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Information Technology and Collaboration in Mexican Small Business

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Abstract **– The rapid change in business environment, the economy globalization and the high competition markets, are three important reasons why Small and Medium Enterprises (SMEs) are keen to keep adopting and using Information Technologies. At the same time, during the last decades, the application of Information Technologies have been considered in several investigations because these facilitate a more efficient and effective collaboration among companies, both public and private. Therefore, the aim of this empirical research is to analyse the relationship between Information Technologies and enterprise collaboration. For that, a random sample of 346 companies, operating in Aguascalientes, México, was established. The results indicated that Information Technologies have positive and significant effects on collaboration activities in Small and Medium Enterprises.**

Keywords **– Collaboration, Information Technology, SMEs.**

I. Introduction

From the literature on management and computing, analysis and discussion in regards to the use of information technology (IT), in a collaborative environment and assisting Small and Medium Enterprises (SMEs), have not been fully supported [1]. Even though various researchers and academics have recognized that developments on collaboration activities generate multiple benefits for businesses [2-10].

At the same time, two basic approaches can be found in the literature in relation to the use and application of IT at various activities in businesses. One of them is the named "instrumental value perspective" [11-16] and other is the called "ontological status of the computerized organizational representation" [17]. The instrumental value perspective was used in this empirical research because it adapts better for a SMEs research.

Moreover, few theoretical and empirical researches related to collaboration and the IT uses have concluded that all businesses participating on collaboration activities have gained higher benefits [1]. For instance, costs reduction and skills improvements on decision-making and problems solving [7 - 18].

Also, IT adoption and collaboration have demonstrated feasibility characteristics on incrementing teamwork´s flow among involved enterprises [19] production engineering [13] and producing goods and services [20]. However, the current empirical evidence appears yet not sufficient and it is required to increase empirical studies on IT and collaboration to reinforce existing empirical evidence that is focused on its positive relationship [1, 21, 22].

Following suggestions from [1, 21, 22] about carrying out research on these constructs, IT and collaboration the main contribution of this empirical research is the relationship between IT and collaboration levels among Mexican SMEs.

This research is presented as follows; in the second section the theoretical framework is explained along with the previous empirical studies and the hypothesis formulation; in the third section the research methodology is described, likewise the sample and used variables; in the fourth section, the results obtained are analysed and in the fifth section a discussion and conclusions are presented.

II. Literature Review

From the literature it is possible to identify various organizations, specifically Small and Medium Enterprises (SMEs) that commonly use inter-organizational alliances with other enterprises, or institutions and public and private research centres, in order to perform collaboration activities that allow them to significantly improve, in both its organizational structure, its demand of products and services, and to adapt themselves in meeting the needs of its business environment [9 - 10]). Consequently, there are many companies that require multiple strategies for high-level competitiveness in a more globalized market. Among the strategies is the adoption and use of IT for more flexible and versatile infrastructure to perform collaboration activities as described in [10]

In particular, SMEs that have increased their use of IT have obtained great benefits like costs reduction and skills improvements in both decision-making and problem solving [7 - 18]. Thus, various empirical studies, which have analysed the use of IT as an essential variable in companies, and considered them as key tools in both organizational design and physical layout, have significantly improved their geographic coordination, by integrating their remote suppliers and clients in collaboration activities [23].

In this sense, organizations that have adopted IT as part of their typical operations, have linked thousands of people from different businesses through a number of collaboration performance, which at the same time have improved not only the level of the company performance, but also made more efficient functions and use of resources at preference costs, assuring external and internal customers satisfaction, along with higher level

competitiveness [24]. Hence, in future investigations it will be important that researchers, academics and professionals, in the business sciences field and computing, expand the use of IT in virtual environments for collaboration activities in SMEs [8].

