KNOWLEDGE MANAGEMENT AND INNOVATION CAPACITY IN HIGHER EDUCATION ORGANIZATIONS[1]

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ABSTRACT
A fundamental purpose of higher education institutions is to train professionals capable of managing knowledge and generating innovation processes, which translates into competitive advantages and optimal productive performance. The purpose of this research is to describe the relationship observed between knowledge management variables and the prevailing innovation capacity in higher education organizations. The research hypothesis establishes the presence of a direct relationship between knowledge management and innovation capacity. For this purpose, a quantitative and descriptive type of research was carried out. The study population consisted of 77 institutions of higher education, and by means of probabilistic sampling by clusters, a sample size of 441 workers from these institutions was determined. A structured questionnaire composed of 88 items on a Likert-type scale was used to collect information in the field. Among the main findings, it was observed that there is a high correlation coefficient (0.921), an estimated ratio of (1.267), a standardized ratio of (.96), and a p-value (0.000), which provides sufficient evidence of the existence of a positive relationship between the two variables analyzed.

KEY WORDS: Knowledge management, Innovation capacity, Educational organizations

MSC: 97B40

RESUMEN
Un propósito fundamental de las instituciones de educación superior es formar profesionistas capaces de gestionar el conocimiento y generar procesos de innovación, lo cual se traduce en ventajas competitivas y un óptimo rendimiento productivo. Esta investigación tiene el propósito de describir la relación observada entre las variables de gestión del conocimiento y la capacidad de innovación prevaleciente en organizaciones educativas de nivel superior. La hipótesis de investigación establece la presencia de una relación directa entre la gestión del conocimiento y la capacidad de innovación. Para ello se llevó a cabo una investigación de enfoque cuantitativo y de tipo descriptivo. La población de estudio la constituyeron 77 instituciones de educación superior, y mediante muestreo probabilístico por conglomerados se determinó un tamaño de muestra de 441 trabajadores de dichas instituciones. En la captación de la información de campo se aplicó un cuestionario estructurado compuesto de 88 ítems en escala tipo Likert. Entre los principales hallazgos se observó que entre las variables de estudio existe un alto coeficiente de correlación (0,921); una razón estimada de (1,267), una razón estandarizada de (.96), y un valor p (0,000), lo que proporciona suficiente evidencia de la existencia de una relación positiva entre ambas variables analizadas.

PALABRAS CLAVE: Gestión del conocimiento, Capacidad de innovación, Organizaciones educativas

1. INTRODUCTION

In the present context of globalization and neoliberal economy, with a more open, interconnected, and competitive world, knowledge has become a key factor for economic and social development of countries and their inhabitants. The intensive use of the information technology requires national economies to modernize and prepare themselves to be able to compete in a world economy where the generation, use, and dissemination of knowledge derived from science, technology, and innovation are determinant of economic and social success. Therefore, governments, businesses, public and private organizations as educational institutions seek to stay on in knowledge strategic able to generate them competitive advantages. In this context, the management of intangible assets, such as knowledge, are of strategic importance for the development and growth of countries and organizations (Salete, et al., 2013).

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De Long and Fahey (2000) classify knowledge into three types: a). Human Knowledege (what individuals know, your skill or expertise to include tacit and explicit knowledge); b). Social Knowledege (collective knowledge which is nothing more than the sum of individual knowledge of the team members and is to a certain extent a largely unspoken part, a result of joint work; c). Structured knowledge (it is incorporated into the systems, processes and tools in an organization. It is an explicit knowledge, and it exists independently of human knowledge, at the time it is converted into an organizational essential resource. Therefore, knowledge, especially structured, is considered a key resource of institutions, so its management and transfer constitutes a basic principle in the administration of organizations Grant (1996).

