Performance implications of organizational and interorganizational ambidexterity

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Abstract

In the pursuit of higher performance, firms often complement their exploitation- and exploration-based innovations with activities of co-exploitation and co-exploration with other organizations. Previous studies have examined organizational and interorganizational implications of ambidexterity in a separate way. However, we combine internal and external contributions of exploitation and exploration by analyzing the moderating role of interorganizational ambidexterity in the relationship between organizational ambidexterity and firm performance. Data are collected from a sample of 245 manufacturing companies that developed exploitation- and exploration-based innovations. A regression model is estimated to test the hypothesis. The results suggest that firms reach superior performance by developing a balance between high levels of organizational and interorganizational ambidexterity simultaneously.

Keywords: organizational ambidexterity; interorganizational ambidexterity; firm performance; exploitation; exploration; co-exploitation; co-exploration

1. Introduction

Organizational ambidexterity improves firm performance (Junni *et al.*, 2013; Marín-Idárraga *et al.*, 2020; Wenke *et al.*, 2020). According to ambidexterity literature, firms may develop innovation activities based on existing knowledge, referred to as exploitation, and/or based on new knowledge, known as exploration (March, 1991). These knowledge-based innovations can be complemented by collaborative interorganizational relationships of co-exploitation and/or co-exploration (Parmigiani and Rivera-Santos, 2011; Sun and Lo, 2014). Co-exploitation is a type of collaborative interorganizational relationship for applying existing knowledge, while co-exploration is a collaborative agreement for searching for new knowledge outside the firm (Parmigiani and Rivera-Santos, 2011). Thus, collaborating with other organizations to simultaneously explore and exploit knowledge (Lee and Kim, 2019), referred to as interorganizational ambidexterity (Brix, 2019), appears as a suitable way for achieving ambidexterity, and has been suggested to improve firm performance (Kauppila, 2010; Kim *et al.*, 2019; Lavikka et al., 2015; Vahlne and Jonsson, 2017).

Several authors have previously addressed ambidexterity in contexts of interorganizational relationships with different approaches and contradictory results (e.g., Lin *et al.*, 2007; Stettner and Lavie, 2014). They suggest that interorganizational ambidexterity helps firms to solve trade-offs within the firm, such as the lack of resources for the simultaneous development of exploitation- and exploration-based innovations and path-dependency of one type of innovation over the other, which might cause learning traps at the firm level (Levinthal and March, 1993). However, the knowledge about how interorganizational relationships help to improve firm performance based on ambi-dextrous strategies is still a matter of research (Marín-Idárraga *et al.*, 2020; O'Reilly III and Tushman, 2013; Parmigiani and Rivera-Santos, 2011). In this regard, we analyze the effects of organizational and interorganizational ambidexterity on firm performance by studying 245 manufacturing companies that develop exploitation- and/or exploration-based innovations in collaboration with other organizations. The results suggest that interorganizational ambidexterity improves the effect of organizational ambidexterity on firm performance. As well, we add to previous studies in the Latin American context that examined organizational learning (Arantes & Lima Soares, 2021), and exploration and exploitation as determinants of organizational ambidexterity (Acevedo & Díaz-Molina, 2019), expanding its performance implications at the firm level.

This paper is organized as follows. First, we address ambidexterity in organizational and interorganizational domains, presenting the hypothesis. Later, we introduce the methodology and results. Then, in the discussion and conclusions section, we address theoretical contributions, as well as managerial implications, limitations, and future avenues of research.

2. Theoretical framework and hypothesis

2.1. Organizational ambidexterity and firm performance

Organizational ambidexterity refers to the simultaneous quest for exploitation- and exploration-based innovations (O'Reilly III and Tushman, 2013). Exploitation consists of the display of behaviors aligned with existing knowledge to respond more efficiently to current demands (Benner and Tushman, 2003). On its part, exploration describes innovation endeavors to develop new knowledge that allows firms to adapt and anticipate future challenges (Benner and Tushman,

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2003). Previous studies suggest that firms that display organizational ambidexterity are successful (O'Reilly III and Tushman, 2013).

