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Dimensions of Innovation Performance for Business Competitiveness

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Abstract

Due to the proliferation of market globalization, the acceleration of technological change, the development of new information systems and the changing environment that companies face today, the need for information is vital to ensure the permanence and growth of companies, allowing them to innovate and thus, be able to be competitive in the sector in which they operate. This is why the objective of the research presented is to analyze the impact that the dimensions of innovation in products, innovation in processes and innovation in management systems have on performance innovation. The study has a quantitative approach, applying the structural equation modeling (SEM) technique, used to test the research hypotheses and, in this way, generate contributions and strategic recommendations for the maintenance and strengthening of the business sector.

JEL classification numbers: M13.
Keywords: Innovation performance, Competitiveness, Product innovation, Process innovation, Innovation in management systems.

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1. Introduction

Over time, the importance of innovation has been highlighted as one of the strategies for the success of companies, as well as the strong relationship between innovation and employees who are empowered by the growth of the organization and who show an entrepreneurial behavior (Seshadri and Tripathy, 2006). So, innovation gains strength and is necessary to be able to stand out against the current problems that have led many companies to leave the market. Thus, innovation not only generates permanence in the market, but also encourages organizations to be competitive (García et al. 2021).

These transformations have established the notion of competitiveness, traditionally conceived as a phenomenon of an exclusively macroeconomic and sectoral nature, in crisis (Alderete and Díez, 2014). This is why, despite being a controversial issue, identifying the origin of competitiveness is something to which researchers, consultants and managers dedicate great efforts (Rubio and Aragón, 2002).

Previous research has insisted on the existence of two alternative ways to compete and develop in this new context of global capitalism: reduce costs or innovate (Alburquerque, 1997). Closely related to the most orthodox view of competitiveness, the first strategy (reducing costs) involves actions with short-lived effects and undesirable consequences at the social and environmental levels. On the other hand, the second development alternative (innovate) causes a virtuous effect on society, since it generates a greater quantity and quality of jobs, better remuneration, less pressure on natural resources and low levels of pollution (Alderete and Díez, 2014).

Therefore, the objective of our research focuses on analyzing the relationships between the main dimensions of innovation performance, taking innovation as the capabilities of product innovation, process innovation and, management systems innovation. The structure of this paper consists on four sections, first, the theoretical development and presentation of the research hypotheses, second, the section of the research methods, third, the analysis of the results, and fourth, the discussion and conclusions obtained.

2. Theory development and research hypothesis

To introduce the concept of innovation, Smith (1776), in his work entitled "An Inquiry into the Nature and Causes of the Wealth of Nations", argues that the division of labor increases the productive faculties through three ways, one being of them the invention of specific machinery since it explains that the worker focused on a certain task will try to improve the way of carrying it out and will have an incentive to invent new tools and machines for it.

In a business sense, Freeman (1982), conceptualizes innovation as the process of integrating existing technology and inventions to create or improve a product, process, or system. Therefore, innovation in an economic sense consists of the consolidation of a new product, process or improved system. Also, Dosi (1988), adds that innovation refers to the search for the discovery, experimentation, development, imitation and adoption of new products, new production processes

and new forms of organization.

A more recent concept of innovation is that provided by O'Sullivan and Dooley (2008), who describes innovation as a driver of change consisting of the application of practical tools and techniques that make large and small changes to products, processes and services, which translates into the introduction of something new for the organization that adds value to customers and contributes to the storage of company knowledge.

Zawislak et al. (2011), identifies two types of innovations, one that refers to technology-driven innovation, which, is divided into technological innovation and operations innovation, and the other is business-driven innovation, which in turn is divided into innovation management and innovation transaction. Technological innovation refers to the development of new design, new materials and new products. In addition, they include the development of new machinery, equipment and new components. And, the innovation of operations focuses on new processes, improvements in current processes, introduction of modern techniques, new layouts, among others. This allows the company to produce products with quality, efficiency and flexibility at the lowest possible cost.

Innovation is a recognized value in the business world, therefore, it is essential that it be integrated into the strategic decisions of the organization, which may include starting a new business, substantially renewing the current one, internationalizing the company, differentiate production or create market niches. These activities allow cataloging the novelties, but the result will vary depending on organizational factors such as size, sector, competitive conditions, etc. (Guzman and Martinez, 2008).

The author's Van Auken, Madrid and García (2008), carried out a study of 1091 SMEs in Spain, where the objective was to analyze the innovation and performance of manufacturing companies, using a scale to measure innovation based on the classification provided by the Association Spanish Accounting and Business Administration (AECA, 1995), divided into three dimensions, which are; innovation in products, innovation in processes and innovation in management systems, each with four measurement variables as shown in Table 3. This scale has been validated in other investigations, such as the study carried out by Gálvez (2011), with the objective of empirically verifying the relationship between the culture of intrapreneurship and innovation in companies, taking as a sample 68 MSMEs from the Colombian tourism sector.

With the above mentioned and, given that the objective of the research is to analyze the influence of the dimensions that address innovation on the performance of innovation, the following three hypotheses are proposed:

H1: The level of innovation in products positively and significantly influences the performance of innovation in companies

H2: The level of innovation in processes positively and significantly influences the performance of innovation in companies.