Knowledge Management (KM) can be understood as the individual or collective ability to generate, disseminate, share and use knowledge, both tacit and explicit. Therefore, the KM has become a useful learning tool, as it contributes to value within an organization, economy or society (Barragán, 2009). In this way, the organization's innovation and competitive advantage processes turn out to be more efficient under the positive influence of KM practices (Segarra, 2006). Therefore, the KM is constituted in a strategic activity essential for the development and growth of any organization, especially in highly competitive environments (Drucker, et al., 2013). Despite of the financial and physical capital, knowledge tends to become into one of the most intangible and important assets (Reza and Pahlavani, 2013). So, given its strategic importance for innovation and competitive advantage, the KM is constituted into a permanent task of the organization (Lee, *et* to 2013; Darroch, 2005).

The KM emerges as a strategic philosophy to help organizations to develop their capacities to cope with the dynamism and uncertainty of the complex environment today. Through the systematic acquisition, creation, sharing and use of knowledge, the organizations take advantage of their assets and are more proactive and adaptable to external changes, thus developing innovative and competitive advantages. (Nguyen, 2010). For the organization to be able to generate innovation processes based on the knowledge it possesses, it is necessary to implement management processes. The various KM approaches are focused on facilitating the innovation process (Swan and Newell, 2000), and this turns out to be more efficient when its workers are, provided with adequate training, as well as opportunities to generate new ideas (Bidmeshgipour, et al., 2012). Thus, diverse studies have investigated the relationship existing between innovation and human capital, understood as the set of knowledge, skills and abilities possessed by employees of the organization (Bornay, et al., 2012). In this regard, there is sufficient evidence of a direct and positive effect of the quality of human capital in innovation (Cabello, et al., 2011).

In short, it can be considered that the capacity of an organization to innovate is closely related to the intellectual assets and knowledge it possesses, and that the organizations that manage knowledge use more efficiently the resources they have, are more innovative and perform better (Darroch, 2005).

2. KNOWLEDGE MANAGEMENT

As mentioned, knowledge is the most important asset of the organization for innovation and competitive advantage (Nonaka and Takeuchi, 1995). Therefore, organizations strive to achieve an efficient KM that boosts their innovation capacity (INC) (Davenport and Prusak, 1998). The relationship of KM and INC within organizations has been extensively studied. López and Meroño (2011) found that the KM strategy has a positive impact on innovation and productive performance. El-Kot, G., y Gamal, D. (2011) confirmed that there is a significant positive correlation between the KM and the organizational innovation as well as the sustainable, competitive advantage. Mehrabani and Shajari (2012) observed that the creation, organization, dissemination and application of the open knowledge or as substantive activities of the KM is associated directly with INC. In the same way, Palacios, et al., (2009) found that the introduction of a KM program in the organization contributes to the development of acquisition skills, transfer, diffusion and application of accumulated knowledge. In summary, this empirical evidence confirms that KM contributes for the organizations to effectively apply their productive resources, as well as the organizational INC.

The literature on KM of organizations in general supports it in two dimensions: infrastructure capacity and process capacity. The first one corresponds to the general activities of the organization and comprises four aspects: organizational structure, organizational culture, human resources and information technology. The second one corresponds to the structured coordination created in order to effectively manage knowledge and is essential, since it allows the organization to capture, process and transfer knowledge, as well as effectively manage internal and external knowledge (Gold, et al., 2001). It is made up of the acquisition, conversion, application and protection of knowledge (Lee and Choi, 2003, Nguyen, 2010).

Also, it highlights the importance of the structural capabilities of the organization (culture, functional structure, human and technological resources) as well as strategic aspects to drive the processes of acquisition, retention, transfer and use of knowledge (Chuang, 2004; Lee and Choi, 2003). For this reason, in this research it is considered that the structural capabilities of the organization are strategic aspects of the KM, since it determines the ratio of the capacity of KM with the capacity of innovation. In short, the KM should be understood as an institutional mechanism that enables knowledge to be created , exploited and shared (Palacios, et al., 2009) , and this process of sharing knowledege leads to the generation of new ideas, processes and products, that is, to innovation (Camelo, et al., 2011).

