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Article

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Economies

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Suggested Citation: Ochoa Jiménez, Sergio; Cervantes Hurtado, Gimena Vianey; Jacobo Hernández, Carlos Armando; Flores López, José Guadalupe (2020) : Knowledge and innovation in Mexican agricultural organizations, *Economies*, ISSN 2227-7099, MDPI, Basel, Vol. 8, Iss. 4, pp. 1-12,
<https://doi.org/10.3390/economies8040103>

This Version is available at:

<https://hdl.handle.net/10419/257152>

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Article

Knowledge and Innovation in Mexican Agricultural Organizations

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Received: 24 September 2020; Accepted: 11 November 2020; Published: 20 November 2020



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.

Author Contributions: S.O.J.: Formal analysis, funding acquisition, investigation, methodology, project administration, validation, writing—review and editing. G.V.C.H.: Data curation, software, formal analysis, investigation, methodology, validation, writing—original draft and editing. C.A.J.H.: Formal analysis, methodology, validation, writing—review and editing. J.G.F.L.: Methodology, validation, writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: The APC was funded by the Program for Strengthening Educational Excellence (PROFEXCE), Program for Promotion and Support of Research (PROFAPI) of the Sonora Institute of Technology (ITSON).

Conflicts of Interest: The authors declare no conflict of interest.

References

- Abebe, Gumataw K., Jos Bijman, Stefano Pascucci, and Onno Omta. 2013. Adoption of Improved Potato Varieties in Ethiopia: The Role of Agricultural Knowledge and Innovation System and Smallholder Farmers’ Quality Assessment. *Agricultural Systems* 122: 22–32. [[CrossRef](#)]

