

Classification of SMEs through a distributed system that allows the generation of e-commerce applications in Mexico

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ABSTRACT

Mexican companies with the current economic model and globalization that we are experiencing have been able to expand into other markets thanks to the interconnectivity of new technologies, which has led to the arrival of multinational companies and the investment of large Mexican capital in other latitudes to a greater extent, and investment outside our country by some companies, that is, looking for new business niches for the expansion of markets where they can compete with their products and services. It is not the case of small and medium-sized companies that despite being a sector that in terms of the constitution of companies, 94% of the micro-enterprises established in this country do not have infrastructure and technology conditions that allow them to make use of of the same that allows them to improve their efficiency, productivity and competitiveness. These represent barriers for Mexican SMEs, continuous loss of market position, thereby endangering their livelihood. The purpose of this research is to carry out a study of Mexican SMEs that serves as a proposal for an innovative model for the implementation of electronic commerce that serves as an instrument to increase the competitiveness and confidence of transactions executed in the context of electronic marketing, using using multivariate statistical methods such as Ward's method and factor analysis as validation that supports criteria of legality, security and guarantee as an adequate means for said commercialization.

Keywords: e-commerce, SMEs, distributed system, competitiveness.

1 INTRODUCCIÓN

We live in a competitive world in which Digital Transformation and the changes associated with the application of digital technologies are present in all aspects of society, we could safely say that the effect of digitization on society is at a global level. whole and global. This implies that, if we take this concept to the business environment, this phase of transformation and the use of digital technological tools and applications is fundamental and important for small and medium-sized companies to facilitate new forms of innovation, creativity and interconnectivity.

Small and medium-sized companies have had to adapt to a large number of challenges, which means that today organizations have had to change the way they do business, the media make them more competitive every day. , and it is important to take into account that if they do not adapt to these constant changes, they will definitely be left out of the existing markets.

In the Mexican Republic, the emergency caused by the COVID-19 virus has caused great consequences in the economies. According to statistics, companies could present social, economic and the most fundamental technological insolvencies in 2023.

This effect directly impacts Small and Medium Enterprises, which contribute 54% of the Gross Domestic Product of our country and, in addition, generate between 10 and 100 jobs per company, depending on the size of the line of business, this entails because it is urgent that they look for new technological strategies to increase their On the other hand, Internet penetration rates among the population are beginning to be high, and the spread of broadband plays a relevant role. This kind of technology facilitates user access to advanced commercial communication systems, personalized

attention, etc., thus making the Internet a more attractive environment for commercial exchanges, which is why it is necessary for the country to modernize its systems. marketing and IT. Previously, electronic commerce did not have sufficient advantages as it does now, that is, the cost of having a computer and having access to the network was expensive and there was not enough technology to carry out negotiations electronically, and it was not until recent years where competitiveness and globalization start these negotiations with a great impact on economic life around the world.

The most important advantage of developing a distributed system that allows the generation of e-commerce applications in Mexico in a simple way, provides performance and scalability at a reasonable cost, is that it will increase the efficiency of SMEs, since it will allow purchasing steps to be made easier. shorter and faster and on the other hand the image of the company will become more attractive to buyers since they will have a better perspective when seeing sales or promotions in images than in traditional advertising and sales systems.

On the other hand, by implementing electronic commerce in Mexico, it will allow them to increase sales quickly and give access to the market, which could not be accessed without web pages. In addition to communication between them, avoiding high costs.

The social and economic impact of electronic commerce in Mexico will allow companies to be closer to their buyers and treat them more personally, therefore it is important to optimize their methods and implement them in the market, but not from an administrative and empirical way only, but from a point of view scientific, this will achieve greater productivity and jobs for the population mainly within the SMEs that are a fundamental part of the development of the country.

2 ECOMMERCE CONTEXT

Tic's are currently transforming the economy and the way of doing business. This is how among the new ways of doing business we find electronic commerce which is a business model based on the transactions of products and services in electronic media and has the characteristic of being a network in which all information circulates freely. , offering a space and giving to the opposition of interests that must be regulated in a legal and social way. Traditional regulation is conditioned by the construction and development of technological tools, telecommunications networks and instruments, computer programs and security controls for online content and transactions .