3. INNOVATION

The innovation construct implies the adoption of a new idea or behavior of an organization (Damanpour, et al. 2009). At an organizational level, innovation is understood as the adoption for the first time of a technology, strategy, or management practice, or a significant restructuring or improvement of a process (Haiyang Li and Atuahene-Gima, 2001).

Innovation can take many forms. According with the results it produces, it may be of process, product and service (Prajogo and Pervaiz, 2006). In accordance with the level of alteration or change it introduces, this can be incremental and radical (Darroch, 2005). The technological innovations correspond to the modifications incorporated into present products and processes based on the application of technologies (Lee, et al. 2013). Non-technical or organizational innovation involves the functional structure and the administrative and management processes (Abdullah and Hassan, 2013). Technical innovation, which is divided into product innovation (new products or services introduced to meet an external user or necessity of the market), and innovation process (it refers to the new elements introduced in the production operations or services of an organization) that can improve operations, cut costs, increase efficiency, productivity, and the yield in a short time (Shu, et al., 2012).

To this respect, Damanpour, et al., (2009) distinguish between two types of product innovation (goods and of services), and two types of innovación process: innovations in operational processes (such as services to the customer, logistics and procurement), and innovations in management processes (such as strategic planning, project management and employee evaluation). Likewise, they classify three types of innovation that are applicable to service organizations: service, technological processes and administrative processes. With regard to the service innovations, Damanpour, et al., (2009) mention that in the investigation of innovation it has not been usually distinguished between the product innovations and service, and that this is because both have one external focus, they are driven mainly by markets, and their results are the introduction of changes in the production of the organization for its consumers or clients. Like product innovations, service innovation engines are the demand and the desire to introduce new services to existing markets or new market niches.

As related to process innovations, these same authors say that contrary to innovations of products or services, the ones about process have an internal focus, as they aim to increase the efficiency and effectiveness of the organization to facilitate production and the delivery of goods or services to customers. The new processes can be associated with the core technology or technical system of the organization (technological processes innovation), or with the core administration organization (administrative process innovation). The innovation of technological processes constitute new elements introduced into the productive and service systems of the organization. This type of innovation is aimed at reducing the time of delivery, increasing operational flexibility and reducing the production costs. Therefore, technological process innovations modify the processes and operating systems of the organization. In service organizations, these innovations are associated with the information technologies, which is why it is also known as technological innovation.

Finally, innovations in administrative processes correspond to new approaches and practices to motivate and reward the members of the organization, design the strategy and structure of tasks and units, and modify the organization's management processes. Technological innovations are directly related to the work and main activity of the organization to produce changes in their operating systems, and the administrative innovations are indirectly related to the core business of the organization's work and mainly affect their management systems. The administrative process innovations refer to changes in the structure and processes of the organization, administrative systems, knowledge used in performing management tasks, and manageability capacity that will allow function and succeed by using their resources effectively. This type of innovation is also known as administrative innovation (Damanpour, et al., 2009).

In short, it is clear that organizations capable of managing knowledge (CMK) achieve better results, and this is the main driver of innovation and competitive advantage (Nonaka and Takeuchi 1995). For knowledge to be created and exploited, it has to be shared. This process of knowledge exchange leads to the generation of new ideas, processes and products, that is, to innovation (Camelo, et al., 2011). For this reason, the CMK, should be assumed as a permanent task to promote the institutional INC (Palacios, et al., 2009). Investigations by Nonaka and Takeuchi (1995) on the creation of organizational knowledge conceive knowledge as the main requirement for innovation and competitive advantage. In this research, the main purpose of this investigation is to analyze the relationship existing between the CMK and the INC in higher education institutions.

In the analysis, the innovation capacity is assumed as a dependent variable and is made up of product innovation and process innovation. The first refers to the development or improvement of new products and services introduced to existing or new markets (Wang and Ahmed, 2003; Damanpour, 2009). The second corresponds to new production methods and management approaches (Wang and Ahmed, 2004; Damanpour, 2009). For its part, the CMK is assumed as an independent variable, and is based on the infrastructure capacity and the process capacity of the higher-level educational institutions studied.