Literature has shown that exploration without exploitation involves abundant costs with moderate benefits (i.e., failure trap), while exploitation without exploration leads to assets stagnation and obsolescence (i.e., success trap) (Kauppila, 2015; Levinthal and March, 1993). Thus, through organizational ambidexterity firms can overcome the limitations of carrying out exclusive strategies of exploitation and exploration (Gilsing and Nooteboom, 2006; Markides, 2013; Tushman and O'Reilly III, 1996). Organizational ambidexterity increases firm performance due to complementarities between exploitation and exploration (Junni et al., 2013; Marín-Idárraga et al., 2020; O'Reilly III and Tushman, 2013; Raisch et al., 2009). Thus, exploration generates opportunities for exploitation, while profits obtained by exploitation allow firms to carry out more exploration (Gupta et al., 2006; Lavie et al., 2010). In this regard, organizational ambidexterity has a positive effect on firm growth (He and Wong, 2004) and overall performance (Cao et al., 2009).

However, not all firms attempting organizational ambidexterity are successful (O'Reilly III and Tushman, 2013). The lack of resources for exploitation and exploration, the trade-offs between them, and the absence of capabilities to integrate them properly may lead firms to opt for specialization in either exploitation or exploration (Gupta et al., 2006; Solís-Molina et al., 2018) or to switch back and forth between them over time (Boumgarden et al., 2012; Mavroudi et al., 2020). Likewise, other studies have pointed out the firm size as a resource limitation to endeavor ambidexterity, fostering SMEs to focus on either exploitation or exploration to enhance performance (Wenke et al., 2020). Thus, the firm may be incapable to solve these limitations, and requires the search for solutions outside its boundaries (O'Reilly III and Tushman, 2013). In this regard, interorganizational collaborations can be one of the few mechanisms to elude trade-offs between exploitation and exploration (Kang et al., 2007).

2.2. Interorganizational ambidexterity and firm performance

Exploitation and exploration developed in collaboration with other organizations are referred to as co-exploitation and co-exploration, respectively (Parmigiani and Rivera-Santos, 2011). Co-exploitation allows partners within a business relationship to apply, share and integrate their existing knowledge (Lavikka et al., 2015; Sun and Lo, 2014). Co-exploitation facilitates firms to use their existing knowledge and obtain plenty of returns on their capacity (Sun and Lo, 2014). However, although in the short-run co-exploitation can help firms in the relationship to achieve tasks more efficiently and benefit their financial performance (Kauppila, 2015), it limits innovation and future opportunities for firm growth (Kang et al., 2007), at the risk that knowledge and results might be obsolete (Lavie et al., 2011).

On the other hand, co-exploration allows firms in a collaborative relationship to discover opportunities and develop new knowledge continuously, promoting innovative results and the firm's growth (Atuahene-Gima and Murray, 2007; Kauppila, 2015). Nevertheless,

focusing just on co-exploration can generate a greater number of new ideas but less viable, increasing the probability of not obtaining benefits and recovering experimentation costs (Cao et al., 2009), harming financial performance in the short term (Kauppila, 2015; Koza and Lewin, 1998). Thus, previous studies suggest that due to synergies between co-exploitation for financial performance and co-exploration for firm growth, ambidextrous interorganizational collaboration or interorganizational ambidexterity favors overall performance (Kauppila, 2015; Kristal et al., 2010; Lavikka et al., 2015; Vahlne and Jonsson, 2017).

Hence, interorganizational ambidexterity is defined as the firm's ability to exhibit high levels of co-exploitation and co-exploration simultaneously (Sun and Lo, 2014). According to Sun and Lo (2014), co-exploitation and co-exploration are crucial for success because they nurture each other for value creation and performance improvement (Cao et al., 2009). Therefore, we expect that the simultaneous use of strategies of co-exploitation and co-exploration leads to superior performance.

However, interorganizational ambidexterity, as well as organizational ambidexterity, faces strong challenges such as limited resources and network restrictions that affect decisions associated with business relationships (Lin et al., 2007). These challenges lead to trade-offs between co-exploitation and co-exploration, associated with the decisions to allocate resources for the refinement of relationships with current partners or the development of new relationships to access new knowledge and resources (Lin et al., 2007). Thus, there is a need to combine ambidextrous contexts at organizational and interorganizational levels simultaneously to benefit performance (Lavie et al., 2011). Therefore, ambidexterity can be reached more successfully by establishing ties inside and outside the firm, and interorganizational relationships play a crucial role to enhance and complement exploitation and exploration at the organizational level (Hoffmann, 2007; Kauppila, 2010; Koza and Lewin, 1998).

