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CONCEPTUAL MODEL OF INTEGRAL INNOVATION FOR DEVELOPERS, WITHIN THE SUPPLY OF AUTO PARTS IN EMERGING COUNTRIES: A SYSTEMATIC REVIEW

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Abstract
The objective of this article is the development of a proposal for a comprehensive conceptual model of innovation for developers, within the supply of auto parts in the context of emerging economies, based on a systematic review of innovation capabilities. For this purpose, prestigious digital sources were used to collect and select related literature, taking into account global quality metrics; the results yielded a selection of 50 articles that address in depth the research constructs with updated studies, and that include both the contexts of the research objective and alternative contexts with important theoretical contributions; The results of the systematic review also clearly show a classification of internal and external factors of the organizations, which influence the dimensions of innovation capacity and developed constructs, as well as their role in a proposal that integrates them in a conceptual model for managing innovation, using the theoretical bases of open innovation and the PDCA cycle..

Key words: *Auto parts supply, Emerging economies, Innovation capabilities, Innovation management.*

JEL Classification: *O32, O36, L62*

I. INTRODUCTION

The development of new markets demands organizational capabilities such as innovation for the creation of new productive ecosystems with new solutions in products and services with the power of competition in global value chains (ProMéxico, 2018; Sulistyo, 2016). In this sense, the automotive and auto parts industry has had a growing development in emerging countries such as India, Mexico, Indonesia, Thailand or China to name a few, where production has increased in ranges ranging from 80% to 290% in the decade from 2008 to 2018, currently standing in the top ten of global vehicle production (OICA, 2019).

However, even though the introduction of vehicle assembly plants in economies like these is relatively easy, it has proven difficulty to develop the auto parts industry (Toshiyuki, 2016); since the demands of the automotive firms go beyond vehicle assembly, by transferring responsibilities such as component design and development to the auto parts supplier in these countries (Kobayashi, 2013; Parra, Pastor & Gómez, 2015; Kale, 2012). However, the response to these requirements is still not sufficient (Kobayashi, 2013; Kale, 2012; Parra, Pastor & Gómez; 2015 Gereffi & Sturgeon, 2013), since there is an inverse relationship between the speed of introduction of new vehicles demanded by automakers and the supply chain's capacity to develop new products (NPD) (Parente & Galli, 2016). This has caused that the national supply of auto parts from emerging economies is only considered for the production of low value-added products, and although the basic capabilities of the sector are maintained, the innovation capabilities are still restricted, limiting the diversification of knowledge, technological growth, and technological innovation in the absence of methodologies to manage innovation processes (Parra, Pastor & Gomez, 2015; Tovar & Morgan, 2017; Lampón, Cabanelas & Delgado, 2018; ProMéxico, 2017). Given the problems identified, the research objective is to design a conceptual model of integral innovation management, which allows the identification and management of success factors oriented towards the improvement of innovation capacities in the supply of auto parts in emerging economies, through a systematic review, since it allows the review and compilation of the most relevant published bibliography on the topic addressed, in order to place it in the perspective of the study, through theoretical and methodological approaches and the identification of the associated variables, which provide answers to new questions (Vera, 2009). The results provide theoretical bases for future research on methodologies for innovation management in contexts with similar characteristics to those addressed in this work. The following section presents the theoretical bases on innovation capabilities, open innovation and the PDCA management cycle, for the construction of the model, followed by a section describing the methodology for the development of the research; subsequently, in a section of results, a summary is presented of the main contributions on innovation

capabilities and their management identified in the works reviewed, the constructs of the proposed model and their description, as well as, the proposal for a comprehensive innovation management model for developers in the supply of auto parts, and finally, a section of conclusions.