4. MATERIAL AND METHODS:

A research with descriptive and confirmatory quantitative approach, whose purpose is to confirm the existence of a positive relationship between the capacity of managing knowledge (CMK) and the capacity of innovation (INC) in higher level educational organizations studied, assume the CMK as an independent variable and the INC as a dependent variable. Having established the problem of research and theoretically based the CMK and INC variables, we proceeded to study the relationship existing between the two constructs. For this purpose tools of descriptive statistical analysis, factorial exploratory and confirmatory were used. In modeling and established hypothesis testing was applied an analysis of Structural Equation (ASEQ), which according to Herrero (2010) is more suitable for this type of analysis. The main purpose is to explain the correlation or covariance observed among a set of variables measured through a latent set variables or factors (Bollen, 1989).

Figure 1. Descriptive data,type of institution

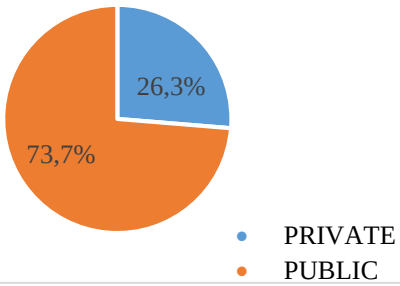
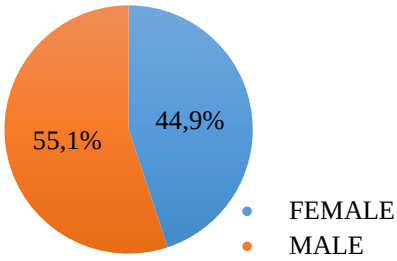


Figure 2. Workers according to sex



The average age range of the workers was between 41 to 45 years (Figure 3), with an average of the years of service from 11 to 15 years (4).

Design. The universe of study corresponds to 77 higher education institutions in the southeast of Mexico. At these institutions there are 8,603 administrative workers, including managers and teachers. In determining the sample size, a probabilistic cluster sampling was applied, with a sampling error of 5%, a confidence level of 95% and a variance of p = .50, q = .50. A sample size of 441 employees was obtained, of which 73.7% worked in public universities and the remaining 26.3% in private institutions. In lifting the information field, a structured questionnaire was administered, designed from the research objectives. Based on the findings of the literature review, the next step was the operationalization of the CMK and INC variables. The instrument consists of 88 items on the Likert scale. In order to measure the CMK, a scale produced by Nguyen (2010) was used, while in measuring the INC, a Al-Husseini, S. and Elbeltagi I.'s scale was used (2012). The reliability of the items was evaluated by estimating Cronbach's alfa coefficient on a scale proposed by Nunnelly (1978): lesser than 0.6 (low); between 0.61 and 0.70 (adequate); between 0.71 to 0.80 (good); greater than 0.80 (high). In construct validation, an exploratory factor analysis (EFA) and a

confirmatory factor analysis (CFA) were used, according to Hair's, et al., criteria (2006). Finally, in processing and data analysis, the SPSS program, version 21, was used. Also, it was used an analysis of structural equations in the study of causal relationships between the data obtained, for this purpose the statistical package, version AMOSS 20 was used.

5. DESCRIPTIVE RESULTS

The analysis of the existing relationship between the KMC and the INC was carried out in 77 higher education institutions in the southeastern of Mexico, of which almost 7 4 % are public and the remaining 26 % are of private capital (figure 1), it was applied to a representative sample of 441 workers, of which 55.1% were male and 44.9% were women (figure 2).