2.3 Organizational and interorganizational ambidexterity on firm performance

Collaboration strategies with other organizations contribute to solving the trade-offs associated with path-dependency and the lack of resources to develop exploitation and exploration simultaneously (Kauppila, 2010; Lavikka et al., 2015). First, interorganizational relationships help to expand the base of resources for exploitation and exploration (Kauppila, 2010; Vahlne and Jonsson, 2017). Second, a portfolio of relationships, some more focused on exploitation and others on exploration, allows firms to avoid that any strategy harms the implementation of the other (Kauppila, 2010; Koza and Lewin, 1998; Wassmer, 2010). In this regard, firms tend to maintain a balance in the formation of alliances for exploration and exploitation over time (Lavie and Rosenkopf, 2006). Third, by establishing relationships with companies that are successful in exploitation and exploration, firms adopt best practices to elude the harmful effects of the excess of exploitation or exploration, reducing the risk of success or failure traps (Kauppila, 2010; Levinthal and March, 1993).

These options to balance the tension between exploitation and exploration by using interorganizational relationships have the potential to reach ambidexterity across domains (i.e., organizational and interorganizational), which may lead to greater performance. In other words, the lack of exploitation or exploration at the organizational level can be compensated with exploitation or exploration at the interorganizational level and vice versa (Lavie *et al.*, 2011; Stettner and Lavie, 2014). Thus, we expect the simultaneous development of organizational and interorganizational ambidexterity to contribute to better performance. In consequence, we suggest that interorganizational ambidexterity facilitates the co-development of knowledge to complement internal efforts of exploitation- and exploration-based innovations and contribute to improving the effect of organizational ambidexterity on firm performance. Thus, we propose the following hypothesis:

H_1. *Interorganizational ambidexterity improves the effect of organizational ambidexterity on firm performance.*

3. Methodology

3.1. Sample and data collection

To test our hypothesis, we performed an empirical study by examining data from innovative manufacturing companies in Colombia. The sample was selected from the manufacturing sectors that exhibited greater percentages of innovative firms and higher investments in R&D. These companies developed at least one new or significantly enhanced, for the national market or the organization, product or service, productive process, marketing activity, or organizational practice. Out of 27,032 companies registered in the Information System and Business Report of Colombia, 4,622 were classified as manufacturing, and 4,287 had turnover data, as a sign of their recent activity. We managed to contact 2,996 companies by telephone. For the rest of the 1,291, due to outdated information, it was not possible to establish contact. At this stage, 268 companies refused to participate in this study, mostly for confidentiality issues. 680 companies reported innovation projects and provided information about a key person.

First, we invited the companies to participate by e-mail. Second, we made an appointment with the key person that was involved in the exploitation- or exploration-based innovation. Third, we applied the questionnaire. We finally gathered data from 245 manufacturing companies that developed exploitation and/or exploration in collaboration with other organizations. Comparing data provided by interviews (i.e., face-to-face, telephone, or online), using an analysis of variance for performance ($F = 0.654$, $p = 0.419$), we did not find any significant difference. Including the method as a control variable ($F = 0.654$, $p = 0.419$), or the interactions of the method with the

variables of the theoretical model, we did not observe any significant changes in R^2 ($\Delta F=0.404$, $p = 0.750$). Therefore, we concluded that the collecting method did not introduce any bias in the estimated model.

The final sample was composed of firms with an operating age of 31 years on average. 83% were the main offices and 17% were subsidiaries. 13% were mostly of foreign capital. With less than 50 employees, 36% were small-sized companies, with more than 50 and less than 200 employees, 41% were medium-sized companies, and with more than 200 employees, 23% were large-sized companies. The manufacturing sectors were distributed as follows: 22% food and beverage, 13% other manufacturing industries, 13% chemical and pharmaceutical, 8% textiles, 7% plastics and electric, 6% non-metallic minerals and printing, 5% metals, 4% automotive and furniture, 3% machinery, and paper and cardboard. The interviews were held with mid-level and senior managers 44% from the production area (i.e., quality control, operations, technical or logistics), 19% from management (i.e., director, president), 15% from administration, 11% from innovation (R&D), 5% marketing (sales), 3% human resources, and 3% finance. 34% of the interviewees were women and 66% were men. On average, the respondents were 41 years old, their tenure was 10 years, and their time of experience in the manufacturing sector was 14 years. 87% obtained a degree of higher education. Their average level of knowledge about the questions was eight on a Likert scale from 0 to 10.