- Acosta Prado, Julio C., and André Luiz Fisher. 2013. Condiciones de la gestión del conocimiento, capacidad de innovación y resultados empresariales. *Un modelo explicativo. Pensamiento y Gestión*, 25–63. Available online: <http://rcientificas.uninorte.edu.co/index.php/pensamiento/article/view/6104/> (accessed on 15 October 2019).
- Adolwa, Ivan S., Stefan Schwarze, Nikolaus Schareika, and Andreas Buerkert. 2017. A Comparative Analysis of Agricultural Knowledge and Innovation Systems in Kenya and Ghana: Sustainable Agricultural Intensification in the Rural—Urban Interface Alliance for a Green Revolution in Africa. *Agriculture and Human Values* 34: 453–72. [CrossRef]
- Alavi, Maryam, and Dorothy E. Leidner. 2001. Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly* 25: 107. [CrossRef]
- Alegre Vidal, Joaquín, and Rafael Lapiedra Alcamí. 2005. Gestión del conocimiento y desempeño innovador: Un estudio del papel mediador del repertorio de competencias distintivas. *Cuadernos de Economía y Dirección de la Empresa* 23: 117–38. Available online: <https://dialnet.unirioja.es/servlet/articulo?codigo=2162933> (accessed on 20 November 2019).
- Aranda Gutiérrez, Heriberto, Martha L. De la Fuente Martínez, and María N. Becerra Reza. 2010. Propuesta metodológica para evaluar la gestión de la innovación tecnológica (GIT) en pequeñas y medianas empresas (PYMES). *Revista Mexicana de Agronegocios* 14: 226–38. Available online: <https://www.redalyc.org/pdf/141/14111976008.pdf> (accessed on 20 February 2020).
- Arias Pérez, José E. 2012. Asociaciones entre madurez de gestión del conocimiento y desempeño innovador: Organización y personas, e interpretación. *Revista Lasallista de Investigación* 9: 86–95. Available online: <https://www.redalyc.org/pdf/695/69524955004.pdf> (accessed on 6 April 2020).
- Armenteros Acosta, María del C., Manuel Medina Elizondo, Laura L. Ballesteros Medina, and Víctor Molina Morejón. 2012. Las prácticas de gestión de la innovación en las micro, pequeñas y medianas empresas: Resultados del estudio de campo en Piedras Negras Coahuila, México. *Revista Internacional Administración & Finanzas* 5: 29–50. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1954074 (accessed on 25 March 2020).
- Auletta, Nunzia, and Edwin Ojeda. 2014. Desafíos de la Innovación Empresarial en América Latina. *Debates IESA* 19: 10–14. Available online: <http://virtual.iesa.edu.ve/servicios/wordpress/?p=2849> (accessed on 12 January 2020).
- Bellinza, Mateo, Norma Guerrero Barrera, Sandra Colon Sirtori, and Wendy Ramírez Mercado. 2011. Gestión del conocimiento: Aproximaciones teóricas. *Clío América* 5: 257–71. Available online: <https://dialnet.unirioja.es/servlet/articulo?codigo=5114804> (accessed on 25 April 2020).
- Bernal Torres, César A., Germán Fracica Naranjo, and José S. Frost González. 2012. Análisis de la relación entre la innovación y la gestión del conocimiento con la competitividad empresarial en una muestra de empresas en la ciudad de Bogotá. *Estudios Gerenciales* 28: 303–15. Available online: <https://dialnet.unirioja.es/servlet/articulo?codigo=5444934> (accessed on 19 February 2020). [CrossRef]
- Boisier, Sergio. 2001. Sociedad del conocimiento, conocimiento social y gestión territorial. *Interações—Revista Internacional de Desenvolvimento Local* 2: 60–94. [CrossRef]
- Bueno Campos, Eduardo. 2002. El capital social en el nuevo enfoque del capital intelectual de las organizacionales. *Revista de Psicología del Trabajo y de las Organizaciones* 18: 157–76. Available online: <https://journals.copmadrid.org/jwop/art/8e82ab7243b7c66d768f1b8ce1c967eb> (accessed on 23 September 2020).
- Bustelo Ruesta, Carlota, and Raquel Amarilla Iglesias. 2001. Gestión del conocimiento y gestión de la información. *Revista PH del Instituto Andaluz de Patrimonio Histórico* 9: 226–30. [CrossRef]
- Chenu, Claire, Denis A. Angers, Pierre Barré, Delphine Derrien, and Dominique Arrouays. 2018. Soil & Tillage Research Increasing Organic Stocks in Agricultural Soils: Knowledge Gaps and Potential Innovations. *Soil & Tillage Research* 188: 41–52. [CrossRef]
- Contreras, Fortunato, and Pedro Leonardo Tito Huamani. 2013. *La Gestión del Conocimiento y las Políticas Públicas*. Lima: Universidad María Auxiliadora. Available online: <http://repositorio.uma.edu.pe/handle/UMA/111> (accessed on 20 August 2020).
- Cronbach, Lee J. 1951. Coefficient alpha and the internal structure of tests. *Psychometrika* 16: 297–334. [CrossRef]
- Cruz, Moritz, and Mayrén Polanco. 2014. El sector primario y el estancamiento económico en México. *Problemas del Desarrollo* 45: 9–33. [CrossRef]
- Cruz Reyes, Rafael. 2012. La gestión del conocimiento y la innovación en servicios de telecomunicaciones en las empresas de México. *Innovaciones de Negocios* 8. Available online: <http://revistainnovaciones.uanl.mx/index.php/revin/article/view/119/113> (accessed on 11 November 2020).