II. THEORETICAL FOUNDATIONS ON INNOVATION CAPABILITY, OPEN INNOVATION AND THE PDCA CYCLE

The innovation capabilities of an organization consist of a business model innovation and its continuous improvement, considering four dimensions, the first being product innovation, which refers to R&D and the acceleration of innovation by integrating technology planning with business strategy; the next dimension is the innovation process, with internal and external R&D focused on quality and sustainability; as a third dimension, technological innovation related to the creation of new processes, products and markets; and service innovation oriented to the generation of new services inherent to the product (Tiengtavaj, Phimonsathienand & Fongsuwan, 2017). Additionally, market innovation is the ability to develop new products and services for the market successfully and efficiently (Chamsuk, Fongsuwan & Takala, 2017), where the level of education, the company's own experience, institutional study and development, the technical skills of the workforce and investment in training and human resource development; as well as external factors, such as financial support from governments for study and development, communication and interaction with customers, suppliers, competitors, research centers and industry associations, which are determinants in organizational innovation capabilities (Sulistyo, 2017). Therefore, as a summary, the innovation capabilities in this work refer to the capacity, talent, potential and ability to achieve innovation in the future, as well as the set of skills and patterns of skills used by organizations for the compilation and implementation of an innovation strategy that includes the creation, development and optimization of resources for innovation (Yaghoubi, et. al, 2017; Barbosa et al, 2019;).

On the other hand, the evolution of innovation models has given rise to the sixth generation models also known as open innovation (OI), and the OI criteria can be summarized as follows: the generation of the ideas, the development and evaluation of the concept, the development and implementation, the technological drive that triggers the innovation, the market drive or a combination of these, the multidisciplinary approach, the organizational and systems integration (including external collaborative networks), flatter and more flexible organizational structures (including delegated decision-making), feedback loops, service and process innovation, as well as the implementation of the product life cycle (Taferner, 2017). Likewise, open innovation practices are broken down according to the stage of New Product Development (NPD) in which they occur, so they can be either development-focused or commercialization-focused OI practices, the value of development-focused OI being strictly dependent on the level of NPD capabilities; The latter, in turn, allows the use of acquired ideas and technologies, since they determine the extent to which a technology system leverages its external resources; given the above, the levels of R&D, marketing and launch capabilities may determine the type of RO to be pursued (Rubera et. to 2016).

Finally, it should be considered that innovation is a managed process, systematized and therefore evaluable (Faherty, 2015), in which the results of the system-product-service and attention to all the interested parties are considered through the control of variables that affect the organizational management and those that operate as feedback mechanisms in the management of the innovation process (Song et al, 2014; Fernández-Ledesma & Duque, 2017; Yaghoubi et al, 2017). In this sense, the Plan-Do-Check-Act cycle (PDCA) allows an organization to ensure that its processes are adequately resourced and managed, and that opportunities for improvement are identified and acted upon (ISO 9001:2015). However, in a profound way, the PDCA cycle or also known as the Deming cycle by its main creator, is a sequence of actions in organizations, aimed at improvement; the PDCA model is extremely versatile and can be successfully used in any type of business to improve its performance, through experiences such as the implementation of change or the implementation of new solutions as part of the continuous improvement process. And although it has been used in global standards on various management models, there have been few studies on the universality of this cycle. The step "plan or plan" (P), focuses on the recognition of the possibility of change, setting objectives for improvement and designing a plan of actions to achieve these objectives. In the step "do" (D), it consists of the development of the plan in order to make the change and the implementation of the processes in the organization, in this stage it is important the understanding and support of the high management. In the step "verify or check" (C), it is the verification and evaluation of the results of the solutions introduced in the organization, according to what was planned, being crucial; since, in case of negative results, it will be necessary to return to the first step. In the step "Act or act" (A), it takes place when the solutions have already been tested, and then these are considered the norm to follow, and the activities are standardized and monitored. Finally, it is important to understand that the PDCA cycle is contained in a never-ending circle, and the knowledge gained from the change in the previous state represents the basis for the next cycle. And it is a support to overcome the internal and external barriers of the organization (Jagusiak-Kocik, 2017).

