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Impact of Absorptive Capacity and Ambidexterity on Innovation*

Impacto de la capacidad de absorción y ambidiestralidad en la innovación

Impacto da capacidade de absorção e ambidestria na inovação

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Abstract

This study attempts to design an approach showing how absorptive capacity and ambidexterity are related to technological innovation in Peruvian manufacturing firms. A structural equation model is proposed. The sample is made up of 783 manufacturing firms. It was found that although Peruvian manufacturing firms invest little money in research and development, they are capable of developing dynamic capabilities, such as absorptive capacity and ambidexterity in order to better carry out technological innovation.

Keywords: Absorptive Capacity; Ambidexterity; Technological Innovation; and Manufacturing.

Resumen

Este estudio intenta diseñar un enfoque que muestre cómo la capacidad de absorción y la ambidiestralidad se relacionan con la innovación tecnológica en las empresas manufactureras peruanas. Se propone un modelo de ecuación estructural. La muestra está compuesta por 783 empresas manufactureras. Se encontró que, aunque las empresas manufactureras peruanas invierten poco en investigación y desarrollo, son capaces de desarrollar capacidades dinámicas, como capacidad de absorción y ambidiestralidad, para llevar a cabo mejor la innovación tecnológica.

Palabras clave: capacidad de absorción, ambidiestralidad, innovación tecnológica, manufactura.

Resumo

Este estudo tenta desenhar uma abordagem que mostre como a capacidade de absorção e a ambidestria estão relacionadas à inovação tecnológica nas empresas manufatureiras peruanas. Um modelo

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de equação estrutural é proposto. A amostra é composta por 783 empresas manufatureiras. Verificou-se que embora as empresas manufatureiras peruanas investem pouco em pesquisa e desenvolvimento, elas são capazes de desenvolver capacidades dinâmicas, como capacidade de absorção e ambidestria, para melhor realizar a inovação tecnológica.

Palavras-chave: capacidade de absorção, ambidestria, inovação tecnológica, manufatura.

1. Introduction

Manufacturing firms in emerging economies face great competitive challenges in a globalized world because they carry out their activities in settings, which are unfavorable to their innovation capability. It can be said in general that systems of production in Latin American countries have a relatively low capacity in order to generate knowledge (Gregson, 2020). Additionally, Latin American manufacturing firms invest relatively little money in research and development (Olavarrieta & Villena, 2014). As Fernandez (2017) indicates, firms in countries like Argentina, Colombia, Chile, Mexico, and Peru demonstrate their low levels of innovation mainly via the indicators of research and development expenditure in relation to GDP.

This study contributes to the literature on dynamic capabilities. The first contribution is to show how manufacturing firms in emerging economies develop their absorptive capacity in order to improve their technological innovation capability (Del Carpio & Miralles, 2018). We should keep in mind that manufacturing firms in emerging economies invest little money in research and development, but despite this limitation, they strive to make technological innovations. Absorptive Capacity (AC) has been studied in different contexts, by indicating that AC has a positive influence on firms' technological innovation (Aljanabi & Mohd Noor, 2015 or Koçoglu, Akgün, & Keskin 2015). Studies have also been conducted in countries, which invest less money in research and development. (Pérez, & Toro-Jaramillo, 2018).

The second contribution is referred to a second dynamic capacity, such as ambidexterity, which allow to carry out exploitation activities, such as increasing production flexibility or reducing production costs, but simultaneously, carrying out exploration activities, such as introducing new products to the market, or expanding the product portfolio (Derbyshire, 2014 and Vrontis, Thrassou, Santoro, and Papa, 2017). In the Latin American context, Solís-Molina, Hernández-Espallardo, and Rodríguez-Orejuela (2018) carried out a study on ambidexterity, which had manufacturing firms as the unit of analysis.

The third contribution is referred to the mediating role of ambidexterity in the

relationship between absorptive capacity and technological innovation, the mediating role of ambidexterity is generally verified in the relationship between context and firm performance (Gibson and Birkinshaw, 2004), or in the relationship between ambidextrous innovation and firm performance (Liao, Liu, and Zhang, 2018). However, as far as we know, it has not been studied that ambidexterity mediates the relationship between absorption capacity and technological innovation.

