

Knowledge Management in Mexican Manufacturing Small Business

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Abstract

In an unpredictable business environment, such as the one that characterized the economy at the beginning of the 21st century, knowledge management has become one of the most valued intangible assets by organizations that have recognized the importance of knowledge in the creation and development of competitive advantages and performance. However, most investigations have been focused on big enterprises, only a few have been paid attention to small and medium-sized enterprises (SMEs). For this reason, the present research analyzes the importance of knowledge management in SMEs through a sample of 125 manufacturing SMEs from Aguascalientes State (Mexico). The results obtained show that manufacturing SMEs have good knowledge management which can be regarded as a competitive advantage.

Keywords: knowledge, knowledge management, SMEs

1. Introduction

In a highly competitive environment, like the one experienced in the early days of the new century, knowledge management (KM) plays an essential role in the success of organizations (Owila, 2010). Such achievement, especially in small and medium-sized enterprises (SMEs), is characterized by the ability they have to create new knowledge in a consistent way, its fast dissemination into the organization and its transformation in new products and services (Tiwana, 2002), since the most valued intangible asset by enterprises in this century is precisely the knowledge of workers and employees (Drucker, 1999) especially in enterprises and sector that use intensive knowledge in their activities which demands from organizations to use the available resources to the fullest (Paulzen & Perc, 2002). Similarly, KM has also been recognized widely as an essential aspect for the survival and competitiveness of enterprises (Chan & Chao, 2008), since an important number of firms have adapted and capitalized on the knowledge and experience of their worker both in the success and business performance (Griffith *et al.*, 2003). Moreover, and despite the good results obtained by several enterprises which have been published in different journals, SMEs usually have problem of uncertainty and face serious threats of possible failures both in the adoption and implementation of KM (Wong & Aspinwall, 2005).

When compared with big enterprises, SMEs have a higher capacity of flexibility to adapt both its production system and the infrastructure for the purposes of a good KM (Wong & Aspinwall, 2005), since this type of enterprises have relatively few communication problems with their workers as well as low cost of product replacement. Similarly, according to Gold *et al.* (2001), an effective KM needs an infrastructure and some adequate production processes which in turn can be developed and used to create a higher level of competitiveness (Chan & Chao, 2008). Regardless of the rise in the level of competition needed to participate in a globalized market and the constant changes produced by the business environment, a higher number of SMEs are adopting the KM since they have realized it has a significant and positive impact in both productivity and economic benefits (Wong & Aspinwall, 2005). Similarly, the research made by Wong and Aspinwall (2005) found out that 49.2% of SMEs interviewed considered that KM allowed them to administrate their resources adequately, 44.4% of SMEs increased the level of economic benefits, 44.4% decreased the duplication of working activities, and 41.3% of SMEs obtained more competitive advantages.

Considering the importance and multiple benefits given to business, KM has had a higher level of acceptance in

firms from different sectors and sizes (Eldridge *et al.*, 2006) because, according to Alavi (2000), there are three forces: *business volatility and competitive environment; globalization, the production of extensive products and services in knowledge* that make necessary the change of strategies to adapt them to the SMEs KM. Therefore, the level of interest of KM from enterprises, especially SMEs, is based on the development of computing, networks and data management services by which knowledge can be shared and transferred among different people (Bose, 2004). Within this set of ideas, the literature presents different empirical researches about KM that were implemented in SMEs (Beijerse, 2000; Lim & Klobas, 2000; Frey, 2001; Sparrow, 2001; Heng, 2001; Kautz & Thaysen, 2001; Wickert & Herschel, 2001; Salojärvi *et al.*, 2005; Grey, 2006; Moffett & McAdam, 2006; Chan & Chao, 2008; Kruger & Johnson, 2009), but none was found in journals regarding the implementation of KM in Mexican or Iberoamerican SMEs. Therefore, Beijerse (2000), Claycom *et al.* (2001), Salojärvi *et al.* (2005) as well as Kruger and Johnson (2009) recommend intensifying the research of KM in SMEs, especially in developing countries with an emerging economy, as it is the case of Mexico.

Within this context, the main contribution of this research is precisely to present the results of adopting the KM in SMEs of a developing country (i.e. Mexico) by using a sample of 125 enterprises. The rest of the research paper is organized in the following parts: the second section examines the theoretical framework and the previously published empirical investigations; the third section shows the methodology, the sample and the variables used; the fourth section analyzes the results obtained and, finally, the fifth section shows the main conclusions and the research discussion.