III. METODOLOGY

The systematic review carried out in this study consisted of the detection, location and selection of publications in the field of innovation capacity in the national supply of auto parts in emerging economies. For the search of the analyzed works, digital databases such as EBSCOhost, Emerald Insight, Emerald Group Publishing, Web of Science, Scopus, Scimago Journal & Country Rank and Google Scholar were used. The main search criteria included the phrases "innovation capability in auto parts supply in emerging economies", "innovation capability in auto parts supply", "innovation capability in emerging economies", "innovation capability in automotive and auto parts industry", as well as "innovation capability" and the publications are from the period 2015-2019. And as a main criterion of quality of the works, priority was given to those whose journal editor has a metric, with impact factor and its location in the quartiles of the measurement model, either Scimago Journal & Country Rank (SJR) or Journal Citation Report (JCR). The corresponding distribution of the selected works with respect to the quartiles in which the corresponding journals are located, places in the quartile 1 to 44% of the works, in the quartile 2 to 24%, in the quartile 3 to 24%, and in the quartile 4 to 4%; it is worth mentioning, that two of the selected works that do not fulfill this criterion, were considered by their theoretical contribution to the review, without neglecting the criteria of explicit relation with the topic and indexation of the journals.

IV. RESULTS

THEORETICAL CONTRIBUTIONS TO INNOVATION CAPABILITIES AND THEIR MANAGEMENT

The results of the theoretical analysis of each of the works reviewed provide the basis for the objective of this research, which is to propose the conceptual model of integral innovation for developers in the supply of auto parts. In table 1, the theoretical contributions on the innovation capabilities and their management identified in each of the studies analyzed are presented as a summary.

Table 1. Main contributions on innovation capacities and their management.

Conceptual contribution	Autor
Impact of empowerment on the innovation capacity of SMEs	Sulistyo, 2016
Influence of entrepreneurship, marketing and empowerment on innovation capabilities in SMEs	Niazi, 2017
Assessment of technological innovation capabilities	Mortazavi et al, 2016
Open innovation platform: stakeholder collaboration	Yeung et al, 2017
Competitive intelligence: marketing - sustainability - operational efficiency for SME leadership in auto parts supply	Frigant, 2016;
Idea competition in innovation models	Smith et al, 2017
Development of combinatorial knowledge for innovation capabilities throughout the supply chain	Goracinova, 2019
Linkage as a strategy for access to infrastructure for R&D and innovation	Lampón, Cabanelas & Delgado, 2018
Knowledge absorption capacity through Join Ventures	Khan, Lew & Sinkovics, 2015
Innovation as a systematized process	Faherty, 2016
Explorative and exploitative innovation	Khan, Lew & Marinova, 2018
Impact of absorption capacities and innovative culture on organizational innovation	Murad & Park, K. 2016
Eco-innovation capabilities	Potter & Graham, 2018
Innovation Ecosystem	Luo, 2017
Complexity of the innovation strategy for good performance	Van den Blink & J. L. Steyn, 2018
Relationship between disruptive innovation and dynamic capabilities	Pandit et al, 2017
Impact of trade termination capabilities on innovation capabilities	Zaefarian et al, 2017
Business start-up and termination capabilities as a key to innovation	Mitrega et al, 2017
Management variables that impact on innovation capabilities	Yaghoubi, et al, 2017
Influence of the political context on innovation	Khan, Lew & Sinkovics, 2015
Knowledge management for innovation	Abdi et al, 2018
Importance of the knowledge supply chain in innovation capabilities	Mahdavi, Akhaven & Mousavi, 2016
Impact factors in the implementation of innovation	Joshi, 2017
Supply chain technology capability	Eshraqi & Eshraqi, 2019
Strategy for innovation and the technological frontier	Intarakumnerda & Techakanontb, 2016
Open innovation strategy in the NPD process	Rubera, Chandrasekaran & Ordanini, 2016
Criteria for Open Innovation	Taferner, 2017
Quality of market intelligence for innovation	Mostaghela, 2018
Managing the benefits of participants in open innovation	Cano-Kollmann et al, 2018
Innovation in management for VUCA environments	Frynas et al, 2018
Supply chain innovation capability	Bellamy, Ghosh & Hora, 2014
Systematic innovation management (product - service system)	Song et al, 2014

