

THE USE OF ICTs AND ITS RELATION WITH THE COMPETITIVENESS OF MEXICAN SMEs

Héctor Cuevas-Vargas

Luis Aguilera Enríquez

Martha González Adame

Autonomous University of Aguascalientes, México

Joe Luis Servin

Instituto Tecnológico Superior de Salvatierra, México

Abstract

This empirical study was aimed to analyze the relationship between the use of Information and Communication Technologies (ICT) and the competitiveness of manufacturing Small and Medium Enterprises (SME) in the state of Aguascalientes, Mexico, using size and age of the company as control variables. The scales in which the use of ICT and competitiveness were measured, were subjected to a first Order confirmatory factor analysis (CFA), through the Method of Maximum Likelihood, for which they have reliability and convergent and discriminant validity. When the survey was applied to managers or owners of 200 manufacturing SMEs, the results obtained through linear regression analysis by Ordinary Least Squares (OLS) under the stepwise method, allowed to infer that ICTs have a positive and highly significant relationship with the competitiveness of these types of businesses, finding no evidence that the size or age of these types of businesses influence over the impact on the competitiveness using ICT.

Keywords: ICT, Competitiveness, Manufacturing SMEs, Size, Age

Introduction

Small and medium enterprises are considered the backbone of the national economy, playing a central role in job creation and contribution to Gross Domestic Product (GDP), accounting for 99.8% of economic units both globally and domestically, in the case of Mexico. However, these organizations currently face many challenges in order to maintain their feet hold in competitive and constant changing global markets. In this situation, high levels of global competition in today's market, have led the majority of SMEs to participate exclusively in the local market, where their products and sales are highly segmented in a market share (Singh, Garg & Deshmukh,

2006). Due to that one of the strategies that SMEs should apply to reduce these challenges are the adoption of Information and Communication Technologies (ICT) that will allow them to boost their efficiency and competitiveness (Ongori & Migiro, 2010), being that ICTs play a prominent role in improving the competitiveness of these organizations. For this reason, ICTs should be considered as technologies that help manage and optimize business processes of the company, ensuring the full or partial automation of staff activities, proper organization of resource management, quality improvement activities of the company and ensure the management of important information for decision-making (Rogers, Bird & Flees, 2011, cited in Puksta & Nedelea, 2012).

According to literature, ICTs are considered a key for the growth of business nowadays (Okoli, Mbarika & McCoy, 2010). This is especially true for dynamic companies with a highly competitive environment that requires the use of advanced ICT technologies to improve efficiency and cost effectiveness, as well as to offer products and high quality services to their customers (Mosleh & Shannak, 2009).

Huerta, Bayo, García-Olaverrí & Merino (2003) suggest that the incorporation of new systems and information technologies facilitate business planning and encourages the development and implementation of production programs, as well as stimulating control processes and products.

It is therefore essential that business management is encouraged in organizations, the use of new ICTs, particularly in SMEs, as it will allow them to achieve competitive success (Donrrosoro *et al.*, 2001; Llopis, 2000). In this situation, the empirical evidence provided in this investigation is important, and together with the above, there have been few studies in developing countries on the use of ICTs and its impact on competitiveness, and the results of investigations made in developed countries are not always applicable in developing countries (Casanova, 2004; Cuervo-Cazurra, 2008), since their economic behavior is very different, and usually has an unstable and chaotic environment, poor educational and political systems, and a low level industrialization, including development, among other things (Jarvenpaa & Leidner, 1998). Therefore, an additional contribution of this study, as well as its application in SMEs in a developing country, such as Mexico, is the application of a methodology that is different to previous studies and consists in testing the theoretical model by validation of constructs through Confirmatory Factor Analysis (CFA) and the verification of their hypotheses through linear regression analysis by Ordinary Least Squares (OLS), using size and age as control variables.

In this order of ideas, this empirical study aims to analyze the relationship between ICTs and the competitiveness of manufacturing SMEs in Aguascalientes, Mexico, using age and the size of the business as control

variables. In this sense, the research was conducted in the state of Aguascalientes with a sample of 200 manufacturing SMEs from a range of 11-250 employees, between the months of September to November 2014. Also, this study will provide empirical evidence of the Mexican industrial manufacturing context, since it shows the need for SMEs to establish technologies that activate their business, and thus improve their competitiveness in the market. In this sense, the present research is divided into five parts: the first part consists of the introduction; the second covers the literature review and the formulated hypothesis; The third part contains the methodological design and representation of the theoretical model; in the fourth part, the analysis and research results are described; and fifth, the conclusions and limitations of the study as well as future research are discussed.

Literature review

The development of the research model applied herein describes the relationship between ICTs and the competitiveness of SMEs.