3.2 Measurement

We searched for performance, exploitation, exploration, co-exploitation, and co-exploration scales in literature. The validity of content relies on scales previously used in other studies and pre-tests with mid-level and senior managers. For firm performance, we selected scales based on the models of effectiveness rational goals, open system, and human relations (Quinn and Rohrbaugh, 1983), resembling the balanced scorecard financial, customer, and learning and growth perspectives (Kaplan and Norton, 2005; Taticchi *et al.*, 2010). The rational goals model uses planning and firm goals to reach productivity and efficiency, maximizing results. On its part, the open system model focuses on flexibility to accomplish growth and resource acquisition. The human relations model is concerned with cohesion and morale, as a path to developing human talent. The effectiveness models and the balanced scorecard perspectives selected are related to an external focus that deals with the company's survival in the long term, which is suitable for ambidexterity literature (O'Reilly III and Tushman, 2013) and the innovator's dilemma (Christensen, 2013). The construct of a firm's performance was modeled as a second-order construct composed of the three above-mentioned dimensions. Table 1 shows the results of the confirmatory factor analysis to determine the unidimensionality and reliability of the dimensions and the second-order confirmatory analysis.

Table 1: First and second-order confirmatory factor analysis of firm performance

First-order constructs Firm performance	Standardized coefficient (t-value)	Standardized Coefficients (t-value)
Express the satisfaction with firm performance over the last three years for:		
Rational goals (financial perspective) SCR=0.86		
Profitability	0.87 (16.28)	0.87[a]
Sales	0.87 (16.38)	0.87 (16.07)
Market share	0.72 (12.42)	0.72 (12.60)
Productivity	0.57 (9.24)	0.57 (9.32)
Open system (customer perspective) SCR=0.82		
External Image and reputation	0.70 (11.56)	0.70[a]
Competitive advantage	0.72 (11.96)	0.72 (9.67)
Adaptation to new necessities and market demands	0.68 (11.17)	0.68 (9.25)
Firm position in the manufacturing sector	0.71 (11.70)	0.71 (9.54)
Client satisfaction	0.63 (10.04)	0.63 (8.59)
Human relations (learning and innovation perspective) SCR=0.78		
The innovative capacity of the firm	0.63 (9.92)	0.63[a]
The professional capability of the personnel	0.65 (10.12)	0.65 (7.84)
Motivation and satisfaction of the personnel	0.73 (11.71)	0.73 (8.46)
Learning about innovation	0.65 (10.16)	0.65 (7.86)

Second-order analysis Firm performance	Standardized coefficients (t-value)
Rational goals	0.65 (8.52)
Open system	0.81 (8.55)
Human relations	0.84 (7.93)

Measurement model of 13 indexes for 3 constructs: $c^2_{(62)}$ = 178.53; GFI=0.89; CFI=0.95, NNFI=0.94, RMSEA=0.092; SRMR=0.060.

[a] Fixed value to 1.

The results suggest an overall acceptable fit for firm performance dimensions (Anderson and Gerbing, 1988). For all three performance dimensions, the scale composite reliability (SCR) was over the suggested value of 0.7 (Bagozzi and Yi, 2012). As evidence of convergent validity, the first-order confirmatory factor loadings were highly significant (Bagozzi and Yi, 1988). Moreover, the confidence intervals of the correlations between constructs at ± 3 standard error (**p** < 0.01) did not include 1, as evidence of discriminant validity (Anderson and Gerbing, 1988). As an indication of highly significant factor loadings, the second-order confirmatory factor analysis of performance showed that the lowest t-value was 7.93. Thus, we considered firm performance as a general concept composed of three dimensions.

For the independent variables of exploitation and exploration, we selected the scales proposed by Atuahene-Gima (2005) to estimate organizational ambidexterity. These scales measure the ability of the firm to exploit the innovation competence of existing products (i.e., exploitation), and the ability to elude established routines and replace them with new competences (i.e., exploration). According to previous studies, organizational ambidexterity can be estimated through separate measures of exploitation and exploration (He and Wong, 2004).

Following a multiplicative approach, the product of these two variables represents organizational ambidexterity (O'Reilly III and Tushman, 2013). Thus, this product reflects the exploitation-exploration balance at the organizational level. High levels of both represent high organizational ambidexterity, while low levels exhibit low organizational ambidexterity.

