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Knowledge and Innovation in Mexican Agricultural Organizations

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Abstract: Knowledge is a determining factor in the creation of competitive advantage by generating new ways of working, which has been widely studied. However, in the agricultural sector, the contributions are minimal. Given the importance of the topic and the sector, the objective of this study is to determine the relationship between knowledge management and innovation in rural agricultural organizations in the state of Sonora in northern Mexico. A quantitative, correlational study was carried out, in which a questionnaire of 36 items with answers on a Likert scale was applied to 91 companies. The information was processed and analyzed in the SPSS program using correlation and linear regression. The results showed a positive and significant relationship between the variables under study, which supports that knowledge management in these companies, has as a consequence, innovations in them; however, it was not possible to determine the impact in economic terms. This can be taken up again in subsequent studies and in a practical sense in the companies by promoting knowledge management actions that encourage new processes, services and/or products that allow a monetary impact on them.

Keywords: organizations; primary sector; processes; products; services

JEL Classification: M10; M19; O13

1. Introduction

Companies promote the well-being of a country by providing sources of employment to its inhabitants. Cruz and Polanco (2014) state they play a very important role in economic and social development in Mexico; in addition, they are classified according to their activity. In the primary sector are those dedicated to agriculture, livestock and fishing; the secondary sector corresponds to processing companies, and the tertiary sector consists of those dedicated to services. Altogether they constitute the productive system. According to the National Institute of Statistics and Geography (INEGI 2016), the first one is fundamental for the nation's development and the well-being of its inhabitants since it represents 3.18% of Mexico's gross domestic product. In particular, in Sonora, it represents 8.8% of the state's economic activity, according to data from INEGI (2017).

The change to adapt to the business environment is encouraged by the generated knowledge when developing better ways of working. Based on this, knowledge has become the main productive resource of companies (Bellinza et al. 2011), since its management allows to increase intellectual capital, and it transforms it into intangible assets (Osorio Núñez 2003; Flores Caicedo 2010); furthermore, it generates wealth or added value, which allows achieving an advantage in the market (Alavi and Leidner 2001;

Nieves Lahaba and Santos 2001; Sánchez Díaz 2005; Rodríguez Gómez 2006) for individuals, organizations, society and even nations (Wiig 1997; Saíz Álvarez 2013). The above, derived from the transition to the so-called knowledge economy, characterized by globalization, the use of information and communication technologies, experience and knowledge as a source of wealth (Boisier 2001; Bueno Campos 2002), the market with changes, increased competition and increasingly demanding customers (Ponce Álvarez 2009). In such a way, that only the organizations with greater reaction and adaptability to the changes in the environment will be able to achieve success and remain (García del Junco and Dutschke 2007).

This organizational knowledge can be managed according to the next models: Andersen or organizational knowledge management, which favors the transmission of valuable information, from workers to the organization and vice versa, in order to generate benefits for customers (De Freitas and Guillermo 2014). The knowledge management assessment tool model focuses on facilitating the management of it by sharing it, as well as coordinating the efforts in the organizations and giving greater importance to facilitators such as leadership, culture, technology, processes and measurement (Contreras and Huamani 2013). The Knowledge Management Model from KPMG Consulting, whose purpose, according to Loggiodice Lattuf (2014), is the exhibition of the factors that condition the learning capacity of an organization, as well as the expected results, in which all elements interact and at the same time form a complex system. Finally, the Creation of Knowledge Model of Nonaka and Takeuchi was raised to know how Japanese companies created the dynamics of innovation (Lovera Aguilar 2009).

The last of the mentioned models states that knowledge is created in two spirals between the interaction of both types of knowledge (tacit and explicit) during the phases of socialization, externalization, combination and internalization (Contreras and Huamani 2013). Of these types of knowledge, the first is personal, and therefore is difficult to formalize and communicate because it is not easy to express it; on the other hand, explicit or codified knowledge can be transmitted by using formal and systematic language, easy to communicate, share (Nonaka and Takeuchi 1999) and has been captured in some tangible form as words, audio recordings or images (Dalkir 2011).

