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Technological level in the relationship between absorptive capacity and response capacity in manufacturing companies

Nível tecnológico na relação entre capacidade de absorção e capacidade de resposta em empresas de manufatura

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Abstract

Purpose: This research analyzed the influence of the acquisition, assimilation, and exploitation of knowledge on the organizational response capacity, given the moderation of the technological level in Mexican manufacturing companies.

Originality/value: A conceptual contribution of response capacity as an understanding of organizational agility is fundamentally necessary for organizations facing changing conditions to use new knowledge to achieve the objectives of the organization, employees, and shareholders. An empirical contribution from the absorptive capacity to make companies respond with innovations to environmental changes and help them develop their absorptive capacity so the opportunities and restrictions in their technological level within a company can be seen.

Design/methodology/approach: The quantitative study was conducted through a survey with a sample of 102 manufacturing companies that promoted some innovation activity in the State of Mexico, Mexico. The data were analyzed using a hierarchical regression model.

Findings: The results showed that the technological level only moderated the relationship between the assimilation of knowledge and organizational response capacity. Also, this study contributed empirically by showing that companies have the same opportunity to improve their absorptive capacity and respond to changes in the environment regardless of their technological level.

Keywords: organizational learning, absorptive capacity, response capacity, technological level, innovation

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Resumo

Objetivo: Esta pesquisa analisou a influência da aquisição, da assimilação e da exploração do conhecimento sobre a capacidade de resposta organizacional, dada a moderação do nível tecnológico nas empresas manufatureiras mexicanas.

Originalidade/valor: Uma contribuição conceitual da capacidade de resposta como compreensão da agilidade organizacional é fundamentalmente necessária para organizações que enfrentam condições de mudança para usar novos conhecimentos para atingir os objetivos da organização, funcionários e acionistas. Trata-se de uma contribuição empírica da capacidade de absorção para fazer as empresas responderem com inovações às mudanças do ambiente e ajudá-las a desenvolver sua capacidade de absorção de modo que possam ser vistas as oportunidades e restrições em seu nível tecnológico dentro de uma empresa.

Design/metodologia/abordagem: O estudo quantitativo foi realizado por meio de uma *survey* com uma amostra de 102 empresas manufatureiras que realizaram alguma atividade de inovação no Estado do México, México. Os dados foram analisados por meio de um modelo de regressão hierárquica.

Resultados: Os resultados mostraram que o nível tecnológico apenas moderou a relação entre assimilação de conhecimento e capacidade de resposta organizacional. Além disso, este estudo contribuiu empiricamente para mostrar que as empresas têm a mesma oportunidade de melhorar sua capacidade de absorção e responder às mudanças no ambiente independentemente do seu nível tecnológico.

Palavras-chave: aprendizado organizacional, capacidade de absorção, capacidade de resposta, nível tecnológico, inovação

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INTRODUCTION

From an organizational point of view, knowledge is conceived as a dynamic and continuous process in which the acquisition and integration of internal capacities can improve organizational competitiveness (Rivera-Porras, 2019).

Knowledge provides value and contributes to developing the capacity to conduct positive external practices, innovation orientation, and the breadth of a better managerial vision (Feijoo-Pardo & González-Illescas, 2020). This capacity, integrated with organizational routines and management cognition, guides the companies' directors toward a more intricate innovation environment. Thus, comprehension and improvement of organizational capacities are useful to develop and implement innovative business models that follow technological evolution and consumer demand (Teece & Linden, 2017).

According to Cohen and Levinthal (1990), knowledge participates in organizational strategy by manipulating future technological advances. These authors, who are proponents of the absorptive capacity, recognize that external knowledge, which is available in the work environment, can be used within the organization (Schweisfurth & Raasch, 2018) by transforming itself into a strong predictor of innovation and knowledge transfer (Zou et al., 2018).

Regarding internal knowledge sources, it enhances innovation to a certain extent. Afterward, this positive effect may decrease. Companies with too much internal knowledge do not obtain better innovative results since, as time goes by, they tend to enter into a stagnation process and require external knowledge sources to renew the existing ones (Saiz et al., 2018).

Based on this logic, the problem that organizations face when they acquire knowledge has been detected. They assimilate and formalize it as their know-how. Nevertheless, they do not use it for commercial purposes; they strengthen their internal processes but not well enough to meet the demands of the knowledge economy or generate innovation processes that ensure success and survival in the long term (Coll & Micó, 2018). The proper development of their dynamic capacities will lead organizations to direct this knowledge toward innovation (Vargas-Hernández & Muratalla-Bautista, 2017).

The technological advance of the company is added. Along these lines, Evangelista and Mastrostefano (2006) point out that the differences between industries in innovation activities can be explained by differences in technological levels, characterized by differences in technological opportunity or the probability of completing significant technological advances. Gumbau-

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Albert and Maudos (2013) mention differences in the benefits of innovation, differences in the degree of accumulation of technical knowledge, and differences in the accessibility of companies to scientific basis or knowledge of a sector.