Innovation management in VUCA environments	Millar, Groth & Mahon, 2018
Management of innovation in sales processes	Castro et al, 2018
Innovation management from marketing and commercialization	Fernández-Ledesma & Duque, 2016
Barriers to non-technological innovation in emerging economies	Acuna-Opazo & Castillo-Vergara, 2018
Strategic orientation, exploitation and exploration capabilities in innovation	Barbosa et al, 2019
SME collaboration for innovation	López et al, 2016
Consideration of technological capacities geographically	Pérez et al, 2017
Integration of SMEs into networks of multinational companies for innovation	Olea, 2018.
Machinery, hardware and software for technological innovation	Del Carpio & Miralles, 2019
Absorption capacity in open innovation	Zobel, 2016
Impact of clusters and competitive advantage on innovation capacity	Tiengtavaj, Phimonsathienand & Fongsuwan, 2017
R&D&I capabilities as a sustainable competitive advantage	Chamsuk, Fongsuwan & Takala, 2017
Competitive intelligence: marketing - sustainability - operational efficiency	Vidigal et al, 2018
Linking with institutions for the improvement of technological capacities in innovation	Nguyena et al, 2017
Regional links for technological capacities	Rasiah et al, 2016
Supply chain integration for innovation capabilities	Parente & Galli, 2015
Modularization of auto parts as a strategy for innovation	Sellitto, Nunes & Valadares, 2018
Innovation capacity in the face of economic recessions	Somohano, López & Martínez, 2017

Source: Own elaboration based on literature review, 2020.

CONSTRUCTS OF THE PROPOSED INNOVATION MANAGEMENT MODEL

Considering the theoretical foundations of innovation and open innovation capabilities for the sixth-generation innovation models, the constructs of the proposed model were developed, which are summarized in Table 2.

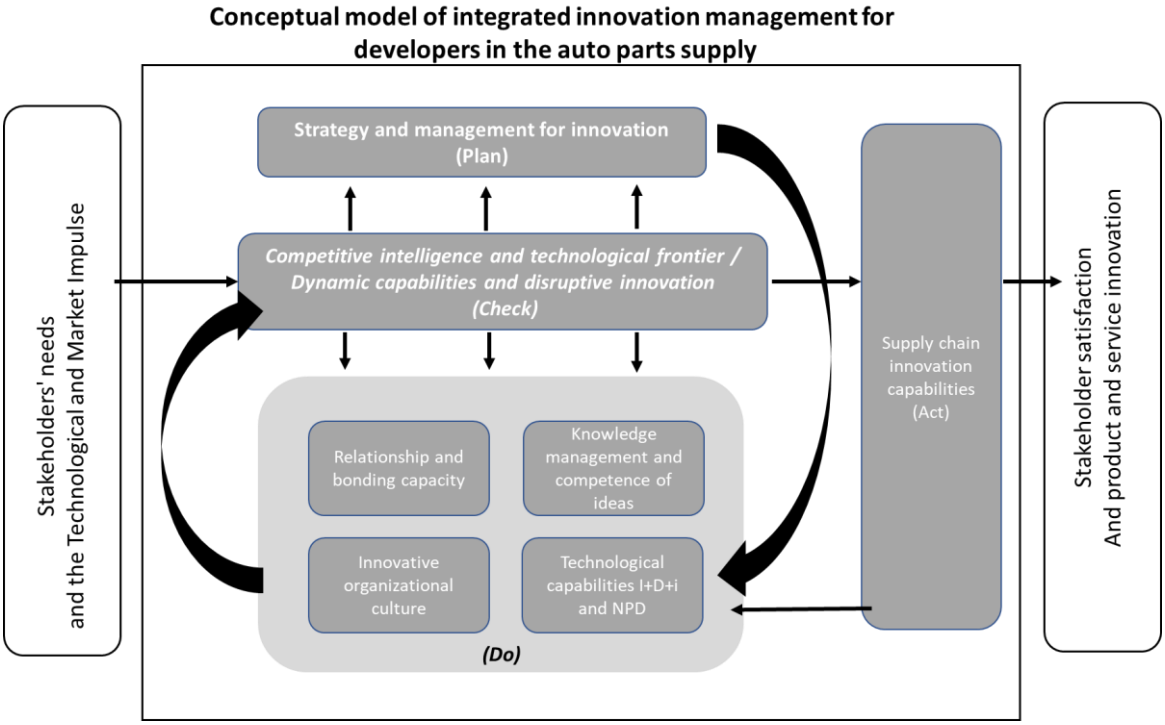
Table 2. Descriptive summary of the constructs of the innovation management model

