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Quality, knowledge, and innovation of manufacturing processes in Ciudad Juárez, Mexico

Calidad, conocimiento e innovación de procesos de manufactura en Ciudad Juárez, México

Dr. Ulises Mendoza-Arvizo is a professor and researcher at the Autonomous University of Ciudad Juárez (México) (ulises.mendoza@uacj.mx) (https://orcid.org/0000-0003-2980-6449)

Dra. Fany Thelma Solís-Rodríguez is a professor and researcher at the Autonomous University of Ciudad Juárez (México) (fany.solis@uacj.mx) (https://orcid.org/0000-0003-2147-9826)

Abstract

Quality consists of the standardization of manufacturing processes, the establishment of controls in operations and continuous improvement, in turn, knowledge promotes process innovation, so the constant learning in companies allows them to stay competitive in the market. The objective of this research is to determine the relationship of significance between quality and knowledge in the innovation of production processes in the manufacturing industry in Ciudad Juarez, Mexico. The study was correlational, cross-sectional with a quantitative approach using the factor analysis method and the modeling of structural equations using the survey technique. The sample was 236 valid questionnaires applied in 30 industrial companies in the maquiladora sector in the locality. The results of the convergent validity test showed that the variables are correlated and that according to the values of the average variance extracted the correlation is strong, likewise with the indicators of goodness-of-fit was obtained the degree to which the model predicts the correlations, in this case, what is observed in the data corresponds to some extent to what was proposed in the model. The relationship between quality, knowledge and innovations is positive and significant, so the research hypothesis is not rejected. Strategies implemented to improve quality and manage knowledge have a positive effect on the development of process innovations.

Resumen

La calidad consiste en la estandarización de los procesos de manufactura, el establecimiento de controles en las operaciones y la mejora continua, a su vez el conocimiento promueve la innovación en los procesos, por lo que el constante aprendizaje en las empresas les permite mantenerse competitivas en el mercado. El objetivo de esta investigación es determinar la relación de significancia entre la calidad y el conocimiento en la innovación de los procesos de producción en la industria de manufactura en Ciudad Juárez, México. El estudio fue de tipo correlacional, transversal con enfoque cuantitativo mediante el método de análisis factorial y el modelo de ecuaciones estructurales utilizando la técnica de encuesta. La muestra fue de 236 cuestionarios válidos aplicados en 30 empresas industriales del sector maquiladora en la localidad. Los resultados de la prueba de validez convergente mostraron que las variables están correlacionadas y que conforme los valores de la varianza media extraída la correlación es fuerte. Con los indicadores de bondad de ajustes se obtuvo que lo observado en los datos corresponde con lo que se propuso en el modelo. La relación entre calidad, conocimiento e innovaciones es positiva y significativa, por lo que la hipótesis de investigación no se rechaza. Las estrategias que se implementen para mejorar la calidad y gestionar el conocimiento pueden tener un efecto positivo en el desarrollo de las innovaciones de proceso.

Keywords | palabras clave

Quality, knowledge, innovation, process, industry, manufacturing, offshoring, production.
Calidad, conocimiento, innovación, proceso, industria, manufactura, maquiladora, producción.

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1 Introduction

Of the 131 countries that make up the classification of the Global Innovation Index 2020, Mexico occupies position number 55; from upper-middle income countries, 11th place; and from Latin America, the second position after Chile (Cornell University, INSEAD and WIPO, 2020).

The foregoing shows that it is necessary to continue promoting innovation in economic activity since with it is possible to increase quality standards and the region's competitiveness. Therefore, continuous improvement in processes and products is necessary, as well as the search for factors that help generate greater innovation (García et al., 2014). In this regard, the Organization for Economic Cooperation and Development [OECD] states the following:

> What seemed like effective innovation strategies (for example, policies designed to strengthen the R&D capacity of local companies) are no longer sufficient in the current environment. The more open and global nature of innovation makes innovation policies more difficult to design and implement at the national level alone. Such challenges are further complicated by new phenomena such as global value chains and the fragmentation of production, the growing role of global corporations, and the ICT revolution. (Primo et al., 2013, p. 1)

According to Villarón et al. (2012), innovation is the creation and improvement of products and/or processes based on creative ideas; that is to say, its implementation is a complex, crucial and high-priority process for companies (Schmuck & Benke, 2020). Haro et al. (2017) maintain that innovation has to do with a change that provides something new, which can be useful for those who require it or even for the environment, which is the result of intelligent thoughts that provide a long-term benefit.

Schumpeter (1943) went so far as to affirm that innovators have control over what they have created, and this allows them to have an advantage over their competitors, which is why innovation is considered a key element in economic growth. For this reason, Maldonado-Pinto and Portilla-Barco (2020) assure that innovators or managers must be aware of the importance of innovation processes in companies and create the right environment to stimulate ideas and projects in the development of improvements and inventions.