The relationship between ICTs and competitiveness

According to Rao (2004, p.262) the term ICT is defined broadly as technologies dedicated to the storage, processing and communicating of information. For their part Martyn, Amanda & James (2003, p.307) argues that ICTs are a range of software technologies, hardware, telecommunications and information management, applications and devices that are used to create, produce, analyze, process, package, distribute, retrieve, store and transform information. That is why ICTs are organized communication networks and data resources that collect process and disseminate information within and between organizations (Seyal, Rahim & Rahim, 2000, p.8; Sharma & Bhagwat, 2006, p.204).

Likewise, business competitiveness has been defined as the ability of a company to perform well (Garengo, Biazzo & Bitici, 2005), or the ability of a company to be competing with each other, can achieve a favorable competitive position that allows the competitive upper hand on competing companies performance (Camison, 1997).

According to Bardhan, Whitaker & Mithas (2006), Diaz-Chao & Torrent-Sellens (2010), the use of information technology is a strategy that allows companies to improve competitiveness in their particular interest in improving their work systems. Some empirical research has shown that investments in information technologies and the capabilities through ICTs are associated with higher productivity, with customer satisfaction, with organizational capacity and the performance of companies (Bhatt & Grover, 2005; Mithas Ramasubbu, Krishnan & Sambamurthy, 2005).

There is theoretical evidence that the adoption and assimilation of ICTs by SMEs is critical in this era of globalization, since SMEs are the key drivers for economic growth in an economy; and the main determinant factors of the adoption of ICTs by SMEs are competition and access to international markets, by increasing the process productivity, the efficiency of internal business operations and easier connects and at lower cost with external contacts at local and global level (Ongori & Migiro, 2010). It has also been found that the adoption and use of ICTs represent the fundamentals of competitiveness and economic growth for companies and countries that are able to exploit them (Higon, 2011; Ollo-López & Aramendia-Muneta, 2012). Therefore, it is essential that SMEs have an adequate strategic plan defining the objective of ICTs, though the technology infrastructure is critical to the organization, by itself, it is not triggered into competitive advantage if it is not supported by a strategic plan defining the objective of ICTs (Bhatt & Grover, 2005).

In terms of empirical evidence, Peña-Vinces, Cepeda-Carrion & Chin (2006), in their empirical study of 100 SME exporters from Peru, whose objective was to evaluate the effect of using ICTs in the international competitiveness of these types of companies, found that SMEs in developing countries follow an isomorphic approach, because they tend to imitate or copy the best practices of developed countries, whose results show evidence that ICTs have a positive effect on the competitiveness of companies under study.

Meanwhile, Diaz-Chao & Torrent-Sellens (2010), in their research with 441 exporting companies in Catalonia, Spain and 771 companies for the case of the explanatory model of sales to the rest of Spain, in which the sources of international competitiveness were analyzed, starting from an export share, found that companies with use of advanced ICTs, both types of investments have positive effects on the export capacity of enterprises, however, companies that present usage of medium and low ICT behave differently, and that there is a high association between mainstreaming and depth of the usage of digital technologies and the ability of the company to gain market share, despite not having found causal relationships between these two components, investment in ICTs does not seem sufficient enough to improve the competitiveness of the company, if a broad and intensive use is not given by all the enterprise elements of value, it does not seem possible to achieve sustainable rates of penetration in international markets.

Similarly, Urquía, Perez & Muñoz (2011), in their research conducted with SMEs from Spain, taking into account the average return found that companies using accounting information systems for all of their management obtained a higher and positive figure in regards to those companies that show a negative average, which means that the

implementation effort made by SMEs in investing and improving their accounting information system, relates to their economic and financial results, as companies that do not or just use them on hand, had losses. However, Aragón & Rubio (2005), in their study on the factors associated with competitive success of SMEs, based on a sample of 1,201 industrial SMEs in Spain, found that ICTs do not show any influence on the outcome indicators used in their research (in internal processes, open system, rational system, human resources, and the overall performance).

On the other hand, Puksta & Nedelea (2012) in their research in which they identify and assess the key aspects of SME's competitiveness improvements and the benefits and drawbacks of the information technology solutions that may affect the competitiveness and development of the business in Latvia, found that the potential of SME in promoting competitiveness is knowledge, that is why it is important to educate and create a society possessing knowledge helping correctly use of ICTs and that with the business processes optimization based on ITCs solutions, the personnel, time and administrative costs resources will be reduced, and the amount of free funds which in accordance with the properly developed strategic plan can be targeted to increase the company's development potential.