Construct	Description	References
Innovation strategy and management	Innovation as a managed, systematized and evaluable process, which includes complex strategies and alliances, oriented to the innovation of the system-product-service, with open innovation practices as a competitive advantage.	Van den Blink & J. L. Steyn, 2018; Cano-Kollmann et al, 2018; Faherty, 2015; Barbosa et al, 2019; Taferner, 2017; Zobel, 2016; Pérez et al, 2017; Mortazavi et al, 2016; Song et al, 2014.
Supply chain innovation capability	Integration of the supply chain in clusters to increase innovation capacities and promote the modularization of auto parts, creating open innovation platforms with technological capacities, which include all the actors in the subsystem in an organized way.	Tiengtavaj, Phimonsathienand & Fongsuwan, 2017; Parente & Galli, 2015; Sellitto, Nunes & Valadares, 2018; Eshraqi & Eshraqi, 2019; Yeung et al, 2017; Bellamy, Ghosh & Hora, 2014; López et al, 2016; Olea, 2018.
R&D&I technological capabilities for NPD	R&D and technology acquisition and generation capabilities in machinery, hardware and software, in contexts of open innovation and eco-innovation in the NPD process, covering the development, implementation and release of innovation, as well as the generation of patents.	Chamsuk, Fongsuwan & Takala, 2017; Del Carpio & Miralles, 2019; Potter & Graham, 2018; Rubera, Chandrasekaran & Ordanini, 2016; Joshi, 2017.
Knowledge management and competence of ideas	Strategies for knowledge management and competence of ideas for innovation, considering learning intent, knowledge supply chain, combinatorial knowledge and joint ventures for knowledge transfer.	Abdi et al, 2018; Khan, Lew & Marinova, 2018; Smith et al, 2017; Mahdavi, Akhaven & Mousavi, 2016; Goracinova, 2019; Khan, Lew & Sinkovics, 2015).
Relationship and bonding capacity	Ability to initiate, maintain and end relationships between the actors of the auto parts supply, to strengthen their links, as well as with universities, research centers, institutions and transnational firms for R & D & I, in order to generate high-tech environments.	Mitrega et al, 2017; Zaefarian et al, 2017; Rasiah et al, 2016; Nguyena et al, 2017; Lampón, Cabanelas & Delgado, 2018.
Innovative organizational culture	The absorption capacities for innovation depend on the organizational culture, which includes factors such as empowerment, communication, entrepreneurship, relational capital, leadership, organizational structure, human resources management, as well as work climate and environment.	Murad & Park, K. 2016; Yaghoubi, et al, 2017; Sulistyo, 2016; Niazi, 2017
Technological frontier: technological and market drive	Alignment of marketing and commercial variables with those of the innovation process, as a feedback mechanism in contexts of competitive intelligence and digital capabilities, for a better performance of product innovation attached to the technological frontier that markets demand.	Fernández-Ledesma & Duque, 2016; Vidigal et al, 2018; Mostaghela, 2018; Intarakumnerda & Techakanontb, 2016; Frigant, 2016; Castro et al, 2018.
Dynamic capabilities and disruptive innovation	Functions and processes to create dynamic capabilities in VUCA environments, political context and/or economic recession, through innovation capabilities and disruptive innovation.	Pandit et al, 2017; Luo, 2017; Millar, Groth & Mahon, 2018; Frynas et al, 2018; Khan, Lew & Sinkovics, 2015; Acuna-Opazo & Castillo-Vergara, 2018; Somohano, López & Martínez, 2017.

PROPOSAL OF INTEGRAL INNOVATION MANAGEMENT MODEL FOR DEVELOPERS IN THE AUTO PARTS SUPPLY

The conceptual model of innovation proposed as a result of the present systematic review of the literature, integrates the variables, dimensions and factors that influence the innovation capacities of the organizations. In the studies analyzed on the supply of auto parts, the models for innovation proposed contribute significant findings on innovation capabilities (Pankom et al, 2016; Mahdavi et. al 2016; de Joshi 2017; Abdi et. al, 2018) showing trends towards open innovation, but only partially, so that the development of the constructs and their integration in the proposed model are based on the theory of open innovation models, and the theoretical bases of the PDCA cycle or Deming cycle.; Given the above, a model is presented that includes all the criteria to be considered in the models of open innovation (Taferner, 2017), as well as the use of a tool for management with which the managers and executives of the organizations become familiar, such as the PDCA cycle (Jagusiak-Kocik, 2017), in such a way that it provides practical support with theoretical support for the management and improvement of the innovation capabilities in the supply of auto parts in the context of emerging economies (figure 1).