Regarding co-exploitation and co-exploration, we asked to what extent the company collaborated with others for the development of innovations of exploitation and exploration, respectively. The use of measures of one item is based on the procedure C-OAR-SE proposed by Rossiter (2002), which supposes that one item is enough if in the mind of the interviewees one element is singular, concrete, uniform, and easy to imagine. In these cases, it is suggested that one item gives more information than several of the less quality that are synonyms of the principal (Bergkvist and Rossiter, 2007). In our case, we understand that once the company performs exploitation and exploration, co-exploitation and co-exploration are concepts that can be answered with one item without ambiguity. The product of these two variables represents interorganizational ambidexterity following a multiplicative approach (Kauppila, 2015). Hence, this product reflects the

co-exploitation-co-exploration balance at the interorganizational level. High levels of both represent high interorganizational ambidexterity, while low levels exhibit low interorganizational ambidexterity.

Table 2 presents the confirmatory factor analysis of the overall model. The results suggest the unidimensionality of the concepts due to the acceptable fit of the measurement model (Anderson and Gerbing, 1988).

Table 2: Confirmatory factor analysis of the measures

Item description	Standardized coefficient (t-value)
Performance* Quinn and Rohrbaugh (1983) and Kaplan and Norton (2005), SCR=0.74	
Rational goals (financial perspective)	1.61 (9.23)
Open system (customer perspective)	1.73 (11.25)
Human relations (learning and innovation perspective)	0.74 (11.43)
Exploitation** Atuahene-Gima (2005), SCR=0.70	
Searched for new markets for taking advantage of existing products and technologies.	0.56 (8.00)
Upgraded knowledge and skills for familiar products and technologies.	0.57 (8.26)
Invested in enhancing skills in exploiting mature technologies that improve the productivity of current innovation operations.	0.59 (8.54)
Enhanced competences in searching for solutions to customer problems near to existing solutions rather than completely new solutions.	0.56 (7.98)
Upgraded skills in product development processes in which the firm already possesses significant experience.	0.52 (7.46)
Exploration** Atuahene-Gima (2005), SCR=0.78	
Explored new products and/or markets unknown to the firm.	0.66 (10.43)
Acquired entirely new managerial and organizational skills.	0.58 (8.86)
Acquired products and manufacturing technologies entirely new to the firm.	0.73 (11.69)
Strengthened innovation skills in areas where it had no prior experience.	0.78 (12.71)
Co-exploitation**	
Collaborated with other organizations.	1.00-[a] (22.09)
Co-exploration**	
Collaborated with other organizations.	1.00-[a] (22.09)

Model of measurement 14 indexes for 5 constructs: $c^2_{(69)}$ = 115.66; GFI=0.94; CFI=0.96; RMSEA=0.050; SRMR=0.054; NNFI=0.95

* Each item corresponds to each dimension average of its items' value.

** Over the last three years, to what extent has your firm. Anchors: 0=no extent and 10=to a great extent.

*** For the development of innovations of exploitation (or exploration) to what extent your company has...

Anchors: 10= to a great extent and 0=no extent.

[a] Valor of l_x fixed to one.

The scale composite reliability was over the minimum value recommended of 0.70 for performance, exploitation, and exploration (Bagozzi and Yi, 2012). As evidence of convergent validity, the lowest t-value was 7.46 (Bagozzi and Yi, 1988). Regarding discriminant validity, none of the upper values of the confidence intervals of the correlations between two constructs at 99% included one (Anderson and Gerbing, 1988). The correlations and descriptive statistics of organizational and interorganizational ambidexterity are presented in Table 3.

Table 3: Correlation matrix and descriptive statistics

Variables	1	2	3	4	5	Variables	1	2	3
1. Performance						1. Performance			
2. Exploitation	0.39*					2. Organizational ambidexterity	0.38*		
3. Exploration	0.26*	0.27*				3. Interorganizational ambidexterity	- 0.05	0.20*	
4. Co-exploitation	-0.04	0.11	0.10						
5. Co-exploration	-0.09	0.08	0.17*	0.50*					
Mean	7.85	7.90	6.50	4.66	4.45	Mean	7.85	52.02	24.34
Standard deviation	0.85	1.07	1.70	2.75	2.62	Standard deviation	0.85	16.96	21.19

*Correlation is significant at 0.01 (bilateral). SPSS 19.