Figure 3. Descriptive data, age

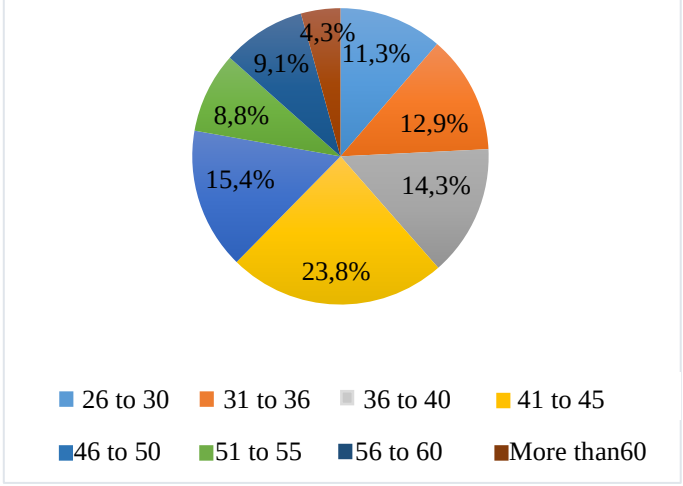
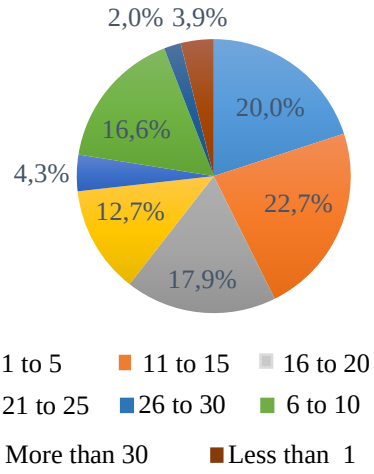
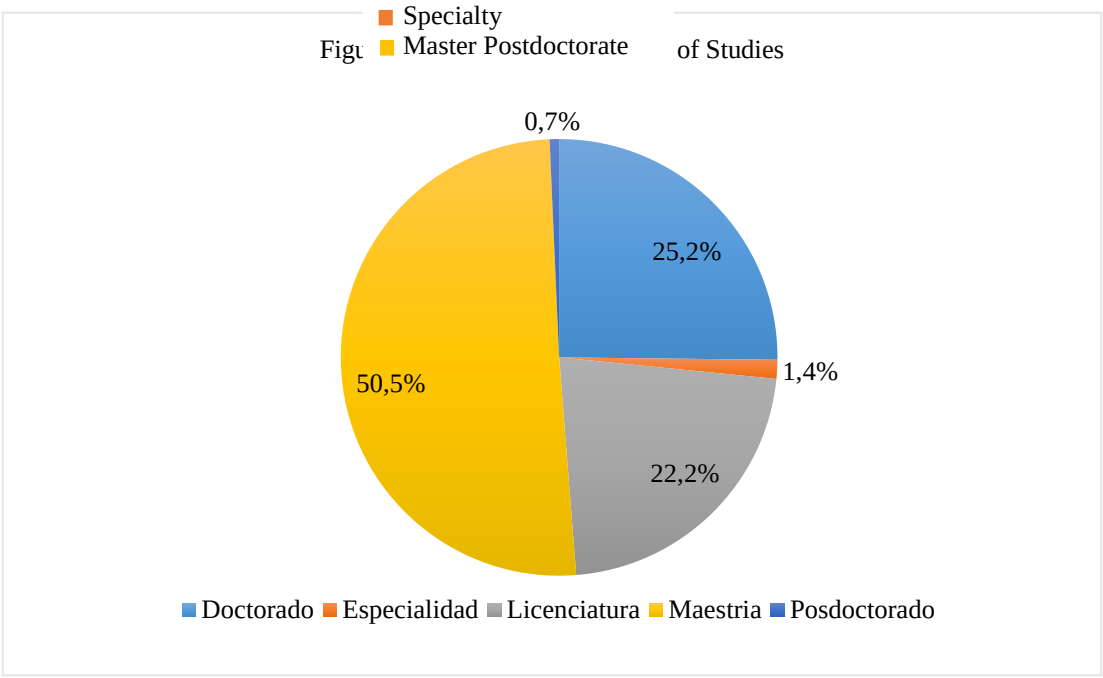