Nieto and Quevedo (2005) point out that the technological level advanced at different rates and with different degrees of difficulty. It is easier to scale when companies acquire, assimilate, and exploit relevant scientific and technological knowledge of the industry to which they belong. In this sense, these authors suggest taking advantage of the technological opportunity that leads companies to respond to rapid environmental changes. In addition, technological opportunity implies the possibility of technological progress translated into the achievement of more efficient production processes, greater technological knowledge, and the learning of the personnel. However, these authors also warn that technological opportunity depends on the nature of the sector and the adaptation of technical knowledge drawn from the stock of technological opportunities.

Thus, the empirical contribution of this work was to shed light on manufacturing companies to focus on developing their absorptive capacity as a dynamic capacity that underpins their ability to respond to changing environments. Furthermore, it provided evidence of the moderating role that the technological level assumes in the relationship: assimilation of knowledge – response capacity.

Following these references, this paper aims to provide empirical evidence of companies with different technological levels that develop absorptive capacity so that they can respond to unforeseeable environments. The objective was to analyze the influence of the acquisition, assimilation, and exploitation of knowledge on the organizational response capacity, given the moderation of the technological level in Mexican manufacturing companies. The theoretical review has conceptualized absorptive capacity, response capacity, and technological level. Below, the characteristics of an explanatory quantitative study with a hierarchical regression model are presented. The research results are also described, and finally, a discussion and the conclusions are stated.

THEORETICAL FRAMEWORK AND HYPOTHESES

Absorptive capacity

Absorptive capacity has been an important topic in the last 20 years due to the researchers' interest in recognizing the value of knowledge for inno-

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vation purposes. Cohen and Levinthal (1990) deduced that absorptive capacity is the capacity that a company develops to recognize the value of new external information. It is based on the combination of valuable information obtained from the environment and the knowledge generated within the organization. This is represented by experience, shared language, interfunctional links, mental models, and ability to solve the problems of the organization's members (Camisón & Forés, 2010).

Changing environments, the speed of technological advancements, new customer demands, and rules that govern the market cause difficulties for organizations to create value for their products and services when they only resort to internal know-how. Hence, the importance of the flow of feedback between internal and external knowledge, as their combination generates an accumulation of knowledge that makes learning always greater (Camisón & Forés, 2010).

The search for adaptation to changes in the environment creates a need for companies to identify opportunities and threats to strengthen and optimize their resources and capabilities. In this sense, the flow of knowledge and organizational learning dynamics become essential (Van den Bosch et al., 1999). Dyer and Singh (1998), Todorova and Durisin (2007), and Ritala and Tidström (2014) agree that absorptive capacity is represented by a set of organizational routines and strategic processes designed to create value as a source of competitive advantage and company performance.

For Van den Bosch et al. (1999), the absorptive capacity is given by 1. the efficiency of the use of external knowledge interrelated with internal knowledge that can improve cost and economies of scale and 2. flexibility as the ability that implies the company to access additional knowledge and that reconfigures the existing one. For these authors, absorptive capacity co-evolves, encouraged by changes in stable or turbulent environments.

For companies, absorptive capacity constitutes one of the most fundamental learning processes since, even in high technological dynamism environments, the speed and frequency of innovations are improved (Van den Bosch et al., 1999). When companies accumulate this absorptive capacity, they stimulate and manage external knowledge in a more efficient way. They allocate more investment in internal and external research and development (R&D) with a strategic vision (Murovec & Prodan, 2009). When companies perceive changes in their environment, they generate innovations with the absorptive capacity of new external knowledge (Engelman et al., 2017). Their results are products or innovation processes, which reflect the evolution of their strategic analysis and the impulse of such factors, which contribute to generating sustainable competitive advantages (Feijoo-Pardo & González-Illescas, 2020).

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Absorptive capacity occurs through the acquisition, assimilation, and exploitation of external knowledge, which is used to predict future technological advances and take advantage of emerging opportunities before their rivals recognize them (Cohen & Levinthal, 1990). These three dimensions complement each other when they operate holistically as they are aimed at achieving a competitive edge (Elizalde Bobadilla et al., 2019). In this way, absorptive capacity dimensions have the particularity to provide feedback among each other since the higher their internal capacities, the better the opportunities to access new knowledge and incorporate it successfully into the productive structure.

Absorptive capacity and response capacity

Companies opt for new styles and ways to manage their complexity. Their learning capacity to survive in a challenging environment will depend on their organizational capacity. Absorptive capacity as a combination of dynamic capacities includes the ability of an enterprise to restructure its resources and routines that generate observed value in the obtained utilities (Vargas-Hernández & Muratalla-Bautista, 2017). Absorptive capacity is essential for any company that seeks to reach a new competitive edge, improve performance, and achieve innovative results in the property and services offered according to the demands of the changing environment (Rotundo & Arias, 2018).