In the case of Mexico, Aguilera, Colin & Hernández (2013), in their study of SMEs in Aguascalientes found that ICTs have a positive impact on the competitiveness of SMEs, since such companies give importance to the effectiveness of their administration and financial control, and therefore, the adoption of appropriate technological tools allows them to have systems to precisely control finances and any cost that is generated in operations. That is why, technological tools or software that is contracted by the company, should allow financial transactions or loans to be monitored and evaluated effectively in order for the company to be really competitive, and its growth not to be stopped by unmanageable resources that it has. On the other hand, Gálvez, Riascos & Contreras (2014) in their study using a sample of 1,201 MSMEs from Colombia found that it is still a very low degree of availability and use of ICT in web environment, however this low level, the ICTs in Web environment influence significantly the different factors of business performance and the overall performance of these kind of business. Thus, under these arguments, the following hypothesis is proposed:

H₁: The use of ICT has a positive and significant impact on the competitiveness of SMEs.

Method

Sampling and data collection

An empirical research was conducted with a quantitative explanatory cross section approach, through a CFA and Multiple Linear Regression by OLS. In this study the use of ICT and its relation with the competitiveness of Mexican SMEs was analyzed. The research instrument is composed of 32 items. For the development of this research the database provided by the Directory of the National Institute of Statistics on Economic Units, INEGI (2015) was taken as reference, in which a total of 4,996 manufacturing companies are registered in the state of Aguascalientes until February 5, 2015, of which 435 are SMEs with 11-250 workers, as shown in Table 1.

Table 1: Business units in the industrial manufacturing sector of Aguascalientes, Mexico

Company size	Number of Workers	Number of Economic Units	Percentage
Micro	0 to 10	4,493	89.93%
Small	11 to 50	343	6.86%
Medium	51 to 250	92	1.84%
Large	More than 250	68	1.37%
Total of Business Units		4,996	100%
Total of SMEs 11 to 250 workers*		435	8.7%

Source: National Statistics Directory of Economic Units INEGI, 2015

Therefore, the sample consisted of 205 SMEs in the manufacturing industrial sector in Aguascalientes, with a confidence level of 95% and a margin of error of 5%. That is why the survey was designed based on the theoretical model that was applied randomly, yielding a response rate of 97.5%, and counting at the end with a total of 200 valid questionnaires which were answered by the managers or owners of these kind of businesses in the state of Aguascalientes, Mexico.

Measurement of variables

For the preparation of the measuring instrument, two blocks were used, the use of ICTs block and the competitiveness block.

Use of ICTs variable

To measure the use of ICTs, an adapted measuring factor by González-Gallego *et al.* (2010) was considered, composed of 14 items, same that were measured with a Likert scale of a 1-5 point range, which refer from low importance to high importance, and has a reliability of .994 according to the coefficient Cronbach's Alpha, so it can be interpreted that there is internal consistency between the variables (Nunnally & Bernstein, 1994).

Thus, the ICTs variable was composed by the arithmetic mean of the 14 items which were used to measure the use of ICTs.

Competitiveness variable

With regard to the measurement of competitiveness, we took into account the three dimensions proposed by Buckley, Pass & Prescott (1988) and adapted by Maldonado, Sánchez, Gaytán & García (2012) and tested by Cuevas-Vargas, Aguilera & Hernandez (2014), being these: the financial performance measured on a scale of 6 items and has a .984 reliability according to Cronbach's Alpha coefficient; the reducing purchasing costs measured on a scale of 6 items and has a reliability of 0.967 according to Cronbach's Alpha coefficient; and the use of technology as measured with a scale of 6 items and has a .987 reliability according to Cronbach's Alpha Coefficient so it can be interpreted that there is internal consistency between the variables (Nunnally & Bernstein, 1994), measured with a Likert-type scale of 1 to 5 points, which refer from total disagreement to total agreement.

To create the competitiveness variable it was necessary to generate the financial performance variable, consisting of the arithmetic mean of the 6 items in which this dimension was measured; the cost reduction, composed of the arithmetic mean of the 6 items in which this dimension was measured; and the use of technology, composed of the average of the 6 items in which this dimension was measured; and once these variables were generated, the competitiveness variable was created which corresponds to the arithmetic mean of the 3 previously mentioned dimensions.

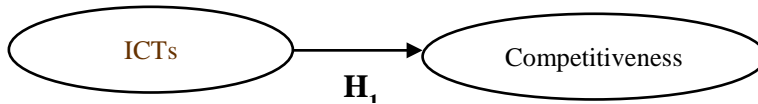
Control variables

To facilitate the control of information, plus the variable that allows assessment of competitiveness, the control variables were considered: Size and age. The size variable was logarithmically measured by the average number of employees of the companies under study. The number of employees has been used as a measure of size in this type of work by Gálvez *et al.* (2014) and Maldonado *et al.* (2010). Age has been measured by the number of years since the established constitution of the company until 2014, and has previously been used by Gálvez *et al.* (2014) and Yasuda (2005).