2. Method

Besides been widely analyzed and discussed in the literature, knowledge is recognized as one of the most important intangible resources of enterprises in the 21st century (Senaji & Nyaboga, 2011), and it has gained more attention in the business management literature (Ondari-Okemwa, 2006), because, according to Szulanski (2003), knowledge allows firms to achieve more competitive advantages and good results. Likewise, Davenport and Prusak (1997) define knowledge as a mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experience and information in enterprises. In a similar trend, Nonaka and Takeuchi (1995) considered that knowledge is the implementation of information and its results. In other words, knowledge encompasses both the hardware and software. The hardware is considered as an articulated form of knowledge that is represented explicitly in physical materials such as patents and it is the know-how of information (Kogut & Zander, 1992). The software is the tacit knowledge which is intuitive, non-verbalized and non-articulated (Polanyi, 1969), and it is the know-how of practical skills or experiences that allow workers to carry out their activities efficiently (Kogut & Zander, 1992).

On the other hand, KM can be defined as the systematic processes of the enterprise for the acquisition, organization and communication of knowledge from workers and employees to other workers and employees so it can be used to make work more productive (Alavi & Leidner, 2001). According to Alavi and Leidner (2001), KM can also be defined as the process of creation, retention, transfer and implementation of existing knowledge in the enterprise. This includes the internal creation of knowledge, the external acquisition of knowledge, the retention of knowledge through documents as well as the internal and exchange of knowledge in the organization. A more recent definition of KM is provided by Jennex (2005), who considers that KM is the implementation of a selective knowledge through previous experiences of decision making that will allow workers to make present and future decisions in different activities, that they carry out to provide a higher level of effectiveness in the organization. Finally, Wong and Aspinwall (2006) provide a definition which is entirely different from the previous ones. They define KM as the formalization of intangible assets to manage and optimize the knowledge resources in an organization.

According to Davenport and Prusak (1997) as well as Davenport and Klahr (1998), KM is precisely an essential element that provides better results in enterprises. That is why the acquisition, organization, exchange, and use of are essential activities of KM in every organization (Lui & Tsai, 2007). Therefore, KM must be oriented towards the integration and coordination of the individual knowledge of workers and employees in such a way that allows creating more knowledge inside the organization (Diakoulakis *et al.*, 2004). In this regard, the main premise of KM in firms is that all factors (organizational creativity, operational effectiveness and quality of products and services), must provide a higher business performance and they will be able to improve depending on the creation of knowledge which turn into a better level of competitiveness for the enterprise (Wiig, 1994). Similarly, Davenport and Volpel (2001) careful that the infrastructure of KM is considered in the literature as fundamental to carry out an optimal KM in firms; that is why the efficiency of the implementation of KM depends on an adequate and robust infrastructure (Tiwana, 2000) which will have to be integrated by four basic components: technology, organizational

culture, organizational structure and intellectual capital (Gold *et al.*, 2001).

Thus, KM will need to have at least one of the following objectives: 1) to make knowledge visible and show its importance in the enterprise; 2) to develop an intensive culture in knowledge and; 3) to build an infrastructure of knowledge (Davenport & Prusak, 1997). Therefore, the KM programs will aim to develop knowledge and put it into practice in the business community (Bose, 2004). Consequently, in order to create an adequate transfer of knowledge, Nonaka (1994) suggested four basic models 1) Socialization (from tacit to tacit); 2) Internationalization (from explicit to tacit); 3) Externalization (from tacit to explicit) and; 4) Combination (from explicit to explicit). On the other hand, KM usually does not have an essential role in SMEs since most of them have a local market. Nonetheless, they are also entrepreneurial so they need to keep a basis of knowledge that allows them to maintain or develop competitive advantages (Gray, 2006). Similarly, SMEs commonly have fewer resources than big enterprises and they have more barriers that stop or limit their participation in the local market which forces them to improve substantially the KM as well as their capabilities and skills to intensify their market participation (Hughes *et al.*, 2002).

Regarding the limitation of resources in SMEs, Sparrow (1999) considered that the specific situation of SMEs is actually the most relevant opportunity so this type of enterprises adopts or implement KM activities. Likewise, Braganza *et al.* (1999) concluded that in the first-place SMEs have to classify and manage adequately their KM projects, based on their contribution to innovation produced by the enterprises so they accomplish their objectives. Thus, these authors distinguish clearly between the different KM projects that can create benefits, and improve enterprises efficiently from those projects that can increase the business performance in their sector, explore new opportunities to obtain new competitive advantages in the industry or explore possible innovations of SMEs (Sparrow, 2001). In this regard, the few researches published in the literature about KM in SMEs confirm that the transfer of knowledge is not simply a case of linear transfer of information but a process of decision making (Weick, 1990), with a considerable effort to develop an amount of self-knowledge (Kogut & Zander, 1992), that improves significantly the systems of organizations (Trompenaars, 1995). Therefore, KM implies that SMEs have to emphasize the management of information instead of having only the perception of the manager (Sparrow, 1998). This indicates that KM must have a conceptual basis of the role it has in SMEs and in the management of systems (Sparrow, 2001).

