneurs who use information technologies for sales activities. Observations from this pilot study, such as the changing the wording of some items and adjusting certain questionnaire design elements, were considered. Once these adjustments were made, the final questionnaire was made up of sociodemographic information about the respondents, such as gender, age, educational level, and position within the organization. Additionally, data related to the company, such as the municipality where it runs, the sector, the number of employees, the company's age, and the number of branches, are collected. The questionnaire includes a total of 29 items corresponding to each of the variables in the proposed theoretical model.

The consideration for its application was based on a non-probabilistic convenience sample, considering a sample of over 100 participating SMEs in north-eastern Mexico. The instrument was applied in SMEs in the main cities of the state of Tamaulipas, such as Nuevo Laredo, Reynosa, Matamoros, Ciudad Victoria, and Tampico.

After normalization and data validation processes, analyses, only 434 out of a total of 448 participants were entered for the main analysis.

Regarding the sociodemographic information of the participants, 53% are female, and 47% are male. In terms of educational level, 51% have a bachelor's degree, 41% have a high school diploma, 4% have a postgraduate degree and the corresponding percentage left with secondary education.

Concerning the sector of the surveyed SMEs, 59% are in the commerce sector, 31% in the service sector, and 10% in the industrial sector.

4. Results

After the instrument validation process, the inferential analysis is carried out using Smart PLS V4., which is an appropriate tool for information technology research as it allows evaluation in two stages [51]: a) measurement model (Table 1), and b) estimation of the structural model (Table 3), the results of which are shown below.

D. Measurement model validation

• Item reliability is examined through factor loadings (β) or simple correlations. To accept an item, it must have a value higher than .707 (50% of the variance explained) [52]. The results show that all items from the different constructs have factor loadings higher than the accepted minimum values.

• Internal consistency (composite reliability) is measured using Cronbach's alpha (minimum value of .7). The results obtained show Cronbach's alpha higher than 0.7, showing good internal consistency.

• Convergent validity is conducted through the average variance extracted (AVE), which requires a value higher than .50 (more than 50% of the variance of the variable/construct is provided by its items) [53]. It can only be applied to reflective indicators. The results displayed in Table 1 prove values higher than the accepted minimum.

• Discriminant validity is evaluated using the HTMT statistic, which corresponds to the average of heterotrait-heteromethod correlations compared to the average of monotrait-heteromethod correlations [54], and the Dijkstra-Henseler indicator (rho_A), which should be greater than .7. The results obtained show that all constructs have a Dijkstra-Henseler indicator (rho_A) greater than 0.7, showing adequate discriminant validity.

Table 1. Measurement model reliability

Indicator / Constructor	Loading	Internal reliability	Cronbach's alpha	AVE	R^2	Rho_A
Management support		0.947	0.926	0.818		0.929
Man_Sup01	0.873					
Man_Sup02	0.918					
Man_Sup03	0.916					
Man_Sup04	0.910					
Employee IT Knowledge		0.923	0.876			0.876
IT_Know01	0.901					
IT_Know02	0.880					
IT_Know03	0.902					
Perceived advantage		0.961	0.956	0.847		0.956
Per_Adv01	0.897					
Per_Adv02	0.926					
Per_Adv03	0.932					
Per_Adv04	0.923					
Per_Adv05	0.924					
Observability		0.916	0.863	0.784		0.877
Obs_Erv01	0.869					
Obs_Erv02	0.912					
Obs_Erv03	0.875					
Ease of use		0.954	0.939	0.805	0.531	0.941
Ease_Use01	0.891					
Ease_Use02	0.903					
Ease_Use03	0.927					
Ease_Use04	0.865					
Ease_Use05	0.899					
Usefulness		0.969	0.961	0.838	0.577	0.961
Use_Ful01	0.897					
Use_Ful02	0.923					
Use_Ful03	0.906					
Use_Ful04	0.922					
Use_Ful05	0.934					
Use_Ful06	0.908					
Intention of use		0.964	0.944	0.899	0.476	0.945
Int_Use01	0.948					
Int_Use02	0.936					
Int_Use03	0.960					

In addition to the convergent validation, one of the important analyses for the measurement model validation is the discriminant validity of the constructs, which is analyzed through the Heterotrait-monotrait (HTMT) indicator, where values should be below 0.85 to be considered valid. Table 2 shows the results obtained, where it can be observed that all values are below the indicated threshold.