The incorporation of ICT in organizations is recognized as a learning process that develops in stages (Peirano and Suárez, 2006; Khurana, 2011; Rivas and Stumpo, 2011; Alderete, 2012). Once a certain level of maturity has been reached, sophisticated and complex uses of ICTs are facilitated 3. These technologies are conducive to supporting decision-making, electronic commerce and inter-organizational

cooperation processes, favoring the integration of the extended value chain through computer networks (Camarinha-Matos, 2002).

The importance of analyzing the adoption of electronic commerce in (SMEs) in developing countries lies in its potential for value creation. The Internet and electronic commerce make it possible to reduce transaction costs and increase the speed and reliability of operations. It also contributes to reducing the inefficiencies that result from the lack of coordination between companies that make up a value chain. Interactions between Internet-based companies (Business to Business or B2B) and real-time communication can reduce information asymmetries between buyers and suppliers and establish closer relationships between trading partners (Moodley, 2002). A corporate website that provides information about products, services or technologies can improve the quality of care and services of a company to its customers (Business to Consumer or B2C), as well as attract new customers.

This work represents a contribution to the importance of implementing electronic commerce in SMEs and the level of adoption that commercial and service companies in developing countries should have of new technologies, particularly Mexico, where empirical work is scarce. published on the subject. Taking as a starting point the perceived multivariate statistical model (Molla and Licker (2004), modifications are incorporated that enrich the analysis of the results through an exploratory-descriptive study. The data comes from a survey of companies in Mexico City and its surroundings. ,

The study uses a perspective that integrates various theories associated with the adoption and diffusion of technologies and innovations and considers internal organizational factors and the environment, which affect the adoption of e-commerce in SMEs. (Molla and Licker, 2004 and 2005; Tan, Tyler and Manica, 2007; Bravo, 2011). For this reason, its application to the specific case of a city in Mexico allows to advance the investigation of electronic commerce in developing countries.

The working hypothesis is that the adoption of electronic commerce is associated with: a) The perception regarding the benefits associated with electronic commerce and ICT in small and medium-sized companies, The level of digital preparation of the organization, The perception of the organization regarding the preparation of the environment, the organizational size and the sector of activity

3 METHOD DESCRIPTION

A mixed classification analysis of the entities (SMEs) was carried out in homogeneous groups using multivariate methods, which first consisted of a factorial analysis according to the nature of the data and then a classification based on a mixed algorithm; Subsequently, a hierarchical classification was carried out with the Ward method and aggregation around moving centers (K-Means), which is a grouping method, whose objective is to partition a set of n observations into k groups in which each observation belongs to the group closest to the mean.

To carry out the aforementioned, an empirical analysis had to be carried out through a survey on the most appropriate distribution channels for the sale between and after-sales service of 28 typical services offered by SMEs and also on the distribution channels most used by the entity they represent. . The channels considered were: direct sales points, telephone and electronic commerce.

The protocol addressed a universe made up of 213 SMEs from which a sample of 35 entities was taken. This sample, although small, is enough to present us with results on the distribution channels of SME service entities with respect to: classification of SMEs in financial services, SMEs in transport services, SMEs in telecommunications services and SMEs in tourism services.

Table 1 shows the total population of entities classified according to the most used distribution channels.

Table 1: Population of SMEs analyzed

	Tourist services SMEs	Transport services SMEs	Financial services SMEs	Telecommunications services SMEs	
Direct sale	4	0	0	2	6
contact by phone	12	0	0	9	21
electronic commerce	91	35	21	39	186
total	107	35	21	50	213

The sample obtained has been 35 questionnaires considered correct, six incorrect questionnaires were sent again for correction and only two were recovered. The total number of entities represented has been 10 SMEs that provide tourism services, one transport, one financial and 23 telecommunication services. The sample represents 16.43 percent of the universe, which is considered a good result for this type of survey; however, the total number of responses, 35, is low enough to carry out conclusive analysis. On the other hand, the sample is unbalanced according to the characterization of the universe, SMEs in tourism services do not reach 10 percent while SMEs in telecommunications services represent 46 percent of the universe and the other entities have only a token presence. (tables 2 and 3).