Absorptive capacity as part of that learning provides the necessary elements to respond to turbulent environments. Organizations face changes in their surroundings that present opportunities and threats that must be overcome so as not to place survival at risk. Understanding why some companies are more sensitive than others to such changes leads to experimenting with absorptive capacity as a means of a strategy that provides knowledge elements of what occurs on the outside to develop and broaden resources and internal competencies, which are necessary to adapt to a changing environment (Rotundo & Arias, 2018).

Companies must reinforce their response to environmental signs. Evidence shows that enterprises that have developed absorptive capacity have a greater likelihood of adapting to external environmental changes since they can foresee, more precisely, the nature and commercial potential of technological advances (Cohen & Levinthal, 1990; Demuner Flores et al., 2018). Acquiring, assimilating, and using external knowledge helps them develop sensitivity to spot emerging opportunities. In this way, they understand, value, and appreciate these signs to exploit critical knowledge available in their surroundings (Ritala & Tidström, 2014).

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When an organization prepares to face such difficulties, its attitude, proactivity, disposition, and alertness are permanently connected to the moment. They accept and wait for that change, take advantage of the turmoil to generate responses that suit their needs, and trust their response capacity. In addition, they align their strategies and the opportunity they may have to amount to their competitive impact and their organizational survival (Sampedro, 2009).

Response capacity hardens with the acquisition, assimilation, and exploitation of knowledge by the organization. The main aim is to generate greater performance in the long term (Denicolai et al., 2016). In this sense, an intelligent organization responds to emergent and dynamic environments.

Response capacity is the process of monitoring and evaluating objectives through acquisition, assimilation, and exploitation of knowledge that focuses on changing the environment by immediate decision-making and deals with how companies' vision is placed in product and service innovation that require further corrective measures (Kohli & Jaworski, 1990). It adjusts to market demands, technological changes, and changes in the clients' expectations to offer products and innovative services.

Technological level

The technological level is the extent to which an industry develops innovation. It is based on the availability and cost (efficiency) of producing scientific and technical knowledge. The technological level differs accordingly to the areas or industrial sectors (Kim & Choi, 2020; Moncada-Paternó-Castello, 2010). Given this relation, the sectorial innovative capacity is represented by intrinsic characteristics of the technology employed by its own sector and the learning process in which the innovative activity is involved (Gumbau-Albert & Maudos, 2013).

This is how technological advances can explain intersectoral differences in innovation activities. The technical characteristics of an industry are represented by the degree of the technological opportunity presented by the firm dynamics (Kim & Choi, 2020). They are characterized by the different opportunities or the probability of completing significant technological advances, the appropriation of innovation benefits, the extent to which technical knowledge is accumulated, and the differences in companies' access to scientific basis or industrial knowledge (Evangelista & Mastrostefano, 2006). These differences occur among the sectors that contribute more energetically to the innovation effort, meaning in the industries with more knowledge intensity (Gumbau-Albert & Maudos, 2013).

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Some authors observe a breach in productivity growth attributable to some sectors (Timmer et al., 2010). The expense of innovation and productivity is greater in those sectors with higher technology (Trachuk & Linder, 2018).

The degree of specialization in industrial sectors is related to intensity in R&D. Mathieu and Potterie (2010) present findings that suggest that specialization in sectors with high intensity in R&D is why R&D is high in some sectors but not in others. For Moncada-Paternó-Castello (2010), the conclusions in these studies cannot necessarily be applied to all countries and economies due to the possible heterogeneity in the intensities of R&D and industrial structures. In other words, the "intrinsic" effect can dominate in some countries, whereas the "structural" one predominates in others.

This research reaches a consensus with some authors that define the technological level of companies from the sectors or districts comprised. Nieto and Quevedo (2005) confirm that the innovative behavior of the companies within different groups is not homogenous and shows the existence of two clearly defined categories: companies with high technological level and others with low technological level.

García et al. (2007) studied the productive connections and their exogenous or endogenous impacts on the global production structure and sectors with the same or different technological profiles. Their classification in blocks is high and medium technology sectors and low-technology sectors.

Eurostat classifies the sectors based on the intensity of knowledge: low, medium, and high (García et al., 2007). Galindo-Rueda and Verger (2016) considered guidelines taken from the Organization for Economic Cooperation and Development (OECD) manual to create the following taxonomy in economic activities based on the research intensity and industry development in every sector: high, high-medium, medium-low, and low intensity.

Table 1 presents the diverse contributions that classify the technological intensity level of the different turns in the manufacturing sector. We also summarize the consensus of the diverse contributions considered in this study in the last column of the table.

The direct and indirect intensity effects of R&D can differ in connection to sectorial productivity and performance. In addition, the main factor against technological advances, to a great extent, is the sector that the company belongs to (Galindo-Rueda & Verger, 2016). This leads to the belief that the technological level influences the response before changes in the environment.