Common method bias was tested because we used one respondent for the whole questionnaire (Harman, 1976). The exploratory analysis determined nine factors for a total variance explained of 66%. These factors agreed with the variables proposed in the theoretical model. The variance was not explained mostly by the first factor (less than 20%) (Menon *et al.*, 1999). The confirmatory factor analysis of the variables using one single factor showed a significant difference $\Delta x^2(19) = 725$ (p < 0.001) compared with the theoretical factorial model proposed. For these reasons, we concluded that it did not seem to be a common method variance bias.

4. Results

The hypothesis was tested using ordinary least squares regression of the following equation:

PER= β_0 + $_i$ + β_1 AMB + β_2 IAMB + β_3 AMB×IAMB
PER= Performance of the firm; CV$_i$ =Control variable.
AMB= Organizational ambidexterity (exploitation x exploration).
IAMB= Interorganizational ambidexterity (co-exploitation x co-exploration).

Due to the presence in the same equation of main and interaction terms, the variables were mean-centered to reduce multicollinearity (Aiken and West, 1991; Cohen *et al.,* 2013; Jaccard *et al.*, 1990). For organizational ambidexterity, we estimated the product of exploitation and exploration. As well as for interorganizational ambidexterity, we calculated the product of co-exploitation and co-exploration. In both cases, products were mean-centered. As for the interaction term, we estimated the product of organizational and interorganizational ambidexterity mean-centered. The maximum VIF is 2.419. As control variables, we included the manufacturing sector (Junni *et al*., 2013), environmental dynamism and competitive intensity (Carbonell and Rodriguez, 2006), and firm size (Schulze *et al.*, 2008) as the number of full-time employees (log10 transformation).

Table 4 shows the three nested models comparing the increase of R^2 obtained by adding more variables. The first model includes control variables. The second model adds the type of ambidexterity represented by organizational and interorganizational ambidexterity. The third model introduces the interaction between them. The third model shows the highest level of explanation significantly better than the other two models (p< 0.001). This final model exhibits a 17.621 % increase of adjusted R-squared compared to Model II (without the multiplicative term). This, along with the high significance of the interaction term, is a clear indication of the contribution of the interaction of organizational and interorganizational ambidexterity on the effects of the individual types on performance.

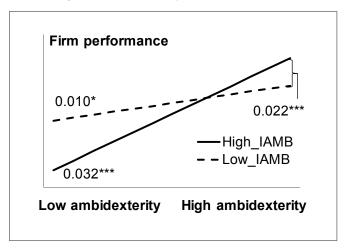**Table 4:** Regression analysis of organizational and interorganizational ambidexterity on firm performance

Dependent variable	Model I Control variables	Model II Type of ambidexterity	Model III Theoretical Model	
Firm performance	Standardized coefficients (t-value)	Standardized coefficients (t-value)	Standardized coefficients (t-value)	VIF
Intercept	7.801 (20.982)	8.001 (22.786)	7.909 (23.044)	
Control				
Food and beverage	0.011 (0.117)	-0.082 (-0.926)	-0.035 (-0.404)	2.419
Chemical and pharmaceutical	-0.100 (-1.178)	-0.093 (-1.176)	-0.042 (-0.540)	1.927
Plastics	-0.070 (-0.938)	-0.081 (-1.164)	-0.068 (-1.001)	1.439
Non-metallic minerals	0.041 (0.554)	-0.044 (-0.619)	-0.048 (-0.697)	1.519
Printing	-0.058 (-0.789)	-0.060 (-0.859)	-0.062 (-0.912)	1.447
Electrics	-0.033 (-0.442)	-0.018 (-0.263)	0.016 (0.234)	1.477
Automotive	-0.242 (-3.379) ***	-0.218 (-3.267) **	-0.189 (-2.894) **	1.350
Metals	0.054 (0.739)	0.045 (0.668)	0.079 (1.187)	1.407
Machinery	-0.021 (-0.308)	-0.023 (-0.353)	-0.023 (-0.365)	1.304
Textiles	-0.080 (-1.036)	-0.100 (-1.394)	-0.078 (-1.113)	1.552
Paper and cardboard	-0.079 (-1.156)	-0.082 (-1.270)	-0.055 (-0.871)	1.262
Furniture	0.056 (0.783)	0.064 (0.972)	0.061 (0.949)	1.320
Environmental dynamism	0.066 (0.978)	0.025 (0.405)	0.026 (0.426)	1.181
Competitive intensity	-0.094 (-1.412)	-0.109 (-1.768) †	-0.104 (-1.739) †	1.139
Firm size-employees	0.109 (1.626)	0.114 (1.841) †	0.105 (1.733) †	1.160
Type of ambidexterity				
Organizational ambidexterity		0.396 (6.291) ***	0.424 (6.852) ***	1.207
Interorganizational ambidexterity		-0.112 (-1.809) †	-0.192 (-2.974) **	1.312
Interaction term				
Organizational ambidexterity x Interorganizational ambidexterity			0.225 (3.605) ***	1.236
				1.236
R^2 (Adj. R^2)	0.109 (0.051)	0.243 (0.187)	0.284 (0.227)	
F value	1.873	4.292	4.990	
F probability	0.039	0.000	0.000	
ΔR^2(Δ adj. R^2)		0.134 (0.136)	0.041 (0.040)	
F value (ΔR^2)		20.091	12.998	
F probability (ΔR^2)		0.000	0.000	

