Influence of cooperation networks on the relation between dynamic innovation capabilities and innovative performance

Influência das redes de cooperação na relação entre as capacidades dinâmicas de inovação e o desempenho inovador

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Marjulie Merini Alberton
Master in Administration
Institution: Centro Universitário Leonardo da Vinci (UNIASSELVI)
Address: Rua Doutor Pedrinho (Anexo ao Shopping Vitória Régia), 79, Rio Morto, Indaiatuba - SC
E-mail: marjuliealberton@gmail.com
Orcid: https://orcid.org/0000-0001-9491-4222

Júlio César da Silva
PhD in Accounting and Administration
Institution: Universidade de Blumenau (FURB)
Address: R. Antônio da Veiga, 140, Itoupava Seca, Blumenau - SC, CEP: 89030-903
E-mail: profjuliosilva72@gmail.com
Orcid: https://orcid.org/0000-0002-6655-284X

Carlos Eduardo Carvalho
PhD in Administration and Tourism
Institution: Universidade do Oeste de Santa Catarina (Unoesc)
Address: Av. Nereu Ramos, 3777D, Seminário, Chapecó - SC, CEP: 89813-000
E-mail: carlos.carvalho@unoesc.edu.br
Orcid: https://orcid.org/0000-0002-7157-0743

Gerson Tontini
PhD in Mechanical Engineering
Institution: Universidade de Blumenau (FURB)
Address: R. Antônio da Veiga, 140, Itoupava Seca, Blumenau - SC, CEP: 89030-903
E-mail: gersontontini@gmail.com
Orcid: https://orcid.org/0000-0002-7430-562X

ABSTRACT
The present paper analyzes the influence of cooperation networks on the relation between dynamic innovation capabilities and innovative performance. Interviewing 258 Brazilian manufacturing organizations, and using Structural Equation Modeling through SmartPLS software, the results show that the dynamic capabilities of products and organizational...
significantly influences product and process innovation performance. Process dynamic innovation capabilities only influence innovation performance in process efficiency. Regarding the performance of organizations in cooperation networks, this favors companies to obtain results in process innovation, as well as influences positively and significantly in the development of all dynamic innovation capabilities observed in this study. This work contributes to increase the knowledge about the influence of cooperation networks on the dynamic innovation capabilities and innovative performance of companies. The results are of relevance to organizations and managers, who can use this information to reflect on organizational practices and management attitudes, in order to assist in the development of organizational strategies and decision making.

Keywords: cooperation networks, dynamic innovation capabilities, innovative performance.

1 INTRODUCTION

In a competitive, changing and challenging environment, organizations continually seek new ways to adapt, responding to environmental and organizational changes, innovating, in order to survive in the marketplace. Thus, many companies make use of their dynamic capability for innovation. Teece and Pisano (1994) describe dynamic
innovation capability as the subset of competencies and capabilities that enable it to generate new products and processes to respond to changing market environments.

Innovative organizations generally tend to respond more quickly to environmental pressures (López, Peón, & Ordás, 2005). Consequently, innovative companies that develop their dynamic capabilities tend to outperform others (Lawson & Samson, 2001; Piening & Salge, 2015). Still, one possibility for organizational development is interorganizational actions, such as cooperation networks (Grandori & Soda, 1995; Olave & Amato, 2001).

Cooperative networks provide organizations with numerous advantages, where it is possible to exchange knowledge, skills, raw materials, and skilled labor. It is worth mentioning that trust and cooperation tend to be relevant factors for the success achieved by interorganizational networks (Balestrin & Vargas, 2004; Hoffmann et al., 2017). Thus, the present paper has the following research question: What is the influence of participation in cooperation networks in the relationship between dynamic innovation capabilities and innovative performance? The present paper analyzes the influence of the participation of companies in cooperation networks in the relationship between their dynamic innovation capabilities and their innovative performance.

This study presents theoretical and empirical contributions. Several publications deal about the relationship between cooperation networks and dynamic innovation capabilities (Andersen, Clausen, Cronin & Piirainen, 2018); other studies address the relationship of cooperation networks with innovative performance (YOU, SHU & LUO, 2017); and others deal with the relationship between dynamic innovation capabilities and innovative performance (Manthey, Verdinelli, Rossetto & Carvalho, 2017). However, we did not find publications studying the relationship between dynamic innovation capability and innovative performance, considering the participation in cooperation networks as a factor of influence in the innovative performance. Regarding empirical contributions, the identification of whether cooperation networks influence the relationship between dynamic innovation resources and innovative performance can help organizations and managers in the decision-making process to define relevant organizational strategies.