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Table 1

Classification of industrial sectors according to their technological level

Manufacturing sector	Nieto and Quevedo (2005)	García et al. (2007)	Eurostat, as cited in García et al. (2007)	CNAE (INE, 2016)	OCDE (INE, 2012)	Gumbau-Albert and Maudos (2013)	Galindo-Rueda and Verger (2016)	Final
Transport equipment	High	High and medium	Medium	Medium-high	Medium-high	High	Medium	High
Food	Low	Low	Low		Low	Low	Medium-low	Low
Chemicals	High	High and medium	High	Medium-high	Medium-high	High	Medium-high	High
Metal products	Low	High and medium	Medium	Medium-high	Medium-low	Low	Medium-low	Low
Textiles	High	Low	Low		Low	Low	Medium-low	Low
Plastic		High and medium	Medium	Medium-high	Medium-low	High	Medium	Low
Clothes and skins	High	Low	Low		Low		Medium-low	Low
Paper	Low	Low	Low		Low	Low	Medium-low	Low
Printing and related industries		Low	Low		Low		Medium-low	Low
Communication equipment	High	High	High	High	High	High	Medium-high	High
Wood	Low		Low		Low		Medium-low	Low
Pharmaceuticals			High	High	High			High

Source: Elaborated by the author.

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Developing new products is the key element among companies competing in high-technology markets (Kim et al., 2013). When these enterprises reach their investment and innovation goals in R&D, and a positive and sustainable correlation is obtained between investment intensity in R&D, innovation investment, and productivity growth (Gumbau-Albert & Maudos, 2013), the companies that operate with high technological levels respond to market pressure. They invest more in R&D and also characterize better performance indexes. Conversely, the opposite effect can be appreciated in companies with low technological development due to the lack of investment in R&D (Trachuk & Linder, 2018).

However, the technological level does not have the same impact on each of the enterprises. Some efficiently take more advantage of technological opportunities. Those with a high technological level will strengthen the relation between absorptive capacity and response capacity, enabling them to enjoy the benefits of belonging to an environment with a great technological opportunity.

Knowledge acquisition – Response capacity

Absorptive capacity comprises acquisition in the first place, which is defined as the ability that companies have to get and dominate externally acquired knowledge (Feijoo-Pardo & González-Illescas, 2020). Those attributes are the intensity and speed at which a company identifies and gathers information and the direction to store such knowledge (Zahra & George, 2002). The organization's management must be responsible for motivating its employees to engage in this activity to acquire knowledge, focusing on searching for relevant information about the industry the company is part of (Guerrero-Sánchez, 2021). With this correlation, to acquire external knowledge, the organization must revitalize the internal one, obtaining, as a result, high levels of performance and sustainable prerogatives (Romero et al., 2017).

Knowledge contributes to creating added value for a firm only when used. The most common form of value-added creation in the new era is innovation. Turulja and Bajgorić's results (2020) show the indirect effect of knowledge acquisition on firm business performance through product and process innovation. According to these authors, both knowledge and innovation are seen as headstones of business success of a contemporary firm because the firms are more capable of developing creative solutions than their competitors.

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When knowledge acquisition is low and emerging, it does not allow the organization to make its decisions. Consequently, its level of response to changes is only appreciative or passive (Romero et al., 2017). Instead, when it is in development, its reactions to such changes are reactive. In other words, its maturity degree does not allow it to face the entirety of the unfavorable that may be generated. When the organization strongly improves its knowledge acquisition capacity and provides experience, it generates favorable responses and adapts to those changes. Thus, we propose hypothesis 1 (H1):

- H1: Technological level moderates the relation between knowledge acquisition and organizational response capacity.

$$RC = \beta 1 + \beta 2\, AC + \beta 3\, TL + \beta 4\, TL * AC \quad (1)$$

Knowledge assimilation – Response capacity

The second ability, assimilation, focuses on converting the externally obtained knowledge into more valuable knowledge for the organization. People relate new knowledge with the one that has already been assimilated, as well as with their own experience. When knowledge is assimilated, there is a process of conversion from explicit to explicit knowledge. The concepts are transferred to a knowledge base by capturing and integrating new essential explicit knowledge (Nonaka & Takeuchi, 1995). Assimilation is complemented by formalized knowledge of the enterprise (manuals, policies, routines, and processes) enabling processing, interpretation, and analysis of newly acquired external knowledge (Zahra & George, 2002).

The assimilation of external knowledge entails routines and procedures for processing, understanding, interpreting, and analyzing information obtained from outside the organization. Assimilative learning processes imply internal discussions and shared interpretation of the new knowledge (Müller et al., 2021). The assimilated knowledge must be communicated among the different departments, maintaining a constant and rapid flow of information, which can be through periodic interdepartmental meetings to exchange news, problems, and achievements (Guerrero-Sánchez, 2021).