Garcia et al. (2014) argue that one of the reasons why organizations decide to innovate is that it allows them to satisfy their customers with products of better quality, durability and price. Meanwhile, Alemayehu et al. (2020) argue that companies develop innovations because it is one of the main reasons for achieving high performance. In this way, innovation generates added value in traditional production processes due to the implementation of improvements, which results in better-elaborated products, cost reduction, and increased productivity, with which a better positioning of the company in the market can be achieved. (Fernández et al., 2013). Even Onufrey and Bergek (2020) comment that innovation is the response of companies to technological changes and commercial pressures from the industrial sector in which they operate. Thus, the sequential process of innovation begins with the knowledge and conception of a creative idea, to then follow strategies until its implementation (Hyvärinen et al., 2020).

García-Fernández (2016) points out that there are certain agents that influence innovation, among them are "strategic planning, finance, rivalry in the technology sector, size, culture, degree of collaboration" (p. 45), the author himself has focused his attention on quality and knowledge management as additional dimensions, pointing out that both foster innovation. In this regard, there are studies that relate quality to the development of new products, and even show a significant relationship between

quality and innovation (López et al., 2009). However, there are few studies that jointly address the relationship between quality, knowledge and innovation (McAdam & Leonard, 2001).

Miller and Shamsie (1996) state that innovation is an exploration strategy, since it allows resources to be directed towards improving inputs based on knowledge of the production process in the industry. Studies such as those by Paula and Silva (2017) even show that company innovation increases when there is a balance between internal investment in research and development, specialized education of human resources, and the collaboration of interest groups.

Regarding quality, in companies, the strategies on it translate into redesign or reengineering of processes to achieve a strategic positioning (González & Ortega, 2011), by virtue of the fact that quality provides new ways to improve processes and products, which is why organizations commit to continuous improvement processes (Ramos, 2018). In fact, quality is one of the strategies most used by companies to achieve sustainability and competitiveness (Hernández et al., 2017).

Quality is measured in standards and control parameters of the characteristics that a process or product must have, which are established to be effective (Sosa & Martín, 2015). Gimenez et al. (2014) note that the advantages of implementing quality strategies are: compliance with customer expectations, improvement of production processes, analysis and correction in production, as well as fostering a culture of continuous improvement. Therefore, quality and innovation are tools that companies use to improve their performance (Carranza et al., 2020).

In this regard, it is required that organizations adopt and generate an attitude of continuous change and that all departments and functional areas cooperate to improve performance, quality and cost reduction (Fajardo et al., 2012). In this sense, quality oriented towards changes and continuous improvement, as well as innovation, are strategies that companies implement to maintain their level of competitiveness (Bourke & Roper, 2017). In turn, knowledge allows companies to be in constant learning, hence Sosa and Martín (2015) suggest that its management and implementation as a strategy provides solutions and encourages continuous improvement in production processes.

In the study by Quezada-Sarmiento et al. (2019) it is pointed out that quality in companies responds to factors related to the management of products and processes, as well as a knowledge system, fluid communication and an innovation approach. Ganguly et al. (2020) highlight that knowledge comprises an integral part of the strategies of businesses and organizations, since it helps their growth and innovation in the market, with which they can obtain a competitive advantage.

Knowledge is a faculty and aptitude that is used when thinking, it consists of the interaction of an individual with reality through their senses, this information is processed with the aim of using it later (Gómez et al., 2014). In companies, knowledge management allows them to develop skills to face their competitors (González & Álvarez, 2019) and as a basis for economic growth (Villarón et al., 2012).

Knowledge management consists of planning, coordinating and controlling the information and learning that occurs within companies with daily interaction, which implies the management of three resources: talent, knowledge itself and collective experience (Pérez & Perez, 2004). This knowledge management allows the skills and talents of workers to be transformed into problem solving (Sosa & Martín, 2015).

Gomez et al. (2014), as well as Solleiro and Colin (2017) mention that it is the employees who end up perfecting and developing skills and techniques learned in daily experience until they become innovations. Therefore, if a company develops compe-

tence in knowledge management, it will be more innovative in the business environment (Rojas & Torres, 2017).

Thus, knowledge is considered as a fuel that allows the prosperity and development of companies through the dissemination of creative and innovative knowledge (Fagiolo, 2012). For this reason, Pérez and Pérez (2004) suggest that companies promote organizational processes with the aim of generating a synergistic combination to increase the capacity to innovate and process information, as well as the creative ability of people and collective knowledge. For small companies that lack a research and development department, knowledge management is also an important factor in generating innovation (Parrilli et al., 2020), as they can stand up to their competitors (Hossain, 2020).

Meanwhile, Kurniawan et al. (2020) point out that companies must improve quality through a greater exchange of knowledge in favor of factors such as the capacity for innovation. In this regard, Ganguly et al. (2019) analyzed the quality, knowledge, and capacity for innovation, and concluded that the role played by the exchange of knowledge in determining the capacity for innovation of an organization is important.