Table 2. Heterotrait-monotrait ratio (HTMT)

	Management support	IT knowledge	Ease of use	Intention	Observability	Usefulness perceived	Relative advantage
Management support							
IT knowledge	0.571						
Ease of use	0.670	0.570					
Intention	0.582	0.430	0.671				
Observability	0.643	0.423	0.623	0.620			
Usefulness perceived	0.625	0.451	0.777	0.686	0.754		
Relative advantage	0.753	0.562	0.698	0.612	0.715	0.699	

E. Structural model validation

For this assessment, two basic indices are used: explained variance or coefficient of determination (R2) and standardized path coefficients (β). The R2 values supply an index of the predictability of the independent (exogenous) variables and are the arrows in the nomogram (PLS graph) that link the variables in the internal model. It is obtained, like multiple regression, for this [52] proposes that it should reach at least a value of .2, ideally above .3, and R2 at a level of .67 stands for a substantial effect, .33 moderate, and .19 weak. Also, significance (t-statistic) should be less than .05 ($p < .05$), and for a one-tailed sub-sample of 5000 [51]: t (.05; 4999) = 1.645, representing * $p < .05$; t (.01; 4999) = 2.327, representing ** $p < .01$, and t (.001; 4999) = 3.092, representing *** $p < .001$.

In addition to the above, there is the F^2 index, which is used to determine if the independent variable has a major impact on the dependent variable.

According to [55], .02, .15, and .35 represent small, moderate, and large effects, respectively.

Table 3. Structural model results

	F^2	Coefficient Path	T-statistic	P Value	Comment
H1. Perceived advantage --> Ease	0.072	0.294	4.314***	0.000	Accepted
H2. Perceived advantage --> Usefulness	0.075	0.286	3.788***	0.000	Accepted
H3. Observability _> Ease	0.040	0.186	3.143***	0.002	Accepted
H4. Observability --> Usefulness	0.232	0.423	5.392***	0.000	Accepted
H5. Management support --> Ease	0.043	0.214	3.207**	0.001	Accepted
H6. Management support --> Usefulness	0.015	0.121	2.061*	0.039	Accepted
H7. Employee IT knowledge --> Ease	0.051	0.186	3.722***	0.000	Accepted
H8. Employee IT knowledge --> Usefulness	0.003	0.046	0.952 n.s.	0.341	Rejected
H9. Ease --> Intention of use	0.092	0.328	4.013***	0.000	Accepted
H10 Usefulness --> Intention of use	0.146	0.412	5.258***	0.000	Accepted

**** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, n.s. – not significant*

In Figure 1, the results of the model, along with the path coefficients and statistical significance, are graphically displayed.