Additionally, there are empirical studies in the literature establishing that the use and adoption of IT must be developed in electronic, virtual, and face-to-face modes [25]. Therefore, it is defined, from such investigations, that the IT applications using both audio and video can substantially improve communication among organizations and institutions working in collaboration [26]. Besides, IT functions have shown articulated collaboration activities among participating businesses [19].

Similarly, a great deal of researchers, academics and professionals, from the fields of management and computing, have concluded that organizations, mainly SMEs, have achieved multiple benefits using and adopting IT, working with suppliers and customers operating in various cities and countries, as an effect of markets globalization. One of the most important benefits is the communication and coordination improvement in collaboration activities, granting achievement of their established goals and objectives [27 - 28]. In this sense, Davis [29] defines that the use of computers along with telecommunications create a new infrastructure that increase transformation of economy and the organization of a number of important businesses.

Additionally, in the actual market, current industrial practices suggest that frequently organizations, including SMEs, have adopted and use IT like a support in collaboration work within virtual environments [30]. For that reason, a great number of researchers and academics have carried out empirical studies, where various scales to measure and to analyse the adoption and use of IT in the organization in a collaboration environment are proposed. However, several of these research analyses have been orientated to solutions in specific IT case of use, letting aside the analysis of diverse IT tools that are used to carry out business collaboration [31].

Thus, in most recent literature, specially in case studies, the use of various tools that integrate IT has been considered because of its relevance to improve collaborative activities [32] since a collaborative adoption and use of multiple efficient and effective IT engines enable macro level results in companies participating in such collaborative work; engines like e-mail systems, teleconferences, videoconferences, data conferences, webpages and electronic data systems, among others [22]. This way, some IT engines have been considered essential, and recently developed in various theoretical and empirical studies; others have been consistently used in investigations by some academics and researchers, for example: the email [33] the web [34], data conferences [35] and electronic data systems [36 - 37]. In the literature, it has been demonstrated that alternatives in communication channels, such as IT, improve collaboration activities and are important for businesses growing and development [38].

On the other hand, from more detailed revision of the literature in the field of management and computing, different IT tools have been analysed in several studies [22], from all of them seven IT tools have gained more attention from researchers, academics and practitioners, including the e-mail for communication from company to company or as an electronic way to communicate with company collaborators [39, 40, 33, 41] teleconferences with two ways audio [42, 43] videoconferences with two ways audio and video [44 - 46].

Similarly, data conferences have been used through graphs, presentations and applications sharing [47,48], collaboration tools on the web like internet, chats, messages and marketing [48,49] company web or in group interfaces [5,45,51,35] and the electronic systems over electronic nets from business to business or various organizations [36,52,53].

Besides, some management and computing researchers, academics and field professionals have found, from their empirical studies, that the use and adoption of IT by big companies generate better results than those obtained in SMEs [54]. Yet, Raymond [55] did not find any substantiation of a positive and significant relationship between the organization size and use and adoption of IT. The possible reason is that big companies custom IT more efficiently and effectively than SMEs, which geographically are more spread, and usually these are more complex in taxes payment and require an excellent coordination on collaborative work with other companies [22].

Moreover, few researchers and academics have found in diverse empirical studies a positive and significant relationship between the firm size and use and adoption of IT [56, 36, 57] but they have not found positive and significant relationship between organization size and an innovative behaviour of IT [57,59,60]. Nonetheless, in recent investigations it has been established empirical evidence that suggest that presumably the firm size is not a significant variable in the use and adoption of some IT tools, such as, email, teleconferences and web pages [61] whereby it is necessary to increment investigations that analyse alternative variables.

