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MSMEs and e-commerce in Mexico

Las mipymes y el comercio electrónico en México

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Adriana Zambrano Martínez*
https://orcid.org/0000-0002-6828-4690
Universidad Michoacana de San Nicolás de Hidalgo, México

Priscila Ortega Gómez**
https://orcid.org/0000-0002-3178-574X
Universidad Michoacana de San Nicolás de Hidalgo, México

ABSTRACT

The objective of this article was to analyze the factors that influence micro, small and medium-sized Mexican companies in the adoption of e-commerce. Data from the 2019 Economic Census, conducted by the National Institute of Statistics and Geography, were used. The sample included 135 775 companies that reported online revenues in 2019. For the analysis of the information, Tornatzky and Fleischer's technology, organization and environment framework was taken as a basis, and a multiple linear regression model by firm size was created. The results reveal that firm size, cash sales, having a website and intranet access have a negative relationship for e-commerce adoption, while access to and use of e-mail, computers and the Internet have a positive relationship. This is because technological integration becomes less important as the company grows, going from being a facilitator to an inhibitor of the acceptance of online sales. This paper demonstrates that technological, organizational and environmental characteristics have significant effects on the adoption of e-commerce by MSMEs in Mexico; the findings may be of help to owners and managers, as well as to policy makers in Mexico responsible for expanding the number of firms adopting e-commerce.

Keywords
Technology, Internet, MSMEs, e-Commerce

RESUMEN

El objetivo de este artículo fue analizar los factores que influyen en las micro, pequeñas y medianas empresas mexicanas para la adopción del comercio electrónico. Se utilizaron los datos del Censo Económico 2019, realizado por el Instituto Nacional de Estadística y Geografía. La muestra incluyó 135 775 empresas que reportaron ingresos en línea en 2019. Para el análisis de la información, se tomó como base el marco de tecnología, organización y entorno de Tornatzky y Fleischer, y se creó un modelo de regresión lineal múltiple por tamaño de empresa. Los resultados revelan que el tamaño de la empresa, las ventas en efectivo, el contar con una página web y el acceso a intranet tienen una relación negativa para la adopción del comercio electrónico; mientras que, el acceso y uso de correo electrónico, computadoras e internet tienen una relación positiva. Esto ya que la integración tecnológica va perdiendo importancia al crecer la empresa,

Keywords
Tecnología, Internet, Mipymes, comercio electrónicio

pasando de ser un facilitador a un inhibidor de la aceptación de las ventas en línea. Este trabajo demuestra que las características tecnológicas, organizativas y del entorno tienen efectos significativos en la adopción del comercio electrónico por parte de las Mipymes en México; los hallazgos pueden ser de ayuda para los propietarios y gerentes, así como para los políticos mexicanos responsables de ampliar el número de empresas que adopten el comercio electrónico

* Bachelor's Degree in International Trade. Master's Degree in Engineering with Specialization in Quality Systems, both from Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico. D. in Administration from the School of Accounting and Administrative Sciences of the Universidad Michoacana de San Nicolás de Hidalgo. E-mail: 1726091h@umich.mx

** Bachelor of Science in Economics, Master of Science in Foreign Trade and Doctor of Science in International Business, both from Universidad Michoacana de San Nicolás de Hidalgo (UMSNH), Mexico. Member of the National System of Researchers, level I. Coordinator of the Master's program in Taxpayer Defense and member of the basic academic nucleus of the Doctorate in Administration at the UMSNH. E-mail: priscila.ortega@umich.mx

INTRODUCTION

Information and communication technologies (ICTs) have rapidly and radically changed the way organizations conduct business. An example of this is the use of electronic commerce (EC), which allows companies to reach their customers anytime and anywhere, giving them the opportunity to gain a competitive advantage over their competitors (Barzallo-Chinchilima *et al*., 2021). EC involves the exchange of goods and services electronically, through transactions based on computers or mobile equipment, between individuals or companies using both Internet network systems and a range of technologies that are digital in nature (Laudon and Traver, 2009).

Although there are many potential advantages of EC for micro, small and medium-sized enterprises (MSMEs), they tend to be slower to adopt this type of technology compared to large companies. This situation makes MSMEs vulnerable to changing economic conditions, as they may have a relatively lower level of competitiveness. Since these firms are considered important economic players, and a strong source of economic growth for most nations (United Nations Conference on Trade and Development, 2019), MSMEs should be more capable than large firms in adopting back-office services and targeting new and innovative ideas, considering their flexibility (Chakravorti & Chaturvedi, 2017).