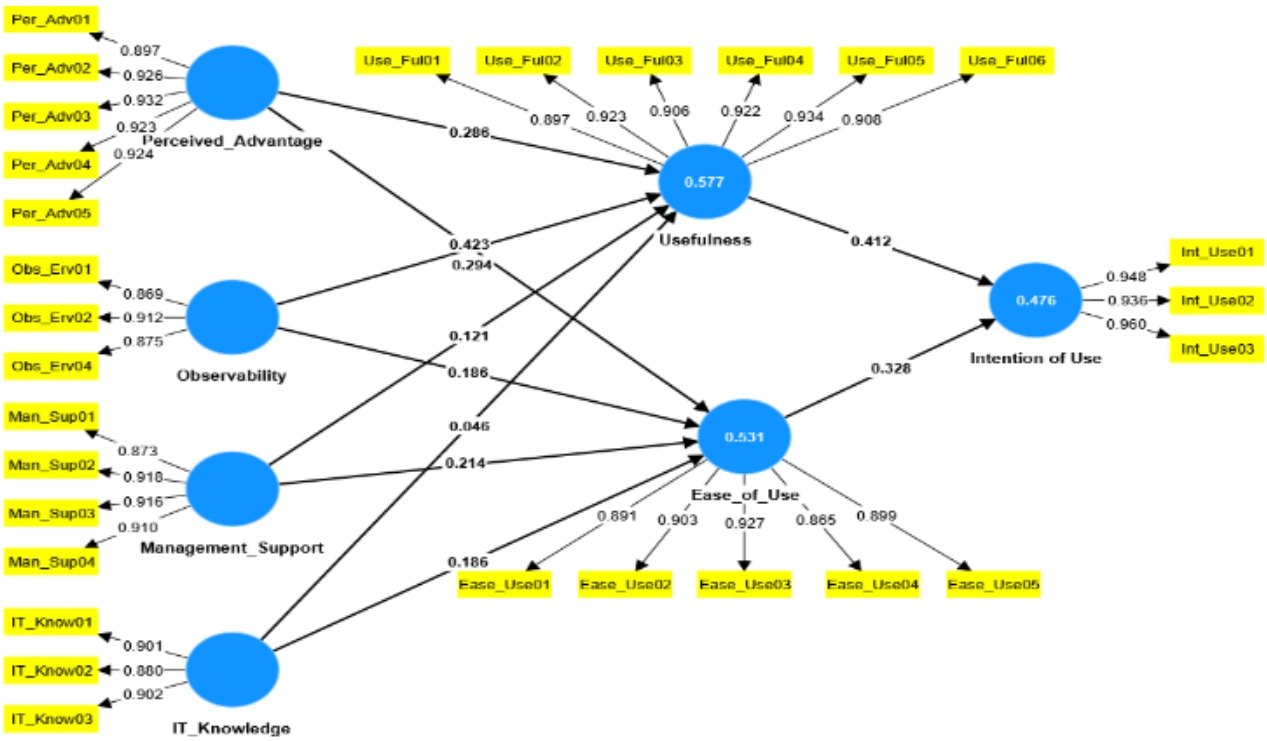

Figure 1. Results from the model: Coefficients and statistical significance

5. Discussion

The interpretations of the hypotheses are explained below.

H1: Relative advantage --> Ease of use: the relative advantage has a small but significant impact on the ease of use of e-commerce (β=0.294, t=4.314, p=0.000).

H2: Relative advantage --> Perceived usefulness: The following values: β = 0.286, a t = 3.788, p = 0.000 indicate that the relative advantage also positively and significantly influences the perceived usefulness of e-commerce. These results align with [28], who found that relative advantage impacts both usage intention and perceived usefulness, supporting the assertion of [31] that relative advantage is related to both dimensions.

Put in another way, relative advantage, which includes elements such as improvement in efficiency, quality, and speed of operations, has a positive incidence on both the ease of use and the perceived usefulness of e-commerce. This suggests that when SMEs perceive clear and tangible benefits in using e-commerce, they are inclined to find it easier to use and more useful for their operations.

H3: Observability --> Ease of use: observability has a positive and small effect on ease of use (β = 0.186, t = 3.143, p = 0.002).

H4: Observability --> Perceived usefulness: Observability has a large and highly significant effect on perceived usefulness (β = 0.423, t = 5.392, p = 0.000).

These findings about observability align partially with [29], who found that observability affects ease of use. However, they differ from [31], who suggests that there is no relationship between observability and ease of use. In other words, observability, shown by the usage of e-commerce by competitors and partners and its visible results in the market, has a small effect on ease of use but a large and significant impact on the belief of its usefulness. This shows that the visibility of e-commerce success in the market environment significantly influences how businesses perceive its usefulness, corroborating the findings of [30] and [32].

H5: Management support --> Ease of use: It could be proved that management support positively influences ease of use (β = 0.214, t = 3.207, p = 0.001).

H6: Management support --> Perceived usefulness: the influence of management support on perceived usefulness is smaller and barely reaches statistical significance (β = 0.121, t = 2.061, p = 0.039).

Management support, including interest in promoting e-commerce usage and communication of its need use, positively influences ease of use, and perceived usefulness differs slightly from [56], who found that top management influences the intention to adopt mobile marketing, suggesting that the influence of management support may vary depending on the context.