Further, numerous empirical studies have shown that not only an excellent infrastructure is required for IT use and adoption in order to obtain a major performance level in organizations [62] if not that it is absolutely necessary to eliminate barriers that block an efficient communication, which generally result among certain areas and departments integrated in organizations. These barriers slow not only an eloquent collaboration with other companies and institutions, but also a proper knowledge management process among participating companies in collaboration activities [63]

In this sense, if SMEs do not have a correct infrastructure for using and adopting IT, the collaboration efforts among the firm and its partners will be biased because of inefficient results obtained from mistaken

information and experience sharing [22]. Thus, it is important that SMEs ensure the necessary infrastructure for IT use and adoption, because it is precisely what facilitates communication, and can substantially increment collaboration processes [64]. In this manner, considering the aspects previously presented it is feasible to establish the following hypothesis:

H1: The greater use of IT, the higher level of collaboration

III. METHODOLOGY

An empirical study has been established in order to confirm the presented hypothesis. It was carried out in SMEs operating in Aguascalientes, México and the Business Information System (SIEM from its acronym in Spanish) was used as a reference framework, which registered 1,342 businesses, from 5 to 250 workers, on June 30th in 2011. Alike, the sample was selected with a randomly with a maximum error of ± 4.5% and a confidence level of 95%, resulting a total of 400 surveys. Data was collected by personal interviews to managers or SMEs owners and these were applied from January and June in 2011. It was a total of 350 surveys, from which 4 were eliminated because did not meet the previously defined requirements, such as, lack of information, and unfilled, leaving a total of 346 valid surveys, obtaining a response rate of 86.5%.

Dependent Variable

To measure IT, 4 questions were used with a 5 points Likert scale, where 1 = total disagreement to 5 = total agreement, which were adopted from Table 1 shows the used questions to measure IT.

Table 1: Questions used to measure IT

Indicate if in the business…	**Total Disagreement**			**Total Agreement**	
IT is similar to that used in industry	1	2	3	4	5
IT is better than competence	1	2	3	4	5
IT is better than that used by customers	1	2	3	4	5
Information is used to negotiate with suppliers	1	2	3	4	5
Software is commonly used in its departments	1	2	3	4	5
There is trained personnel to use IT	1	2	3	4	5
IT is commonly used for decision making	1	2	3	4	5

Independent variable

In order to measure collaboration, 14 questions were used and measured with a 5 Likert scale, where limits 1 as in total disagreement and 5 as total agreement; this was adapted from [65, 66, 67]. Table 2 presents the survey questions used to measure collaboration.

Table 2: Questions used to measure collaboration

Indicate if in the business there is a joint work with suppliers in:	**Total Disagreement**			**Total Agreement**	
Technology development	1	2	3	4	5
Development of production and services production processes	1	2	3	4	5
Reduction of market costs	1	2	3	4	5
Projects planning	1	2	3	4	5
Creating of new ideas to develop new products and services	1	2	3	4	5
Developing of management processes	1	2	3	4	5
Establishing of strategy goals and objectives	1	2	3	4	5
Developing of other strategic activities	1	2	3	4	5
Developing of projects	1	2	3	4	5
Sharing information about the business goals and objectives	1	2	3	4	5
Comparing commercial plans in order to align them	1	2	3	4	5
Discussing plans, goals and objectives for specific products	1	2	3	4	5
Defining the most appropriate cost of products	1	2	3	4	5
Developing specific plans based on previously shared information	1	2	3	4	5
Technology development	1	2	3	4	5

The sizevariable was measured through an average number of employees working in the company in 2011.

The age variable was measured by the number of the operating years, since construction of the company or beginning of the activity until date of survey application.

IV. Results

To verify the relationship between IT and collaboration in SMEs in Mexico and in this way to corroborate the established research hypothesis, a regression analysis was carried out using the minimum ordinary squares (MCO from its acronym in Spanish) over this model:

$$Collaboration_i = b_0 + b_1 \cdot Information\ Technology_i + b_2 Size + b_3 Age + \varepsilon_i$$

Where, *Collaboration*indicates the level of agreement from the average responses in surveys from the used 14 questions. *Information technology* correlates its IT level of usage in organizations and represent the average level from the 7 variables employed in survey. *Size*, represents the average number of employees in 2011 in the company, and *Age*, the company´s life.