This issue can pose a remarkable problem in developing countries, where they lack the appropriate human resources or technological infrastructure. It is from this approach that this research starts.

The advantages of adopting electronic sales are plentiful and have been empirically recognized by several studies; they can help MSMEs gain better access to information and expertise, reach new markets and customers, manage the business more efficiently and effectively, create innovative products and be more competitive (Cardona *et al*., 2022). The adoption of EC also allows reducing production and labor costs, adding value to products and services, as well as increasing a company's competitive advantage

(Mera, 2021; Reyes, 2020). Therefore, the use of internet sales by MSMEs is a challenge in developed and developing countries.

The use of these technologies is variable. Cardona *et al*. (2022) found that small and medium-sized enterprises in Manizales, Colombia, used the internet to communicate with internal and external parties, obtain information from suppliers, provide information, conduct research and development activities, be at the forefront of technology, conduct market and product research, place orders with suppliers, and take orders from their customers.

Nazir and Roomi (2021) also found that MSMEs in emerging countries used email and intranet applications for internal communication, while websites were used for advertising, promotion, recruitment and procurement.

To complement these ideas, Jain *et al*. (2021) mention that EC technologies can help MSMEs in a wide range of activities, such as: providing information about goods and services offered, receiving and placing orders, receiving payments, delivering goods and services, managing after-sales service or contact, identifying suppliers, purchasing inventory, communicating with internal and external parties, exchanging documents and design with customers or suppliers, seeking information, advertising, and procurement activities.

The extent of the use of electronic transactions in business activities reflects the level of EC adoption; the greater the extent and use of electronic sales, the more likely it is that greater benefits will be realized (Shirazi *et al*., 2021; Sundaram, 2020). These results suggest that while senior managers and owners of MSMEs seem to recognize the importance of having an internet presence, only a small segment of them use it for business purposes.

When reviewing the literature, many studies were found on the use, impact, adoption and dissemination of EC in micro, small and medium-sized companies; in addition to some works that have attempted to discover the factors that influence the adoption of this type of transactions. However, little research was found on these two topics combined in MSMEs in economies such as Mexico.

When examining the factors for the adoption of EC by MSMEs, it is possible to identify that the obstacles affect differently depending on the socioeconomic context of each country. Although several theories are trying to explain the acceptance and use of online sales, including the Technology Acceptance Model (Davis *et al*., 1989) and the unified theory of technology acceptance and use (Venkatesh *et al*., 2003), this study adopted and applied the developed Technology, Organization and Environment (TOE) framework of Tornatzky *et al.* (1990), which comprises three distinct but interrelated contextual dimensions: technological (the internal and external technologies relevant to MSMEs); organizational (those referring to scope, size and financial constraints); and environmental (how firms manage their business in a local environment and competition).

Very few studies have applied this framework and identified the factors linked to the adoption of Internet sales in economies such as Mexico in its three original

dimensions. Moreover, much of the research on MSMEs and EC adoption, especially those focused on developing countries, is descriptive in nature and lacks a solid theoretical basis. Therefore, this study focuses its attention on proposing the basis for assessing the factors that influenced micro, small and medium-sized companies adopting online transactions, developing a model grounded in theory, built with data provided by establishments in Mexico.

The following section justifies the selection of micro, small and medium-sized enterprises in Mexico as the object of study for this research, and presents the detailed description of the TOE framework and the hypotheses derived from its components. This is followed by the methodology carried out to develop this study, and then the results obtained, limitations and contributions of this research are presented and discussed.

The EC boom is a general trend worldwide. Mexico is one of the markets where this electronic modality has had a rapid growth, positioning itself as the second most important online market in Latin America (Statista Research Department, 2022), since it is estimated that one third of the population in Mexico makes some purchase-sale on the Internet. According to data from the Asociación de Internet MX (AIMX, by its acronym in Spanish), in 2020, the number of Mexican buyers was close to 51 million and most of these reside in the central and eastern region of the country, and the penetration rate is located among citizens between 25 and 35 years old, higher in women than in men.

Mexico and e-commerce

On average, Mexican shoppers make an electronic transaction at least once a month, using payment methods such as credit and debit cards through computers, although smartphones are gaining more users. The most popular shopping categories are: fast food, fashion, beauty and personal care (AIMX, 2020; Statista, 2022).

Data from the 2019 Economic Census, conducted by the Institute of Statistics and Geography (INEGI (by its acronym in Spanish), 2020), identifies that established businesses in Mexico are classified as micro (96%), small (3%) and medium-sized companies (0.6%); of these, only 37% are connected to the Internet. By 2019, the Mexican internet sales market reached 631 billion pesos, a figure that reflects an increase of 28.6% over the previous year (Statista Research Department, 2022).