H3: The level of innovation in management systems positively and significantly influences the performance of innovation in companies.

It is important to highlight the existence of barriers to innovation in companies, which may be the reason for not innovating or the reason for the failure of the innovation developed, leaving the classification as follows (OCDE, 2005):

- Economic factors: excessively perceived risks, excessively high costs, lack of adequate sources of financing and the amortization period of the innovation.

- Business factors: insufficient innovation potential, lack of qualified personnel, lack of information about technology, lack of information about markets, innovation spending difficult to control, resistance to change in the company, deficiencies in the availability of external services and the lack of opportunities for cooperation, the lack of technological opportunity and the lack of infrastructure.

3. Research Method

The development of this research is under the scientific method, since it seeks to obtain relevant and reliable information to understand, verify, correct or apply knowledge (Tamayo, 2004). Since the collection of information is used to test or verify the hypotheses through the use of statistical strategies based on numerical measurement and, by using the Structural Equation Model (SEM), therefore, the analysis approach used is quantitative (Hernández et al. 2010).

The type of sample is simple random sample, with a universe of 2121 MSMEs belonging to the commerce sector in the State of Aguascalientes, México, with a margin of error of +/- 5% globally, with a confidence level of 95% (p,q=0.5) and an estimated sample size of 326 surveys, applied to randomly selected companies based on the registry of the National Statistical Directory of Economic Units (DENUE).

The survey is the method for data collection, structured by the three dimensions of performance in innovation, using the scale of the author's Van Auken et al. (2008), where the first dimension is innovation in products, the second dimension is innovation in processes, and the third dimension is innovation in management systems (Table 1). The three dimensions conformed with 5-point Likert-type response options.

Table 1: Composition of the evaluation instrument

Variable	Dimensions	Items description	Authors	Total items	Response type
Innovation performance	Product innovation	PI1-Number of products PI2-Entrepreneurial carácter PI3-Speed to enter products IPI4-Investment in products	Van Auken, Madrid-Guijarro & García (2008)	12	Likert of 5 points
	Process innovation	PR1-Number of modifications PR2-Entrepreneurial carácter PR3-Speed to enter process PR4-Investment in process			
	Innovation in management systems	MS1-Number of changes MS2-The novelty of the systems MS3-Executive Search MS4-Entrepreneurial character			

The table 1 is self-made based on Van Auken et al. (2008), shows the scale used to measure the dimensions of innovation performance, the items number and description that conformed the scale and the type of response options.

4. Main results

The first stage to proceed with the analysis of the results is to confirm the reliability of the analyzed data, for this the data reliability tests are generated and verified, since these provide the essential language of the measurement and constitute the quality index of the collection instrument (Batista-Foguet et al. 2004). As tests to confirm the reliability of the data, the Cronbach's alpha coefficient is calculated for the internal consistency of the scale based on the average of the correlations between the items, the second test is through the CRI indicator (Composite Reliability Index) and the third the Extracted Variance Index (EVI).

For the innovation performance construct, there is a Cronbach's alpha of 0.832 which corresponds to the product innovation dimension, for the process innovation

dimension there is an alpha of 0.857 and, for the systems dimension management has an alpha of 0.875. Regarding the IFC test, there are 0.840, 0.858 and 0.875 for each dimension, respectively. And, finally, the data obtained with the IVE test are 0.568, 0.602 and 0.637, respectively. Therefore, it can be concluded that the data of the innovation construct have the required reliability, obtaining three acceptable tests (Table 2).

Table 2: Data validation tests

Variable	Dimensions	(α) Cronbach alpha	Acceptability condition	CRI	Acceptability condition	EVI	Acceptability condition
Innovation performance	D1- Product innovation	0.832	Acceptable	0.840	Acceptable	0.568	Acceptable
	D2- Process innovation	0.857	Acceptable	0.858	Acceptable	0.602	Acceptable
	D3- Innovation in management systems	0.875	Acceptable	0.875	Acceptable	0.637	Acceptable

Table 2 shows the set of results obtained for each data reliability test, the Chronbach's alpha indices, the CRI test and the EVI test, as well as their acceptability condition.

Once the reliability tests of the data have been carried out, the values obtained within the studied model are presented, where a value of 0.722 corresponding to the NFI was obtained, a 0.872 of the NNFI and a value of 0.878 for the CFI index, obtaining an average of 0.824, a value that is within the range that estimates a good or normal fit. As for the RMSEA, a value of 0.041 is obtained, which indicates a very good fit of the theoretical model described in the research. And on the normed Chi-square index (S-B X2/gl), a value of 1.552 is obtained which, in the same way, indicates a good fit of the study model.

Once the adjustment of the research model has been determined, the results obtained through the application of the system of structural equations are presented to subsequently respond to the research hypotheses raised. Next, we proceed to present the standardized factor loads, the t values and the R2 determination coefficients obtained for each item that make up the three dimensions with the 12 total items that make up the innovation performance scale (Table 3).