In addition, Honarpour et al. (2018) examined the relationship between total quality management [TQM] and knowledge management [KM] and its effect on process and product innovation through a survey of 190 directors of research and development units [R&D] in Malaysia, then did a structural analysis; the results revealed that there is a reciprocal relationship between total quality management and knowledge management, as well as an association with the innovation of processes and products, that is, companies are not only capable of managing their activities efficiently, they can also function effectively in innovative ways.

Quality strategies allow the standardization of production and manufacturing processes, as well as the establishment of controls in operations, thereby generating knowledge for self-learning and continuous improvement. Therefore, to respond to the challenges of competitiveness, as well as the uncertain and dynamic environment, knowledge is a factor that is capitalized for problem solving and strategy formulation, since according to Urgal et al. (2011), some studies show a positive relationship between knowledge and innovation as a result of the application of certain practices of creating and transferring.

Meanwhile, innovation causes organizational changes that allow companies to increase productivity (Camacho et al., 2020) and is related to improvements in production processes (Kim et al., 2012). Ramos (2018) argues that companies see quality, knowledge and innovations as essential activities to achieve high performance and better positioning in the industry, they are also important because they create a competitive advantage by making imitation difficult (Barasa et al., 2017).

This is how innovation in companies raises the need to identify the factors that contribute to its development, as is the case of knowledge and quality. Hence, the research question is: Is there a significant relationship between quality and knowledge in the generation of process innovations in manufacturing companies in Ciudad Juárez, Mexico? In this way, the objective of the research focused on determining the significance of the relationship between quality and knowledge in the generation of process innovations in manufacturing companies in Ciudad Juárez, Mexico.

2 Materials and method

This research is correlational, cross-sectional with a quantitative approach. Correlational because it is intended to demonstrate the significant relationship

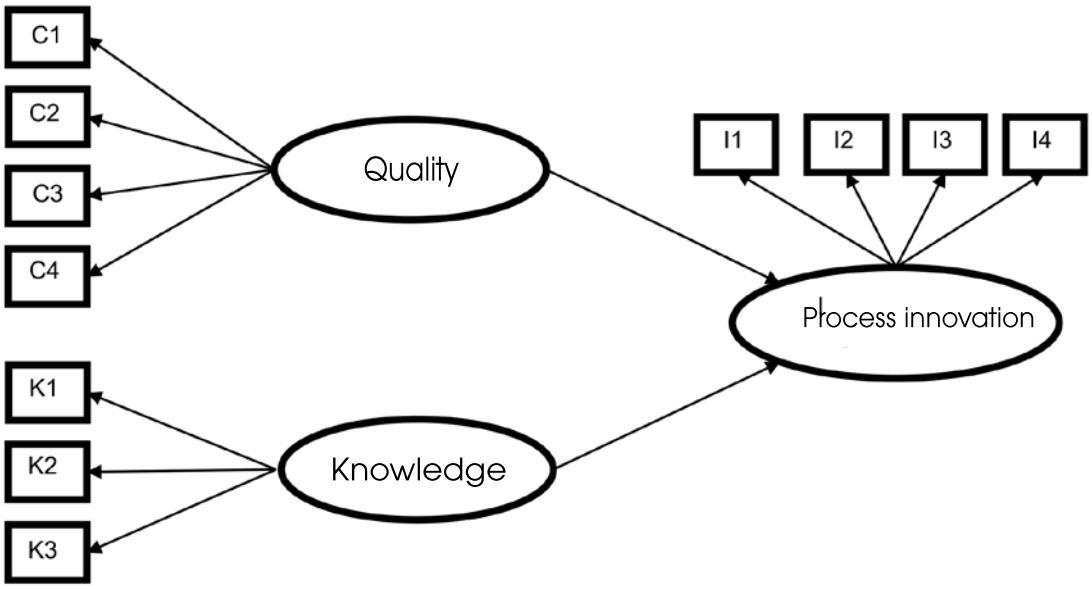
between different variables. Cross-sectional, since the information was collected on a single occasion. It is not experimental because the information is examined without altering variables and it is ex post facto because the events that have already occurred were examined.

The research element was the manufacturing industry in Ciudad Juárez, Mexico, especially the sector called *maquiladora*, which is characterized by the work of product assembly. This sector is made up of 327 factories distributed in different industrial parks in the locality, according to information provided by Index Juárez, Asociación de Maquiladoras, A.C.

The hypothesis of this research is that quality and knowledge contribute significantly to the generation of process innovations in manufacturing companies in Ciudad Juárez, Mexico. In order to contribute to the correlation analysis, a structural model was previously designed, which is included in Figure 1.