Only 15% of the businesses that already make online sales do so outside of Mexico[1], and these sales represent 25% of their revenues. Most businesses offer card payments and e-wallets, and there has been an increase in the use of gift cards and a positive relationship with payments accepted at convenience stores and other physical merchants that facilitate transactions for shoppers (AIMX, 2020). Due to the perspective of electronic sales in Mexico, it is considered important in this research to have a clear understanding of the factors that are determining the adoption of EC in MSMEs.

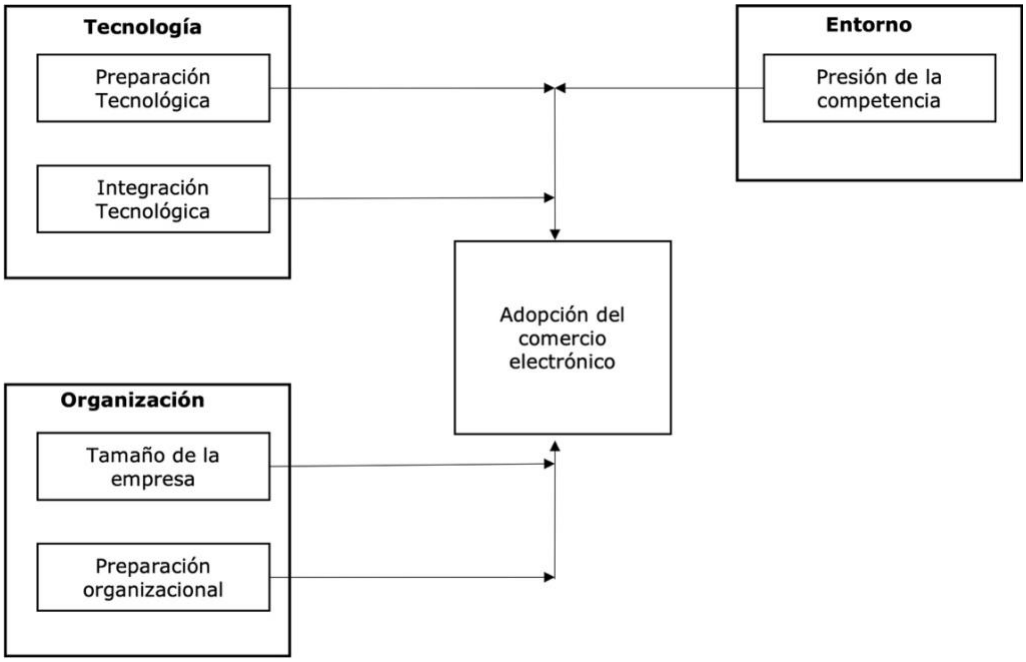
[1] The region to which they sell the most is the United States, followed by Latin America.

Technology, organization and environment framework

This framework was first described in The processes of technological innovation by Tornatzky *et al*. (1990); this work details the entire innovation process, from the development of innovations by engineers and entrepreneurs to their adoption and implementation by users in the context of a firm. This framework represents one segment of that process: how the context of the firm influences the adoption and implementation of innovations. This theory is at the organizational level and explains that three different elements of a firm's context influence adoption decisions. These are: the technological context, the organizational context, and the environmental context, and they are positioned to influence technological innovation (Baker, 2012; Tornatzky *et al*., 1990).

Based on this theoretical framework, a research model is proposed where organizational, technological and environmental factors are posited to influence the adoption of EC (see Figure 1).

Figure 1. Research model: Organizational, technological and environmental factors.



Source: Prepared by the authors based on Martins & Oliveira (2009).

Technology and the adoption of e-commerce

The technological context represents the set of technologies available for a firm to adopt. These can be either the technologies available in the market or the firms' current equipment (Rahayu & Day, 2017). The decision to adopt an innovation depends not only on what is available in the market, but also on how those technologies fit with the technologies a firm possesses (Rogers, 1995; Tornatzky *et al*., 1990).

Technology integration

EC is a complex technology that requires close coordination of several components along its value chain. Thus, a greater integration of the applications that the company has and the Internet platform will represent a greater capacity to do business through the network. Evidence from the literature suggests that technology integration helps to improve company performance, improve customer service and reduce costs. This element has been measured by the number of ICT systems for managing orders that are automatically linked to other ICT systems in the company. This variable reflects how well the systems are connected on a common platform (Muslim & Sandhyaduhita, 2017; Oliveira, 2010; Zhu, 2004; Zhu & Kraemer, 2005). From this factor, hypotheses derive:

- H1. Internet use for banking operations has a positive effect on EC adoption (H1a, micro; H1b, small; H1c, medium).