The management process consists of the acquisition, organization, use and dissemination of knowledge (Bustelo Ruesta and Iglesias 2001; Suárez and Escorsa 2001; León Santos et al. 2006; Bellinza et al. 2011), whose purpose is related to establishing mechanisms for the use and reuse of this, both by individuals and groups of individuals within the organization (Ordoñez De Pablos 2001); to increase business opportunities; improve communication, and present and future competitiveness; to improve the performance and leadership of companies in their market (Nieves Lahaba and Santos 2001); and also, to generate a technological platform that allows information and knowledge to be distributed quickly and agilely (León Santos et al. 2006).

In this knowledge society, companies require a greater effort to obtain knowledge through the generation of ideas that become innovation (Aranda Gutiérrez et al. 2010), since their management directly impacts innovation and product improvement (Marulanda Echeverry et al. 2013). This can begin by detecting market demands to identify differentiation factors that can be turned into sustainable advantages (Auletta and Ojeda 2014), creating or increasing existing resources to produce wealth (Drucker 2008) and concluding when the product or service developed is acquired by the client (Varela Villegas 2008).

Innovation can be conceived as the capacity that companies must mobilize the knowledge in the personnel, promoting new ideas (Acosta Prado and Fisher 2013) to turn them into new or improved products, services or processes (Delgado Verde et al. 2013) that satisfy a market need (Auletta and Ojeda 2014). It must be not only satisfactory but accepted and valued in a successful way (de López 2011), generating value to the consumer, and at the same time, economic growth for the organization (Iglesias Durán 2014).

These new and/or better ways of carrying out activities in a company can cover various aspects, from offering new products or services, as well as improving their characteristics and forms of use

(Iglesias Durán 2014); introducing new methods and processes of production or distribution (Palacios Fierro et al. 2017); applying new organizational methods (García González 2012), and innovative ways of promoting or marketing products or services (Revilla Gutiérrez 2001). These innovations will emerge because there is a systematized work method (García González 2012) with a creativity component (Gil Ruiz et al. 2008), which can be summarized in three stages: generating knowledge, making the changes or new product, service or process, and carrying it out through commercialization (Revilla Gutiérrez 2001).

In addition to the theoretical contributions, empirical work has been generated on knowledge management in relation to competitiveness (Estrada and Dutrénit 2007; Ochoa et al. 2012; Tinoco Gómez et al. 2014) and with business performance (Tarí Guilló and Fernández 2013). In these cases, a close relationship was identified between both aspects. In relation to innovation, the sectors that carry out the greatest innovations have been analyzed (Ruiz Porras and García 2016): the level of innovation (Armenteros Acosta et al. 2012), its relationship with performance (Gálvez Albarracín and de Lema 2012), as well as with social capital (Delgado Verde et al. 2013). When trying to explain both variables, there are some noteworthy investigations that try to do so with other concepts or complementary dimensions—in this sense, determining the maturity of knowledge management and innovation from the perspective of performance (Alegre Vidal and Alcamí 2005; Arias Pérez 2012), measuring technological knowledge resources and capabilities of an explicit and tacit nature with the capacity for innovation (Díaz et al. 2006) and directly studying the relationship between knowledge management and innovation (Cruz Reyes 2012; Moreno and Salgado 2011; Ojeda López et al. 2012; Cuevas et al. 2014).

Knowledge management and innovation are key pieces for the success and development of organizations. In such a changing environment, companies have the need to generate knowledge which allows them to generate better products, services and processes, and thus create a competitive advantage. These are issues of great importance, which in recent years have increased empirical research, and can identify the relationship between both variables. These studies have identified that there is a positive relationship between knowledge management and innovation, which indicates that companies with innovation capacity are influenced by the way they manage their knowledge (Alegre Vidal and Alcamí 2005; Díaz et al. 2006; Cruz Reyes 2012; Moreno and Salgado 2011; Cuevas et al. 2014). Both elements are strongly associated since the first is the main basis for decision-making, continuous improvement in innovation processes (Valencia Bonilla et al. 2016), and new management techniques are created to contribute to the dynamics of innovation (Ojeda López et al. 2012; Ollivier Fierro and Parada 2013).