Figure 1

Structural model composed of the variables quality and knowledge, which promote process innovation in the manufacturing industry in the maquiladora sector



The data collection technique was the survey. The instrument used consisted of an 11-question questionnaire with a five-point Likert scale. The questions were divided into three sections. The first were questions related to the quality variable, which are based on the Molina-Castillo and Munuera-Aleman (2009) criteria; Jiménez-Jiménez and Sanz-Valle (2011); and Song et al. (2011). These questions address the quality policies followed by the company in the production of its products, as well as the procedures necessary to implement continuous improvement systems in a process, the use of Six Sigma, statistical process control, and other tools for quality.

In the second section, questions regarding the knowledge variable were included, according to the criteria of Jiménez-Jiménez and Sanz-Valle (2011); Chen et al. (2009) and Zhang et al. (2009), who refer to aspects related to the academic level, the technical skills of the employees, as well as the acquisition and application of knowledge for the development of innovations in the processes.

In the third section, innovation in processes is included. The questions about this variable were based on the studies by Pla-Barber and Alegre (2007); Chen et al. (2009); Jiménez-Jiménez and Sanz-Valle (2011); and Laforet (2008), these questions focus on the number of innovations in the processes that were carried out, the improvements made, the inclusion of machinery and the automation of processes, as well as questions about company data, such as the size and line of business or economic activity.

Regarding the validity of the instrument, this was carried out through a pilot test of 40 applications of the questionnaire, as suggested by Levy and Varela (2003). Cronbach's Alpha for this pilot was 0.96, which is greater than the 0.70 minimum validity index suggested by Hair et al. (2010).

Once the questionnaire was applied, the data was captured and analyzed in the Statistical Program for the Social Sciences [SPSS]. In the first stage, those questionnaires that presented missing data were eliminated, for which a total of 236 surveys were obtained. Then, to check if the sample was adequate for an Exploratory Factor Analysis [EFA], the Kaiser-Meyer-Olkin and Bartlett's sphericity tests were performed, as well as the Varimax rotation method for understanding the correlation matrix, as suggested by Levy and Varela (2003).

The measurement instrument was applied in 30 companies of the maquiladora industry in Ciudad Juárez. 250 questionnaires were obtained, of which 14 were eliminated because they were not answered completely, therefore a total of 236 valid questionnaires were obtained.

3. Results

Cronbach's Alpha index was 0.965, which indicates that the instrument was reliable because this test has to exceed the value of 0.70, which is the minimum recommended value. Likewise, the same index was determined for each variable, the results are shown in table 1.

Table 1

Cronbach's alpha by variable

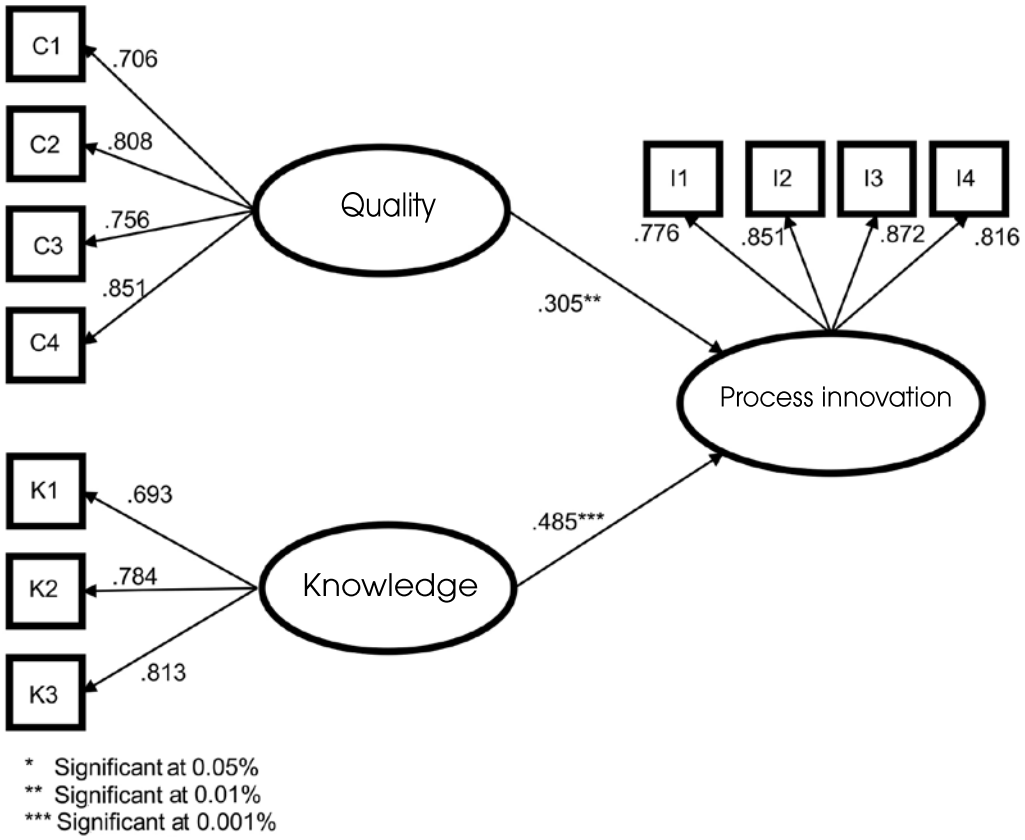
Variable	Cronbach's Alpha
Quality	0.849
Knowledge	0.819
Process innovations	0.904

Note. Cronbach's Alpha values for the independent variables of quality and knowledge, as well as the dependent variable of process innovations.