- H2. Internet use for government procedures has a positive effect on EC adoption (H2a, micro; H2b, small; H2c, medium).

- H3. Internet use for search has a positive effect on EC adoption (H3a, micro; H3b, small; H3c, medium).

- H4. Internet use for business management has a positive effect on EC adoption (H4a, micro; H4b, small; H4c, medium).

Technological readiness

This factor can be defined as the technological infrastructure and human resources for ICT management; specifically, it refers to hardware resources, operating systems and software, which allow companies to interact via the Internet, and the knowledge of employees, how much they know and the skills they possess to use and implement Internet-related applications effectively (Al-Somali *et al*., 2015). The following hypotheses start from this element:

- H5. Computer access has a positive effect on EE adoption (H5a, micro; H5b, small; H5c, medium).

- H6. Access to e-mail has a positive effect on EC adoption (H6a, micro; H6b, small; H6c, medium).

- H7. Internet access has a positive effect on EC adoption (H7a, micro; H7b, small; H7c, medium).

- H8. Intranet access has a positive effect on EC adoption (H8a, micro; H8b, small; H8c, medium).

E-commerce environment and adoption

Five competitive forces are identified as shaping business strategy: new entrants, the threat of a substitute, bargaining power of customers, bargaining power of suppliers, and rivalry among existing competitors (Porter & Millar, 1985). Similarly, it was suggested that the adoption of information technologies would change the competitive environment in three ways: changing the industry structure, changing the rules of competition, and providing firms with new methods to gain a competitive advantage over their competitors (Contreras, 2008). Studies have shown that the intensity of competition is also associated with the degree of CE adoption (Reinartz *et al*., 2019; Tugbiyele, 2019).

Competitive pressure

By using a new technology, firms could alter the rules of competition, affect the industry structure and take advantage of new ways to outperform their rivals, thus changing the competitive landscape (Porter & Millar, 1985). Such analysis can be extended to the adoption of CE, in this context, many scholars have identified competitive pressure as an important element (Almoawi & Mahmood, 2011; Amin & Hussin, 2014; Awiagah *et al*., 2016; Chatzoglou & Chatzoudes, 2016; Mohtaramzadeh *et al*., 2018; Muslim & Sandhyaduhita, 2017; Oliveira, 2010). Some of the indicators used to measure these variables are competitive pressure to use the internet, competitive pressure for website and competitive pressure for online sales. The following hypotheses derive from this factor:

- H9. Internet use has a positive effect on EC adoption (H9a, micro; H9b, small; H9c, medium).

- H10. Having a web page has a positive effect on the adoption of EC (H10a, micro; H10b, small; H10c, medium).

E-commerce organization and adoption

In Mexico, one of the vital elements that influence the adoption of electronic transactions technology by MSMEs is the nature of the company, including the different characteristic elements that are manifested within the organization (such as its size and financial infrastructure).

Company size

Company size is one of the most influential factors in the adoption of the Internet and therefore the decision to participate in EC (Galhotra & Dewan, 2020); it not only plays a role in a company's ability and willingness to adopt Internet sales, but also in the extent

to which it will adopt the technology (Serrano-Guerrero *et al*., 2020). A company with a large number of operations and data is more likely to adopt EC, as it can be helpful in optimizing operations and provide process efficiencies within the company (Khaleel, 2020). The following hypothesis arises from this question:

- H11. The number of occupied personnel has a positive effect on the adoption of EC (H11a, micro; H11b, small; H11c, medium).

Financial infrastructure

This factor affects the availability of resources required by the company for the adoption of EC, as it plays an important role in the implementation of this technology. Small businesses that lack a financial structure present evidence of being slower to adopt technological innovations such as EC, this due to the risks of receiving payments (Gallego *et al*., 2016; Kurnia *et al*., 2015; Muslim & Sandhyaduhita, 2017). The hypotheses regarding financial infrastructure are as follows:

- H12. Cash sales have a negative effect on EC adoption (H12a, micro; H12b, small; H12c, medium).

- H13. Bank card sales have a positive effect on EC adoption (H13a, micro; H13b, small; H13c, medium).

- H14. Bank deposit sales have a negative effect on EC adoption (H14a, micro; H14b, small; H14c, medium).

- H15. Sales with bank transfer have a positive effect on EC adoption (H15a, micro; H15b, small; H15c, medium).