Figure 4. Descriptive data, years of service

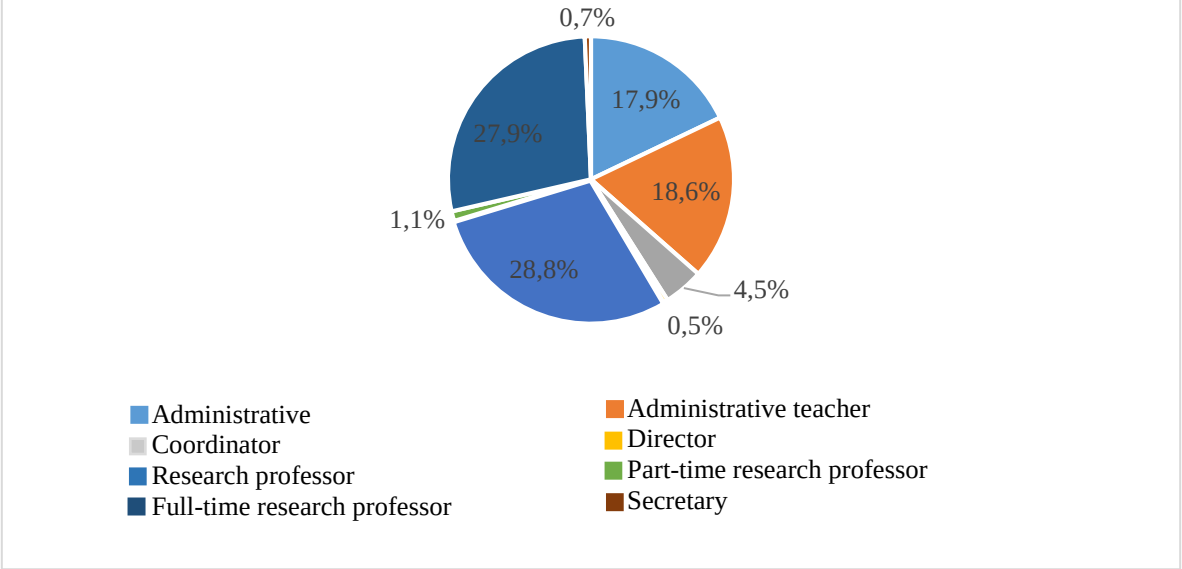


The average level of studies were that of a master degree, with a 50.5% of the total. It is worth mentioning that 25.5% of the people interviewed had doctoral studies, and 1.4% with different specialties. Likewise, 22.4% had a bachelor's degree (figure 5).



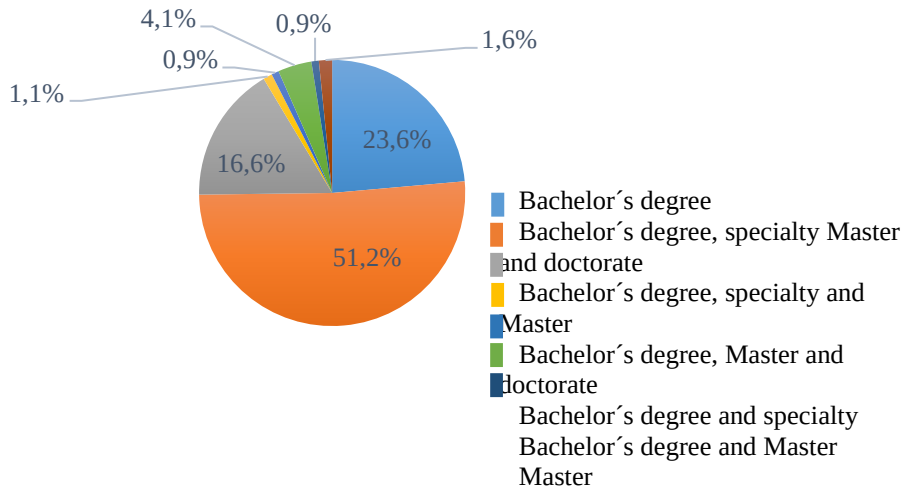
At the time of the interview, the workers had mainly been carrying out a teaching labor, since almost 57% held the position of full-time and subject research professors. It is also highlighted the administrative activities and administrative teaching with almost 37% of the total. In a lesser order of importance are the managerial functions, which occupied the remaining 6% (figure 6).