- Cuevas, Héctor, Jorge Rangel, and Octavio Hernández. 2014. La influencia de las actividades de innovación y la gestión del conocimiento en la competitividad de las PyMES manufactureras: Un estudio empírico. In *Desarrollo Económico en el Crecimiento Empresarial, Tópicos Selectos de Riesgo*. Edited by M. Ramos y M. Solís. Ciudad de México: ECORFAN. Available online: https://www.ecorfan.org/series/riesgos/Serie_Topicos%20selectos%20de%20Riesgos_5.pdf (accessed on 19 May 2020).
- Dalkir, Kimiz. 2011. *Knowledge Management in Theory and Practice*, 2nd ed. Cambridge: MIT Press. Available online: <https://dianabarbosa.files.wordpress.com/2009/03/knowledge-management-kimiz-dalkir.pdf> (accessed on 31 October 2019).
- De Freitas, Vidalina, and Yáber Guillermo. 2014. Modelo holístico de sistema de gestión del conocimiento para las instituciones de educación superior. *Enlace Revista Venezolana de Información, Tecnología y Conocimiento* 11: 4. Available online: <https://www.redalyc.org/pdf/823/82332932007.pdf> (accessed on 24 January 2020).
- de López, Alba M. Guerrero Spínola. 2011. Innovación: Clave para el éxito de la gestión empresarial en la micro, pequeña y mediana empresa. *Revista Nacional de Administración* 2: 61–80. [CrossRef]
- Delgado Verde, Miriam, Gregorio Martín de Castro, José E. Navas López, and Jorge Cruz González. 2013. Capital social, capital intelectual e innovación de producto. *Evidencia empírica en sectores manufactureros intensivos en tecnología. Innovar* 23: 93–110. Available online: <https://www.redalyc.org/pdf/818/81828692008.pdf> (accessed on 14 August 2019).
- Díaz, Díaz Nieves Lidia, Inmaculada Aguiar Díaz, and Petra De Saá Pérez. 2006. El conocimiento organizativo tecnológico y la capacidad de innovación: Evidencia para la empresa industrial española. *Cuadernos de Economía y Dirección de la Empresa* 27: 33–59. Available online: <https://www.redalyc.org/pdf/807/80702702.pdf> (accessed on 23 May 2020).
- Drucker, Peter F. 2008. La disciplina de la innovación. *Harvard Business Review* 82: 3–7. Available online: <http://s017.sela.org/media/2366647/r-la-disciplina-de-la-innovacion.pdf> (accessed on 10 December 2019).
- Estébanez, María Elina, Gabriela Sued, and Magalí Turkenich. 2016. Género e Innovación en la Producción Agrícola de Baja Escala Género e Inovação Na Produção Agrícola de Baixa Escala Gender and Innovation in Small-Scale Farming. *Revista CTS* 11: 217–46. Available online: <https://www.redalyc.org/pdf/924/92443623010.pdf> (accessed on 29 September 2020).
- Estrada, Salvador, and Gabriela Dutrenit. 2007. Gestión del conocimiento en pymes y desempeño competitivo. *Engevista* 9. [CrossRef]
- Fáziková, Mária, and Katarína Melichová. 2014. The Problems of Knowledge Economy and Innovation Processes in Agriculture Case Study of the Nitra Region. *Acta Regionalia et Environmentalica* 11: 24–29. [CrossRef]
- Moreno, Eréndira Fierro, and Patricia Mercado Salgado. 2011. Innovación organizativa y gestión de conocimiento en hospitales públicos en el Estado de México. *Estudios Gerenciales* 28: 109–23. Available online: <https://www.redalyc.org/pdf/212/21225840007.pdf> (accessed on 11 March 2020).
- Flores Caicedo, Julio C. 2010. La Gestión del conocimiento y las herramientas colaborativas: Una alternativa de aplicación en Instituciones de educación superior. *Revista de Investigación* 34: 11–31. Available online: <https://www.redalyc.org/pdf/3761/376140386001.pdf> (accessed on 11 September 2019).
- Frías Navarro, Dolores. 2014. Apuntes de SPSS. *Universidad de Valencia*. Available online: www.uv.es/friasnav/ApuntesSPSS.Pdf (accessed on 14 February 2020).
- Gálvez Albarracín, Edgar J., and Domingo García Pérez de Lema. 2012. Impacto de la innovación sobre el rendimiento de la mipyme: Un estudio empírico en Colombia. *Estudios Gerenciales* 28. Available online: <http://www.scielo.org.co/pdf/eg/v28n122/v28n122a02.pdf> (accessed on 3 March 2020).
- García del Junco, Julio, and George Dutschke. 2007. Las organizaciones con capacidad de aprendizaje: A propósito de una revisión de la literatura. *ACIMED*. 16. Available online: http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S1024-94352007001100005&lng=es&nrm=iso (accessed on 27 March 2020).
- García González, Fernando. 2012. Concepto sobre Innovación contribución al análisis PEST (política, economía, sociedad, tecnología). *Plan estratégico 2013–2020. Asociación Colombiana de Facultades de Ingeniería*. Available online: http://www.acofi.edu.co/wp-content/uploads/2013/08/DOC_PE_Conceptos_Innovacion.pdf (accessed on 1 March 2020).
- Gil Ruiz, Antonio M., Gorka Varela Azcue, and Armando González Díez. 2008. *Guía Práctica para Abordar la Innovación y su Gestión en las Empresas de Sector de la Edificación Residencial*. Éibar: Fundación Tekniker. Available online: http://www.euskadi.eus/contenidos/informacion/guia_innova/es_innova/adjuntos/tomo1cast.pdf (accessed on 14 February 2020).