- H16. Sales by check have a negative effect on EC adoption (H16a, micro; H16b, small; H16c, medium).

Methodology

The data used in this study were provided by INEGI (2020), the result of the 2019 Economic Census. In this study, company size was defined according to the stratification of the Ministry of Economy (INEGI, 2019): microenterprises are considered to be those with fewer than ten employees; small enterprises, from eleven to 50 employees; medium-sized enterprises, from 51 to 100 employees. Thus, contemplating all economic sectors that had online sales in the year immediately prior to the census survey, the sample consists of 96,620 micro, 25,508 small and 13,647 medium enterprises.

It was decided to apply a multiple regression model as an analysis technique for each company size group, since it is one of the most effective and flexible procedures to determine the relationship between a dependent variable and one or more independent variables. This method has been used in works on the adoption of EC by small and medium enterprises in Nigeria (Awa *et al*., 2016), Malaysia (Ahmad *et al*., 2015), UAE

(Gorla *et al*., 2015), Sri Lanka (Senarathna *et al*., 2014), Saudi Arabia (Almoawi & Mahmood, 2011), Jordan (Alsaad *et al*., 2018), among others.

This procedure can be used to determine whether the independent variables explain a significant variation in the dependent variable, that is, whether a relationship exists (Malhotra, 2008). Multiple regression models can be defined as a statistical technique that simultaneously develops a mathematical relationship between two or more independent variables and a dependent variable.

According to the previous section, where the selection of variables was reviewed, the following multiple regression models proposed for this research are defined:

$$ACEmicro = (\beta_1 It + \beta_2 Pt + \beta_3 Te + \beta_4 If + \beta_5 Pc) + \varepsilon \quad (1)$$

$$ACEpequeña = (\beta_1 It + \beta_2 Pt + \beta_3 Te + \beta_4 If + \beta_5 Pc) + \varepsilon \quad (2)$$

$$ACEmediana = (\beta_1 It + \beta_2 Pt + \beta_3 Te + \beta_4 If + \beta_5 Pc) + \varepsilon \quad (3)$$

Where:

$ACEmicro$ = Ingresos por CE de las microempresas en México

$ACEpequeña$ = Ingresos por CE de las pequeñas empresas en México

$ACEmediana$ = Ingresos por CE de las mediana empresas en México

β = Nivel de relación o de influencia

ε = Elemento aleatorio

It= Integración tecnológica

Pt = Preparación tecnológica

Te = Tamaño de la empresa

If = Infraestructura financiera

Pc = Presión de la competencia

Results

This section shows the findings obtained from the study, which aimed at analyzing the factors that influence micro, small and medium-sized companies that adopted Internet sales in Mexico. After estimating a multiple linear regression model by company size (micro, small and medium), the postulated hypotheses were tested by analyzing the sign of the statistical significance of the estimated coefficients. Positive and significant coefficients imply that the relevant variable is a facilitator of adoption, while negative and significant coefficients indicate that the corresponding variables are inhibitors of adoption.

Of the 135,775 companies that adopted the EC, 54.53% of their revenues were through the Internet, with small companies having the highest average, with 58.61% of revenues coming from electronic means. Microenterprises had the highest average of cash sales, with 51.63%.

Table 1 shows the summary results of each of the proposed regression models. In the microenterprise model, of 16 indicators introduced in the first regression test, only 15 remain, with bank deposit sales disappearing as significant and being eliminated from the model. Seven inhibitors to the adoption of online sales can be identified: use of the Internet for government procedures, having a web page, access to an intranet, the number of personnel employed, cash sales, bank transfers and by check.

Table 1. Results of the logistic regression analysis

Variable	Micro	Small	Median
Technological integration			
1) Use of internet for banking operations	1.991***	-3.639***	NC
2) Use of Internet for government procedures	-2.454***	-0.937***	-3.279***
3) Use of the Internet for Internet searches	0.869**	-3.950***	-4.637***
4) Use of internet for business management	5.366***	6.594***	NC
Competitor pressure			
5) Internet use	9.526***	5.076***	9.261***
6) Web Sites	-0.702***	-1.007***	-1.007***
Technological readiness			
7) Computer access	0.109***	0.006***	0.572***
8) E-Mail access	0.578***	3.211***	2.411***
9) Internet access	2.004***	3.003***	3.995***
10) Intranet access	-0.062***	-0.326***	-0.616***

Size of the company			
11) Staff employed	-0.139***	-0.088***	-0.052***
Financial integration			
12) Cash sales	-0.303***	-0.409***	-0.654***
13) Bank transfer sales	-0.200***	-0.337***	-0.522***
14) Bank deposit sales	NC	-0.118***	-0.198***
15) Bank card sales	0.067***	0.067***	-0.119***
16) Sales by check	-0.176***	-0.285***	-0.371***
Constant	54.540***	77.970***	88.646***
Observations	96 620	25 508	13 647
R^ Adjusted	0.708	0.735	0.711
Residual Standard Error	33.788	33.08	32.738
Statistic F	1 372***	539.1***	564.1***

Note: NC means that the indicator was not considered in the analysis.
Source: Prepared by the authors based on data processing.