Figure 6. Sample distribution according to the position in public and private higher education institutions



The educational institutions investigated preferably taught a wide range of research studies. Thus, more than 51% offered bachelor's degrees, different specialties, doctoral studies, and just over 41%, the offer is focused on undergraduate, specialty and Master (Figure 7).

Figure 7. Descriptive data, level of education at the institution



Confirmatory. As mentioned above, the developed analysis considers the CMK as an independent variable made of the SCKM and PCKM constructs, having validated that both constructs are unidimensional and are related to one another. With respect to INC, it is considered as a dependent variable, also confirming its dimensionality. The ASEQ's results made demonstrated a correlation coefficient of 0.921 between both variables. Likewise, the estimated relationship (1,267), the standardized relationship (.96) and the p-value (0.000) provide evidence of the existence of a positive relationship between them. Therefore, it can be affirmed that the CMK positively influences the INC of the higher-level educational institutions studied. Regarding the relationship existing between the SCKM and PCKM and inside the educational institutions, it was found sufficient evidence to confirm that the SCKM positively determines the PCKM. This is supported by empirical evidence, which shows that the general activities of the organization included in the SCKM are mechanisms that decisively influence the creation of knowledge, as well as its protection and interchange, a conclusion coinciding with Lee y Choi, 2003, and Nguyen, 2010. Similarly, the dimension of the SCKM that most influences the PCKM turns out to be the organizational culture, which has a direct and significant relationship on the application of knowledge and indirectly with the acquisition and protection of knowledge. In the same way, the organizational structure also has an indirect relationship on the conversion and application of knowledge.

6. DISCUSSION

The theoretical review carried out, as well as the empirical evidence derived from the research, show that KM contributes in a decisive way so that educational organizations apply knowledge efficiently and effectively and achieve a better consolidation of their innovation processes. It was also confirmed that there is a positive and significant relationship between the CMK and the INC organizational, and between the organizational innovation and the sustainable competitive advantage. Thus, the results agree with Nonaka and Takeuchi's conclusions (1995), who conceive knowledge as a strategic resource of the organization, as well as for the innovation and a sustainable competitive advantage (Grant, 1996).
Furthermore, the implementation of KM programs in the organization has not only positive effect on innovation, but it also helps to develop skills to acquire knowledge, and in its conversion, distribution and internal application (Palacios, et al.,2009). In this sense, the KM must be understood as an institutional mechanism capable of stimulating the coordination of tacit and explicit knowledge that is disseminated

throughout the organization and its environment. Therefore, the CMK is strongly linked with INC inside the educational organizations (Palacios, et al., 2009).

The findings of the empirical research on the positive and significant influence of CMK on INC in educational institutions coincide with preliminary studies by Noruzy, et al., 2016. The results also show that innovation requires knowledge creation activities at the organizational level (Shu, Page, Gao, & Jiang, 2012); other results show that the application of knowledge has a mediating effect on innovation (Li, et al., 2009). The KG strategy has a positive impact on the innovation and performance of the organization, through an increase in the INC (López and Meroño, 2011). The creation and acquisition of knowledge is decisive in innovative performance (Zhang, et al., 2010), and the combination of knowledge directly impacts product and process innovation *(*Shu, et al., 2012).