Theoretical model

In this regard, to test the hypothesis, the theoretical model shown in Figure 1 was considered.

Figure 1: Theoretical model of the construct research base



Source: Use of ICTs taken from González-Gallego *et al.* (2010), and competitiveness taken from Maldonado *et al.* (2012).

$$Y = \beta_0 + \beta_1 * TICS + \beta_2 * Size + \beta_3 * Age + e$$

Reliability and validity

To assess the reliability and validity of the measurement scales a Confirmatory Factor Analysis (CFA) was performed using the Maximum Likelihood Method through EQS 6.1 statistical software, working the four dimensions as first order factors (Bentler, 2005; Brown, 2006; Byrne, 2006). Also, the reliability of the four proposed measurement scales was assessed through Cronbach’s Alpha coefficients and Compound Reliability Index (CRI) (Bagozzi & Yi, 1988). From the results obtained, all scale values exceeded the recommended level of 0.7 for the Cronbach’s Alpha providing evidence of reliability and justifies the internal reliability of the scales (Hair, Anderson, Tatham & Black, 1998; Nunally & Bernstein, 1994). Similarly, we worked with robust statistical testing to provide better evidence of statistical adjustments (Satorra & Bentler, 1988).

Model settings

The settings that were used in the model under study were the Normed Fit Index (NFI), the Non-Normed Fit Index (NNFI), the Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) (Bentler & Bonnet, 1980; Hair *et al.*, 1998). It is noteworthy that values of NFI, NNFI and CFI between 0.80 and 0.89 represent a reasonable adjustment (Segars & Grover, 1993) and a value equal to or greater than 0.90 are good evidence of a good adjustment (Byrne, 1989; Jöreskog & Sörbom 1986; Papke-Shields *et al.*, 2002).. Likewise, RMSEA values below 0.080 are acceptable (Hair *et al.*, 1998; Jöreskog & Sörbom, 1986).

Therefore, in applying the CFA, it was found that the original model did not present adjustment problems, since the model has a good adjustment of the data taking into reference robust statistics (SB $X^2 = 805.7513$; $df = 458$; $p = 0.000$; $SB X^2 / df = 1.759$; $NFI = 0.906$; $NNFI = 0.953$, $CFI = 0.957$, and $RMSEA = 0.062$), since the values of NFI, NNFI and CFI are higher than 0.90, and RMSEA is less than 0.08, which are acceptable (Hair *et al.*, 1998; Jöreskog & Sörbom, 1986), same as in Table 2, for which the original model has high setting rates and therefore is valid in content; Likewise, not having eliminated any variable to the theoretical model because all have

factor loadings higher than 0.6 (Bagozzi & Yi, 1988), this indicates that theory and reality match, since the theoretical model reflects the reality of what is measured.

Table 2: Internal Consistence and convergent validity of the theoretical model

Variable	Indicator	Factor Loading	Robust t-value	Average Factor Loading	Cronbach's Alpha	CRI	AVE
Use of ICT	TIC1	0.935***	1.000 ^a	0.962	0.994	0.994	0.927
	TIC2	0.914***	52.919				
	TIC3	0.951***	53.972				
	TIC4	0.959***	42.472				
	TIC5	0.973***	60.796				
	TIC6	0.951***	45.098				
	TIC7	0.956***	40.602				
	TIC8	0.977***	47.440				
	TIC9	0.960***	37.967				
	TIC10	0.982***	46.772				
	TIC11	0.984***	47.451				
	TIC12	0.982***	45.277				
	TIC13	0.975***	42.489				
	TIC14	0.975***	49.599				
Financial Performance	DF1	0.932***	1.000 ^a	0.955	0.984	0.985	0.914
	DF2	0.957***	25.941				
	DF3	0.975***	22.065				
	DF4	0.975***	22.360				
	DF5	0.963***	18.506				
	DF6	0.933***	20.464				
Cost Reduction	RC1	0.785***	1.000 ^a	0.907	0.967	0.966	0.828
	RC2	0.883***	14.760				
	RC3	0.922***	14.025				
	RC4	0.953***	13.456				
	RC5	0.933***	15.187				
	RC6	0.971***	14.308				
Use of Technology	UT1	0.910***	1.000 ^a	0.962	0.987	0.987	0.926
	UT2	0.954***	40.315				
	UT3	0.985***	34.084				
	UT4	0.987***	33.024				
	UT5	0.974***	28.736				
	UT6	0.963***	29.859				
S-B $\chi^2= 805.7513$; $df= 458$; (S-B χ^2/df)= 1.759; $p= 0.000$; NFI= 0.906; NNFI= 0.953; CFI= 0.957; RMSEA= 0.062							