This paper is organized into five topics: the first is this Introduction, followed by the Theoretical Framework. The third topic presents the Methodology of the study,
followed by the Analysis of Results, and finally, topic five presents the Final Considerations.

2 THEORETICAL REFERENCE

The theoretical framework addresses the themes of the study, namely: Innovative Performance, Dynamic Innovation Capability and Cooperation Networks.

2.1 INNOVATIVE PERFORMANCE

Innovative organizations tend to respond more quickly to environmental pressures and, as a result, perform better (López, Peón, & Ordás, 2005). Rosenbusch, Brinckmann and Bausch (2011) mention that innovation tends to positively influence organizational performance. However, there are factors that impact this performance, such as the type of innovation, the age of the company and the cultural context in which it operates. Thus, the innovative performance of organizations can be assessed in several ways, making this measurement a challenge as there is no standard (Hannachi, 2015). This is because the innovative performance of an organization may depend on internal and external factors (Alegre & Chiva, 2009).

Studies related to innovative performance are derived from studies on new-product performance and innovation performance, such as Brown and Eisenhardt (1995) and Griffin and Page (1996), highlighted after the publication by Alegre, Lapiedra and Chiva (2006). In addition, several other researchers have studied measurement scales of product innovation performance (Hsu & Fang, 2009; Blindenbach-Driessen, Dalen, & Ende, 2010; Hannachi, 2015). The growing research about innovation management activates the need to measure the performance provided by the various innovation actions (Manthey et al., 2016). In this article, innovative performance will be approached through two different dimensions: product effectiveness and process efficiency, based on Alegre, Lapiedra and Chiva (2006).

The effectiveness of innovation can be measured by the economic results of product innovation, considering the economic impact of innovation on the organization (Gomes, Machado, & Alegre, 2014). Efficacy shows the success level of innovation (Alegre, Lapiedra, & Chiva, 2006; Bakar & Ahmad, 2010; Henttonen, Ritala, &
2.2 DYNAMIC CAPACITIES FOR INNOVATION

The concept of innovation within dynamic capability studies was first developed by Teece and Pisano (1994). They propose dynamic innovation capability as a subset of the competencies and capabilities that enable the organization to generate new products and processes to respond to changing needs of market environment. However, several other similar concepts can be found in the literature, such as Wang and Ahmed (2007), which refer to the ability of an organization to develop new products and/or markets, innovating in behaviors and processes. Still, Camisón and Villar-López (2014) mention that dynamic innovation capability represents the way resources and capacities are adapted and reconfigured, using management, processes and practices that significantly change the way work is performed.

Organizations can achieve superior performance when engaging in a set of innovation-driven activities (Piening & Salge, 2015), with innovation capability being a key resource (Lawson & Samson, 2001). Excellent organizations often invest and stimulate their capability for innovation, from which they effectively execute processes that drive innovation in products, services and business, and consequently, result in superior performance (Lawson & Samson, 2001).

This paper applies the approach developed by Camisón and Villar-López (2014) to measure dynamic innovation capability, which measures product, process and organizational innovation. This choice is justified by the need to develop more researches in the area of organizations' studies, considering the various levels of innovation capability (Piening & Salge, 2015; Sicotte, Drouin, & Delerue, 2015; Manthey et al., 2017).

Regarding measurement measures, product innovation capability refers to the ability of an organization to significantly develop new or improved products (Camísó, Villar-López, & 2014; Manthey et al., 2017). On the other hand, process innovation...
capability reflects the innovation actions’ effectiveness of companies to adjust their processes, such as the way of delivering products, how they create and develop them, aiming to achieve better innovation performance (Piening & Salge, 2015; Manthey et al., 2017). Finally, the capability for organizational innovation is subdivided into three dimensions, which coincide with the categorization provided by the OECD (2005): innovation in business or business practices; innovation in the workplace; and new organizational Methods (Camisón & Villar-López, 2014; Manthey et al., 2017).