In all these cases, the business approach is mainly in the industrial trade and services sectors, so that the primary sector is not addressed with these topics in particular, specifically in the agricultural enterprises that directly impact the region's economy. For this reason, their growth is of vital importance to social well-being since it contributes to the generation of jobs. In the agricultural sector, the study of these variables in the management field is incipient. Innovation has been studied in relation to other topics, such as gender (Estébanez et al. 2016), productivity and technology (Tello 2016), crop selection (Abebe et al. 2013), sustainability (Jiggins et al. 2014; Mircea 2008) and in both producers and small and medium enterprises (Shiferaw et al. 2009; Vargas-Canales et al. 2018). Meanwhile, research focused on knowledge and innovation can be encompassed from various perspectives, such as studies focused on reflection and analysis of the relationship between both variables (O'Flynn 2017; Klerkx et al. 2012; Rijswijk et al. 2019; Zahran et al. 2020), those whose priority is food security and sustainability (Hassen and Bilali 2020; Chenu et al. 2018), and those that deal in some way with the relationship between them on the European and African continent (Adolwa et al. 2017; Pascucci 2011; Klerkx and Leeuwis 2008; Fáziková and Melichová 2014).

Because of the importance of these two variables, as well as the sector, the objective of this study is to determine the relationship between knowledge management and innovation in rural agricultural organizations in the state of Sonora, northern Mexico. The document consists of the next sections:

The materials and methods include the description of the subjects of study, the used instrument and the procedure for the study. In the results and discussion, the most relevant findings of the relationship between the study variables are presented: Knowledge management and innovation, as well as the discussion of the results with the vision of other previous studies; finally, the derived conclusions from the above.

2. Materials and Methods

The study was carried out in a rural production society, located in the municipality of Benito Juárez, Sonora, Mexico, which is dedicated to the sale of fertilizer products, agrochemicals and seeds, and essential implements for agricultural activity, integrated by 200 producers of the region. This organization was selected as a case study because it is one of the largest in the region, dedicated to the agricultural sector and has more than 100 members among individual farmers and companies. It was decided to conduct a census to cover all members; however, a response rate of 45% was obtained with a total of 91 farmers responding, who are mainly dedicated to the cultivation of basic grains such as wheat, corn, chickpeas, beans, safflowers and soybeans, in a territorial extension of 12,000 hectares in the region of the Valleys: Yaqui and Mayo. The study is quantitative, with a correlational scope. An instrument was used to identify the actions carried out by the farmers in relation to the two variables mentioned, conformed by 36 items, with a Likert scale from 1 to 5, in which 1 is “totally disagree” to 5, which is “totally agree” (See Table 1).

Table 1. Table of variables.

| Variables | Items | Dimension |
|----------------------|-------|---------------|
| Knowledge Management | 1–6 | Generation |
| | 7–10 | Adaptation |
| | 11–15 | Socialization |
| Phases Innovation | 16–19 | Introduction |
| | 20–25 | Development |
| | 26–29 | Research |
| | 30–36 | Incubation |

The questionnaire was applied through personalized interviews during the period of June–August. Later, they were captured in the SPSS program, and a database was generated, which was verified for possible errors related to data capture or lack of information. The descriptive analysis continued, and tables were elaborated with combined information of the questions. The next step was the reliability analysis, using Cronbach’s alpha (α), to measure the reliability and validity of the instrument; then, the linear regression was analyzed through the elaboration of constructs with each one of the variables and in this way, the regression was obtained through the method of bivariate linear regression; consequently, a model of Durbin–Watson was obtained to measure the independence of the variables. Finally, an analysis was elaborated to identify the bivariate correlations through Pearson’s method.