Figure 1. Proposed conceptual model of innovation management.



Source: Own elaboration, 2020.

The elements of entry and exit in the model include the attention to all the interested parties, as well as the technological and market impulse, which are generated from the technological tendencies and evolution of the markets of the automotive sector, so, they are considered the key entries to the innovation process in the proposed model; and on the other hand, the results and performance of the innovation in the system, product and services, represent the exit (Song et al, 2014; Frigant, 2016).

As an initiation of the innovation process, the constructs "competitive intelligence and technological frontier" as well as that of "dynamic capabilities and disruptive innovation", are considered in the model as the foundation of the step "verify or check" (C) of the PDCA cycle and central axis of the model, so, in a different way to the traditional use of the Deming cycle, the innovation process in the proposed model begins with this step, by the function that both constructs exert as activators of the other constructs and their direct interrelation to the other elements of the model, by co-considering the control of external variables and their harmony with the variables of the innovation process, operating both as a verification and feedback mechanism, which promotes disruptive innovations aimed at adapting the product to a new consumption pattern towards the sustainability of the organization in environments of Volatility, Uncertainty, Complexity and Ambiguity (VUCA).

In the planning stage of the model, the construct "strategy and management for innovation" is considered, since innovation is a process that is managed and therefore must also be planned (Faherty, 2015), from the direct interrelation of "competitive intelligence and technological frontier" that provides external information of the technological and market impulse, in the proposed model, the construct "strategy and management for

innovation" is associated with the step of "planning or plan" (P), in which the necessary change and innovation objectives are determined; at this stage, the strategic orientation for the improvement of innovation capabilities, determines the competitive advantage and performance of innovation in the organizations.

Finally, the execution for the implementation and change is carried out in the step "do or do" (D) since for the operation of the innovation process, the constructs "Technological R&D&I capabilities for NPD", "Knowledge management and ideas competition", "Relationship and linkage capabilities" and "Innovative organizational culture" are integrated, for the direction of change and the implementation of the innovation processes, as a consequence of the direct interrelation of the construct "strategy and management for innovation", and also of the construct "competitive intelligence and technological frontier"; It is worth mentioning that the intention of integrating these four constructs in the "doing" stage is to raise the variables or factors that the auto parts supplier companies should consider in the execution of their innovation processes.

V. CONCLUSIONS

The studies found in this review on innovation capabilities in the supply of auto parts, propose variables, factors and dimensions that facilitate the improvement in innovation capabilities, and the conceptual innovation models proposed by different authors, show valuable contributions that provide knowledge about specific intra-organizational and extra-organizational factors (Pankom et al, 2016; Mahdavi et. al, 2016; Joshi, 2017; Rubera et. al, 2016), which partially contribute to the management of innovation in the same sector. In this sense, the conceptual model of innovation proposed in this work, integrates such contributions in a model that proposes a practical approach for innovation management, based on the PDCA cycle or Deming cycle; and at the same time it considers the theoretical criteria on models of open innovation or of sixth generation; in such a way, that it allows the managers of the auto parts supply company a broader knowledge in the management of innovation; and thus, be able to sustain operations of greater scale and added value, reduce the gaps between the development of new auto parts products and the launch of products in the automotive sector, and with this, attend more effectively to the functions of research and development that are transferred to them from the OEMs, representing an alternative solution in the search for improved innovation capabilities in an industrial sector that demands world-class practices, as is the case of the auto parts supplier (Vidigal, 2018),

Finally, future studies are necessary for the validation of the model's operability, through empirical studies in the field, which will allow a deep understanding of the interrelations of the model's constructs and this will broaden the scope of knowledge, as well as its contributions to other industrial sectors with similar characteristics in similar or different contexts.

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