^a = Parameters constrained to this value in the identification process

*** = $p < 0.001$; ** = $p < 0.05$; * = $p < 0.1$

As evidence of convergent validity, the results of CFA indicate that all items of the related factors are significant ($p < 0.001$), the size of all the standardized factor loadings are greater than 0.60 (Bagozzi & Yi, 1988) and

the average standardized factor loadings of each factor are greater than the value of 0.70 (Hair *et al.*, 1998). As seen in Table 2, there is a high internal consistency of the constructs, in each case; the Cronbach’s Alpha exceeds the value of 0.70 recommended by Nunnally & Bernstein (1994). The composed reliability represents the extracted variance between the group of observed variables and the fundamental construct (Fornell & Larcker, 1981). Generally, a Composed Reliability Index (CRI) greater than 0.60 is considered desirable (Bagozzi & Yi, 1988), in our research, this value is largely amplified. The Average Variance Extracted (AVE) was similarly calculated for each of the constructs, resulting in an AVE higher than 0.50 (Fornell & Larcker, 1981) in each one of the factors.

With regard to the evidence of discriminant validity, the measurement is provided in two forms, the first with a 95% interval of reliability, none of the individual elements of the latent factors of the correlation matrix contain the value 1.0 (Anderson & Gerbing, 1988). Second, the extracted variance between the pair of constructs is greater than its corresponding AVE (Fornell & Larcker, 1981). Based on these criteria, it can be concluded that the different measurements in this study demonstrate sufficient evidence of reliability and convergent and discriminant validity of the adjusted theoretical model, as seen in Table 3.

Table 3: Discriminant validity of theoretical model measurement

Variables	Use of ICT		Financial Performance		Cost Reduction		Use of Technology
Use of ICT	0.927		0.023		0.035		0.081
Financial Performance	0.078	0.226	0.914		0.012		0.025
Cost Reduction	0.110	0.262	0.068	0.152	0.828		0.039
Use of Technology	0.174	0.394	0.097	0.217	0.136	0.260	0.926

NOTE: The diagonal numbers (in bold) represent the Average Variance Extracted (AVE), below the diagonal is part of the variance obtained in the Reliability Interval Test, and above the diagonal the results for the Extracted Variance Test are shown through the covariance square between each of the factors.

Source: Original production based on results of EQS V 6.1.

Results

To verify the applicability conditions of the Multiple Linear Regression Analysis applied to the research model to determine the relationship of ICT and the competitiveness of manufacturing SMEs in Aguascalientes, the normality tests were conducted, homoscedasticity and linearity, being that the variables under study had only problems of normality; However, since the linearity test was of greater importance for this statistical technique, and in virtue that the variables did not present problems of linearity nor homoscedasticity, we proceeded to the analysis of multiple linear regression through the IBM SPSS Statistical Software V21, in

Table 4 the model summary is presented, in which an R value of 0.572 was obtained, and R² of .328, indicating that the use of ICTs is correlated in 57.2% with competitiveness of Manufacturing SMEs in Aguascalientes, and that the competitiveness of these businesses is explained in 32.8% by the use of ICTs.

Table 4: Model summary^b

Model	R	R square	Adjusted R square	Standard Error	Durbin-Watson
1	.572 ^a	.328	.324	.42207	1.735

a. Predictor variables: (Constant), USE OF ICTs

b. Dependent variables: COMPETITIVENESS

Source: Original production based on Multiple Linear Regression results

Likewise, a Pearson correlation was applied finding three positive and significant correlations between the variables of the object of study : 1) the size variable is correlated with age by 38% and is significant (p <0.001), 2) size is correlated with the use of ICTs in 16.4% and is equally significant (p <0.001), and 3) the use of ICT is correlated with competitiveness in a 57.2% and is significant (p <0.001); not finding any correlation between competitiveness and the size and age of the company, or between the use of ICT with age, as presented in Table 5.

Table 5: Pearson Bivariate correlations

VARIABLE	Competitiveness	Size	Age	Use of ICTs
Competitiveness	1.000			
Size	.087	1.000		
Age	.011	.380***	1.000	
Use of ICTs	.572***	.164***	.084	1.000

***P < 0.001; **P < 0.05

Source: Original production based on Multiple Linear Regression results

However, based on the results of the Multiple Linear Regression OLS presented in Table 6, it is concluded that about 35.5% of the competitiveness of manufacturing SMEs in Aguascalientes is due to the use of ICTs, impacting significantly in competitiveness, with a t-value of 9.824. Because there were no significant betas for the examined controlled variables, it is not possible to demonstrate through this research that the size or age of these businesses influences the impact on the competitiveness of manufacturing SMEs from Aguascalientes in the use of ICTs. Emphasizing the finding that the model was positive and highly statistically significant (F = 96.520; p <0.001).