The use of the Internet for banking, Internet searches and business management, as well as access to computers, e-mail and the Internet and bank card sales, are shown as facilitators of the acceptance of Internet transactions. This model is able to explain 72.4% of the variability observed in EC adoption.

In small businesses, the use of the Internet for business management, the use of the Internet, access to computers, e-mail and the Internet, and bank card sales are identified as facilitators of the adoption of online sales. This model explains 77.5% of the variability in online sales for small businesses. In this model, all 16 proposed indicators remain statistically significant.

The model for the medium-sized company explains 77.1% of the variability of Internet revenues in this sector. Of the 16 indicators proposed at the beginning of the test, only fourteen remain statistically significant in the final model. The use of the Internet for searches, having a web page, access to an intranet, employed personnel and all the indicators of the financial integration variable are inhibitors of the acceptance of online transactions; on the other hand, the facilitators for this group of companies are: the use of the Internet, access to e-mail, computers and the Internet.

The Durbin Watson index for the micro, small and medium enterprise model was 2.113, 2.132 and 2.342, respectively, indicating that there is no autocorrelation between the variables and the nearby observations, as they tend to be different. In addition, the significance of the F-value for the three models was 0.01, indicating that the independent variables are appropriate for testing the regression models created. Finally, the tolerance values and variance inflation factors are within acceptable limits (<10), indicating that there is no collinearity between the study variables (see Table 2).

Table 3 shows the results of the hypothesis tests for three levels of companies. The study indicates that, at the micro level, hypotheses 1a, 4a, 5a, 7a, 8a, 9a, 12a and 16a are accepted at a significance level of 0.01, while hypothesis 3a is accepted at a significance level of 0.05. The results for small companies indicate that hypotheses 4b, 5b, 7b, 8b, 9b, 12b, 14b and 15b were accepted, with a significance level of 0.01; and hypothesis 16b is accepted, but with a significance level of 0.1. Regarding the medium-sized company, the results show that hypotheses 5c, 8c, 9c, 10c, 11c and 12c were accepted, with a significance level of 0.01, and hypothesis 7c is accepted with a significance level of 0.05.

Table 2. Summary of the model

	Micro		**Small**		**Median**	
Durbin Watson	2.113		2.132		2.342	
	Tolerance	**FIV**	**Tolerance**	**FIV**	**Tolerance**	**FIV**
Technology Integration						
Use of internet for banking operations	0.643	1.554	0.829	1.206	NC	NC
Use of Internet for government procedures	0.602	1.660	0.820	1.219	0.834	1.200
Use of the Internet for Internet searches	0.835	1.197	0.945	1.058	0.822	1.217
Use of internet for business management	0.900	1.112	0.723	1.542	NC	NC
Competitive pressure						

Internet Use	0.909	1.100	0.967	1.035	0.899	1.112
Web Sites	0.826	1.107	0.896	1.976	0.223	1.367
Preparación tecnológica						
Computer access	0.867	1.672	0.912	1.043	0.108	3.51
e-Mail access	0.134	1.089	0.845	1.126	0.324	2.876
Internet access	0.744	1.456	0.974	1.466	0.932	1.09
Intranet access	0.651	3.364	0.767	1.194	0.717	1.245
Size of the company						
Staff employed	0.835	1.198	0.961	1.041	0.915	1.093
Financial integration						
Cash sales	0.144	6.943	0.895	1.118	0.047	1.180
Bank transfer sales	0.323	3.096	0.938	1.066	0.071	4.184
Bank deposit sales	NC	NC	0.953	1.049	0.138	7.249

Bank card sales	0.161	6.225	0.812	1.345	0.026	8.369
Sales by check	0.602	1.661	0.921	1.086	0.221	4.532

Note: NC means that the indicator was not considered in the analysis.
Source: Prepared by the authors based on data processing.