Table 2: Statistic sample obtaine

	Tourist services SMEs	Transport services SMEs	Financial services SMEs	Telecommunications services SMEs	
Direct sale	1	0	0	2	3
contact by phone	2	0	0	3	5
electronic commerce	7	1	1	18	27
total	10	1	1	23	35

Table 3: Statistic Sample percentage

	Tourist services SMEs	Transport services SMEs	Financial services SMEs	Telecommunications services SMEs	
Direct sale	25	0	0	100	50
contact by phone	16.67	0	0	33.33	23.81
electronic commerce	7.69	2.86	4.76	46.15	14.52
total	9.35	2.86	4.76	46	16.43

To check if this imbalance in the sample has a decisive influence on the result of the investigation, we have divided the sample between SMEs in telecommunications services and the rest of the entities and we have carried out the chi-square test to determine if there are differences in the distributions. frequency of responses to the questionnaires. The null hypothesis is that there is no difference in frequency distribution between SMEs in telecommunications services and the rest of the entities. The result is shown in Table 4 and provides us with the probabilities associated with accepting the null hypothesis for each of the variables. As the chi-square result tends to move away from zero, it does not seem that the sample imbalance presented by the questionnaires collected in the field work will decisively affect the result of the investigation.

The chi-square test of independence, returns the value of the chi-square distribution for the statistic and the appropriate degrees of freedom, this test first calculates a chi-square statistic and then sums the differences between the actual values and the expected values (Table 4-5-6).

Table 4: Total percentage table

	Direct sale	contact by phone	electronic commerce	total
Tourist services SMEs	1	2	7	10
Transport services SMEs	0	0	1	1
Financial services SMEs	0	0	1	1
Telecommunications services SMEs	2	3	18	23
Total	3	5	27	35
Porcentaje	0.085714286	0.142857143	0.771428571	1

Table 5: Obtaining proportions

	Direct sale	contact by phone	electronic commerce	total
Tourist services SMEs	0.857142857	1.428571429	7.714285714	10
Transport services SMEs	0.857142857	0.142857143	0.771428571	1
Financial services SMEs	0.857142857	0.142857143	0.771428571	1
Telecommunications services SMEs	1.971428571	3.2857144286	17.74285714	23
Total	3	5	27	35

Table 6: Values obtained with CHI square

	Direct sale	contact by phone	electronic commerce	CHI Cuadrada
Tourist services SMEs	0.23809524	0.228571429	0.066137566	
Transport services SMEs	0.085714286	0.142857153	0.067724868	
Financial services SMEs	0.085714286	0.14287143	0.067724868	
Telecommunications services SMEs	0.0000414079	0.2484472	0.003726708	
Total	0.195652174	0.142857143	0.20531401	0.940096618

To carry out the multivariate analysis, the Ward method was applied, analyzing the relationship or behavior that may exist between the variables, for this reason the covariance matrix tables 5 and 6 will be used, since when using the covariance and simple linear correlation coefficient, help us explain this relationship (Table 7).

Table 7: Values obtained mean and variance

	Direct sale	contact by phone	electronic commerce
Tourist services SMEs	1	2	7
Transport services SMEs	0	0	1
Financial services SMEs	0	0	1
Telecommunications services SMEs	2	3	18
MEAN	0.75	1.25	6.75
VARIANCE	0.9166667	2.25	64.25

From which we obtain our covariance matrix (Table 8).

Table 8: Matrix of covariance

Matrix of covariance	Direct sale SMEs	contact by phone	by e-commerce
Direct sale	0.916666667	1.416666667	7.583333333
contact by phone	1.416666667	2.25	1.416666667
electronic commerce	7.583333333	2.86	64.25

Using the covariance as an absolute measure of dependency is difficult because its value depends on the scale of measurement. That is why it is difficult at first glance to tell if the covariance is large. This difficulty can be eliminated by standardizing its value by means of the simple linear correlation coefficient, so by entering the data in SPSS and applying Ward's method, the following analysis is obtained in (Table 9-10).

Table 9: Case Analysis

case analysis					
valid		lost		total	
N	percentage	N	percentage	N	percentage
3	100.0	0	0	3	100

Table 10: Conglomerates Combine

Stage	Conglomerates That Combine			Stage In Which The Conglomerate First Appears		Next Stage
	Conglomerate 1	Conglomerate 2	Coefficients	Conglomerate 1	Conglomerate 2	
1	1	2	7.768	0	0	2
2	1	3	2095.324	1	0	0

Throwing the following results (Table 11-12).