H7: IT knowledge of employees --> Ease of use: employees' IT knowledge has a positive effect on ease of use (β = 0.186, t = 3.722, p = 0.000)

H8: IT knowledge of employees --> Perceived usefulness: No significant relationship could be established between employees' IT knowledge and perceived usefulness, since the following values were computed: $\beta = 0.046$, $t = 0.952$, and $p = 0.341$.

Employees' IT knowledge, encompassing skills to use the Internet and other related technologies, has a positive incidence on ease of use but does not show a meaningful relationship with perceived usefulness. This may show that the more technological skills employees have, the easier it is for them to use e-commerce, but this does not necessarily translate into a perception of greater usefulness.

H9: Ease of use --> Intention to use: A moderate and highly significant incidence of ease of use on the intention to use ($\beta = 0.328$, $t = 4.013$, $p = 0.000$) was found.

H10: Perceived usefulness --> Intention to use: A positive and significant effect was discovered from perceived usefulness to adopting e-commerce ($\beta=0.412$, $t = 5.258$, $p = 0.000$).

Ease of use has a moderate and highly significant effect on the intention to use, implying that the easier the use of e-commerce, the more likely SMEs are to adopt it. On the other hand, perceived usefulness shows a positive and meaningful relationship with the adoption intention, showing that the belief of the benefits of e-commerce strongly influences the decision to adopt it. The results align with what was mentioned by [57], who pointed out that the features of the TOE framework affect the adoption of technological platforms through perceived usefulness and perceived ease of use.

These findings suggest that the perceived ease and usefulness of e-commerce are critical factors in the adoption intention of SMEs. This is consistent with previous results from literature that have emphasized the relevance of these aspects in the adoption of emerging technologies. However, there are variations in how specific studies perceive the impact of observability, showing the need for a nuanced understanding of this factor in different business contexts.

6. Conclusion

This research has examined the determinants that influence the adoption of e-commerce by SMEs located in Tamaulipas, northeastern Mexico, integrating key concepts from Rogers' DIT, the TOE, and the TAM models. The results reveal that the perceived ease and usefulness of e-commerce are essential for its adoption. It is highlighted that both perceived advantage and observability have direct and significant influences on the perceived usefulness and ease of use of e-commerce.

This paper also emphasizes the importance of management support in e-commerce adoption, underscoring the need for clear leadership and communication. Additionally, it was found that employees' IT knowledge affects perceived ease of use, although it does not have a significant impact on perceived usefulness.

This research, however, is not free from limitations. It specifically focuses on SMEs in Tamaulipas, which could restrict the generalization of the results to other contexts. Another important aspect is that factors such as complexity and trialability were not included, which could have given a broader view of the factors affecting e-commerce adoption. Looking further into the future, this work opens various lines of research. It would be valuable to expand these studies to different geographical contexts to better understand how cultural and economic factors influence e-commerce adoption. Additionally, investigating aspects such as complexity and trialability could enrich our understanding of the adoption process. Longitudinal studies could reveal how attitudes and e-commerce adoption evolve. Delving into the role of management support in e-commerce adoption and exploring the adoption of other emerging technologies by SMEs, such as the used of AI and big data, would also be fruitful areas for future research.

References:

[1]. Choshin, M., & Ghaffari, A. (2017c). An investigation of the impact of effective factors on the success of e-commerce in small- and medium-sized companies. *Computers In Human Behavior*, *66*, 67-74. Doi:10.1016/j.chb.2016.09.026

[2]. Turban, E., King, D., Lee, J., Liang, T. P., & Turban, D. (2012). *Electronic Commerce 2012: A Managerial and Social Networks Perspective (7th ed.).* Prentice Hall.

[3]. Qu, Y., & Zahedi, F. (2003). E-Commerce Adoption by Small and Medium-Sized Enterprises in China: The CEO Perspective. *Americas Conference on Information Systems.*

[4]. Oliveira, T., & Martins, M. F. (2010). Firms Patterns of E-Business Adoption: Evidence for the European Union. *The Electronic Journal Information Systems Evaluation, 13*(1), 47-56.