This study has proposed the following research question: How are AC and ambidexterity related to technological innovation in manufacturing firms in an emerging economy? To answer this question, 783 manufacturing firms that participated in a national innovation survey carried out in Peru in the year 2018 have been analyzed.

This study sheds light on the innovation behavior of manufacturing firms, by emphasizing the following relationships: first, how AC positively impacts the relationship between ambidexterity and technological innovation; second, how ambidexterity favors technological innovation; and third, how ambidexterity partially mediates the relationship between AC and technological innovation.

2. Theoretical Framework

Prior to explaining the formulated hypotheses, it is necessary to clarify four concepts: dynamic capabilities, absorptive capacity, ambidexterity, and technological innovation. Regarding the first concept, Teece, Pisano, & Shuen (1997) proposed the dynamic capabilities approach, by noting that they are the resources, which allow firms to create competitive advantages. Then, Eisenhardt & Martin (2000, p.1105) "argue that dynamic capabilities are a set of specific and identifiable processes such as product development, strategic decision making, and alliancing." Later, Wang & Ahmed (2007) pointed out that dynamic capabilities allow firms to identify and to rethink resources so that companies can face changing environments and achieve competitive advantage. In this regard, it can be said that firms must build dynamic capabilities if they want to be competitive in changing environments in terms of absorptive capacity and ambidexterity.

It is recognized that AC is a dynamic capability (Zahra & George, 2002). Thus, the most representative definition points out that AC is "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends." (Cohen & Levinthal, 1990, p. 128).

As for ambidexterity, Gibson and Birkinshaw (2004) have defined this concept as the ability of the firm to achieve alignment and adaptability. O'Reilly and Tushman (2008) define ambidexterity as a dynamic capability through which

managers develop their ability to design both new and mature strategies simultaneously, by allowing the firm to achieve long-term success. That is to say, ambidexterity is the ability of the firm to carry out exploration and exploitation activities simultaneously.

He and Wong (2004) state that exploitation activities are geared to improving the quality of existing products, improving production flexibility, reducing the costs of production, and reducing the consumption of raw materials. Meanwhile, exploration activities are related to the introduction of new products, increasing the firms' product portfolios, opening new markets, and making use of new technologies.

Finally, in order to define technological innovation, it can be mentioned that this concept has two dimensions: product innovation and process innovation (Camisón & Villar-López, 2014). According to Gunday, Ulusoy, Kilic, and Alpkan (2011), product innovation is the introduction of new or significantly improved goods or services. Moreover, the same authors define process innovation as the implementation of a new or significantly improved production or delivery method (Gunday et al., 2011).

2.1 Absorptive Capacity and Ambidexterity

The relationship between AC and ambidexterity has attracted the attention of many researchers. For example, Cao, Gedajlovic, and Zhang (2009) carried out a theoretical analysis of ambidexterity, by proposing that firms possessing lower levels of exploitation activities than of exploration activities will possess low levels of AC, which will negatively affect the firm, as this does not help the firm to take advantage of the acquisition, processing, and utilization of external knowledge. On a more general level, Lavie, Stettner, and Tushman (2010) analyzed how AC can help to achieve a better understanding of how firms carry out exploration and exploitation activities. Furthermore, even when many scholars have understood AC to be linked to exploration, it should be taken into account that the application of external knowledge to develop innovations is, in and of itself, an exploitation activity. Along these same lines, Lucena and Roper (2016) carried out a panel study of Spanish manufacturing firms during the 2004-2011 period, and they were able to verify on an empirical level that both AC and ambidexterity helped firms to improve their innovation capability. Moreover, Najafi-Tavani, Najafi-Tavani, Naudé, Oghazi, and Zeynaloo (2018) found that developing AC has a positive impact on the development of both product and process innovation capabilities. That is to say, when the firm comes into contact with collaboration networks involving customers, suppliers, competitors, universities, and research centers, it also obtains valuable information, which allows it to develop its innovation capability.