As a result of this, Cagliano *et al.* (2001) and Beijerce (2000) suggested that if KM has an essential role in SMEs then it can compensate the lack of strategic planning. The same idea is discussed by Simonin (1999), as he had already considered the necessity to improve the strategy substantially in SMEs since it is important for the implementation of empirical researches of KM. Also, Wilkes and Dale (1998) concluded that SMEs focus more directly on the knowledge of the market environment than in strategic planning to design improvement plans in business. Accordingly, it can be considered in general that SMEs are less bureaucratic and more flexible than big enterprises (Gunasekaran *et al.*, 1996). That is why it is easier the adoption and implementation of KM activities (Moffet & McAdam, 2006). Additionally, the literature presents several ways to classify and measure KM. Among the most recent ones is the one proposed by Bozbura (2007), which is the classification that is considered in this research. Bozbura (2007) claimed that KM can be measured and classified through four dimensions: *a)* employee training; *b)* policies and strategies of knowledge management; *c)* creation and acquisition of external knowledge; and *d)* effects of organizational culture. Therefore, by considering the information presented above, the following hypotheses can be stated:

H₁: The higher level of training of employees, the higher level of KM

H₂: The higher level of implementation of policies and strategies, the higher level of KM

H₃: The higher level of creation and acquisition of knowledge, the higher level of KM

H₄: The higher level of effect of organizational culture, the higher level of KM

2.1 Sampling Procedures

In order to prove the hypotheses established in this empirical study, an empirical investigation was implemented in manufacturing SMEs in Aguascalientes State (Mexico), by using the business directory of the Sistema de Información Empresarial de México (Business Information System of Mexico) for Aguascalientes State as reference. The selected manufacturing enterprises were only the ones that had between 20 and 250 employees. Consequently, only 130 enterprises were in the list with these characteristics by July 30, 2015. A census was applied due to the fact that the sample was too small and the implementation of questionnaires took place between September and December 2015 as a personal interview to the managers of the 130 SMEs. 125 questionnaires were returned which

represents a reply rate of 96%.

2.1.1 Variables

A classification created by Bozbura (2007) was used to measure KM. He proposed four dimensions: *employees training* measured by means of a five-point scale and adapted from Bontis (2000) and the OECD (2003); *KM policies and strategies* measured by means of a 13 point scale and adapted from Bozbura (2004, 2007); *creation and acquisition of external knowledge* measured by means of a five-point scale and adapted from the OECD (2003) and Bozbura (2007); and *effects of the organizational culture in KM* measured by means of a four-point scale and adapted from the OECD (2003) and Bozbura (2007). Similarly, all the items of the four dimension were measured by means of a five-point Likert scale from 1 = Totally agree to 5 = Totally disagree as its limits. Furthermore, the following variables were created from the answers obtained in each of the four dimensions: *employees training, policies and strategies, creation and acquisition of external knowledge*, and *organizational culture*. The summation of the values obtained from the previous dimensions was considered for the creation of the variable *management of knowledge*.

Size. This variable was measured by considering the average number of employees in enterprises in 2014.

Age. This variable was measured through the number of years from the beginning of the activity of enterprises to the moment of the questionnaire.

3. Results

A linear regression by means of MCO was carried out to provide answers regarding the hypotheses established in this research paper as well as to determine the level of adoption of KM that manufacturing SMEs have in Mexico, by using a general model for each one of the four hypotheses which are discussed below.

$$KM_i = b_0 + b_1 * Employees\ training + b_2 * Size + b_3 * Age + \epsilon_i$$

$$KM_i = b_0 + b_1 * Implementation\ of\ Policies\ and\ Strategies + b_2 * Size + b_3 * Age + \epsilon_i$$

$$KM_i = b_0 + b_1 * Creation\ and\ Acquisition\ of\ External\ Knowledge + b_2 * Size + b_3 * Age + \epsilon_i$$

$$KM_i = b_0 + b_1 * Effects\ of\ the\ Organizational\ Culture + b_2 * Size + b_3 * Age + \epsilon_i$$

The following charts present the information obtained from each one of the four regression models that were carried out to compare the established hypotheses.