- Hanke, John E., and Dean W. Wichern. 2006. *Pronósticos en los Negocios*. Octava Edición. Ciudad de México: Pearson Educación. Available online: <https://es.scribd.com/doc/307056273/Pronosticos-en-Los-Negocios-John-E-Hanke-y-Dean-W-Wichern> (accessed on 21 April 2020).
- Hassen, Tarek Ben, and Hamid El Bilali. 2020. Knowledge and Innovation in Agriculture: Contribution to Food Security and Sustainability. In *Encyclopedia of the UN Sustainable Development Goals*. Edited by Pinar Gökçin Özüyar, Tony Wall Walter Leal Filho, Anabela Marisa Azul and Luciana Brandli. Cham: Springer, pp. 457–67. [CrossRef]
- Iglesias Durán, Raúl. 2014. La innovación como elemento clave de competitividad empresarial. *Revista de Estudios Económicos y Empresariales* 26: 75–94. Available online: <https://core.ac.uk/download/pdf/72046045.pdf> (accessed on 28 February 2020).
- Instituto Nacional de Estadística y Geografía (INEGI). 2016. Estimación Oportuna del PIB Trimestral al cuarto Trimestre de 2016. Available online: <http://www.inegi.org.mx/est/contenidos/proyectos/cn/pibo/default.aspx> (accessed on 23 April 2020).
- Instituto Nacional de Estadística y Geografía (INEGI). 2017. Indicador Trimestral de la Actividad Económica Estatal. Cuentas Nacionales, Sonora. Available online: <http://www.inegi.org.mx/sistemas/bie/CuadrosEstadisticos/GeneraCuadro.aspx?s=est&nc=1564&e=26&c=30214> (accessed on 30 March 2020).
- Jiggins, Janice, Ray Ison, and Niels Roling. 2014. Innovation toward sustainable agriculture introduction. *Outlook on Agriculture* 43: 145–47. [CrossRef]
- Klerkx, Laurens, and Cees Leeuwis. 2008. Matching Demand and Supply in the Agricultural Knowledge Infrastructure: Experiences with Innovation Intermediaries. *Food Policy* 33: 260–76. [CrossRef]
- Klerkx, Laurens, Marc Schut, Cees Leeuwis, and Catherine Kilelu. 2012. Advances in Knowledge Brokering in the Agricultural Sector: Towards Innovation System Facilitation. *IDS Bulletin* 43: 53–60. Available online: <https://core.ac.uk/download/pdf/43538567.pdf> (accessed on 26 September 2020). [CrossRef]
- León Santos, Magda, Gloria Ponjuán Dante, and Mahyvin Rodríguez Calvo. 2006. Procesos estratégicos de la gestión del conocimiento. *ACIMED* 14. Available online: http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S1024-94352006000200008&lng=es&nrm=iso (accessed on 17 March 2020).
- Loggiolice Lattuf, Zuleyma. 2014. *Gestión del Conocimiento para las Agencias de Viajes*. Letonia: Dictus Publishing.
- Lovera Aguilar, María I. 2009. La organización creadora de conocimiento: Una perspectiva teórica. *Omnia* 15: 178–93. Available online: <https://www.redalyc.org/pdf/737/73711658012.pdf> (accessed on 14 February 2020).
- Marulanda Echeverry, Carlos Eduardo, López Trujillo Marcelo, and Mejía Giraldo Marcelo. 2013. Análisis de la gestión del conocimiento en pymes de Colombia. *Revista Gerencia Tecnológica Informática* 12: 33–44. Available online: <https://dialnet.unirioja.es/servlet/articulo?codigo=4546794> (accessed on 27 November 2019).
- Mircea, Adrian Grigoraş. 2008. Integrating Local Knowledge and Local Innovation with Development Policies for a Sustainable Agriculture. *Journal of Central European Agriculture* 9: 635–40. [CrossRef]
- Nieves Lahaba, Yadira, and Magda León Santos. 2001. La gestión del conocimiento: Una nueva perspectiva en la gerencia de las organizaciones. *ACIMED* 9: 121–26. Available online: http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S1024-94352001000200004 (accessed on 24 April 2020).
- Nonaka, Ikujiro, and Hirotaka Takeuchi. 1999. *La Organización Creadora de Conocimiento: Cómo las Compañías Japonesas Crean la Dinámica de la Innovación*. Ciudad de México: Oxford University Press. Available online: https://eva.fcs.edu.uy/pluginfile.php/86017/mod_resource/content/1/Nonaka%20y%20Takeuchi_cap%203.pdf (accessed on 27 March 2020).
- O'Flynn, Patricia. 2017. *From Knowledge to Invention: Exploring User Innovation in Irish Agriculture*. Milton Keynes: The Open University. Available online: <https://t-stor.teagasc.ie/handle/11019/1521> (accessed on 25 September 2020).
- Ochoa, Ruiz Josefina, Elva L. Parada Ruiz, and María L. Verdugo Tapia. 2012. La gestión del conocimiento como factor de competitividad en las pequeñas y medianas empresas. *Revista de Investigación en Ciencias y Administración* 7. Available online: <https://inceptum.umich.mx/index.php/inceptum/article/view/245> (accessed on 20 March 2020).
- Ojeda López, Ruth N., Jennifer Mul Encalada, and Olivia Jiménez Diez. 2012. Gestión del conocimiento e innovación en empresas del sector servicios en Yucatán, México. *Global Conference on Business & Finance Proceedings* 7. Available online: <http://eprints.uanl.mx/6150/1/6.%20ISSN-1931-0285-V7-N2-2012%20Costa%20Rica.pdf#page=1100> (accessed on 25 April 2020).