By the same token, Aryasa, Wahyuni, Sudhartio, and Wyanto (2017) researched how AC helps firms to process external knowledge and use it in the development of new innovations. Additionally, AC affects the ambidexterity of the firm, by helping it to seek alliances with external agents, who can provide such external knowledge. Diaz-Molina (2018), also, found that AC affects organizational ambidexterity according to his analysis of 5,600 Chilean firms in the year 2015. He showed how AC helps firms to process external knowledge so they can achieve their objectives and develop their organizational ambidexterity. Diaz-Molina (2018) also provides some examples of how collaboration can be carried out with suppliers, who can suggest possible applications of technology to their customers, or vice versa, when customers invite their suppliers to make cost-cutting or waste-cutting proposals. Mardi, Arief, Furinto, and Kumaradjaja (2018), through a quantitative study carried out in several economic sectors of Indonesia, empirically verified that the social adoption of technology positively affected ambidexterity through AC.

These arguments allow the following hypothesis to be proposed:

Hypothesis 1: *Absorptive capacity is related to ambidexterity in Peruvian manufacturing firms.*

2.2 Absorptive Capacity and Technological Innovation

Many researchers have described a strong, positive relationship between AC and firms' technological innovation capability. One example of such research is the work of Aljanabi and Mohd Noor (2015), who, by analyzing 249 Iraqi firms, confirmed that AC does indeed has a positive relationship with firms' technological innovation capability. That is to say, they have the ability to develop product and process innovations. It is also important to mention Koçoglu, Akgün, and Keskin (2015), who carried out a theoretical analysis, found that AC favors the development of product innovation. Moreover, Martinez-Senra, Quintas, Sartal, and Vázquez (2015), by analyzing information from more than 8,000 Spanish firms, which participated in the 2007 communitarian innovation survey, found that AC helped them to acquire, to process, and to assimilate external knowledge. In this way, they could improve product innovation capability. Additionally, the same authors state that the firms considered the development of new products to be a knowledge-intensive activity. In that sense, the development of AC plays an important role in the improvement of product innovation capability.

On the one hand, Limaj, Bernroider, and Choudrie (2016) analyzed information from more than 100 small Austrian firms and found empirical evidence that AC has a direct influence on motivation to carry out product and process innovation. On the other hand, Ince, Imamoglu, and Turkcan (2016) carried out a litera-

ture review and, based on the literature included, they proposed a conceptual model. In this model, a firm designs a system in which the input is knowledge; the process is AC, which the firm uses to analyze and to assimilate knowledge; and the output is improved innovation capability.

Zou, Ertug, and George (2018) conducted an analysis of 241 articles published between 1989 and 2017 in order to elucidate the relationship between AC and technological innovation capability, by finding that age and size of the firm affected this relationship and that there was also a positive relationship for small businesses, although this relationship was not significant for young firms.

Thus, the following hypothesis can be proposed:

Hypothesis 2: *Absorptive capacity is related to technological innovation in Peruvian manufacturing firms.*

2.3 Ambidexterity and Technological Innovation

At this stage, the relationship between ambidexterity and innovation has been the focus of several studies. One the one hand, He and Wong (2004) analyzed how ambidextrous firms apply two types of technological innovation strategies. The first one is exploration innovation, which is geared to developing new products for the market, and the second one is exploitation innovation, which is geared to improving existing products. Also, Chang et al. (2011), by analyzing 265 small and medium-sized Scottish firms, found that those firms, which applied an ambidextrous focus, implemented different innovation strategies due to the fact that small and medium-sized businesses have fewer resources, and their managers have less experience. On the other hand, Lin et al. (2013) indicate that ambidexterity is known as the ability to carry out two types of activities simultaneously. They also indicate that some researchers have thought that firms, which carry out exploration activities, are more likely to carry out radical innovations, while firms, which carry out exploitation activities, carry out incremental innovations. The authors (Lin et al., 2013) indicate that firms' ambidextrous capability stems from the fact that these firms develop their capability to learn and to transfer knowledge, by improving their innovation capability in this way.