This paper, therefore, indicates that by creating shared awareness and understanding of technological level between organizational members, com-

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panies can encourage both exploratory and exploitative innovation strategies in response to industry changes. Hypothesis 2 (H2) is as follows:

- H2: Technological level moderates the relation between knowledge assimilation and organizational response capacity.

$$RC = \beta 1 + \beta 2\, AS + \beta 3\, TL + \beta 4\, TL * AS \quad (2)$$

Knowledge exploitation – Response capacity

The third ability is exploitation, which integrates an organizational capacity that improves the current competencies and creates new ones through routines. Exploitation is united with knowledge acquisition and assimilation to incorporate new knowledge into their operations (Zahra & George, 2002). According to Denicolai et al. (2016), external knowledge takes less time to be absorbed, and it benefits from internally generated knowledge. In turn, internal knowledge generates better performance in the long term. The exploitation of knowledge supports the idea of prototyping, reconsideration of technology, and its adaptation. In this dimension, the company develops the ability to work more effectively by adopting new technologies according to new knowledge (Engelman et al., 2017).

This way, the ability to exploit knowledge has a direct positive effect on the company's performance. The companies that only focus on acquiring and assimilating external knowledge can continuously increase their level of knowledge, even though they may suffer acquisition costs without obtaining the benefits of exploitation performance (Volberda et al., 2010). A company cannot exploit external knowledge without previously acquiring it. Companies with greater exploitation of knowledge have greater possibilities of achieving a competitive advantage by developing new products and new processes (Dyer & Singh, 1998). Knowledge exploitation can ultimately become tangible in the form of new products and services, process innovations, or organizational innovations (Martínez-Caro et al., 2020).

Absorptive capacity

> […] helps a firm to upgrade, expand and utilize existing capabilities and technologies to innovate, incorporating the technological knowledge acquired and transforming the firm's operations to increase the productivity of the goods and capital employed (Mahmood & Mubarik, 2020, p. 5).

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A company that develops acquisition and assimilation of external knowledge skills will not be able to turn it into a competitive advantage unless it has the necessary exploitation skills. In this perspective, performance in exploiting knowledge differs according to the company's ability to create value. Exploiting technological know-how can only be done based on the knowledge and learning processes that have already been mastered by the firm (Mahmood & Mubarik, 2020). Drawing on the aforementioned, hypothesis 3 (H3) is the following:

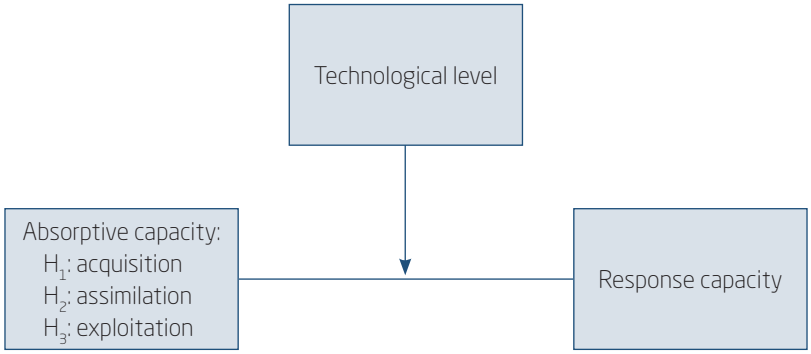
- H3: Technological level moderates the relation between knowledge exploitation and organizational response capacity.

$$RC = \beta 1 + \beta 2\, EX + \beta 3\, TL + \beta 4\, TL * EX \quad (3)$$

Following the theoretical foundation, the research hypotheses are presented in Figure 1:

Figure 1

Research hypotheses



Source: Elaborated by the author.

METHODOLOGICAL PROCEDURES

This research has a quantitative approach, non-experimental design, and cross-sectional and explanatory scope. Statistical tests were performed through a survey of manufacturing companies that underwent some innovation activity in Toluca, state of Mexico, to test these predictions. The choice

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was because, during 2018, the state of Mexico contributed 9.1% to the gross domestic product (GDP) and occupied second place nationally (Instituto Nacional de Estadística y Geografía – INEGI, 2019). Toluca concentrated the largest participation in the state. In addition, it was highlighted to be the municipality with the greatest staff proportion in the manufacturing industry, with 64.6% of manufacturing enterprises in the state (INEGI, 2015). The data were obtained from the directory of companies of the state of Mexico, selecting only those companies located in Toluca. A 30% rate for the mid-market and big manufacturing companies was obtained.

The self-administered survey technique was adopted for data collection during the second semester of 2018. First-class executives answered it on a Likert-type scale of five points: one meant never, and five, always. After the database underwent a cleaning stage, the sample was finally composed of 102 enterprises, of which 65 were deemed big (with over 250 employees), and 37, mid-market (between 51 and 249 employees). We concluded that 52 companies had a high technological level, and 50 had a low technological level (Table 2).