Regarding collinearity statistics, a Variance Inflation Factor (VIF) of 1.028 was obtained, indicating that the model did not present any multicollinearity problems for being near 1.0 (Hair *et al.*, 1998). In that

regard, the model is validated, since a high positive relationship between the use of ICT and competitiveness of SMEs was found though the Adjusted R-Squared value of 0.324, is above .160 marking by Cohen & Cohen (1983) for 5 independent variables and a sample size of 100 observations, and .070 for a sample of 250 surveys, at a 99% confidence level, therefore, it may explain the increased competitiveness of the SMEs, through the use of ICTs.

Table 6: Results of Linear Regression Analysis by OLS

Variables	Competitiveness
Use of ICTs	$\beta = 0.355^{***}$ $t = 9.824$
Size	$\beta = -0.007$ (N.S.) $t = -.126$
Age	$\beta = -0.038$ (N.S.) $t = -.646$
Adjusted R ²	0.324
F value	96.520***
Highest VIF	1.028

***P < 0.001; **P < 0.05

Source: Original production based on Multiple Linear Regression results

Therefore, in terms of this hypothesis, we proceed to checking, with respect to H₁, the results ($\beta = .355$, $p < 0.001$) indicate that the use of ICTs have significant positive effects on competitiveness, under which the use of ICTs positively impact 35.5% in the competitiveness of manufacturing SMEs in Aguascalientes, therefore, the H₁ is accepted, in this sense, the findings are consistent with the results of Aguilera *et al.* (2013), who found that ICTs have a positive impact on the competitiveness of the Mexican SME; also confirming the findings of Diaz-Chao & Torrent-Sellens (2010), as companies with advanced ICTs applications in both types of investments have positive effects on the export capacity of Spanish companies; further they are also consistent with the results of Gálvez, *et al.* (2014) who found that it is still a very low degree of availability and use of ICTs in web environment in MSMEs from Colombia, however this low level of ICTs in Web environment influence significantly the different factors of business performance and the overall performance of these kind of businesses; and finally support the findings of Peña-Vinces *et al.* (2006), whose results show empirical evidence that ICTs have a positive effect on the competitiveness of exporting SMEs in Peru; furthermore our results contrary to those found by Aragón & Rubio (2005) in their research with industrial SMEs in Spain, that ICTs do not show any influence on the outcome indicators used in their research (in internal processes, open system, rational system, human resources, and the overall performance).

Conclusion

According to the objective of this research, it is concluded that the use of ICTs has a positive and significant impact on the competitiveness of manufacturing SMEs in Aguascalientes, which allows us to infer that SMEs that are giving greater importance to the use of ICTs in their business strategy are obtaining a higher competitive level in comparison to those companies that have not given them a high importance. Whenever the use of ICTs is implemented, it represents the fundamentals of competitiveness and economic growth for companies and countries that are able to exploit them (Higon, 2011; Ollo-López & Aramendia-Muneta, 2012).

We have also found empirical evidence that the size and age control variables of the company do not influence the impact on the competitiveness of using ICTs, having no significant results, which means that the age or the size of the company did no matter in order to achieve competitive success, as long as the use of ICTs is accompanied by an appropriate implementation strategy that defines the objective of ICTs (Bhatt & Grover, 2005), as its proper use will allow companies to achieve a higher level of competitiveness and the satisfaction of their customers and suppliers.

On the other hand, SMEs should pay special attention to knowledge (Puksta & Nedelea, 2012), since it will allow these kind of businesses to improve their competitiveness by educating and creating a society possessing knowledge helping correctly the use of ICTs, which will be reflected in the reduction of time and administrative cost resources as well as increasing the company's development potential.

Finally, the ICTs variable that had the most competitive influence on was the use of ICTs for document exchange with suppliers, which means that these businesses have given more importance to this variable giving higher benefits that have enabled them to streamline their processes and have higher attentiveness and a better relationship with their customers, largely achieving satisfaction to these requirements, delivering higher quality products and / or services. Therefore, the results obtained in this study are of great value to managers and decision makers of Mexican SMEs as well as for policy makers, as managers or owners may find out the relationship that the appropriate use of ICTs with the competitiveness of SMEs, to thereby be more efficient when investing.

Within the limitations, it can be noted that the study only includes small and medium enterprises in the industrial sector, which using this model is suggested in further research with other kind of companies, as well as utilizing a comparative analysis of the industry with other geographic areas and / or productive sectors in order to increase the validity of the theoretical model used. It is also suggested to analyze the impact of the use of ICTs on every single dimension used to measure the competitiveness by applying

other statistical technique with this theoretical model. Finally establishing new constructs are suggested with the ICTs variable to extend the results and compare them with the conclusions set out in this article.