[5]. Rogers, R. W. (1983). Cognitive and Physiological Processes in Fear Appeals and Attitude Change: A Revised Theory of Protection Motivation. *Social Psychological: A source book,* 153-176

[6]. Tornatzky, L.G. & Fleischer, M.(1990). *The process fo technology innovation*, Lexington, MA: Lexington Books, Lexington.

[7]. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

[8]. Schneider, G.P. & Perry, J.T. (2000). *Electronic Commerce*. Course Technology, Ontario.

[9]. Walker, J. H., Saffu, K., & Mazurek, M. (2016). An empirical study of factors influencing e-commerce adoption/non-adoption in Slovakian SMEs. *Journal of Internet Commerce, 15*(3), 189-213.

[10]. Gibbs, J. L., & Kraemer, K. L. (2004). A cross-country investigation of the determinants of scope of e-commerce use: an institutional approach. *Electronic markets, 14(*2), 124-137.

[11]. Grandon, E. E., & Pearson, M. J. (2004). Electronic commerce adoption: an empirical study of small and medium US businesses. *Information & Management, 42(*1), 197-216.

[12]. Ghobakhloo, M., Arias-Aranda, D., & Benitez-Amado, J. (2011). Adoption of e-commerce applications in SMEs. *Industrial Management & Data Systems, 111*(8), 1238-1269.

[13]. Shah Alam, S., Ali, M. Y., y Mohd, J. M. (2011). An empirical study of factors affecting electronic commerce adoption among SMEs in Malaysia. *Journal of Business Economics and Management, 12*(2), 375-399.

[14]. Van Huy, L., Rowe, F., Truex, D., y Huynh, M. Q. (2019). An empirical study of determinants of E-Commerce adoption in SMEs in Vietnam: an economy in transition. *Journal of Global Information Management, 20*(3), 23-54.

[15]. Al-Momani, A. M., Mahmoud, M. A., y Ahmad, M. S. (2018). Factors that Influence the Acceptance of Internet of Things Services by Customers of Telecommunication Companies in Jordan. *Journal of Organizational and End User Computing, 30*(4), 51-63. Doi: 10.4018/JOEUC.2018100104

[16]. Alrousan, M. K., Al-Adwan, A. S., Al-Madadha, A., y Al Khasawneh, M. H. (2020). Factors Affecting the Adoption of E-Marketing by Decision Makers in SMEs: Evidence From Jordan. *International Journal of E-Business Research, 16*(1), 1-27. Doi: 10.4018/IJEBR.2020010101

[17]. Alaskar, T. H., y Alsadi, A. K. (2023). Drivers of mobile commerce adoption intention by Saudi SMEs during the COVID-19 pandemic. *Future Business Journal, 9*(1). Doi: 10.1186/s43093-023-00190-8

[18]. Li, L. W., y Wang, X. H. (2018). M-Commerce Adoption in SMEs of China: The Effect of Institutional Pressures and the Mediating Role of Top Management. *Journal of Electronic Commerce in Organizations, 16*(2), 48-63. Doi: 10.4018/JECO.2018040103

[19]. Lu, L. Y., Liang, C. Y., Gu, D. X., Ma, Y. M., Xie, Y. G., y Zhao, S. P. (2021). What advantages of blockchain affect its adoption in the elderly care industry? A study based on the technology-organisation-environment framework. *Technology in Society,* 67.

[20]. Iranmanesh, M., Lim, K. H., Foroughi, B., Hong, M. C., y Ghobakhloo, M. (2023). Determinants of intention to adopt big data and outsourcing among SMEs: organisational and technological factors as moderators. *Management Decision, 61*(1), 201-222.

[21]. Takahashi, C. K., De Figuereido, J. C., y Favaretto, J. E. (2023). Deep learning diffusion by search trend: a country-level analysis. *Future Studies Research Journal: Trends and Strategies, 15*(1).