Table 2

Sample description: Manufacturing sector

Classification in Table 1	Manufacturing sector	Frequency		Percentage	Accumulated percentage
		High	Low		
High	Transport equipment	20		19.6	19.6
Low	Food		17	16.7	36.3
High	Chemicals	24		23.5	59.8
Low	Metal products		13	12.7	72.5
Low	Textiles		5	4.9	77.5
Low	Plastic		7	6.9	84.3
Low	Printing and related industries		4	3.9	88.2
High	Communication equipment	8		7.8	96.1
Low	Wood		4	3.9	100
	Total	52	50	100.0	

Source: Elaborated by the author.

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The questionnaire was taken from Demuner Flores et al. (2018). It integrated two demographic variables: size and specific manufacturing branch. Questions about the absorptive capacity variable included acquisition (seven items), assimilation (seven items), and exploitation (five items) of external knowledge to foresee future technological advances and take advantage of the emerging opportunities even before their competitors become aware of them. Acquisition seeks to identify, select, and value critical external knowledge to improve companies' capacity of processing, classifying, interpreting, analyzing, and internalizing this newly acquired external knowledge (Cohen & Levinthal, 1990; Zahra & George, 2002; Todorova & Durisin, 2007). Exploitation, in turn, is the capacity to use this new knowledge for commercial purposes (Cohen & Levinthal, 1990).

The technological level variable was obtained from the consensus in Table 1. The justification is the fact that companies belonging to the same group are involved in similar industrial activities so that research interests can bear some resemblance. They use similar technology, and their activities are related to the same scientific fields and have the same technological opportunities (Nieto & Quevedo, 2005). Companies with a high technological level were assigned the value of one, whereas those with a low technological level were assigned zero.

The dependent variable response capacity refers to monitoring the aims and subsequent corrective actions that meet the market's needs and demands, technological changes, and the customers' changing expectations (Demuner Flores et al., 2018).

PRESENTATION OF THE RESULTS

The statistical procedure was developed first by identifying the reliability of the questionnaire and the normality of the data. The hypothesis testing procedure was done in three steps: the first one consisted of making simple hierarchical regression calculations to analyze the influence of acquisition, assimilation, and exploitation of knowledge on response capacity; and the second one included hierarchical regression calculations to analyze H1, H2, and H3. Additionally, although it is not included in the objective of the study, in the third stage, a *t* test was performed to analyze whether the technological level generates significant differences among the groups regarding their absorptive and response capacities.

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From the dimension Cronbach's alpha, it resulted in acquisition 0.717 (seven items), assimilation 0.720 (seven items), exploitation 0.717 (five items), and response capacity 0.862 (11 items). Every variable obtained values above 0.7. According to Nunnally and Bernstein (1994), it is considered satisfactory. Additionally, the obtained kurtosis values and asymmetry were below 1 and -1 for each variable, which shows an assumption of normality.

Table 3 shows models 1, 2, and 3, representing a positive and significant correlation with $p = < 0.001$ in the variables: acquisition, assimilation, and exploitation with the response capacity of the organization. Also, in Table 3, the hierarchical regressions were tested in the second part of the procedure. Models 4 and 6 represent non-significant correlations, which leads to the dismissal of the hypotheses. In other words, the technological level does not moderate the relation between acquisition and response capacity of the organization (H1). The technological level does not moderate the relation between exploitation and response capacity of the organization (H3). However, a significant relation between external knowledge assimilation and response capacity was found, confirming H2.

Last part of the procedure. Despite the difference between the technological levels of the groups at high or low being considerably small (Table 4), significance among them was sought. We considered the technological level a contrast variable, and acquisition, assimilation, exploitation, and response capacity, independent variables.

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Table 3

Regression coefficients on the response capacity of the organization

Independent variable	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β	*t*	β	*t*	β	*t*	β	*t*	β	*t*	β	*t*
Constant	4.215	95.056	4.215	88.145	4.215	82.069	4.218	95.489	4.222	89.868	4.216	82.257
Acquisition	0.456	6.625***					0.434	6.211***				
Assimilation			0.369	4.9***					0.378	5.076***		
Exploitation					0.18	2.787***					0.175	2.717***
Technological level							0.133	1.503	0.136	1.442	0.158	1.54
Acquisition technological level							-0.142	-1.022				
Assimilation technological level									-0.298	-1.996**		
Exploitation technological level											-0.071	-0.548
Square R	0.309		0.197		0.073		0.332		0.245		0.099	
Adjusted R squared	0.302		0.189		0.064		0.311		0.221		0.07	
F	43.889		24.009		7.767		15.909		10.387		3.499	
Change in R square	0.309		0.197		0.073		0.332		0.245		0.099	

Source: Elaborated by the author based on IBM SPSS Statistics 20.0.