- Ollivier Fierro, Juan Oscar, and Ana Ordóñez Parada. 2013. La influencia de la Gestión del Conocimiento en la Innovación en Empresas Mexicanas. *XVIII Congreso Internacional de Contaduría, Administración e Informática*. Available online: <http://132.248.164.227/congreso/docs/xviii/docs/2.08.pdf> (accessed on 26 February 2020).
- Ordoñez De Pablos, P. 2001. La gestión del conocimiento como base para el logro de una ventaja competitiva sostenible: La organización occidental versus japonesa. *Investigaciones Europeas de Dirección y economía de la Empresa* 7: 91–108. Available online: <https://dialnet.unirioja.es/descarga/articulo/206171.pdf> (accessed on 5 February 2020).
- Osorio Núñez, Maritza. 2003. El capital intelectual en la gestión del conocimiento. *ACIMED* 11. Available online: <http://eprints.rclis.org/5038/> (accessed on 16 March 2020).
- Palacios Fierro, Andrés, Patricio Arévalo Chávez, and Jorge G. Lan. 2017. Tipología de la Innovación Empresarial según Manual de Oslo. *CienciAmérica* 6: 97–102. Available online: <http://cienciamerica.uti.edu.ec/openjournal/index.php/uti/article/view/76> (accessed on 11 February 2020).
- Pascucci, Stefano. 2011. The Effects of Changing Regional Agricultural Knowledge and Innovation System on Italian Farmers Strategies. *Agricultural Systems* 104: 746–54. [CrossRef]
- Ponce Álvarez, Ana A. 2009. Fundamentos de la gestión del conocimiento. *Revista Contribuciones a las Ciencias Sociales*. Available online: <https://www.eumed.net/rev/ccss/06/aapa.htm> (accessed on 21 January 2020).
- Revilla Gutiérrez, Elena. 2001. *Innovación Tecnológica. Ideas Básicas*. Madrid: Fundación Cotec. Available online: <https://studylib.es/doc/5404893/innovaci%C3%B3n-tecnol%C3%B3gica.-ideas-b%C3%A1sicas> (accessed on 19 February 2020).
- Rijswijk, Kelly, Laurens Klerkx, and James A. Turner. 2019. Digitalisation in the New Zealand Agricultural Knowledge and Innovation System: Initial Understandings and Emerging Organisational Responses to Digital Agriculture. *NJAS—Wageningen Journal of Life Sciences* 90–91: 100313. [CrossRef]
- Rodríguez Gómez, David. 2006. Modelos para la creación y gestión del conocimiento: Una aproximación teórica. *Educar* 37: 25–39. Available online: <https://ddd.uab.cat/pub/educar/0211819Xn37/0211819Xn37p25.pdf> (accessed on 9 March 2020).
- Ruiz Porras, Antonio, and Juan C. Zagaceta García. 2016. La innovación en las empresas mexicanas de servicios: Un análisis a nivel de sectores, subsectores y ramas económicas. *Análisis Económico* 31: 29–45. Available online: <https://www.redalyc.org/pdf/413/41344590003.pdf> (accessed on 13 March 2020).
- Saíz Álvarez, José Manuel. 2013. Ética, capital intelectual y gestión del conocimiento. *Revista Escuela de Administración de Negocios* 73: 44–58. Available online: <http://www.scielo.org.co/pdf/ean/n73/n73a04.pdf> (accessed on 18 December 2019).
- Sánchez Díaz, Marlerly. 2005. Breve inventario de los modelos para la gestión del conocimiento en las organizaciones. *ACIMED* 13. Available online: http://scielo.sld.cu/scielo.php?pid=S1024-94352005000600006&script=sci_abstract&tlng=es (accessed on 17 February 2020).
- Shiferaw, Bekele A., Julius Okello, and Ratna V. Reddy. 2009. Adoption and Adaptation of Natural Resource Management Innovations in Smallholder Agriculture: Reflections on Key Lessons and Best Practices. *Environment, Development and Sustainability* 11: 601–19. [CrossRef]
- Suárez, J., and P. Escorsa. 2001. Consideraciones sobre la interrelación entre la gestión del conocimiento y la gestión de la innovación. *Pastos y Forrajes* 24. Available online: <https://payfo.ihatuey.cu/index.php?journal=pasto&page=article&op=view&path%5B%5D=915> (accessed on 10 April 2020).
- Tarí Guilló, Juan J., and Mariano García Fernández. 2013. ¿Puede la gestión del conocimiento influir en los resultados empresariales? *Cuaderno de Gestión* 13. [CrossRef]
- Tello, Mario. 2016. Productividad, Capacidad Tecnológica y de Innovación y Difusión Tecnológica En La Agricultura Comercial Moderna En El Perú: Un Análisis Exploratorio Regional. *Economía* 33: 103–44. [CrossRef]
- Tinoco Gómez, Oscar R., Julio A. Salas Bacalla, and Félix E. Tinoco Ángeles. 2014. Gestión del conocimiento y su incidencia en la competitividad empresarial de las Mypes del sector textil y de confecciones en Lima Metropolitana. *Theorēma* 1: 16–70. Available online: <https://revistasinvestigacion.unmsm.edu.pe/index.php/Theo/article/view/11949> (accessed on 14 April 2020).
- Valencia Bonilla, María B., Marisleidy Alba Cabañas, and Katy C. Herrera Lemus. 2016. La gestión del conocimiento y su relación con la innovación y la mejora continua en modelos de gestión. *Cofin Habana* 10: 101–12. Available online: http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S2073-60612016000100008&lng=pt&nrm=iso (accessed on 20 April 2020).