3. Results and Discussion

The companies under study show a relative balance between the two types of tax registration; however, the enterprises registered as natural persons are slightly superior by eight percent. On the other hand, according to the number of employees of most of the surveyed enterprises, they correspond to a significantly higher value than micro-enterprises (See Table 2).

Table 2. Type and size of companies.

| Company | | Employees | |
|----------------|---------|---------------|---------|
| Natural person | 49; 54% | 1 to 10 | 78; 86% |
| | | 11 to 50 | 10; 11% |
| Legal entity | 42; 46% | More than 250 | 3; 3% |

In relation to the ownership of the company, in 42% of them, there was a sole owner or, alternatively, no relatives among them; however, when it came to deciding who worked in them, the vast majority of them hired family members, so it can be said that 86% of them could be classified as family businesses (See Table 3).

Table 3. Family owners and employees.

| Family Owners with Each Other | | Relatives of the Owner(s) Who Work in the Company | |
|-------------------------------|-----|---------------------------------------------------|-----|
| 0 | 42% | 0 | 14% |
| 1 or more | 58% | 1 | 86% |

Over time, agriculture has been characterized as a job developed by the male gender, which was corroborated in this work. The level of education reflects an interesting fact: all have obtained formal education, since about 70% have studied at least high school, and some have even obtained a postgraduate degree. The remaining percentage located in the others correspond to primary and secondary level (See Table 4).

Table 4. Gender and academic level of directors.

| Gender | | Academic Level | |
|--------|---------|-------------------|---------|
| F | 10; 11% | High School | 31; 34% |
| | | Bachelor's degree | 30; 33% |
| M | 81; 89% | Postgraduate | 2; 2% |
| | | Others | 28; 31% |

The interviewed people in the research had different responsibilities within their companies. Most respondents were the owners and president of the society; the latter corresponded to companies registered as legal entities. In terms of the time that people performed their position within the agricultural companies, they had greater participation than those who had more than 15 years in the position (See Table 5).

Table 5. Seniority in the position.

| Job Position | | Seniority in the Position | |
|--------------|---------|---------------------------|---------|
| Owner | 50; 55% | 0–3 years | 13; 14% |
| Director | 27; 30% | 4–7 years | 10; 11% |
| Manager | 8; 9% | 8–11 years | 9; 10% |
| Partner | 3; 3% | 12–15 years | 6; 7% |
| Employee | 3; 3% | More than 15 years | 53; 58% |

The analysis was carried out to measure the degree of reliability and validity by checking the reliability and internal consistency of the questionnaire, which was calculated using Cronbach's alpha

index (Cronbach 1951). In order to evaluate the values of the coefficients, according to George and Mallery, cited by Frías Navarro (2014), the following values that describe the acceptance of reliability were suggest: alpha coefficient <0.5 is unacceptable, alpha coefficient >0.5 is low, alpha coefficient >0.6 is questionable, alpha coefficient >0.7 is acceptable, alpha coefficient >0.8 is good, and alpha coefficient >0.9 is excellent.

As can be seen in Table 6, the indicators were favorable with a Cronbach's alpha of 0.917 for the knowledge management variable and 0.949 for the innovation variable, which represents an excellent level of coefficient; thus, allowing greater confidence in the variables under study. The obtained results support a favorable internal consistency.

Table 6. Reliability statistics.

| | Cronbach's Alpha | Cronbach's Alpha Typified Elements | No. of Elements |
|----------------------|------------------|------------------------------------|-----------------|
| Knowledge Management | 0.917 | 0.925 | 15 |
| Innovation | 0.949 | 0.952 | 21 |

When the data were analyzed using the Statistical Package for the Social Sciences (SPSS) program 21 version, the results yielded a linear regression model with an R-squared of 0.469, meaning that there is a 46% standardization by the results in a positive way. A model was generated from the variables, which shows that innovation depends on knowledge management at 46%. It can also be shown that a Durbin–Watson model was generated, which allows us to measure the independence of the variables. As shown in Table 7, the Durbin–Watson indicator was 2.206, meaning there is no self-correlation between the variables, and according to the theory, it should be in a range greater than 1.28 and less than 2.5 (Hanke and Wichern 2006).