Table 3. Hypothesis testing results

		Micro		Small		Median	
	Hypothesis	**Result**	**Significance**	**Result**	**Significance**	**Result**	**Significance**
Technology	**Technological Integration**						
	H1. The use of internet for banking operations has a positive effect on EC adoption	Accepted	0.01	Rejected	0.01	Not considered.	Not considered.
	H2. The use of internet for government procedures has a	Rejected	0.01	Rejected	0.01	Rejected	0.01

	positive effect on CE adoption.						
	H3. The use of the internet for search has a positive effect on CE adoption	Accepted	0.05	Rejected	0.05	Rejected	0.05
	H4. The use of the Internet for business management has a positive effect on the adoption of the CE	Accepted	0.01	Accepted	0.01	Not considered.	Not considered.
	Technological preparation						
	H5. Access to computers has a positive effect on CE adoption.	Accepted	0.01	Accepted	0.01	Accepted	0.05

	H6a. Access to e-mail has a positive effect on EC adoption.	Accepted	0.01	Accepted	0.01	Accepted	0.01
	H7. Access to the Internet has a positive effect on EC adoption.	Accepted	0.01	Accepted	0.01	Accepted	0.01
	H8. Access to the intranet has a positive effect on the adoption of the CE	Rejected	0.01	Rejected	0.01	Rejected	0.01
Enviroment	**Competitor pressure**						
	H9. The use of the Internet has a positive effect on the	Accepted	0.01	Accepted	0.01	Accepted	0.01

	adoption of CE.						
	H10a. Having a web page has a positive effect on the adoption of SC.	Rejected	0.01	Rejected	0.01	Rejected	0.01
Organization	**Size of the company**						
	H11. The number of staff employed has a positive effect on the adoption of the EC.	Rejected	0.01	Rejected	0.01	Rejected	0.01
	Financial integration						
	H12. Cash sales have a negative effect on CE adoption.	Accepted	0.01	Rejected	0.01	Aceptada	0.01

	H13. Bank transfer sales have a positive effect on CE adoption.	Rejected	0.01	Rejected	0.01	Rejected	0.05
	H14. Bank deposit sales have a negative effect on CE adoption.	Not considered.	Not considered.	Accepted	0.01	Accepted	0.01
	H15. Sales with bank card have a positive effect on the adoption of CE	Rejected	0.05	Accepted	0.01	Rejected	0.01
	H16. Sales by check have a negative effect on	Accepted	0.01	Accepted	0.1	Accepted	0.01

	CE adoption.						

Source: Prepared by the authors.

The models tested examine different aspects of technology, organization and business environment, with the objective of analyzing the factors of MSMEs that adopted EC in Mexico, and generate the results of the study in a formal and systematic way. The result of data analysis and model fitting illustrates the effects of different organization-related factors in explaining the willingness of MSMEs in Mexico to adopt online transactions and can be set as the following functions:

$$\begin{aligned} ACEmicro = {} & 54.54 + 1.99 \text{ Use of the Internet for banking transactions} \\ & - 2.45 \text{ Internet usage for government transactions} \\ & + 0.869 \text{ Internet usage for internet research} \\ & + 5.33 \text{ Internet usage for business management} \\ & + 9.52 \text{ Internet usage} - 0.70 \text{ Own website} \\ & + 0.10 \text{ Computer access} + 0.57 \text{ E} - \text{mail access} \\ & + 2.00 \text{ Internet access} - 0.06 \text{ Intranet access} \\ & - 0.13 \text{ Staff employed} - 0.30 \text{ Cash sales} \\ & - 0.20 \text{ Bank transfer sales} + 0.06 \text{ Credit card sales} \\ & - 0.17\ 0.17 \text{ Check sales} \end{aligned} \tag{4}$$

$$\begin{aligned} ACEpequeña = {} & 77.97 - 3.63 \text{ Use of the Internet for banking transactions} \\ & - 0.93 \text{ Internet usage for government transactions} \\ & - 3.91 \text{ Internet usage for internet research} \\ & + 6.59 \text{ Internet usage for business management} \\ & + 5.07 \text{ Internet usage} - 1.00 \text{ Own website} \\ & + 0.006 \text{ Computer access} + 3.21 \text{ E} - \text{mail access} \\ & + 3.003 \text{ Internet access} - 0.32 \text{ Intranet access} \\ & - 0.08 \text{ Staff employed} - 0.50 \text{ Cash sales} \\ & - 0.01 \text{ Bank transfer sales} + 0.06 \text{ Credit card sales} \\ & - 0.28 \text{ Check sales} \end{aligned} \tag{5}$$

$$\begin{aligned} ACEmediana = {} & 88.64 - 3.27 \text{ Internet usage for government transactions} \\ & - 4.63 \text{ Internet usage for internet research} \\ & + 9.26 \text{ Internet usaget} - -1.00 \text{ Own website} \\ & + 0.57 \text{ Computer access} + 2.41 \text{ E} - \text{mail access} \\ & + 3.95 \text{ Internet access} - 0.61 \text{ Intranet access} \\ & - 0.05 \text{ Staff employed} - 0.65 \text{ Cash sales} \\ & - 0.52 \text{ Bank transfer sales} - 0.19 \text{ Bank deposit sales} \\ & - 0.11 \text{ Credit card sales} - 0.33 \text{ Check sales} \end{aligned} \tag{6}$$