Organizations with intense dynamic capability, according to Teece (2007) and Wang and Ahmed (2007), in addition to adapting to business environments, also create differentiation through innovation and collaboration with other organizations. Thus, we arrive at the first hypothesis of this study:

**H1:** Dynamic innovation capabilities positively impact on innovative performance.

### 2.3 COOPERATION NETWORKS

In the field of social science studies, the term network designates a group of people or organizations directly or indirectly interconnected (Marcon & Moinet, 2000). Thus, the networks are formed by a group of organizations that are interconnected by interactions and with a certain degree of convergence (Franco & Belo, 2013). For Olave and Amato (2001), one of the main characteristics of the organizational environment is the need for joint and associated action. Therefore, as a possibility for organizational development, the various forms of relations between companies arise, such as joint ventures, strategic alliances, outsourcing relationships, industrial districts, consortia, cooperation networks, among others (Grandori & Soda, 1995; Olave & Amato, 2001).

Due to the variety of forms a network can take, there is no single rule regarding its advantages (Olave & Amato, 2001). According to Ahuja (2000) and Powell, Koput and Smith-Doerr (1996), networks are a medium for exchanging hard-to-measure resources such as know-how, technology, technological capability, production style, knowledge, skills, spirit of innovation or experimentation. Thorgren, Wincent and Örtqvist (2009) mention that trust, diversity, relationship and knowledge transfer are some of the features of well-functioning networks. Trust and cooperation tend to play a
central role to the success achieved by networks (Balestrin & Vargas, 2004; Hoffmann et al., 2017). It should be noted that the existing trust and cooperation in the networks act as a mechanism for obtaining resources that individual firms could not obtain.

In addition to organizations' interest in accessing and acquiring resources, they are also interested in maintaining and improving what they already have (Zonta et al., 2015). According to Gulati (1998), the need to complement resources is a key factor for inter-organizational cooperation. Cooperation networks are an informal affinity mode of association that leaves each organization responsible for its own development (Provan, Fish, & Sydow, 2007).

This cooperation, according to Thorgren, Wincent and Örtqvist (2009), can lead organizations to obtain resources, create necessary combinations to introduce new products, expand to new markets, make organizational changes, among other strategic purposes. Given the established context, that cooperation networks allow access to resources and can influence the performance of organizations, the following research hypotheses are stated:

H2: Participation in cooperation networks positively influences innovative performance.

H3: The cooperation network impacts more positively on efficiency than on effectiveness.

3 METHODOLOGICAL PROCEDURES

This study presents a quantitative approach in order to examine the relationship between variables (Creswell, 2010). As for the objectives of the study, it fits as descriptive. The population is made up of Brazilian manufacturing companies, and the sample is composed of 258 organizations, from all segments and sizes, characterized as non-probabilistic and classified as a convenience sample. The research instrument used for data collection was through the application of an online questionnaire consisting of 35 questions, divided into six dimensions, with scales for answers from 1 to 7, of Likert's type, answered by the company main manager or the innovation manager, between June and September 2018. Direct contacts were made by online messages and forwarding of the electronic questionnaire on the esurv.org platform, freely available on the Internet.
The questionnaire (Table 1) is composed of the Dynamic Capability of Innovation in Product, Process and Organizational, based on OECD (2005), Camisón and Villar-López (2014), Sicotte, Drouvin and Delerue (2015) and Manthey et al. (2017). Innovation Performance is measured through Product Effectiveness and Process Efficiency (Alegre, Lapièdra and Chiva, 2006; Alegre & Chiva, 2009; Bakar & Ahmad, 2010; Henttonen, Ritala, & Jauhiainen, 2011; Gomes, Machado & Alegre, 2014). The dimension of Cooperation Networks is measured by items of cooperation, trust, knowledge transfer and social relations, conceived through Hoffmann et al. (2017) and Zonta et al. (2015).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Theoretical Basis</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our company is able to expand the range of products.</td>
<td></td>
<td>Dynamic Innovation Capabilities - Product Innovation</td>
</tr>
<tr>
<td>Our company is able to improve product design.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our company is able to reduce the time it takes to develop a new product until it comes to market.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our company is able to replace obsolete products.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our company is capable of developing environmentally friendly products.</td>
<td>OECD (2005); Camisón e Villar-López (2014); Sicotte, Drouvin, &amp; Delerue (2015); Manthey et al. (2017)</td>
<td>Dynamic Innovation Capabilities - Process Innovation</td>
</tr>
<tr>
<td>Our company continually develops programs to reduce production costs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our company has valuable knowledge of the best work organization processes and systems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our company manages production organization efficiently.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our company allocates resources to the production department efficiently.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our company maintains databases with best practice information, lessons and others knowledge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practices are in place to develop employees and improve worker retention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of quality management systems occurs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is decentralization in decision making.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There are cross-functional workgroups.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is flexibility at work.</td>
<td></td>
<td>Dynamic Innovation Capabilities - Organizational Innovation</td>
</tr>
</tbody>
</table>
Collaboration with customers is developed.  
Methods for integrating with vendors are used.  
There is outsourcing of business activities.  
Replacing Outdated Products.  
Product line extension.  
Product development outside the main segment of the organization (secondary products).  
Development of new product lines.  
Development of green products.  
Increased market share.  
Opening of new markets abroad.  
Opening of new national markets.  
Average time in weeks for the development of the Product.  
Average time in total hours product development.  
Average cost per innovation project.  
Degree of satisfaction with the product.  
Existence of cooperation.  
Existence of Trust.  
Existence of knowledge transfer.  