[22]. Dibra, M. (2015). Rogers Theory on Diffusion of Innovation-The Most Appropriate Theoretical Model in the Study of Factors Influencing the Integration of Sustainability in Tourism Businesses. *Procedia - Social and Behavioral Sciences, 195*(3), 1453-1462. Doi: 10.1016/j.sbspro.2015.06.443

[23]. Acikgoz, F., Elwalda, A., y De Oliveira, M. J. (2023). Curiosity on Cutting-Edge Technology via Theory of Planned Behavior and Diffusion of Innovation Theory. *International Journal of Information Management Data Insights, 3*(1), 100152. Doi: 10.1016/j.jjimei.2022.100152

[24]. Dissanayake, C. A., Jayathilake, W., Wickramasuriya, H. V., Dissanayake, U., y Wasala, W. M. (2022). A Review on Factors Affecting Technology Adoption in Agricultural Sector. *The Journal of Agricultural Sciences (Sri Lanka), 17*(2), 280-296. Doi: 10.4038/jas.v17i2.9743

[25]. Zurina, P. (2021). Affiliate Marketing in SMEs: The Moderating Effect of Developmental Culture. *Pentanika Journal of Social Sciences and Humanities, 29*(2). Doi: 10.47836/pjssh.29.2.27

[26]. Rezaei-Moghaddam, K., y Salehi, S. (2010). Agricultural specialists' intention toward precision agriculture technologies: Integrating innovation characteristics to technology acceptance model. *African Journal of Agricultural Research, 5*(11), 1191-1199.

[27]. Soman, M., Kevin Kam, F. S., y Miyoung, J. (2019). Consumer adoption of the Uber mobile application: Insights from diffusion of innovation theory and technology acceptance model. *Journal of Travel & Tourism Marketing, 36*(7), 770-783. Doi: 10.1080/10548408.2018.1507866

[28]. Chelliah, P. P., Thurasamy, R., Alzahrani, A., Alfarraj, O., y Alalwan, N. (2016). E-Government Service Delivery by a Local Government Agency: The case of E-Licensing. *Telematics and Informatics, 33*(4). Doi: 10.1016/j.tele.2016.02.003.

[29]. Nezamdoust, S., Abdekhoda, M., y Rahmani, A. (2022). Determinant factors in adopting mobile health application in healtcahre by nurses. *BMC medical informatics and decision making, 22*(1), 1-10. Doi: 10.1186/s12911-022-01784-y.

[30]. Arkorful, V., Anhwere, K., y Odoi, N. (2022). Factors affecting use of massive open online. *Cogent Education, 9*(1), 2023281.

[31]. Al-Rahmi, W. M., Yahaya, N., Aldraiweesh, A., Alamri, M. M., Aljarboa, N. A., Alturki, U., y Aljeraiwi, A. A. (2019). Integrating technology acceptance model wit innovation difussion theory: An empirical investigation on students' intention to use E-learning systems. *IEEE Access*, *7*, 26797-26809. Doi: 10.1109/ACCESS.2019.2899368

[32]. Shiau, S. J., Huang, C. Y., Yang, C. L., & Juang, J. N. (2018). A derivation of factors influencing the innovation diffusion of the OpenStreetMap in STEM education. *Sustainability*, *10*(10), 3447. Doi: 10.3390/su10103447

[33]. Alamri, M. M. (2022). Investigating students' adoption of MOOCs during COVID-19 pandemic: students' academic self-efficacy, learning engagement, and learning persistence. *Sustainability*, *14*(2), 714. Doi: 10.3390/su14020714

[34]. Alnagrat, A. J., Ahmed, K. M., Alkhallas, M. I., Almakhzoom, O. A., Idrus, S. Z., y Ismail, R. (2023). Virtual Laboratory Learning Experience in Engineering: An Extended Technology Acceptance Model (TAM). *En IEEE 3rd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering (MI-STA)*, 474-479. IEEE.

[35]. Fitria, P., Rafinda, A., Hafid, A., y Waspodo, L. (2023). Analisis penerimaan aplikasi flip dengan pendekatan technology acceptance model (TAM). Al-Masraf: *Journal Lembaga Keuangan dan Perbankan*, *8*(1), 79-93.

[36]. Siswoyo, A., y Irianto, B. S. (2023). Analisis technology acceptance model (TAM). Tehadap Pengguna Aplikasi Mobile Banking. Owner: *Riset dan Jurnal Akuntansi*, *7*(2), 1196-1205.