- Varela Villegas, Rodrigo. 2008. *Innovación Empresarial: Arte y Ciencia en la Creación de Empresas*, 3rd ed. Bogotá: Pearson Colombia. Available online: <https://jhonatanmorenodelacruz.jimdo.com/app/download/13123776030/231047690-Innovacion-Empresarial.pdf?t=1459720725> (accessed on 20 April 2020).
- Vargas-Canales, Juan Manuel, María Isabel Palacios-Rangel, Jorge Aguilar-Ávila, Joaquín Huitzilihuitl Camacho-Vera, Jorge Gustavo Ocampo-Ledesma, and Sergio Ernesto Medina-Cuellar. 2018. Efficiency of Small Enterprises of Protected Agriculture in the Adoption of Innovations in Mexico. *Estudios Gerenciales* 34: 52–62. [[CrossRef](#)]
- Wiig, Karl M. 1997. Knowledge management: Where did it come from and where will it go? *Expert Systems with Applications* 13: 1–14. [[CrossRef](#)]
- Zahran, Yehia, Hazem S. Kassem, Shimaa M. Naba, and Bader Alhafi Alotaibi. 2020. Shifting from Fragmentation to Integration: A Proposed Framework for Strengthening Agricultural Knowledge and Innovation System in Egypt. *Sustainability* 12: 5131. [[CrossRef](#)]

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