The collected data were initially treated with descriptive statistics techniques, and later with Structural Equation Modeling, using SmartPLS software.

### 4 RESULTS ANALYSIS

This section consists of two subsections: the sample profile and the results of structural equation modeling.

#### 4.1 SAMPLE PROFILE

Table 1 presents, through descriptive statistics, the sample profile, composed by the level of technological intensity according to the company branch, the number of employees and the respondent's gender.
Table 1 - Sample profile

<table>
<thead>
<tr>
<th>Technological Intensity Level</th>
<th>N</th>
<th>%</th>
<th>Number of employees</th>
<th>N</th>
<th>%</th>
<th>Manager Gender</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>0</td>
<td>0%</td>
<td>1-19</td>
<td>49</td>
<td>19%</td>
<td>Male</td>
<td>176</td>
<td>68.22%</td>
</tr>
<tr>
<td>High average</td>
<td>23</td>
<td>8.91%</td>
<td>20-99</td>
<td>67</td>
<td>18.21%</td>
<td>Female</td>
<td>30</td>
<td>11.62%</td>
</tr>
<tr>
<td>Low average</td>
<td>50</td>
<td>19.38%</td>
<td>100-499</td>
<td>47</td>
<td>25.97%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>132</td>
<td>51.16%</td>
<td>500 or more</td>
<td>43</td>
<td>20.15%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uninformed</td>
<td>53</td>
<td>29.54%</td>
<td>Uninformed</td>
<td>52</td>
<td>16.67%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


According to Furtado and Carvalho (2005), technological intensity reflects the innovative R&D effort of a nation and its respective organizations; and according to the OECD (2005) this intensity can be classified into four main groups: a) high technological intensity: aerospace sectors; pharmaceutical; computer science; electronics and telecommunications; instruments; b) medium-high technological intensity: sectors of electrical material; auto-vehicles; chemistry, excluding the pharmaceutical sector; rail and transport equipment; machines and equipment; c) medium-low technological intensity: shipbuilding sectors; rubber and plastic products; coke, refined petroleum products and nuclear fuels; other non-metallic products; basic metallurgy and metal products; d) low technological intensity: other sectors and recycling, wood, paper and pulp; editorial and graphic; food, drink and smoke; textile and clothing, leather and footwear.

The majority of surveyed companies is comprised by organizations of low technological intensity (132), distributed among: textile and clothing (26), food (18), wood (14), beverages and tobacco (08), editorial and printing (05), paper and pulp (04), recycling (02), leather and footwear (01). The remaining 54 organizations refer to other sectors such as agribusiness, health, education, hospitality, construction, miscellaneous manufactured goods and services. Thus, 51.16% of the studied companies are considered of low technological intensity; 19.38% are of medium-low technological intensity, and only 8.91% of the companies correspond to medium-high technological intensity. No organization characterized as of high technological intensity composed the sample of this research.

Furthermore, according to Table 1, most of the respondent companies are classified as micro enterprise (from 1 to 19 employees) and small enterprise (from 20 to 99 employees). Together, these categories add up to 116 organizations, corresponding to
44.96%, almost half of the sample. The distribution of companies by size complied with the classification criteria used by SEBRAE (2018) and recommended by the OECD (2005). Regarding the gender of the respondent, 68.22% of the companies have men ahead of women, which in turn represent only 11.62% of leadership in this sample.