Likewise, Wong, Wong, and Boon-itt (2013) researched how ambidextrous firms depend on internal and external interactions in order to improve their product innovation capability, and they found that internal interactions allow the different areas of firms to work collaboratively. At the same time, external interactions are related to the alignment of business processes, sharing of information, and cooperation with suppliers

and customers. Wei, Yi, and Guo (2014) analyzed information collected from 213 Chinese firms and found that, first, ambidexterity affects how well new products are developed and that, second, ambidextrous learning is crucial when firms face dynamic environments. The authors emphasized that firms should proceed in a dynamic way, not a static way, when they leverage their scarce resources via exploitation and exploration activities in their quest to develop new products successfully. Along these same lines, Pelagio Rodriguez, Hechanova, and Regina (2014), by using data collected from 245 interviewees, split into 56 teams of 3-13 members coming from 17 firms, were able to verify empirically that ambidexterity is positively associated with innovation.

Based on the aforementioned, the following hypothesis can be proposed:

Hypothesis 3: *Ambidexterity is related to technological innovation in Peruvian manufacturing firms.*

2.4 Ambidexterity as a Mediator in the Relationship between Absorptive Capacity and Technological Innovation

The mediating role of ambidexterity has been studied in different relationships, so Gibson and Birkinshaw (2004) analyzed how ambidexterity mediates the relationship between context and performance. They empirically verified their hypothesis through the collection of information from over 4,000 people, who worked in more than 40 business units. Also, Revilla, Prieto, and Rodríguez (2011) found that ambidexterity totally mediates the relationship between information technology and improved product development performance.

Additionally, Dutta (2013) surveyed upper and mid-level managers belonging to 11 organizations and obtained valid results for 222 questionnaires. He found that ambidexterity mediates the relationship between a firm's context and its market orientation. Along these same lines, Wang and Rafiq (2014), after collecting data from 150 English firms and 242 Chinese firms, found that contextual ambidexterity partially mediates the relationship between ambidextrous organizational culture and product innovation. In the same way, Liao, Liu, and Zhang (2018), by analyzing information from more than 200 Chinese firms, found that business model ambidexterity mediates the relationship between ambidextrous innovation and the firm's performance.

Although it is true that, as far as can be ascertained, the extant literature does not include studies analyzing the mediating role of ambidexterity in the relationship between AC and technological innovation, based on the aforementioned, the following hypothesis is proposed:

Hypothesis 4: *Ambidexterity mediates the relationship between absorptive*

capacity and technological innovation in Peruvian manufacturing firms.

3. Methodological Procedures

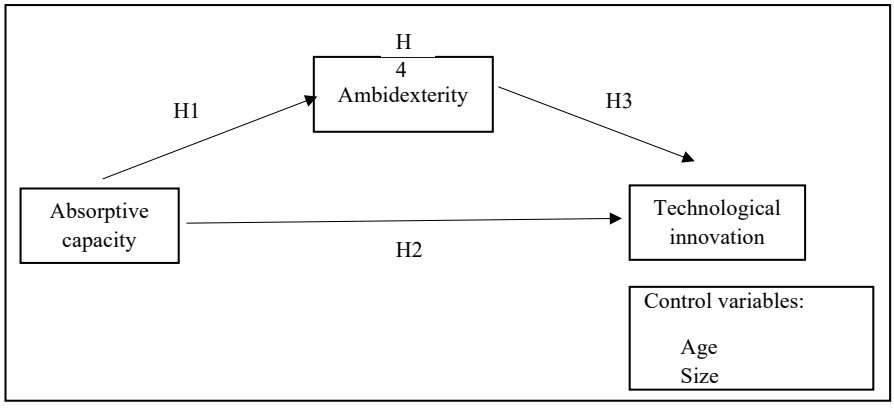
This section presents and describes the data, provides the definition of the research variables, and explains the method of analysis used. A structural equation model is proposed, which is estimated, by using AMOS version 26 software. Figure 1 reflects the mediating role of ambidexterity.