** 0.05; *** 0.001.

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Table 4

Technological level statistics

Variable	Technological level	N	Mean	Standard deviation	Standard error mean
Acquisition	High	51	40	0.58276	0.08160
	Low	49	39	0.71272	0.10182
Assimilation	High	51	41	0.67565	0.09461
	Low	49	40	0.59994	0.08571
Exploitation	High	51	37	0.80908	0.11329
	Low	49	36	0.79550	0.11364
Response capacity	High	51	43	0.48491	0.06790
	Low	49	41	0.56615	0.08088

Source: Elaborated by the author based on IBM SPSS Statistics 20.0.

According to Table 5, all variables behaved the same way; Levene's statistical test presented values $p = > 0.05$, indicating equal variances. The t test for two independent samples, assuming equal variances, presented $p = > 0.05$, which means there was insufficient empirical evidence to reject Ho. There are no significant differences between the groups of high and low technological levels. Therefore, a void hypothesis is comparable with the data.

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Table 5

The t test for the technological level

		Levene test of homogeneity of variance		*t* test for equality of means				
		F	Significance	*t*	*gl*	Two-tailed significance	Mean difference	Standard error difference
Acquisition	Equal variances assumed	1.347	0.249	0.713	98	0.478	0.093	0.130
	Equal variances not assumed			0.710	92.737	0.480	0.093	0.130
Assimilation	Equal variances assumed	1.647	0.202	0.769	98	0.444	0.098	0.128
	Equal variances not assumed			0.770	97.406	0.443	0.098	0.128
Exploitation	Equal variances assumed	0.138	0.711	0.545	98	0.587	0.088	0.161
	Equal variances not assumed			0.545	97.946	0.587	0.088	0.160
Response capacity	Equal variances assumed	1.781	0.185	1.646	98	0.103	0.173	0.105
	Equal variances not assumed			1.641	94.460	0.104	0.173	0.106

Source: Elaborated by the author based on IBM SPSS Statistics 20.0.

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DISCUSSION OF THE RESULTS

The absorptive capacity in its three dimensions is indeed positively related to the response capacity of the organization. The result of this study corroborates Liao et al. (2003), who found that absorptive capacity is a critical element that affects organizations' response capacity as, without previous knowledge, organizational response capacity in companies would be limited. The companies that develop a better absorptive capacity have greater success possibilities over changes in their environment because of the evolution or changes in their organizational and innovation procedures (Rodríguez & Cunha, 2018; Turulja & Bajgorić, 2020). Coincidentally, according to Elizalde Bobadilla et al. (2019), all dimensions act in conjunction to promote absorptive capacity. Consequently, firms can reinforce their technological competencies by importing external technologies and technological knowledge and, then, absorbing, assimilating, communicating, and diffusing them throughout their organizations (Mahmood & Mubarik, 2020).

According to Liao et al. (2003) and Nieto and Quevedo (2005), the three dimensions positively affect responsiveness. The result leads companies to respond to the environment with marketing mechanisms and innovative products (Medase & Barasa, 2019; Müller et al., 2021).

This paper assumes that a result of the response capacity in an organization against changing environments is innovation. The higher the ability of an organization to acquire, assimilate, and exploit new information, the higher its capacity to launch innovations (Müller et al., 2021), consequently, the ability to respond to the environment is improved. In this sense, comparing the results obtained with those reported by Expósito et al. (2011), they differ since these authors detected that external knowledge assimilation did not directly relate to innovation. The authors identified that the lack of relations was due to some elements that were typical to those of the companies studied and that external knowledge was found just in specific contexts, which, in some cases, hindered assimilation and replication.

Regarding the hypotheses, a moderator of the technological level was detected, but only in the organization's relation to external knowledge assimilation and response capacity. This can be explained since assimilation tends to convert external knowledge use into more valuable knowledge. This means that companies translate obtained knowledge into procedures and routines to process, classify, interpret, analyze, and internalize this newly acquired external knowledge (Zahra & George, 2002).

Assimilation is transformed, therefore, into the internalization that a company adequate to its own know-how to respond to changing environ-

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ments as its participants have broadened their knowledge. The new knowledge created through assimilation has an impact when it is incorporated into the enterprise's way of doing business and, thus, enables innovation (Martínez-Caro et al., 2020). In this sense, knowledge assimilation is positively related to the response capacity through product and service innovation (Feijoo-Pardo & González-Illescas, 2020). Technological advances characterized by differences in the opportunity or probability of achieving them successfully (Evangelista & Mastrostefano, 2006) have a moderator impact on the accumulation degree of technological knowledge (Gumbau-Albert & Maudos, 2013) and how companies react to innovation. In line with Martínez-Caro et al. (2020), the assimilation of technology knowledge can facilitate organizational agility and performance.