References:

- Aguilera, E.L., Colín, S.M., & Hernández, C.O. (2013). La influencia de las Tecnologías de la Información en los procesos productivos para una mayor competitividad de la Pyme de Aguascalientes: Un estudio empírico. *Desarrollo Gerencial*, 5(1), 40-68.
- Anderson, J., & Gerbing, D. (1988). Structural equation modeling in practice: a review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411-423.
- Aragón, S.A., & Rubio, B.A. (2005). Factores asociados con el éxito competitivo de las pyme industriales en España. *Universia Business Review*, Cuarto Trimestre, 38-51.
- Bagozzi, R.P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16(1), 74-94.
- Bardhan, I., Whitaker, J., & Mithas, S. (2006). Information Technology, Production Outsourcing, and manufacturing plant performance. *Journal of Management Information Systems*, 23(2), 13-40.
- Bentler, P.M., (2005). *EQS 6 Structural Equations Program Manual*. Encino, CA: Multivariate Software.
- Bentler, P.M., & Bonnet, D. (1980). Significance tests and goodness of fit in analysis of covariance structures. *Psychological Bulletin*, 88(3), 588-606.
- Bhatt, G.D., & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: An empirical study. *Journal of Management Information Systems*, 22(2), 253-277.
- Brown, T. (2006). *Confirmatory Factor Analysis for Applied Research*, New York, NY: The Guilford Press.
- Buckley, J.P., Pass, L.C., & Prescott, K. (1988). Measures of international competitiveness: A critical survey. *Journal of Marketing Management*, 4(2), 175-200.
- Byrne, B.M. (1989). *A primer of LISREL: Basic applications and Programming for Confirmatory Factor Analysis Analytic Models*. New York, NY: Springer.
- Byrne, B.M. (2006). *Structural Equation Modeling with EQS, basic concepts, applications, and programming*, 2nd edition, London: LEA Publishers.
- Camisón, Z.C. (1997). *La competitividad de la PYME industrial Española: estrategia y competencias distintivas*. Madrid: Civitas.

- Casanova, L. (2004). East Asian, European and North American multinational firm strategies in Latin America. *Business and Politics*, 6(1), DOI: [10.2202/1469-3569.1074](https://doi.org/10.2202/1469-3569.1074)
- Cohen, J., & Cohen, P. (1983). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. 2nd Edition. Hillsdale, NJ: Lawrence Erlbaum.
- Cuervo-Cazurra, A. (2008). The multinationalization of developing country MNEs: the case of multilatinas. *Journal of International Management*, 14(2), 138-154.
- Cuevas-Vargas, H., Aguilera, E.L., & Hernández, C.O. (2014). The influence of innovation activities and knowledge management on the production processes for a higher level of competitiveness of Mexican SMEs. *International Journal of Business and Social Science*, 5(13), 53-63.
- Díaz-Chao, A., & Torrent-Sellens, J. (2010). ¿Pueden el uso de las TIC y los activos intangibles mejorar la competitividad? *Estudios de Economía Aplicada*, 28(2), 1-24.
- Donrosoro, I., García, C., González, M., Lezámiz, M., Matey, J., Moso, M., & Unzueta, M. (2001). *El modelo de gestión de las PYMEs vascas de éxito*. Edita Cluster del Conocimiento (Portal de Gestión) y ediciones PMP, Bilbao.
- Fornell, C., & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Gálvez, A.E.J., Riascos, E.S.C., & Contreras, P.F. (2014). Influencia de las tecnologías de la información y comunicación en el rendimiento de las micro, pequeñas y medianas empresas colombianas. *Estudios Gerenciales*, 30(133), 355-364.
- Garengo, P., Biazzo, S., & Bitici, U.S. (2005). Performance measurement systems in SMEs: a review for a research agenda. *International Journal of Management Review*, 7(1), 25-47.
- González-Gallego, N., Soto-Acosta, P., Trigo, A., Molina-Castillo, F.J., & Varajao, J. (2010). El papel de las TICs en el rendimiento de las cadenas de suministro: el caso de las grandes empresas de España y Portugal. *Universia Business Review*, Cuarto Trimestre, 28, 102-115.
- Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W.C. (1998). *Multivariate Data Analysis* (5th Edition). New Jersey: Prentice Hall.
- Higon, D.A. (2011). The impact of ICT on innovation activities: evidence for UK SMEs. *International Small Business Journal*, 30(6), 684-699.
- Huerta, E., Bayo, J.A., García-Olaverri, C., & Merino, J. (2002). *Los desafíos de la competitividad. La innovación organizativa y tecnológica en la empresa española*. Fundación BBVA, Bilbao.
- INEGI, Instituto Nacional de Estadística, Geografía e Informática (2015). *Directorio Estadístico Nacional de Unidades Económicas*. [On Line].