3.1 Data

The sample of the study is the Peruvian manufacturing industry. The unit of analysis is the Peruvian manufacturing firm, which participated in the 2018 National Survey of Innovation in the Manufacturing Industry and Knowledge-Intensive Services. This survey was carried out by the National Statistics and Informatics Institute of Peru. The fieldwork produced 2,229 completed surveys over a period of three consecutive years (from 2015 to 2017). These 2,229 firms belong to two difference categories: 1,463 firms are manufacturing firms, and 766 are knowledge-intensive business service firms (KIBS). Out of the 1,463 manufacturing firms, only 783 firms were considered for this study. Such firms were the ones, which did not present missing data. For this analysis, the information collected in 2017 was used.

Table 1 presents the descriptive statistics of the firms included in the sample. They have been classified according to their technological intensity, age, and size.

Figure 1. Conceptual model



Source: Authors

Table 1. Number of firms according to their technological intensity, age, and size

Technological intensity	
Low	393
Medium-low	220
Medium-high	142
High	28
Total	**783**
Firm age	
Young (25 years old)	494
Intermediate (from 26 to 43 years)	175
Old (≥ 44 years old)	114
Total	**783**
Firm size	
Small (50 employees)	265
Medium (51 to 250 employees)	323
Large (≥ 251 employees)	195
Total	**783**

Source: INEI 2018 and the authors

3.2 Variables

The dependent variable is technological innovation, which is made up of product and process innovation. Product innovation is a continuous variable, which occurs when the firm declares that completely new goods or services or important modifications to existing goods or services have been introduced. It was compiled via factorial analysis, which is made up of two dichotomous items: (1) New goods and (2) Significantly improved goods; a value of 1 means that an innovation was introduced, while a value of 0 means that innovation was not introduced.

Process innovation, also a continuous variable, occurs when the firm indicates that it has introduced some significant modifications to the production, marketing, logistical, or distribution processes. It was compiled via factorial analysis, which is made up of three dichotomous items: (1) Improved promotional and/or product positioning and/or price setting methods, or techniques for goods or services; (2) Improved business administration and management, methods of organizing work, organization of external relationships with other firms, or public institutions; and (3) Improved R&D processes, creativity, or design for the development of products or business processes. For this variable, a value of 1 means that an innovation was introduced, while a value of 0 means that innovation was not introduced.

On the other hand, AC and ambidexterity are the independent variables. AC is made up of the following items: (1) Research & Development (R&D), (2) Training for innovation activities, and (3) Presence of a Research and/or Development and/or Innovation Department according to Escribano, Fosfuri, and Tribó (2009) and Rammer, Czarnitzki, and Spielkamp (2009). These items are dichotomous; a value of 1 means an item was implemented, while a value of 0 means it was not implemented.

Ambidexterity, based on the definitions by Derbyshire (2014) and Vrontis, Thrassou, Santoro, and Papa (2017), used questions regarding the innovation

objectives of the firm. Three items represent exploitation, which are combined via a factorial analysis: (1) Increased production flexibility, (2) Production cost reduction, and (3) Improved performance or reduced consumption of raw materials. Exploration is represented by three items, which are combined via a factorial analysis: (1) Introduction of a new generation of products, (2) Entrance to new technological fields, and (3) A wide range of products. All of these items were measured on a Likert scale according to level of importance, the scale being the following: 1 = not at all, 2 = low, 3 = medium, 4 = high.

Additionally, firm size and age are control variables. They can influence the implementation of technological innovation. Firm size (expressed as a logarithm) is measured by the number of employees (Schoenmakers & Duysters, 2006; Laursen & Salter, 2006), and firm age (Thornhill, 2006) is measured as the number of years (expressed as a logarithm) from the year of the firm's foundation until the current year, 2020.

Finally, in Table 6, in the Annex, the type and scale and conceptual and operational definitions of the variables can be found.

3.3 Method of Analysis

AMOS version 24 software was used to estimate a structural equation covariance model in two steps. Firstly, the measurement model was estimated when the relationship between the indicators and the latent construct was determined through the use of confirmatory factorial analysis (CFA). Secondly, the structural model was estimated, in which the relationships between the constructs were obtained, by using the coefficients and the level of statistical significance.