Regarding the analysis of SCKM, it was observed that the results match with Gold, Malhotra and Segars (2001) and Lee and Choi (2003), who indicate the existence of a relationship directly between the culture of knowledge and technology, and indirectly with the human resources of the organization. Regarding the organizational structure as a source of encouragement to the MC within the education organizations, the analysis indicates the presence of an indirect connection with the acquisition, conversion and application of knowledge, a result consistent with the findings of Nonaka and Takeuchi (1995), Wang and Ahmed (2003) and Nguyen (2010). Regarding technology, Gold, et al., (2001) also find that it represents a fundamental element of the structural dimension necessary for the creation of new knowledge, since it allows to overcome the communication barriers present in the educational organization. Similarly, Gold, et. al., (2001) and Allameh, et al., (2011) find that the information technology determines access to knowledge within the educational organization, and therefore, it must invest in the appropriate technological infrastructure that support the scientific activities developed in itself.

Regarding the finding within the structure of educational organizations analyzed, human resources facilitate the process of knowledge exchange in various areas, it is compatible with Bharadwaj, et al., (2015), who find that a flexible structure allows the formation of collaborative work teams. Likewise, Lee and Choi (2003) argue that human capital is the key in the creation of organizational knowledge. Therefore, for Nguyen (2010), the continuos development of skills and competencies of workers in the organization is fundamental.

Regarding the organizational culture, the analysis showed that it is directly related to the application of knowledge and indirectly to its acquisition and protection, which coincides with Gold, et al., (2001), who find that the greatest obstacle to a effective KG is the absence of organizational culture. Also, with respect to information technology, the analysis established the existence of a relationship directly between it and the acquisition of knowledge, finding that it is in line with the results of Lee and Choi (2003), who argue that it has a positive impact on knowledge, facilitating the acquisition, storage and knowledge sharing on a large scale, contributing thus to the knowledge creation process. These results are also compatible with Hsu (2014) and Bharadwaj, Chauhan and Raman, (2015) who claim that it is a key factor in knowledge management.

Regarding the CMK, understood as the capacity of the educational institutions to create new knowledge, the analysis shows the existence of a direct and significant result consistent with the one reached by Nonaka and Takeuchi (1995). Now, Lee and Suh (2003) found that knowledge management processes are aimed at achieving that existing knowledge be useful for the organization. Finally, regarding the INC in educational institutions, the results of the study indicate a direct and significant relationship between the CMK and the INC of products and educational processes, a finding in agreement with Shu, et al., (2012), Al - Husseini and Elbeltagi (2012), who find that the ability of an organization to combine and use different types of knowledge is essential to achieve effective innovation processes.

Likewise, empirical evidence of a direct relationship between the organizational structure and the innovation of educational processes was found, a finding compatible with those of Dilnutt (2000), who finds that the organizational structure directly influences the management of knowledge and innovation within the organization. In the regard, Nonaka and Takeuchi (1995) affirm that certain types of structure make the exchange and generation of knowledge easy, as well as a boost to innovation.

7. CONCLUSIONS

In a more open, interconnected and competitive world, knowledge has become a key factor for the economic and social development of all the countries of the world. Therefore, knowledge, above all, the one structured, is considered as a key resource for organizations, and its management and transfer constitutes a basic principle of the administration of themselves. The research results show that higher education

institutions that manage knowledge use more efficiently the resources available to them, are more innovative and have a better performance. Likewise, the innovation capacity of these educational organizations is closely related to the intellectual assets and knowledge they possess. Likewise, there is a positive and significant relationship between its capacity to generate knowledge and its capacity for innovation, and this capacity for innovation drives its sustainable competitive advantage. All these empirical evidences are widely supported in the theoretical review carried out.

To summarize, the implementation of programs for the generation of knowledge in higher-level educational organizations has a positive effect not only on their capacity for innovation, but it also contributes to developing skills for the acquisition of knowledge, as well as its conversion, diffusion and internal application. In this sense, the management of knowledge should be understood as a mechanism capable of stimulating an institutional generation of tacit and explicit knowledge that diffuses through the organization and its environment. Therefore, the capacity for generating knowledge is strongly linked to the capacity for innovation within higher-level educational institutions.

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