Available at:
<http://www3.inegi.org.mx/sistemas/mapa/denue/Cuantificar.aspx> Consulted on February 8th, 2015.

Jarvenpaa, S.L., & Leidner, D.E. (1998). An information company in Mexico: extending the resource-based view of the firm to a developing country context. *Information Systems Research*, 9(4), 342-361.

Jöreskog, K.G., & Sörbom, D. (1986). *LISREL VI: Analysis of Linear Structural Relationships by Maximum Likelihood, Instrumental Variables and Square Methods*, Moorsville, IN: Scientific Software.

Llopis, J. (2000). *Dirigiendo: 11 factores clave del éxito empresarial*. Barcelona: Ediciones Gestión 2000.

Maldonado, G.G., Martínez, S.M.D.C., García, P.D.L.D., Aguilera, E.L., & González, A.M. (2010). La influencia de las TICs en el rendimiento de la PyME de Agascalientes. *Investigación y Ciencia, Abril*, 47, 57-65.

Maldonado, G.G., Sánchez, G.J., Gaytán, C.J., & García, R.R. (2012). Measuring the competitiveness level in furniture SMEs of Spain. *International Journal of Economics and Management Sciences*, 1(11), 9-19.

Martyn, R., Amanda, N., & James, S. (2003). Barriers to start up and their effect on aspirant entrepreneurs. *Education & Training*, 45(6), 308-316.

Mithas, S., Ramasubbu, N., Krishnan, M.S., & Sambamurthy, V. (2005). Information technology infrastructure capability and firm performance: An empirical analysis. Working paper. Ross School of Business, university of Michigan, Ann Arbor.

Mosleh, F., & Shannak, R.O. (2009). The effective utilization of information and communication technology and its impact on competitive advantage. *European Journal of Scientific Research*, 29(3), 302-314.

Nunnally, J.C., & Bernstein, I.H. (1994). *Psychometric Theory*. 3^a Ed. New York: McGraw-Hill.

Okoli, C.H., Mbarika, V.W.A., & McCoy, S. (2010). The effects of infrastructure and policy on e-business in Latin America and Sub-Saharan Africa. *European Journal of Information Systems*, 19(1), 5-20.

Olló-López, A., & Aramendia-Muneta, M.E. (2012). ICT impact on competitiveness, innovation and environment. *Telematics and Informatics*, 29(2), 204-210.

Ongori, H., & Migiro, S.O. (2010). Information and communication technologies adoption in SMEs: Literature review. *Journal of Chinese Entrepreneurship*, 2(1), 93-104.

Papke-Shields, K.E., Malhotra, M.J., & Grover, V. (2002). Strategic manufacturing planning systems and their linkage to planning system success. *Decision Science*, 13(1), 1-30.

- Peña-Vinces, J.C., Cepeda-Carrión, G., & Chin, W.W. (2006). Effect of ITC on the international competitiveness of firms. *Management Decision*, 5(6), 1045-1061.
- Puksta, K., & Nedelea, A. (2012). Using Information Technologies to raise the competitiveness of SMEs. *The USV Annals of Economics and Public Administration*, 12(15), 74-83.
- Rao, S.S. (2004). Role of ICTs in India rural community information systems. *Journal of Information Systems*, 6(4), 261-279.
- Satorra, A., & Bentler, P.M. (1988). Scaling corrections for chi square statistics in covariance structure analysis. *American Statistics Association 1988 Proceedings of the Business and Economic Sections*, 208313.
- Segars, A.H., & Grover, V. (1993). Re-examining perceived ease of use and usefulness: a confirmatory factor analysis. *MIS Quarterly*, 17(4), 517-525.
- Seyal, A., Rahim, M., & Rahim, N. (2000). An empirical investigation of the use of information technology among small and medium business organizations. A Bruneian scenario. *The Electronic Journal of Information Systems in Developing Countries*, 2(7), 1-17.
- Sharma, M.K., & Bhagwat, R. (2006). Practice of information systems, an evidence from select Indian SMEs. *Journal of Manufacturing Technology*, 17(2), 199-223.
- Singh, R.K., Garg, S.K., & Deshmukh, S.G. (2006). Competitiveness analysis of a médium scale organization in India: a case. *International Journal of Global Business and Competitiveness*, 2(1), 27-40.
- Urquía, G.E., Pérez, E.R., & Muñoz, C.C. (2011). The impact of Accounting Information Systems (AIS) on performance measures: empirical evidence in Spanish SMEs. *The International Journal of Digital Accounting Research*, 11, 25-43.
- Yasuda, T. (2005). Firm growth, size, age and behavior in Japanese manufacturing. *Small Business Economics*, 24(1), 1-15.