No moderator effect that impacts the technological level in the relation between the absorptive and response capacity in the organization was detected. This means that regardless of how low or high the companies' technological level, according to Lane et al. (2006), they will develop special skills to identify, select, and value essential external knowledge for their operations. Companies extend and take advantage of their existent competencies to respond to the environment and develop their organizational capacity, enabling them to focus on perfecting their procedures and routines.

Liao et al. (2003) suggest that the impact of companies' capacity to absorb external knowledge on their response capacity depends on their technological level. The higher the technological level, the bigger the impact the absorptive capacity has on the response capacity of the organization. However, considering the technological level a contrast variable, and acquisition, assimilation, exploitation, and response capacity independent variables, no significant differences were found. Regardless of the technological level that the companies have developed, they have the same opportunity to improve their absorptive capacity to changes in the environment. This result was different from Kim and Choi's (2020). In their study, the high-technology sector from the potential absorptive capacity and innovation performance was more strongly identified than those of the low-technology sector.

The technological level is characterized by technological opportunity. The possibility of achieving significant technological advances is the appropriation of the benefits of innovation, the degree to which there is an accumulation of technical knowledge (Evangelista & Mastrostefano, 2006). Therefore, companies of the same sector can ask their contemporaries for advice and even opt for their own staff of technicians and employees, giving them the opportunity to acquire and assimilate knowledge. In turn, for

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Nieto and Quevedo (2005), technological opportunities in any given factor do not affect all companies that operate with it in the same intensity. Using these opportunities progressively will depend, of course, on each company's knowledge and capacities, and they must do their own research (Pérez Hernández et al., 2019). However, in line with Kim and Choi (2020), we believe the firms in the low-techonolgy sector are required to support policies related to learning and management of knowledge based on their own R&D capabilities for product development and process innovation.

In the words of Rincón Moreno and Guerrero Piratque (2019), dynamic capacity development is an important competitive edge, especially in sectors characterized by turbulent knowledge and strong protection of intellectual property rights. These enable companies to be prepared in environments of constant changes (Feijoo-Pardo & González-Illescas, 2020).

FINAL CONSIDERATIONS

The first variable under study reveals that companies that develop their absorptive capacity accumulate internal knowledge and stimulate and manage external knowledge more efficiently. Their results are products or processes of innovation. It has been proven that the three dimensions of the absorptive capacity – acquisition, assimilation, and exploitation of external knowledge – are positively related to the response capacity of an organization.

The results led to finding the partial existence of moderation among variables. In the pursuit of moderation of the technological level in the relation between absorptive capacity and response capacity in an industrial context, the technological level only moderates the relation between external knowledge assimilation that the surveyed manufacturing companies underwent and response capacity. The study shows no moderation in the acquisition and exploitation dimensions.

The technological level is increased as the company achieves significant technological advances and appropriates the benefits of innovation. Under these conditions, this study detected no significant differences between the absorptive capacity and response capacity of high and low technological level groups.

The research identified the perception of the concept of absorptive capacity and response capacity and the methodological approach to their study, a fundamental gap to which this research contribute with new knowledge. The former is a conceptual contribution of response capacity, as under-

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standing organizational agility is fundamentally necessary for organizations facing changing conditions to use new knowledge to achieve the objectives of the organization, shareholders, and employees.

This paper contributes to empirical research on absorptive capacity to make companies respond with innovations to environmental changes and help them develop their absorptive capacity so that their opportunities and restrictions can be identified.

It also contributes to empirical research in comprehending mechanisms that allow companies access to more knowledge for innovation purposes, leading them to respond to changes in their environment, foster networking relations in the same sectors to minimize costs and share knowledge, and strengthen external ties in the same district, enabling access to new ideas and opportunities.

This study provides empirical evidence of the significance of the technological level in the manufacturing industry concerning absorptive capacity and response capacity to changes in the environment.

It is advisable to follow suit in this line of exploration, in order to find more explanations about why these dimensions – acquisition and exploitation in a group of companies belonging to different sectors – do not coincide with the moderation between absorptive capacity and response capacity.

In line with the research of Cohen and Levinthal (1990) and Zahra and George (2002), this work proposes to continue the empirical exploration of absorptive capacity and its relation with the technological level. Future research is necessary for emerging economies, focusing on sectors with low technological intensity, such as food, clothing, metal products, textile, plastic, paper industries, among others. The purpose is to identify behavior patterns in the making of activities that lead to innovation development.

We also propose to continue research on business response capacity (Demuner Flores et al., 2018) and investigate the agility of companies to respond to changing and contingency environments, such as the one we currently experience.

The limitation consists of having used cross-sectional research directed only at the manufacturing sector. Also, there is a limitation in terms of the size of the sample, since it was not possible to survey other branches of the manufacturing sector, which may be an opportunity to continue this research line. It is important to broaden the sample, explore new variables, seek divergences among the different sectors, and compare the rising effects.

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