4. Results

4.1 Measurement Model

A CFA was carried out to ensure the goodness of fit of the model. The normalized chi-square value was 16.293, the comparative fit index (CFI) was 0.994, the root mean square error of approximation (RMSEA) was 0.047, and all of the indicators were statistically significant (p-value ≤ 0.01). This meant that the recommended requirements for a model had been met (Byrne, 2010; Hair, Black, Babin, & Anderson, 2010).

The study data were analyzed and presented, by using reliability and convergence indicators. As for the composite reliability (CR), all of the constructs possessed values greater than 0.7, with the exception of technological innovation, which had a value very close to 0.623, and the average variance extracted (AVE), which was over 0.5. Moreover, it was revealed that all of the variables possessed discriminant validity according to the Fornell & Larcker (1981) criterion.

This is the level at which the indicators in a model represent a single construct and the indicators in the construct are different from the other constructs in the model. Based on the results of the indicators, and since the values are greater than 0.5, as it can be seen in Table 2, it is possible to carry out the structural model. Moreover, the R2 value is 0.485, which indicates a reasonable model fit.

Table 2. Convergent validity, reliability, and discriminant validity (Fornell-Larcker Criterion)

	Ambidexterity	AC	Technological Innovation
Exploration	0.71		
Exploitation	0.58		
AC1		0.83	
AC2		0.61	
AC3		0.88	
Product			0.63
Process			0.54
Average Variance Extracted (AVE)	0.858	0.561	0.507
Compound Reliability (CR)	0.896	0.766	0.623
Discriminant Validity*	Ambidexterity	AC	Technological Innovation
Ambidexterity	**0.926**		
AC	0.289	**0.749**	
Technological Innovation	0.543	0.499	**0.712**

* Note: The bold values in the diagonal are the square root of AVE, and the other values show correlations among the constructs of the model.
Source: AMOS software

4.2 Structural Model

The normalized chi-square was 75.190, the CFI was 0.972, the RMSEA was 0.064, and the probability of significance for the coefficients was less than 0.001, as shown in Table 3. Therefore, the structural model is considered acceptable, a good fit (Hair et al., 2010). The result shows that both AC and ambidexterity have a positive relationship with technological innovation because their coefficients are positive and statistically significant.

Table 3. Results of the structural model

Hypotheses	Coefficient	P-value	Support for the hypothesis studied?
H1: AC→AMB	0.285***	0.001	Yes
H2: AC→TI	0.374***	0.001	Yes
H3: AMB→TI	0.467***	0.001	Yes

Note: TI: Technological Innovation; AC: Absorptive Capacity; AMB: Ambidexterity. P-value: *p≤0.1; **p≤0.05; ***p≤0.001
Source: AMOS software.

The model also meets the goodness-of-fit index according to the following indicators: CMIN / df, GFI, TLI, CFI, and RMSEA. The values obtained indicate an adequate goodness of fit for the research model. See Table 4.

Table 4. Goodness-of-Fit Index

Indices	Structural model
CMIN/DF	4.177
GFI	0.979
TLI	0.944
CFI	0.972
RMSEA	0.064

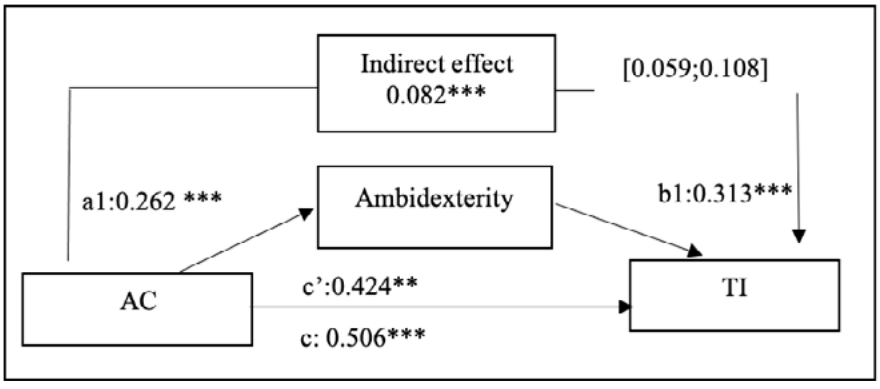
Source: AMOS software

4.3 Mediation Analysis

In the analysis, a mediating variable absorbs the effect of an independent variable (an exogenous construct) on a dependent variable (an endogenous construct) to a certain degree (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). According to Zhao, Lynch, and Chen (2010), the mediation is carried out through the interpretation of the significance of direct and indirect effects. Total mediation is when the indirect effect is significant. However, the direct effect is not significant. Partial mediation is when the indirect and direct effects are both significant.