4.2 STRUCTURAL EQUATION MODELING

After the descriptive analysis we verified constructs’ unidimensionality. Table 2 presents the results of the constructs reliability tests.

Table 2 - Reliability Tests of the research constructs

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Number of Items</th>
<th>Alpha (A.C.) &gt;0,60</th>
<th>Composite Reliability (C.R.) &gt;0,60</th>
<th>Average Variance Extracted (A.V.E.) &gt;0,50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Innovation Capability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td>05</td>
<td>0.810</td>
<td>0.868</td>
<td>0.571</td>
</tr>
<tr>
<td>Process</td>
<td>05</td>
<td>0.895</td>
<td>0.924</td>
<td>0.709</td>
</tr>
<tr>
<td>Organizational</td>
<td>09</td>
<td>0.975</td>
<td>0.902</td>
<td>0.513</td>
</tr>
<tr>
<td>Innovative Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td>08</td>
<td>0.878</td>
<td>0.904</td>
<td>0.544</td>
</tr>
<tr>
<td>Process</td>
<td>04</td>
<td>0.921</td>
<td>0.944</td>
<td>0.810</td>
</tr>
<tr>
<td>Cooperation Networks</td>
<td>04</td>
<td>0.915</td>
<td>0.940</td>
<td>0.797</td>
</tr>
</tbody>
</table>


Table 2 shows that all values obtained were higher than the limits indicated in the literature, which indicates that the constructs present acceptable levels of reliability. Then, the analysis of discriminant validity between dimensions was performed, which is presented in Table 3.

Table 3 - Discriminating Validity

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D.I.C Product</td>
<td>0.756</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.I.C Process</td>
<td>0.590</td>
<td>0.842</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.I.C Organizational</td>
<td>0.564</td>
<td>0.742</td>
<td>0.716</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.D Product</td>
<td>0.622</td>
<td>0.620</td>
<td>0.674</td>
<td>0.737</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.D Process</td>
<td>0.525</td>
<td>0.520</td>
<td>0.529</td>
<td>0.706</td>
<td>0.900</td>
<td></td>
</tr>
<tr>
<td>Cooperation Networks</td>
<td>0.266</td>
<td>0.246</td>
<td>0.257</td>
<td>0.273</td>
<td>0.310</td>
<td>0.893</td>
</tr>
</tbody>
</table>

According to Table 3, all dimensions are distinct at the 0.05 level, which means that there is no collinearity between the variables under study, i.e., there are distinctive measures for different constructs. After verifying the content, one-dimensionality and discriminant validity, a new analysis was performed in order to verify the Student's t test values ($\geq 1.96$), as well as the p-value values ($<0.05$) for the relations between the constructs.

Figure 1 shows the values for the Student's t-test and the p-value of each relationship between the constructs. For the Student's t-test the parameter indicated in the literature is $t \geq 1.96$, and in relation to the p-value, below $<0.05$ are considered significant. Thus, we verify that the relations between Cooperation Networks $\rightarrow$ Innovative Product Performance ($t \geq 1.203$ and p-value 0.229) and DIC Process $\rightarrow$ Innovative Performance Product ($t \geq 1.803$ and p-value 0.072) are not significant in the theoretical model of this study.

Figure 1 - Structural Model

![Diagram showing the structural model with relationships and t-test values.](Source: Resource data (2018).)
In the others, there is a positive and significant relationship between the constructs, indicating significance in the model. More specifically, dynamic product innovation capabilities positively and significantly influence innovation performance, both in product effectiveness ($t \geq 5.932$ and p-value 0.000) and process efficiency ($t \geq 3.805$ and p-value 0.000). Dynamic product innovation capability refers to the ability of an organization to develop significantly new or improved products (Camisón & Villar-López, 2014; Manthey et al., 2017). In this sample, this capability significantly influences innovative performance in product effectiveness and process efficiency. Positive relationships between dynamic innovation capabilities and product and process innovation were also found in the study by Hernández, Vega and Acosta-Prado (2017), although in another context.