The sample adequacy test using the Kaiser, Meyer, and Oklin [KMO] coefficient was carried out, with which a significance of 0.926 was obtained, which shows that the variables are correlated in the measurement instrument, that is, the variables are grouped into the factors they belong to. Regarding Bartlett's sphericity test, a significance tending to zero was obtained, which indicates a correlation between the variables of the questionnaire without collinearity between them and a pertinent factorial analysis. Next, the structural model of the study is shown in Figure 2.

Figure 2

Structural model that includes the significance values of each component of the independent variables of quality and knowledge, as well as the correlation values with the dependent variable of process innovation and its respective components for the manufacturing industry in the maquiladora sector



With the purpose of corroborating the information, a confirmatory analysis was carried out in the AMOS program, through which the causal relationship between the study variables was established. Table 2 is included below with the convergent validity data.

Table 2

Convergent validity

Variable	Item	AVE	l	l (Average)
Quality	C1	0.611	0.706	0.78
	C2		0.808	
	C3		0.756	
	C4		0.851	
Knowledge	K1	0.585	0.693	0.772
	K2		0.784	
	K3		0.813	

Variable	Item	AVE	l	l (Average)
Process innovation	I1	0.688	0.776	0.828
	I2		0.851	
	I3		0.872	
	I4		0.816	

Note. Convergent validity shows the causal relationship between the study variables.

The convergent validity test of table 2 is used to demonstrate that the variables that belong to or are grouped in the same construct are correlated. Table 2 shows the values of the average variance extracted (AVE), which are greater than 0.5, this indicates that there is a strong correlation, as suggested by Hair et al. (2010), therefore, there is a convergent validity for the variables of the structural model.

The goodness-of-fit indicators show the degree to which the model predicts the correlations, that is, that what is observed in the data corresponds to a certain extent with what was proposed in the model. One of the indicators is the CMIN/DF, which has a value of 1.807, which means that the data support the relationships between the variables, this is because the value of this indicated is less than 4, while the indicators of Comparative fit such as NFI, CFI and TLI should have values close to 0.95.

According to the values obtained, the model is valid, since the goodness-o-fit (GFI) must have a value close to 1 to indicate that the model is well adjusted, while the corrected goodness of fit index (AGFI) is an extension of the GFI and displays the model fit and degrees of freedom. Regarding the root mean square residual of approximation (RMSEA), it must have values between 0.05 and 0.08, the value obtained in this study was 0.059, which means an approximation value of the model with the population and not with the sample.

The results show that there is a positive and significant relationship between the variables of quality and knowledge with process innovation, therefore the research hypothesis is not rejected. It is possible to assume that the strategies implemented to improve quality and manage knowledge can have a positive effect on the development of process innovations.

Knowledge positively and significantly affects the development of innovations, while this variable is favorable to the company's performance. In any case, if activities and strategies aimed at knowledge management are carried out within companies, it will promote the development of innovations and productivity.

Meanwhile, the results of the research show that quality is a preponderant and highly significant factor in the development of process innovations due to the strategies implemented for continuous improvement in manufacturing processes.

4. Discussion and conclusions

This research confirms the results of the study carried out by Quezada-Sarmiento et al. (2019) where they state that quality and knowledge are positively and significantly related to process innovation. Regarding knowledge, it coincides with the statements of Ganguly et al. (2020) by pointing out that quality, knowledge and innovation are positively related.

It should be taken into account that companies today face an intense level of competition, which requires companies to be more innovative (Gómez, 2016). Hence, it can be affirmed that the variables of quality and knowledge strengthen the process

innovation development model, that is, those companies that strategically manage quality and knowledge will have greater possibilities of facing the changing and competitive environment of the market. Therefore, as González and Álvarez (2019) suggest, knowledge is a tool that helps companies to generate strategies that cannot be imitated by their competitors, which in turn contributes to increasing their productivity (Pérez & Pérez, 2004).

This study confirms the interaction of quality and knowledge variables with respect to process innovation for development in the manufacturing industry of the maquiladora sector. The results are valid due to the statistical analysis of the information and the measurement instrument used. In this way, quality is a factor that affects production processes, thus increasing the performance of companies (Ramos, 2018), being a strategy used to achieve business sustainability (Hernández et al., 2017).