According to Figure 2, ambidexterity is a significant partial mediator between AC and technological innovation. Moreover, through the PROCESS analysis, the association is significant because the corrected confidence intervals, due to bias, did not include zero. It can be concluded that mediation was present (Cabeza-Pullés, Fernández-Pérez & Roldán-Bravo, 2020). Therefore, research hypothesis 4 is supported.

Figure 2. Analysis of the mediation between AC and TI.



Source: Process version 3
Note: TI: Technological Innovation; AC: Absorptive Capacity. P-value: *p<=0.1; **p<=0.05; ***p<=0.001

Table 5 shows the coefficients of the control variables for technological innovation. It can be seen that firm age is positive and statistically significant. In other words, the oldest firms have more experience, by implementing technological innovations. Additionally, firm size possesses a positive coefficient, which is not statistically significant.

Table 5. Coefficients of the control variables

Control Variables	Coefficient	P-value
Age	0.063**	0.033
Size	0.019	0.528

Note: P-value: *p<=0.1; **p<=0.05; ***p<=0.001
Source: AMOS software

5. Discussion and Conclusions

Manufacturing firms should focus their efforts and energy on developing dynamic capabilities like AC and ambidexterity because in this way, they will improve their technological innovation capability. This study presents empirical evidence, which allows to verify the existence of a relationship between AC and ambidexterity in manufacturing firms. These results agree with those obtained by Diaz-Molina (2018) and Mardi et al. (2018). In both cases, these authors' quantitative studies confirmed the existence of a positive relationship between AC and ambidexterity.

A second aspect that was able to be verified refers to the relationship between AC and technological innovation in manufacturing firms. This result is in line with the results obtained by Martinez-Senra et al. (2015) and Limaj et al. (2016), who found that there is a positive relationship between AC and innovation. AC brings about innovative changes, which, in turn, demonstrate the fact that AC is a dynamic capability. These changes help firms to analyze their environments and to identify knowledge. This knowledge is acquired, assimilated, and processed in order to help to develop innovation capability.

A third result deals with the relationship between ambidexterity and technological innovation. The findings in the present study agree with those of Wei et al. (2014) and Pelagio Rodriguez et al. (2014), who found that the interaction of exploration and exploitation activities, that is, firms' ambidextrous behavior, improves those firms' ability to develop innovations. As indicated by He and Wong (2004), exploration activities are geared to search, discovery, experimentation, and innovation. Meanwhile, exploitation activities are concentrated on implementation, efficiency, and production. A balanced implementation of both activities will improve a firm's innovation capacity.

The fourth aspect is related to the mediating role of ambidexterity in the relationship between AC and technological innovation. This study contributes to the literature on the mediating role of ambidexterity, as some studies have already shown its partial mediating role in the re-

lationship between ambidextrous organizational culture and product innovation (Wang & Rafiq, 2014), and other studies have analyzed the mediating role in the relationship between ambidextrous organizational culture and firm performance (Liao et al., 2018). The contribution of the present study has been to empirically verify the partial mediating role of ambidexterity on the relationship between AC and technological innovation.

As for control variables, it can be appreciated that the only statistically significant control variable is firm age, a finding, which agrees with the findings of Wellalage and Fernandez (2019): mature firms are more able to acquire financial resources and to orient them toward innovation processes.

5.1 Practical Implications

The present study also has practical implications: managers should encourage exploitation and exploration activities. According to He and Wong (2004), exploitation activities are geared to improving the quality of existing products, by making production more flexible, by reducing production costs, as well as the consumption of raw materials. Meanwhile, exploration activities deal with the introduction of new products, with the expansion of firms' product portfolios, with the opening of new markets, and with the implementation of new technologies.