Regarding the dynamic process innovation capabilities, it is found that these only significantly influence innovation performance in process efficiency ($t \geq 2.122$ and p-value 0.036), but not in product effectiveness ($t \geq 1.803$ and p-value 0.072). The process innovation capability reflects the tendency for companies to innovate and effectively act to adjust various processes in order to achieve better innovation performance (Piening & Salge, 2015; Manthey et al., 2017). The fact that dynamic process innovation capabilities only impact innovative performance in process efficiency may be related to the companies’ sample of the present research, mostly of low technological intensity. Companies with low technological intensity do not have entirely new products, and as a result, tend to introduce more process innovations than products, as observed in the study by Paula e Silva (2017).

Process innovations often occur involving the purchase of machinery and equipment, either alone or in combination with a technology manufacturing strategy (Goedhuys & Veugelers, 2012; Hervas-Oliver et al., 2017). However, this action is not unique in the search for innovations (Guan et al., 2006), as other factors are also responsible for promoting innovative activity in organizations, such as shared knowledge (LIN; CHEN, 2008), intellectual capital (Ansari, Barati, & Sharabiani, 2016), supply and demand chain (De La Calle, Grus, & Alvarez, 2017) and the organizational climate (Ramzi, Salah, & 2018). Gomes, Machado and Alegre (2014) emphasize that it is
necessary to innovate in processes, so that organizations are more competitive, increase quality, improve working conditions and have more productive flexibility.

Finally, the dynamic capabilities of organizational innovations positively influence innovation performance, both in product effectiveness (t ≥ 5.413 and p-value 0.000) and in-process efficiency (t ≥ 2.798 and p-value 0.005). Organizational innovation capability refers to business practices, the workplace and new organizational methods (Camisón & Villar-López, 2014; Manthey et al., 2017). Even though Lokshin, Gils and Bauer (2009) have suggested that companies that build organizational competencies do not directly improve their innovative performance, other studies have found different results. Lin and Chen (2008) state that internal and external integration significantly influences the share of knowledge about internal resources, customers and suppliers among new-product development team members. The results also indicate that knowledge share by team members enables the company to improve innovation capacity and competitive advantage of new products (Lin & Chen, 2008).

De La Calle, Grus and Álvarez (2017) also indicate that there is a strong relationship between customer-related processes and activities (demand chain), such as identifying market characteristics and creating differentiation through product development or customer relationship management. Similarly, the business processes and activities that companies perform to fulfill customer orders, the components of value creation, effectiveness and efficiency, are positively and significantly related to business outcomes (De La Calle, Grus, & Alvarez, 2017).

According to Ansari, Barati, Sharabiani (2016), managers try to improve employee knowledge, skills and training by using intellectual capital and dynamic capability as drivers for innovation and competitive production. Thus, from these observations and analyzes, hypothesis H1: “Dynamic innovation capabilities positively impact innovative performance” is supported.

It is observed that acting in networks favors companies to obtain results in innovation in process efficiency (t ≥ 2.170 and p-value 0.030), but not in product effectiveness (t ≥ 1.203 and p-value 0.229).). This result may be related to the type of companies and sectors of the sample of companies of the present research, as most organizations are categorized as low-technological intensity. Companies with low-
technology intensity tend to introduce more process than products innovations (Paula & Silva, 2017). This is because there is less need to innovate in low-tech products than in their processes, which should be continually improved and innovated.

Although the study by Padilha et al. (2016) occurs from the perspective of organizational learning capacity, the authors find that innovative performance is impacted more by process efficiency than by product effectiveness. Criscuolo, Laursen, Reichstein and Salter (2017) also find that studies about product innovation (effectiveness) are broader than studies about processes (efficiency). The results suggest that process innovations require less combinatorial knowledge activities than product innovation. However, it is noteworthy that this does not mean innovation process is simple, as it may involve significant organizational change (Criscuolo et al., 2017).