Table 3: Factor loads, *t* and R^2 values for the dimensions of innovation performance variable

Variable	Dimensions	Items description	Standardized factor loading	Robust *t*-value	R^2
Innovation performance	D1- Product innovation	PI1	0.741	1.000	0.549
		PI2	0.774	13.325	0.599
		PI3	0.796	13.686	0.633
		PI4	0.699	12.026	0.488
	D2- Process innovation	PR1	0.766	1.000	0.587
		PR2	0.709	12.873	0.503
		PR3	0.840	15.547	0.706
		PR4	0.784	14.407	0.614
	D3- Innovation in management systems	MS1	0.771	1.000	0.595
		MS2	0.778	14.381	0.605
		MS3	0.809	15.029	0.654
		MS4	0.834	15.552	0.69

Table 3 shows that the three dimensions that frame the innovation scale have standardized factorial loads and significant t values, as well as substantial R2 determination coefficients, denoting that the items of each dimension have an adequate level of explanatory capacity towards the innovation.

In the first dimension of innovation in products, the factorial loads show that the first factor with the greatest influence on innovation performance is PI3 with a factorial load of 0.796, corresponding to the speed to introduce improvements or changes in existing products or the introduction of new products. In the second dimension, which is innovation in processes, the factorial load shows that the first factor with the greatest influence on the performance of innovation is PR3 with a factorial load of 0.840, corresponding to the speed to introduce improvements or changes in existing processes or the introduction of new processes. And, in the third dimension, innovation in management systems, the factor loads show that the factor with the greatest impact is MS4 with a load of 0.834 corresponding to the entrepreneurial character of the company to integrate improvements, changes or new management systems.

For the contrasting of the Research Hypotheses, the analysis is carried out with the Structural Equations Model (SEM), obtaining the standardized ß coefficients (Table 4), which allow inferring that the dimension of innovation in products positively and significantly influences the performance levels of the innovation with a ß coefficient of 0.861, so H1 is accepted; In the process innovation dimension, a ß coefficient of 0.915 is obtained, which allows inferring that process innovation positively and significantly affects the levels of innovation performance, therefore, H2 is accepted. And, for the third dimension, innovation in management systems, a coefficient ß 0.837 is obtained, which allows inferring that innovation in management systems positively and significantly affects innovation performance, therefore, H3 is accepted.

Table 4: ß coefficients for the dimensions of innovation performance variable

Variable	Dimensions	ß coefficients	Items description	Standardized factor loading
Innovation performance	D1- Product innovation	0.861	PI1	0.741
			PI2	0.774
			PI3	0.796
			IPI4	0.699
	D2- Process innovation	0.915	PR1	0.766
			PR2	0.709
			PR3	0.840
			PR4	0.784
	D3- Innovation in management systems	0.837	MS1	0.771
			MS2	0.778
			MS3	0.809
			MS4	0.834

Table 4 shows the data for the verification of the research hypotheses, through the System of Structural Equations (SEM), obtaining the ß coefficients for each dimension of the innovation performance measurement scale.

5. Conclusion

Based on the theoretical support and the results obtained through the analysis of results, it can be concluded that the practices of innovation in products, the practices of innovation in processes and the practices of innovation in management systems, have a positive influence. And significant in the performance levels in the innovation of the companies.

Following the theoretical basis of the dimensions that support the performance of innovation (products, processes and management systems) (Van Auken et al. 2008), we proceed to list the most relevant practices for companies to implement according to the level of impact they have in the innovation construct, as shown in the results presented in the previous section:

D1 - Product innovation: the speed in introducing any improvement, change or new product has a greater impact on the level of innovation performance, therefore, it is recommended to generate strategic, tactical and operational planning focused on achieving objectives in the estimated time, placing special emphasis in giving priority to the launch of any improvement that has been made in the existing product line or, in the launch of a new product that is added to the product line, always considering that the speed of introduction of these innovations has a greater influence on business performance goals.

D2 - Innovation in processes: in this dimension, the speed in introducing changes or improvements in the production processes (product/service), is the factor that has

the greatest impact on the level of innovation performance, for which the main recommended practice is have a schedule for the operational application of any change, improvement or new process that is going to be included in the company, in the same way encourage all the company's collaborators to generate these new ideas about changes, improvements or new processes that can optimize the resources necessary for the business process, without forgetting that, once the decision is made, priority should be given to implementing the change in the process as soon as possible.

D3 - Innovation in management systems: within this dimension, the factor with the greatest influence on the performance of innovation is the entrepreneurial nature of the company, including the possibility of making changes, improvements or the implementation of new management systems, which have the purpose of optimizing any administrative process that is applied in the business model, for which it is recommended to develop a culture of entrepreneurship in all the company's collaborators, to encourage these changes in the management systems, through training, multidisciplinary teamwork and the use of gratification systems or awards for collaborators who have generated an idea for the improvement of their area or the organization and that has been implemented in the management systems that the company has.

Although the management of innovation performance depends on several factors, as in this case, the products, processes and management systems are studied, it is important to know the entire universe of business practices that are usually used, estimate a hierarchy of selection and application of practices that have the greatest impact on the performance of innovation that allow to ensure the success and the real optimization of the company’s resources.

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