Table 3: Relationship between IT and collaboration (n = 346)

Variables	Collaboration
Information Technologies	0.556*** (12.496)
Size of the firm	0.034 (0.754)
Age of the firm	0.154*** (3.445)
Higher VIF	1.017
F value	54.720***
Adjusted R^2	0.318
Below every standardized coefficient, in parenthesis, value of the t-student statistical *= p ≤ 0.1; **= p ≤ 0.05; ***= p ≤ 0.01	

In relation to the existing relationship between IT and collaboration, table 4 shows greater use of IT, which influence, in a positive and significant way, collaboration in Mexican SMEs ($\beta = 0.556$ y $p < 0.01$). This confirms what established in the hypothesis. On the other hand, firm size does not have any significant positive effect on SMEs collaboration ($\beta = 0.034$). However, age has a positive and significant effect on collaboration ($\beta = 0.154$ and $p < 0.01$), but at a lower level compared with IT. At the same time, the validity of the model is contrasted with the adjusted $R^2 = 0.318$ and F value=54.720 ($p < 0.01$). As the independent variables have a variance inflation factor (VIF) near 1 (1.017), it can be defined an absence of multi-colinearity in this regression model.

V. Conclusions and Discussion

From the results obtained it is possible to provide conclusions in two ways about the existing relationship between information technologies and collaboration. Firstly, the collaboration activities carried out by SMEs with other firms, research centres and public and private higher educations institutes, is highly benefited from the use of IT, because these are precisely which improve more efficiently and effectively collaboration activities in a compelling way. As a result, managers must incorporate IT in there organizational strategies, both short time and long time, because these will improve their collaboration practices.

Secondly, it is possible to conclude that the firm size has no positive and significant effect on Mexican SMEs collaboration. Thus, apart from the company size the use and adoption of IT will have a strong impact on collaboration. Consequently, both micro, small and medium enterprises will have great benefits integrating different tools of IT along with their information in collaboration operations with other companies.

Then, SMEs managers not only have to increase their use of IT but also to implement a continuous training program for personnel manipulating this type of tools, because it will facilitate organizations to make an efficient use of technology. Meanwhile, SMEs managers have to look for the necessary economical resources or government programs that directly support them in the acquisition and renewal of IT, in this way they can seriously improve collaboration activities developed among other organizations and private and public institutions.

In this sense, it is not enough that SMEs managers and owners acquire and renew IT in their businesses, though it is necessary to construct an adequate infrastructure for their appropriate use and performance of IT. Otherwise all management efforts will be unfavourable for the aimed success not only in collaboration activities but also on efficiency and effectiveness using and adopting IT. Therefore, it is necessary that executives look for some guidance to generate the fundamental infrastructure, before implementing any of these types of tools.

Additionally, this research has some limitations important to consider. The first limitation is the scale used to measure innovation and collaboration technologies as it only considers one dimension, by which it will be necessary to integrate different scales in future research in order to test these results. The second one is the type of information gathered, because only a small part of information related to IT and collaboration was considered through qualitative variables, by which it will be relevant to include qualitative variables in future research as to prove results. The third limitation is the measurement of IT and collaboration, considering seven items to measure IT and 14 to measure collaboration, so in future research will be useful to add alternative items to measure these two constructs.

The fourth limitation is related to the applied surveys, because these were focused on SMEs managers and therefore the results could vary if another population were used, for example, on suppliers or customers. Hence, in future research these should be integrated to confirm the presented results. The last limitation is that only SMEs from 5 to 250 workers were considered, in particular those operating in Aguascalientes state, México. Thus in future research it will be necessary to consider companies with less than 5 workers, which represent more than 60% of the population, in order to confirm obtained results. Also, it would be valuable in future research to analyse and discuss in more detail the presented results, for example,

what would be the effect on SMEs collaboration if a quantitative scale is used to measure IT? among other research questions that can be answered in future research.

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