The model proposed in this research shows that knowledge and quality have an effect on the development of process innovations, since the positive and significant correlation can be increased by developing the appropriate strategies to improve performance.

The results confirm that companies must learn, apply and transfer knowledge in order to respond promptly to changes in the environment and new opportunities in the market, as it is a key factor in the development of innovations. Thus, high performance in companies requires greater training and implementation of knowledge management and quality strategies aimed at developing innovations.

Finally, it is suggested to corroborate the robustness of the model and the correlations of the constructs in other types of industry and contexts or markets, with the purpose of analyzing the behavior of the variables under study in different circumstances.

References

Alemayehu, A., Gebreeyesus, A., Palladino, G., & Setti, M. (2020). Behavioral precursors in the innovation-decision process: The case of bioenergy in Ethiopia. *Energy Strategy Reviews*, *30*(1). https://doi.org/10.1016/j.esr.2020.100499

Barasa, L., Knoben, J., Vermeulen, P., Kimuyu, P., & Kinyanjui, B. (2017). Institutions, resources, and innovation in East Africa: A firm level approach. *Research Policy*, *46*(1), 280-291. https://doi.org/10.1016/j.respol.2016.11.008

Barroso, A., Sanguino, R., & Bañegil, T. (2012). El enfoque basado en el conocimiento en las empresas familiares. *Investigación Administrativa*, *41*(109), 62-69. https://doi.org/10.35426/IAv41n109.05

Bourke, J. y Roper, S. (2017). Innovation, quality management and learning: Short-term and longer-term effects. *Research Policy*, *46*(1), 1505-1518. https://doi.org/10.1016/j.respol.2017.07.005

Camacho, R., Rivas, C., Gaspar, M., y Quiñonez, C. (2020). Innovación y tecnología educativa en el contexto actual latinoamericano. *Revista de Ciencias Sociales*, *26*(1), 460-472. https://bit.ly/3JZyg9k

Carranza, G., Garcia, M., & Sánchez, B. (2020). Activating inclusive growth in railway SMEs by workplace innovation. *Transportation Research Interdisciplinary Perspectives*, *7*(1). https://doi.org/10.1016/j.trip.2020.100193

Chen, M., Huang, M., & Cheng, Y. (2009). Measuring knowledge management performance using a competitive perspective: An empirical study. *Expert Systems with Applications*, *36*(4), 8449-8459. https://doi.org/10.1016/j.eswa.2008.10.067

Chu, L. y Hoang, D. (2020). The impact of corporate political activity on innovation in Sub-Saharan African countries: A double-edged sword. *Borsa Istanbul Review*, *20*(4), 358-374. https://doi.org/10.1016/j.bir.2020.04.004

Cornell University, INSEAD, y WIPO (2020). *The Global Innovation Index 2020: Who Will Finance Innova-*

tion? Ithaca, Fontainebleau, and Geneva. https://bit.ly/3tdjmoU

Fajardo, M., Cano, L., & Tobón, M. (2012). Impacto de la gestión de calidad en la estructura organizativa y en la innovación de la industria azucarera colombiana. *Estudios Gerenciales, 28* (No. Edición Especial), 317-338. https://doi.org/10.18046/j.estger.2012.1491

Fagiolo, M. (2012). El conocimiento como bien común. Cayapa. *Revista Venezolana de Economía Social, 12*(23), 65-83. https://bit.ly/358Zf3i

Fernández, R., Almagro, F., & Terán, J. (2013). Un análisis de la productividad total de factores ampliada en la industria manufacturera de México 2003-2010. *Investigación Administrativa, 42*(112), 51-63. https://bit.ly/3vicwkC

Ganguly, A., Talukdar, A., & Chatterjee, D. (2020). Social capital, knowledge quality, knowledge sharing, and innovation capability: An empirical study of the Indian pharmaceutical sector. *Knowledge and process management, 27*(1), 25-42. https://doi.org/10.1002/kpm.1614

Ganguly, A., Talukdar, A., & Chatterjee, D. (2019). Evaluating the role of social capital, tacit knowledge sharing, knowledge quality and reciprocity in determining innovation capability of an organization. *Journal of Knowledge Management, 23*(6), 1105-1135. https://doi.org/10.1108/JKM-03-2018-0190

García-Fernández, M. (2016). Influencia de la gestión de la calidad en los resultados de innovación a través de la gestión del conocimiento. Un estudio de casos. *INNOVAR Revista de Ciencias Administrativas y Sociales, 61*(26), 45-63. https://doi.org/10.15446/innovar.v26n61.57119

García, F., Sánchez, M., & Sevilla, J. (2014) Vínculos de conocimiento de las empresas maquiladoras del sector eléctrico electrónico en Tamaulipas, México. Caso de estudio. *Investigación Administrativa, 113*(1), 28-44. https://bit.ly/33RBwUA