Table 7. Model summary.

| Model | R | R-Squared | Corrected R-Squared | Standard Error of the Estimation | Statistics of Change | | | | Durbin-Watson | |
|-------|--------|-----------|---------------------|----------------------------------|----------------------|-------------|-----|-----|---------------|-------------------|
| | | | | | Change in R-Squared | Change in F | gl1 | gl2 | | Sign. Change in F |
| 1 | 0.685a | 0.469 | 0.463 | 0.51141 | 0.469 | 77.699 | 1 | 88 | 0.000 | 2.206 |

a. predictive variables: (constant), knowledge management.

As shown in Table 8, the generated model is significant because the significance within the ANOVA table indicates that the variables are linearly related, and it has a value in the model of 0.000, which is below 0.05.

Table 8. ANOVA.

| Model | Suma of Squares | gl | Root Mean Square | F | Sig. |
|--------------|-----------------|----|------------------|--------|--------|
| 1 Regression | 20.321 | 1 | 20.321 | 77.699 | 0.000b |
| 1 Residual | 23.015 | 88 | 0.262 | | |
| Total | 43.336 | 89 | | | |

a. dependent variable: innovation. b. predictive variables: (constant), knowledge management.

As can be seen in Table 9, regarding the correlation of the two variables under study, there is a positive and significant correlation coefficient with a coefficient of 0.685, which allows us to establish that 68% of the independent variable of knowledge management is related to the dependent variable of innovation; therefore, it is important there is good knowledge management to increase innovation; it will allow companies in the agricultural sector greater benefits, when taking advantage of the human

capital of the company, as well as generating greater innovation, which directly impacts on improving productivity, services and products thus becoming more competitive.

Table 9. Correlations.

| | Management | Innovation |
|------------|------------|------------|
| Management | 1 | 0.685 ** |
| Innovation | 1 | |

** The correlation is significant at the 0.01 level (bilateral).

The results are similar to previous studies on the existence of this relationship and above all with the importance of both variables in the agricultural activities (Adolwa et al. 2017; Chenu et al. 2018; Fáziková and Melichová 2014; Hassen and Bilali 2020; Klerkx and Leeuwis 2008; Klerkx et al. 2012; O’Flynn 2017; Pascucci 2011; Rijswijk et al. 2019; Zahran et al. 2020).

4. Conclusions

Based on the presented findings, it can be stated the existence of a positive and significant relationship between knowledge management and innovation in companies in the agricultural sector; in addition, the higher the level of knowledge management, the higher the level of innovation in the mentioned companies. It coincides with what was mentioned in the initial part of this study, with references from previous research, in which a close, positive and significant relationship between these two variables is evident. This leads to the development of better ways of working and taking advantage of the opportunities that arise in the market in order to remain or increase participation in it.

It has been mentioned that the generation, adaptation and socialization of knowledge contributes to improving the ways of working of a company, allowing to obtain better results through the reduction of costs, implementing processes, products and innovative services that allow the growth of the organization, and managing the internal and external knowledge impacts on the innovations. It could be thought to result in an impact in the competitiveness of the company, and at the same time in its results (Acosta Prado and Fisher 2013; Cuevas et al. 2014); nevertheless, Bernal Torres et al. (2012) mention that these activities are not related to the competitiveness of the companies, that is, there is no relationship between these variables and the improvement of the companies. This statement generates new concerns and proposals for future research in relation to the results and impacts.

As a future line of research, it is recommended to develop new research in the agricultural sector, where the relationship of knowledge management and innovation with the productivity of the companies is established, as well as to deepen the role of the family in the companies of this sector, due to the fact that a great number of family-type companies were found in the results.

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