Table 11: Conglomerates Variance

Conglomerates		
	1	2
VAR00001	1.16	7.58
VAR00002	1.91	11.41
VAR00003	9.50	64.25

Table 12: Conglomerates Combine table

conglomerate	
Conglomerate 1	2.000
Conglomerate 2	1.000
Valid	3.000
lost	0.000

As we can see, the method gives us the partition of 2 clusters by the Ward method, grouping all the clusters into homogeneous groups at the same height, obtaining a subdivision into three clusters, the

first formed by two groups that are sales by telephone and direct sales and the second second formed by a single group that is electronic commerce which checks how the method can form new clusters.

4 CONCLUSIONS

In Mexico, the current situation requires the government to assume leadership in promoting the development of Information Technology industries and in promoting the digital reconversion of processes to achieve improvements in the productivity of our economy. The development of electronic commerce in SMEs is presented as a real alternative to produce and export products and services with high added value.

Electronic commerce has become a very successful tool for the business world thanks to the openness and ease of access to the Internet. On the other hand, companies that wish to have a more effective Internet presence cannot settle for a corporate page. just provide information.

As has been seen, when clustering companies (SMEs) the creation of services will be facilitated through the contribution of several companies that provide personalized marketing methods, methods that by other means would be much more expensive.

The implementation of clustering will allow companies to be closer to their buyers and have a more personalized treatment, and thus have a unique advantage to sell their products since, thanks to electronic commerce, new paths can be opened to have a competitive advantage in the globalized world in that we currently live

On the other hand, this model allows forecasting with support in Statistical values, e-commerce applications in a simple way on a computer cluster, providing performance and scalability at a reasonable cost in SMEs in the State of Mexico. Details of the adopted methodology are presented, which makes this study easily applicable to real-world processes.

REFERENCES

- Alderete, M. V. (2012). Medición de las tecnologías de la información y la comunicación en empresas de ser vicios de Colombia. *Cuadernos de Administración*, 25 (45), 39 -62.
- Bravo, S. (2011). Electronic commerce in developing coun- tries a study of B2B E-commerce adoption by small and medium sized enterprises. (Master of Science T hesis). INDEK School of Industrial Engineering and Management. Estocolmo, Suecia: K T H Royal Institu- te of Technolog y. Industrial Management.
- Boateng, R., Molla, A ., & Heek s, R. (2009). E- Commerce in developing economies: a review of theoretical f ra- mework s and approaches. In K. Rouibah, O.E. Khalil, & A .E. Hassanien (eds.). *Emerging markets and e-commer- ce in developing economies* (pp. 1-56). El Cairo, Egipto: Universidad del Cairo
- Camarinha-Matos, L . M. (2002) Collaborative business ecosystems and vir tual enterprises. Lisboa, Por tugal: USA Kluwer Academic Publishers.
- , H., Goel, M., Singh, H., & Bhutani, L . (2011). E- Commerce: role of e-commerce in today 's business. *International Journal of Business Management Research VSRD -IJBMR*, 1 (7), 454-461.
- Molla, A ., & Licker, P. S. (2004). eCommerce adoption in developing countries: a model and instrument. *Informa- tion & Management*, (424), 87 7-899.
- Molla, A . (2004). T he impact of ereadiness on ecommerce success in developing countries: firm-level evidence. *Development Informatics. Working paper N°18*. Man- chester, United Kingdom. Institute for Development Policy and Management Universit y of Manchester.
- Peirano, F., y Suárez, D. (2006).T ICS y empresas: propues- tas conceptuales para la generación de indicadores para la sociedad de la información. *Journal of informations Systems and Technology Managment*, 3 (2) 123-142.
- Rivas, D., y Stumpo, G. (2011). Las TIC en el tejido productivo de América Latina. En M., Novick, y S., Rotondo (Comp.). *El desafío de las TIC en Argentina. Crear capacidades para la generación de empleo* (pp. 43-79). Santiago de Chile, Chile: CEPAL
- Tan, J., Tyler, K., & Manica, A. (2007). Business-to-business adop- tion of eCommerce in China. *Information & management* 44 (3), 332-351.