It is also noteworthy that, in this research, the cooperation networks construct was formed by the items of trust, cooperative behaviors, knowledge sharing and social relationships with other companies. The cooperative relations between organizations, through these items, tend to promote improvements in the organizational processes of companies inserted in cooperation networks. This is because knowledge sharing enables joint resolution of common innovation problems and practices (Balestrin & Vargas, 2004; Molina-Morales et al., 2015), trusting relationships tend to minimize concerns about opportunistic behavior (Molina-Morales, Martínez-Fernandez, & Torlò, 2011), and social interaction relations form information channels that facilitate access to external knowledge, which can be added to existing knowledge (Molina-Morales & Martínez-Fernandez, 2009). These benefits provide better performance in the efficiency of organizational processes. In the study by Balestrin and Vargas (2004), it is observed that some incremental improvements are considered in relation to the innovation process, especially in the production processes. Improvements in production processes, even if incremental, show that sharing information and knowledge within a network can facilitate the pooling of complementary skills from different organizations (Balestrin & Vargas, 2004). It is noteworthy that the strategy and processes at the network level are related to business results (Verschoore, Balestrin, & Teixeira, 2017).
Thus, we accept the hypothesis H2: “Participation in cooperation networks positively influences innovative performance” and also H3: “Cooperation network impacts more positively on efficiency than on effectiveness”.

In addition, acting in networks influences the development of dynamic product innovation capabilities (t ≥ 4.024 and p-value 0.000), processes (t ≥ 4.003 and p-value 0.000) and organizational (t ≥ 3.918 and p-value 0.000). This may be justified by the fact that cooperation networks are an enabling environment for the exchange of diverse resources among the participating organizations, such as know-how, technology, technological capacity, productive style, knowledge, skills and innovative spirit (Powell, Koput, & Smith-Doerr, 1996; Ahuja, 2000; Balestrin & Vargas, 2004). These exchanges, in turn, foster the development of dynamic innovation capabilities. In this sense, Balestrin and Vargas (2004) show that the biggest gain of organizations, through the formation of the network, is the sharing of information and knowledge, and that the shared information with benefits for the network deals with production processes, suppliers, inputs, technologies and market. Similar studies can be seen throughout the literature. Ai and Wu (2017) found participation in cooperation networks as an opportunity for companies to improve dynamic innovation capabilities. Costa et al. (2017), which assess how organizational capabilities affect the dynamics of cooperation between Brazilian multinationals. Andersen et al. (2018), who sought to increase innovation capacity through cooperation between institutions in the area of wind services.

Finally, it appears that the effect of networking on product innovation performance is only indirect, obtained by the effect of network on dynamic capabilities. However, Tomlinson and Fai (2013) note that the strength of cooperative ties is relevant to the innovative capacity of small and medium enterprises; and Zhang et al. (2010) find that business cooperation coexists in strategic alliances that increase knowledge acquisition, leading to innovative performance. The next section presents concluding remarks and highlights some suggestions and possibilities as well as research limitations.

5 FINAL CONSIDERATIONS

The present study analyzed the influence of cooperation networks on the relationship between dynamic innovation capabilities and innovative performance in
manufacturing companies located in Brazil. Based on a sample of 258 organizations from the Brazilian manufacturing industry, the results show that the relationship between dynamic innovation capability and innovative performance of companies is statistically evidenced by data analysis, indicating a positive and significant relationship between the constructs. Dynamic product and organizational innovation capabilities significantly influence innovative performance in both, product effectiveness and process efficiency. Dynamic process innovation capabilities, on the other hand, influence innovation performance only in process efficiency, but not in product effectiveness.

It is observed that acting in networks favors companies to obtain innovative results in process efficiency, but not in product innovation. Perhaps networking has more impact on process efficiency because it is related to the type of companies in the sample and the sectors in which they operate, since most organizations are categorized as having low technological intensity. Moreover, it was found that the performance of companies in cooperation networks influences the development of dynamic innovation capabilities in product, process and organizational. A secondary result was that the effect of networking on innovative performance in terms of product effectiveness is only indirect, obtained by the effect of cooperative networks on dynamic capabilities.

As limitations, the results cannot be generalized due to using a non-probabilistic sample. It is also recognized that there is a possibility of bias in the responses due to only one representative from each company participating in the survey. Using more than one respondent per company could increase data validity (Gomes & Wojahn, 2017). Finally, cross-sectional design of research and single-point analysis also set another limitation of research.

In future research, it is suggested to verify the influence or moderation of cooperation networks in specific environments such as industrial parks, in which there is also the issue of the business clusters. Another suggestion would be to apply the research in high technology-intensive companies to observe how the dynamic capabilities of innovation impact the innovative performance of these companies, as well as the influence of cooperation networks in these organizations. Finally, a longitudinal follow-up could observe to what extent cooperation networks positively and significantly impact
the relationship between dynamic innovation capabilities and innovative performance, as well as verify these facts on the face of external events and turbulence.
REFERENCES