Discussion and conclusions

The objective of this study was to analyze the technology, organization and environmental factors that influenced the micro, small and medium-sized enterprises that adopted the EC in Mexico. As part of the work, a literature review was conducted on the aspects that had been addressed by other researchers in the technology, organization and environment framework, and a research model was developed, emphasizing the main characteristics of each of the contexts of the TOE framework as predictors of the model.

A multiple linear regression model by firm size was estimated to examine the adoption of EC, this includes: two technological characteristics (technological readiness and technological integration), two organizational characteristics (firm size and financial infrastructure), and one environmental characteristic (competitive pressure). The study used data provided by INEGI as a result of the 2019 Economic Census, with a sample of 135,775 businesses that had online sales during the year immediately prior to the census.

The technological context was analyzed, defining that the factors Integration and Technological readiness had a positive effect on the decision to adopt EC in the companies, however, the results show that, apparently, technological integration is losing importance as the size of the company grows, going from being a facilitator to an inhibitor of the adoption of online sales. With respect to technological readiness, with the exception of intranet access, computer access to e-mail and the Internet are facilitators of e-sales acceptance. These results are consistent to those obtained in previous similar studies (Sanchez-Torres *et al*., 2021; Sanchez-Torres & Juarez-Acosta, 2019; Shirazi *et al*., 2021).

The context of the environment assessed the factor of competitive pressure as an accelerator of the adoption of electronic transactions, the use of the internet turned out to be a facilitator, but having a website is an inhibitor at the time of making the decision to participate in this modality. Previous studies, such as Al-Omoush (2017) and Jayaram *et al*. (2015), had similar results to those found in this research; they show that, within the progressive process of EC acceptance, MSMEs in Mexico are in the initial stage, barely adapting to innovations such as the internet. Additionally, it is considered that the creation, management and administration of a web page is a process that requires certain technological skills and financial resources to exploit this tool.

Financial integration and company size were evaluated as part of the organizational context. Bank transfer sales were found to be an inhibitor of electronic sales in all company sizes. This is related to the percentage of cash sales that companies make, showing the low level of bankarization existing in Mexico (INEGI, 2016). On the other hand, bank card sales are also an inhibitor for microenterprises, it seems that as companies grow it becomes a facilitator.

Lastly, the result of firm size can be described as inversely correlated with EC adoption, as the lower the number of employees, the higher the internet revenue, which decreases the percentage of revenue as the number of employees grew. These results are consistent with Nazir and Roomi (2021) but contradictory to previous studies such as

Kraemer and Gibb (2005), and Martins and Oliveira (2009); however, the difference in the results obtained may be due to the moment in time, history and diffusion of the internet in which each study was conducted. This could mean that technological advances resulting in greater access to mobile devices, mobile applications and platforms for Internet sales have made it easier for companies with fewer employees to benefit from online sales.

These results could also demonstrate that MSMEs are slowing down their technological evolution as they increase the number of employees. This could be attributed to different reasons. First, it seems that micro-enterprises, while trying to generate the necessary capital to help them grow, neglect to invest in new technologies. Secondly, the employees that make up MSMEs tend to have an average education, and when trying to assume the risks of investing in technology, they do not visualize the indirect benefits that this can bring them. Another reason is the lack of technological experience, both on the part of managers or owners and employees, which could be understood by the penetration of the Internet, which also decreases as the company grows.

This study addresses the behavior of the adoption of EC by MSMEs in Mexico. At the time it was conducted, no similar studies could be identified to investigate the acceptance of this innovation in Mexico. In this research, the behavior of electronic sales in different economic sectors and other strategic organizational variables were not considered, so this work has great value in demonstrating that technological, organizational and environmental characteristics have significant effects on the adoption of EC by MSMEs in Mexico.

It is hoped that practitioners, interested government departments and other academic researchers can accept and build on the results of this study and take the necessary steps to encourage the adoption rate of EC that would boost the state of affairs of MSMEs in Mexico, and thus help promote the economic development of the country.

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