[37]. Widyaningrum, D., y Theotista, G. (2023). Tipologi Financial Technology Paylater: Technology Acceptance Modelo (TAM). *Formosa Journal of Multidisciplinary Research, 2*(1), 207-2016.

[38]. Thong, J. Y. (1999). An integrated model or information systems adoption in small businesses. *Journal of Management Information Systems, 15*(4), 187-214.

[39]. Scupola, A. (2009). SME's e-commerce adoption: perspectives from Denmark and Asutralia. *Journal of Enterprise Information Management, 22*, 152-166.

[40]. Alamro, S., Tarawneh, S.S. & Allahawiah, S. (2016). Factors affecting e-commerce adoption in Jordanian SMEs. *European Journal of Scientific Research, 64*(4), 497-506.

[41]. Ifinedo, P. (2011). Internet e-business technologies acceptance in Canada's SMEs: an exploratory investigation. *Internet Research, 21*(3), 255-281.

[42]. Abed, S. S. (2020). Social commerce adoption using TOE framework: An empirical investigation of Saudi Arabian SMEs. *International Journal of Information Management*, *53*, 102118.

[43]. Hassan, H. (2017). Organisational factors affecting cloud computing adoption in small and medium enterprises (SMEs) in service sector. *Procedia computer science*, *121*, 976-981.

[44]. Lertwongsatien, C., & Wongpinunwatana, N. (2003). E-commerce adoption in Thailand: an empirical study of small and medium enterprises (SMEs). *Journal of Global Information Technology Management*, *6*(3), 67-83.

[45]. Alrousan, M. K., & Jones, E. (2016). A conceptual model of factors affecting e-commerce adoption by SME owner/managers in Jordan. *International Journal of Business Information Systems*, *21*(3), 269-308.

[46]. Ahmad, S. Z., Abu Bakar, A. R., Faziharuden, T. M., y MohamadZaki, K. A. (2015). An empirical study of factors affecting e-commerce adoption among small and mediu-sized enterprises in a developing country: Evicence from Malaysia. *Information Technology for Development, 21*(4), 555-572

[47]. Awiagah, R., Kang, J., & Lim, J. I. (2016). Factors affecting e-commerce adoption among SMEs in Ghana. *Information Development*, *32*(4), 815-836.

[48]. Walker, J. H., Saffu, K., & Mazurek, M. (2016). An empirical study of factors influencing e-commerce adoption/non-adoption in Slovakian SMEs. *Journal of Internet Commerce*, *15*(3), 189-213.

[49]. Al-Bakri, A. A., & Katsioloudes, M. I. (2015). The factors affecting e-commerce adoption by Jordanian SMEs. *Management Research Review*, *38*(7), 726-749.

[50]. Lee, H. Y., Ahn, H., & Han, I. (2006, January). Analysis of trust in the e-commerce adoption. In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'06)*, *6.* IEEE.

[51]. Hair, J. F., Risher, J. J., Sarstedt, M., y Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31*(1), 2-24. Doi: 10.1108/EBR-11-2018-0203.

[52]. Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In Marcoulides, G. A., *Modern Methods of Bussines Research*, 295-336. USA: Psychology Press: Mahwah, NJ.

[53]. Fornell, C., y Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement ettot. *Journal of Marketing Research, 18*(1), 39-50. Doi: 10.2307/3151312.

[54]. Henseler, J., Ringle , C. M., y Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43,* 115-135.

[55]. Cohen, J. (1988*). Statistical Power Analysis for the Behavioral Sciences*. USA: L. Erlbaum Associates: Hillsdale, NJ.

[56]. Maduku, D. K., Mpinganjira, M., y Duh, H. (2016). Understanding mobile marketing adoption intention by South African SMEs: A multi-perspective framework. *International Journal of Information Management, 36*(5), 711-723. Doi: 10.1016/j.ijinfomgt.2016.04.018

[57]. Skelly, L., y Rusu, C. (2023). *Crafting Open Research advocacy messages using Diffusion of Innovation theory*. Edinburgh Open Research. Doi: 10.2218/eor.2023.8107.