Table 1. Relationship between KM and employees training

Variables	Knowledge Management
Employees Training	0.862*** (18.686)
Size	0.042 (0.869)
Age	0.057 (1.200)
FIV	1.026
F-Value	120.385***
R ² Adjusted	0.743

Below each standardized coefficient, in parentheses, value of the t statistic-student

* = p ≤ 0.1; ** = p ≤ 0.05; *** = p ≤ 0.01

Table 1 displays the results obtained from the relation between KM and employees training ($\beta = 0.862$, $p < 0.01$) which show that the training has a positive and significant influence in the KM of SMEs. This verifies the first

hypothesis. Furthermore, it can be observed that neither the size nor the age of the firms had any significant influence in KM ($\beta = 0.042$, $\beta = 0.057$, respectively). Regarding the validity of the linear regression model, it was compared through the adjusted R^2 (0.743), the F value (120.385***) and the factor of inflation of the variance (FIV) whose value (1.026) is very close to the unit which allows us to eliminate the presence of *multicollinearity*.

Table 2. Relationship between KM and implementation of policies and strategies

Variables	Knowledge Management
Implementation of Policies and Strategies	0.831*** (16.126)
Size	0.004 (0.066)
Age	- 0.037 (- 0.702)
FIV	1.038
F-Value	89.921***
R^2 Adjusted	0.683

Below each standardized coefficient, in parentheses, value of the t statistic-student

*= $p \leq 0.1$; **= $p \leq 0.05$; ***= $p \leq 0.01$

Now, considering the policies and strategies of KM in SMEs, Table 2 shows that this dimension also has a significant and positive influence in KM ($\beta = 0.831$, $p < 0.01$). Likewise, neither the size (0.004) nor the age of the enterprises (-0.037) had any significant influence in KM. Consequently, the values of the adjusted R^2 (0.683), and F (89.921***), are significant, and the FIV value (1.038) is very close to the unit which allows us to eliminate the presence of *multicollinearity* and validate the linear regression model.

Table 3. Relationship between KM and creation and acquisition of external knowledge

Variables	Knowledge Management
Creation and Acquisition of External Knowledge	0.843*** (17.347)
Size	0.058 (1.153)
Age	- 0.086 (- 1.715)
FIV	1.021
F-Value	103.896***
R^2 Adjusted	0.713

Below each standardized coefficient, in parentheses, value of the t statistic-student

*= $p \leq 0.1$; **= $p \leq 0.05$; ***= $p \leq 0.01$

By taking into consideration at this point the creation and acquisition of external knowledge, Table 3 indicates that this dimension has a strong and positive influence on KM in SMEs ($\beta = 0.843$, $p < 0.01$). Just as with the previous hypotheses, neither the size (0.058) nor the age of the enterprises (-0.086) had any significant influence in the KM of manufacturing SMEs. However, the values of the adjusted R^2 (0. 713), and F (103.896***¹) are really significant as well as the FIV value (1.021) which is very close to the unit. This allows us to indicate that there is no *multicollinearity* and it helps to validate the linear regression model.

Table 4. Relationship between KM and effects of the organizational culture

Variables	Knowledge Management
Effects of the Organizational Culture	0.812*** (15.627)
Size	0.087 (1.606)
Age	0.007 (0.134)
VIF	1.010
F-Value	84.511***
R^2 Adjusted	0.669

Below each standardized coefficient, in parentheses, value of the t statistic-student

*= $p \leq 0.1$; **= $p \leq 0.05$; ***= $p \leq 0.01$

Finally, by considering the effect of cultural organization in KM, Table 4 shows that this dimension has significantly positive effects on KM in manufacturing SMEs in Mexico ($\beta = 0.812$, $p < 0.01$) but in a lower scale than the three previous dimensions. Nonetheless, it does not happen the same with the size (0.087) or the age of the enterprises (0.007) but the values of the adjusted R^2 (0. 669), and F (84.511***¹) are really significant as well as the FIV value (1.010) which is very close to the unit. This allows us to indicate that there is no *multicollinearity* and it helps to validate the linear regression model.