Giménez, J., Jiménez, D., & Martínez, M. (2014). La gestión de calidad: importancia de la cultura organizativa para el desarrollo de variables intangibles. *Revista Europea de Dirección y Economía de la Empresa, 23*(3), 115-126. https://doi.org/10.1016/j.redee.2014.02.002

Gómez, J. (2016). El Liderazgo de aprendizaje y su incidencia en la innovación y competitividad de la MIPYMES de la ciudad de Durango, México. *Investigación Administrativa, 45*(117), 52-67. https://bit.ly/3HkwiOL

Gómez, J., Villarreal, M., & Villarreal, F. (2014). La cultura empresarial y su relación con los estilos de aprendizaje en la industria de celulosa, cartón y papel en México. *Investigación Administrativa, 43*(113), 2014, 7-27. https://bit.ly/3HovTea

González, E., & Ortega, C. (2011). La calidad en el sistema de salud. *Revista Médico Científica, 23*(1), 40-47. https://bit.ly/3BPWq36

González, J. J., & Álvarez, L. (2019). Gestión de conocimiento e innovación abierta: hacia la conformación de un modelo teórico relacional. *Revista Venezolana de Gerencia, 24* (88), 1199-1222. https://doi.org/10.37960/revista.v24i88.30173

Hair, J., Black, B., Babin, B., & Rolph, A. (2010). *Multivariate Data Analysis*. Pearson.

Haro, F. A., Córdova, N. C., & Alvarado, M.A. (2017). Importancia de la innovación y su ejecución en la estrategia empresarial. *INNOVA Research Journal, 2*(5), 88-105. https://doi.org/10.33890/innova.v2.n5.2017.167

Hernández, H., Cardona, D., & Pineda, M. (2017). Proyección estratégica de la calidad como facilitadora para la innovación en el sector salud de la ciudad de Barranquilla. *Revista Lasallista de Investigación, 14*(1), 170-178. https://doi.org/10.22507/rli.v14n1a15.

Honarpour, A., Jusoh, A., & Md Nor, K. (2018). Total quality management, knowledge management, and innovation: an empirical study in R&D units. *Total quality management & business excellence, 29*(7-8), 798-816. https://doi.org/10.1080/14783363.2016.1238760

Hossain, M. (2020). Frugal innovation: Conception, development, diffusion, and outcome. *Journal of Cleaner Production, 262*(1), 1-10. https://doi.org/10.1016/j.jclepro.2020.121456

Hyvärinen, A., Keskinen, M., & Levänen, J. (2020). Innovation process and uncertainties in resource-constrained environments: A case from the water service sector in East Africa. *Environmental Science & Policy, 114*(1), 242-252. https://doi.org/10.1016/j.envsci.2020.07.007

Jiménez-Jiménez, D., & Sanz-Valle, R. (2011). Innovation, organizational learning, and perfor-

mance. *Journal of Business Research*, *64*(4), 408-417. https://doi.org/10.1016/j.jbusres.2010.09.010

Kim, D., Kumar, V., & Kumar, U. (2012). Relationship between quality management practices and innovation. *Journal of Operations Management*, *30*(4), 295-315. https://doi.org/10.1016/j.jom.2012.02.003

Kurniawan, P., Hartati, W., Qodriah, S., & Badawi, B. (2020). From knowledge sharing to quality performance: The role of absorptive capacity, ambidexterity, and innovation capability in creative industry. *Management Science Letters*, *10*(2), 433-442.: https://doi.org/10.5267/j.msl.2019.8.027

Laforet, S. (2008). Size, strategic, and market orientation effects on innovation. *Journal of Business Research*, *61*(7), 753-764. https://doi.org/10.1016/j.jbusres.2007.08.002

Lévy, J. P., & Varela, J. (2003). *Análisis Multivariable para las Ciencias Sociales*. Pearson Educación.

López, N., Montes, J., & Vázquez, C. (2009) Are Quality and Innovation Management Conflicting Activities? *Technovation*, *29*(8), 537-545. https://doi.org/10.1016/j.technovation.2009.02.005

Maldonado-Pinto, J. E., & Portilla-Barco, L. F. (2020). Procesos de innovación en la industria manufacturera colombiana. *Revista CEA*, *6*(11), 145-163. https://doi.org/10.22430/24223182.1395

McAdam, R., & Leonard, D. (2001). Developing TQM: The knowledge management contribution. *Journal of General Management*, *26*(4), 47-61. https://doi.org/10.1177/030630700102600404

Miller, D., & Shamsie, J. (1996). The resource-based view of the firm in two environments: The Hollywood Film Studios from 1936 to 1965. *The Academy of Management Journal*, *39*(3), 519-543. https://doi-org.ezproxy.uacj.mx/10.2307/256654

Molina-Castillo, F. J., & Munuera-Aleman, J. L. (2009). The Joint impact of quality and innovativeness on short-term new product performance. *Industrial Marketing Management*, *38*(8), 984-993. https://doi.org/10.1016/j.indmarman.2008.06.001

Onufrey, K., & Bergek, A. (2020). Transformation in a mature industry: The role of business and innovation strategies. *Technovation*. https://doi.org/10.1016/j.technovation.2020.102190.