Managers should also foster the development of AC because this allows their firms' technological innovation capability to be improved. AC is any capability, which will allow a firm to recognize external knowledge, which can then be assimilated by the firm, and apply it for commercial purposes.

Besides, managers recognize that the introduction of new products into the market, or the increase of product portfolios, leads to more satisfied customers. Likewise, cost reduction, or the more efficient use of materials, will allow firms to improve their performance.

5.2 Conclusions, Limitations, and Further Research.

The purpose of this study was to show how the interaction of two dynamic capabilities such as absorptive capacity and ambidexterity improve the technological innovation capability of emerging economy manufacturing firms. It has been empirically verified that, for Peruvian manufacturing firms that participated in the 2018 innovation survey, made efforts to develop AC, a dynamic capability which, allows firms to identify external knowledge, to absorb it, and in this way, they can improve their technological innovation capability.

Besides, AC impact on ambidexterity´s firm, as a second dynamic capability. Manufacturing firms that develop ambidexterity are able to carry simultaneous-

ly two different activities: exploitation and exploration. this study has provided deeper knowledge on how manufacturing firms that develop their ambidexterity, that is, the ability to carry out exploration and exploitation activities are able to carry out innovations in products and processes.

Furthermore, it has been shown that ambidexterity behaves as a partial mediator in the relationship between absorptive capacity and technological innovation. This finding constitutes a contribution to the literature of the mediating role of ambidexterity, because this role has generally been established, in the relationship between the context and the firm performance, or in the relationship between ambidextrous innovation and the firm performance. In other words, if AC improves technological innovation capability of manufacturing firms, the ambidexterity role enhances this capability.

The present study is not free from several limitations, and this opens the door to future research opportunities. The first limitation has to do with the use of a database compiled from the 2018 National Survey of Innovation in the Manufacturing Industry and Knowledge-Intensive Services, published by the National Statistics and Informatics Institute of Peru. In the future, primary source information should be collected through surveys, which will allow constructs to be developed more carefully.

A second limitation is due to the fact that the study by its very nature is cross-sectional, which makes it difficult to prove causality between the constructs. It would be ideal to carry out longitudinal studies in the future.

A third limitation is due to the fact that the unit of analysis was manufacturing firms studied at one particular moment in time in a specific economy, which makes it difficult to generalize the results. More studies on emerging Latin American economies would allow for comparisons with other low-tech manufacturing firms' innovation behavior to be made.

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Annex

Table 6. Definitions of the variables in the study

Variable	Technological innovation
Type and scale	Quantitative and continuous.
Conceptual definition	The firm has produced product and/or process innovation.
Operational definition	Product innovation is made up of two dichotomous items: New goods. Significantly improved goods. Process innovation is made up of three dichotomous items: New or significantly improved promotional techniques and/or product positioning and/or establishment of prices for goods or services. New or significantly improved business administration and management methods, work organizational methods, or organization of external relationships with other firms or public institutions. New or significantly improved R&D processes, creativity, or design for product or process development.
Variable	**Absorptive capacity**
Type and scale	Qualitative and ordinal.
Conceptual definition	The firm has developed absorptive capacity for innovation.
Operational definition	Absorptive capacity is made up of three dichotomous items: R&D development. Training for innovation activities. Possesses a Research and/or Development and/or Innovation Department.

Variable	Ambidexterity
Type and scale	Quantitative and continuous.
Conceptual definition	The firm carries out exploitation and exploration activities in order to develop innovations.
Operational definition	Exploitation is made up of three polytomous items: Improved production flexibility. Reduced cost of production. Improved performance or reduced consumption of materials. Exploration is made up of three polytomous items: New generation of products introduced. New technological fields entered. Expanded range of products.
Variable	**Firm size**
Type and scale	Quantitative and continuous.
Conceptual definition	Size of firm according to the number of employees.
Operational definition	Expressed as a logarithm of the number of employees.
Variable	Firm age
Type and scale	Quantitative and continuous.
Conceptual definition	Age of the firm from the date of its foundation.
Operational definition	Expressed as a logarithm of the number of years in operation.

Source: Authors.