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

In the third model, organizational ambidexterity, and the interaction of organizational and interorganizational ambidexterity have positive and significant effects on firm performance. In the case of interorganizational ambidexterity alone, the effect on firm performance is negative and significant. The control variable of firm size has a positive and significant effect on firm performance, while competitive intensity and the automotive manufacturing sector have a negative and significant effect on firm performance in contrast with other manufacturing industries. The hypothesis was tested using a simple slope analysis (Aiken and West, 1991; Cohen *et al.*, 2013; Jaccard *et al.*, 1990).

The effect of organizational ambidexterity on firm performance at high levels of interorganizational ambidexterity (+1 standard deviation = 21.19) represented by the continuous line in Fig. 1 is positive and highly significant (β= 0.032, $p < 0.001$). Regarding low levels of interorganizational ambidexterity (-1 standard deviation = -21.19) exhibited by the dashed line in Fig. 1, the effect of organizational ambidexterity on firm performance is also positive and significant ($\beta = 0.010$, $p < 0.05$). Comparing the effects of organizational ambidexterity on firm performance for high and low levels of interorganizational ambidexterity, the difference is positive and highly significant ($\beta = 0.022$, $p < 0.001$). Therefore, the effect of organizational ambidexterity on firm performance is greater for high levels than for low levels of interorganizational ambidexterity, and, in both cases, the effects were positive and significant. Thus, interorganizational ambidexterity improves the effect of organizational ambidexterity on firm performance supporting hypothesis H_1.

Figure 1. Effect of organizational ambidexterity on firm performance for levels of interorganizational ambidexterity

5. Discussion and conclusions

Previous studies have evidenced that the combination of exploitation and exploration at the organizational level has a positive effect on firm performance (Junni *et al.,* 2013; Marín-Idárraga *et al.*, 2020). However, there are other studies with inconclusive or even the opposite results. Some studies found a negative effect (Kauppila, 2015; Lin *et al.*, 2007). Others that this effect is positive just for larger-sized firms (Lin *et al.*, 2007), when variables from the organizational domain were involved (Kauppila, 2010; Kristal et al., 2010), or when this interaction was analyzed with internal modes (Stettner and Lavie, 2014). This study examines whether interorganizational ambidexterity helps organizational ambidexterity to reach superior performance.

Our results confirm that organizational ambidexterity improves firm performance, while interorganizational ambidexterity, by itself, affects it negatively. However, when organizational ambidexterity and interorganizational ambidexterity are used simultaneously, we observe a more positive effect on firm performance than the effect of organizational or interorganizational ambidexterity independently. This result suggests that the greatest performance is achieved by firms with high levels of organizational ambidexterity in the presence of high levels of interorganizational ambidexterity. Hence, we contribute to clarifying previous contradictory results about the effects of interorganizational ambidexterity on organizational ambidexterity and firm performance.