Parrilli, M. D., Balavac, M., & Radicic, D. (2020). Business innovation modes and their impact on innovation outputs: Regional variations and the nature of innovation across EU regions. *Research Policy*, *49*(8), 1-15. https://doi.org/10.1016/j.respol.2020.104047.

Paula, F.d.O., & Silva, J.F.d. (2017). Innovation performance of Italian manufacturing firms: The effect of internal and external knowledge sources. *European Journal of Innovation Management*, *20*(3), 428-445. https://doi.org/10.1108/EJIM-12-2016-0119

Pérez, A., & Pérez, I. (2004). Conocimiento, gestión e innovación tecnológica como clave del rendimiento económico. *Revista de Ciencias Sociales*, *10*(2), 338-349. https://bit.ly/3BS2jfY

Pla-Barber, J., & Alegre, J. (2007). Analyzing the link between export intensity, innovation, and firm size in a science-based industry. *International Business Review*, *16*(3), 275- 293. https://doi.org/10.1016/j.indmarman.2008.06.001

Primo, C., Padoan, P., Chandra V., & Eröcal, D. (2013). Innovación y crecimiento: En busca de una frontera en movimiento. En Dutrénit, G. *Foro Consultivo Científico y Tecnológico. A.C.*, México, D.F: OCDE. https://doi.org/10.1787/9789264208339-es

Quezada-Sarmiento, P. A., Salas, W. T., Mayancela, R., Suárez-Morales, L., Chango-Cañaveral, P. M., & Rosero-Bustos, G. (2019). Analysis of the relationship between quality management, knowledge management based on bodies knowledge and innovation in SMEs. En *2019 14th Iberian Conference on Information Systems and Technologies (CISTI)*, 1-6. IEEE. https://doi.org/10.23919/CISTI.2019.8760620

Ramos, J. (2018) Influencia del sistema de calidad e innovación tecnológica en los resultados enfocados en la mejora continua en la manufactura de transformadores de distribución y potencia. *Industrial Data*, *21*(1), 63-72. https://doi.org/10.15381/idata.v21i1.14912

Rojas, R.S., & Torres, C. L. (2017). La gestión del conocimiento basado en la teoría de Nonaka y Takeuchi. *INNOVA Research Journal*, *2*(4), 30-37. https://doi.org/10.33890/innova.v2.n4.2017.147

Schmuck, R., & Benke, M. (2020). An overview of innovation strategies and the case of Alibaba. *Procedia Manufacturing*, *51*(1-3), 1259-1266. https://doi.org/10.1016/j.promfg.2020.10.176.

Schumpeter, J. (1943). *Capitalism, socialism, and democracy*. Harper and Row.

Solleiro, J. L. y Colin, H. M. (2017). Las fundaciones Produce, una innovación para la innovación. *Revista Mexicana de Agronegocios*, *41*(1), 670-683. https://bit.ly/3si8rv0

Song, M., Im, S., Bij, H., & Song, L. (2011). Does strategic planning enhance or impede innovation and firm performance? *Product Innovation Management*, *28*(4), 503-520. https://doi.org/10.1111/j.1540-5885.2011.00822.x

Sosa, Y., & Martín, M. (2015). La creación del conocimiento e innovación a través de los sistemas de calidad. Tres estudios de caso. *Economía y Sociedad*, *33*(1), 37-57. https://bit.ly/3BSJv09

Urgal, B., Quintás, M., & Arévalo, R. (2011). Conocimiento tecnológico, capacidad de innovación y desempeño innovador: el rol moderador del ambiente interno de la empresa. *Cuadernos de Economía y Dirección de la Empresa*, *14*(1), 53-66. https://doi.org/10.1016/j.cede.2011.01.004

Villarón, J., Pineda, D., & Andrade, M. (2012). Modelo que relaciona el capital intelectual y la innovación tecnológica en empresas de manufactura mexicanas. *Investigación Administrativ*a, *41*(110), 18-33. https://bit.ly/3hkNwkw

Zhang, J., Hoenig, S., Di Benedetto, A., Lancioni, R. A., & Phatak, A. (2009). What contributes to the enhanced use of customer, competition and technology knowledge for product innovation performance?: A survey of multinational industrial companies' subsidiaries operating in China. *Industrial Marketing Management*, *38*(2), 207-218. https://doi.org/10.1016/j.indmarman.2008.12.007