4. Discussion

The results obtained in this research can help to conclude that the training of employees in manufacturing SMEs in Mexico plays an essential role in KM. In other words, most enterprises provide their workers and employees with both formal and informal training related to KM; they encourage their workers and employees constantly to keep up with their education and take courses regarding their working field. They also use formal practices of counseling regularly for workers and employees of SMEs, which allows them to obtain more skills and experience to share with their coworkers, and consequently improve the KM of the organization which can imply the creation of better products and services. The training of workers and employees is currently considered in the literature as one of the best investments that enterprises can make because the human resource is the most important intangible asset that any organization can have. Similarly, sharing experiences and knowledge with other workers and employees creates or produces new knowledge besides facilitating the development of working activities which implies the substantial improvement of KM in enterprises.

As a result of this, the creation and acquisition of external knowledge also plays an essential role in KM because SMEs use, in general terms, the knowledge obtained from other industrial sources or their sector, public institutions and research centers for their own benefit, they constantly spend their own resources to obtain knowledge from external entities and they frequently use internet to get the necessary external knowledge for the development of their business activities. These practices allow enterprises to obtain the necessary external information to know the market, the competitors and clients in a deeper way. Thus, manufacturing SMEs of Mexico need to take advantage of the

knowledge produced in higher education institutions, both public and private, and research centers since this information is very important for the creation of new knowledge in enterprises as well as the training of employees. Likewise, SMEs should work together with government institutions and business chambers for the development of activities prone to develop the working skills and experience of their workers which will result into a better KM now and in the future.

Regarding the policies and strategies of KM, SMEs usually support the development of new ideas, they have established procedures to promote innovation, they normally have access to the information they need and they have their business strategies clearly defined. This allows workers and employees to have access to the information they require for the development of their labor activities. Therefore, the skills and experience of employees and workers of manufacturing SMEs can be favored because the organization gives all the personnel all the necessary means and information for the implementation of innovation activities. Simultaneously, SMEs have to align the policies and strategies of KM with the business strategies since it is essential that the strategy of KM is integrated in the general strategies of the organization so all the departments or functional areas of the organization work together in the creation of new knowledge as well as in the transformation of tacit knowledge into explicit knowledge, that is, in the development of new products or services as this will facilitate them to obtain better business results as well as their place in the market and the survival of the enterprise as such.

Finally, regarding the effects of organizational culture in KM, the manufacturing SMEs of Mexico often encourage their executives, workers and employees to transfer their knowledge, experience and skills to the new workers and employees. The enterprises have clearly established a system of values and cultural promotion among their workers and employees, they motivate incessantly their workers and employees to work as a team in the different labor activities that are carried out. Enterprises also motivate constantly their workers and employees to develop and implement new ideas and to express their opinions freely as part of their organizational culture. This cultural openness from manufacturing SMEs permits the creation of new ideas or knowledge that can be expressed in the current or new innovation activities that SMEs carry out. Similarly, when sharing experience, skills and knowledge between the executives and workers with new workers, it creates an ideal working environment for the creation and development of knowledge which can turn into the provision of better services or in the creation of products with a high-quality standard which will in turn improve substantially the level of growth and competitiveness of SMEs.

On the other hand, it is important to clarify the limitations that exist in this investigation. The first one is related to the sample because this research paper considered only small and medium size manufacturing enterprises that had between 20 and 50 workers from Aguascalientes State (Mexico) and excluded those enterprises that had between one and 19 workers. Consequently, it will indispensable to consider in future investigations all the micro, small and medium size enterprises to carry out similar researches as well as considering the enterprises from other states to determine the behavior of the variables analyzed. Secondly, there is the limitation regarding the attainment of information since only one part of the information of KM was considered (in its four dimensions). Further investigations should consider other dimensions or widen the items of the current dimensions to analyze their behavior. Similarly, the collection of information was very difficult to obtain because the information requested was confidential so the participants were not willing to share it and the information provided by the managers of SMES may not reflect the real activities of KM.

Thirdly, the instrument used to measure KM was applied only to managers of manufacturing SMEs from Aguascalientes State (Mexico). This creates the assumption that managers have a lot of knowledge regarding KM activities that are carried out in the organization. Therefore, it will be necessary to apply this instrument to workers and employees as well as middle rank executives of SMEs to obtain information from every point of view in the enterprise and correlate their information with the one of managers to verify whether there are significant differences. Finally, only four to five items were considered in the scale of KM in three of the four dimensions used. It is important that future investigations consider more items or other more quantitative measurements to gauge knowledge management. Therefore, it would be important at this point to ask the following: what would happen with the knowledge management of SMEs if other more quantitative dimensions are considered? Or, what would happen with the knowledge management if SMEs give priority to the training of employees and do not apply the other three dimensions? These and other questions may arise from this empirical research. The answers could be found in future investigations.

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