Thus, we confirm the results of Kauppila (2015) and Lin *et al.* (2007), which evidenced a negative effect of the interaction of co-exploitation and co-exploration on firm performance when it is analyzed without including the interaction of exploitation and exploration at the organizational level. For Lin *et al.* (2007), their results showed a negative effect of interorganizational ambidexterity on firm performance for small-sized firms. For Kauppila (2015), despite the belief that when co-exploitation and co-exploration are pursued simultaneously they lead to superior performance (Kauppila, 2010; Kristal *et al.*, 2010), this strategy drives to less performance due to trade-offs between both strategies (i.e., lack of resources and one strategy saturates the other). The results of Kauppila (2015) match those obtained by Lin *et al.* (2007), in the way that interorganizational ambidexterity harms performance when it is implemented independently of the organizational level. In this regard, Lavie *et al.* (2010) suggest that the negative results obtained by Lin et al. (2007) can be explained because the organizational and interorganizational domains of the firm were not included simultaneously. In the case of Kauppila (2015), we understand it is a similar case because exploitation and exploration were not included, and therefore organizational and interorganizational domains were not analyzed simultaneously.

Therefore, for better performance, it is required to complement organizational ambidexterity with interorganizational business relationships. This is in line with Kauppila (2010) who suggested that an ambidextrous organizational context and interorganizational business relationships are not substitutes but complements. In the same way, this study agrees with Stettner and Lavie (2014) about the convenience to combine internal and external domains to improve firm performance, because it allows firms to benefit from the complementarities of exploitation and exploration.

5.1. Theoretical contribution

We contribute with Lavie *et al.* (2011; 2010) to expand the field of study of ambidexterity, including not just the organizational and interorganizational domains in a separate way, but integrating them simultaneously and measuring their effects on firm performance. In this regard, our main contribution is to address the effects of organizational ambidexterity on firm performance with the moderating role of interorganizational ambidexterity. The results suggest that interorganizational ambidexterity improves the effect of organizational ambidexterity on firm performance, mitigating its negative effects when it is applied alone. Hence, this outcome support that the combination of organizational and interorganizational settings of high levels of exploitation and exploration outperforms other alternatives (Hernandez-Espallardo *et al.*, 2012; Holmqvist, 2004; Lavie *et al.*, 2011). Moreover, we propose a way to combine organizational and interorganizational ambidexterity simultaneously by using the multiplicative approach.

5.2. Managerial implications

The development of strategies of organizational ambidexterity requires that firms carry out processes of learning to increase their levels of exploitation and exploration, by complementing their internal efforts of innovation with co-exploitation and co-exploration. Table 5 shows the different alternatives for combining organizational and interorganizational domains for ambidexterity strategies.

Table 5: Organizational ambidexterity vs. Interorganizational ambidexterity

		Interorganizational ambidexterity	
		Low	**High**
Organizational	**High**	2. Ambidexterity is obtained mainly from internal sources. Suboptimal performance.	4. Ambidexterity is achieved by the combination of organizational and inter-organizational sources. Superior performance.
Ambidexterity	**Low**	1. Performance is not improved.	2. Ambidexterity is obtained mainly by external sources. Negative effects on performance.

In the first case, at low levels of organizational and interorganizational ambidexterity, performance is not improved due to exploitation or exploration activities. In the second case, at low organizational ambidexterity and high interorganizational ambidexterity, innovation originated mainly from external sources, which might harm firm performance. In the third case, at high levels of organizational ambidexterity and low levels of interorganizational ambidexterity, innovation mainly results from internal efforts and performance is positive but suboptimal. Finally, in the fourth case, at high organizational and interorganizational ambidexterity, internal and external efforts come together and represent the most promising scenario for higher performance. In other words, internal balance at the organizational level and productive collaborative relations with allies at the interorganizational level will boost firm performance more than any other condition.

5.3 Limitations and future avenues of research

This is a cross-sectional study, so longitudinal studies that examine the change of the variables in time to study organizational and interorganizational ambidexterity effects on firm performance are suggested. One of the limitations of this study is the lack of inclusion of control variables for the portfolio of relationships. That is, whether firms have collaborated with their partners before or not, or about the diversity of the knowledge bases of their partners (i.e., new, or old). Future studies should test moderating variables that help to improve the interaction between organizational and interorganizational ambidexterity in the short- and long-term such as absorptive capacity (Acevedo & Díaz-Molina, 2019; Patel, Terjesen, & Li, 2012), alliance capabilities (Kim *et al.*, 2019; Russo and Vurro, 2019; Solís-Molina *et al.*, 2022), and control mechanisms among others (Solís-Molina *et al.*, 2020; Sun and Lo, 2014).

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