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Original Article

Control systems and interorganizational identification in technology parks cooperation*

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ABSTRACT

The aim of this study was to analyze the influence of the design of management control systems (MCSs) on interorganizational cooperation and the moderating role of companies' identification with their technology park. The conditions that promote the emergence of interorganizational cooperation are indicated in the literature as an important research gap, as well as the little evidence about how MCS design influences cooperation, especially in relationships based on innovation. MCSs in interorganizational partnerships have been shown to be relevant for the coordination and maintenance of the relationship, and this study reveals that MCSs promotes cooperative behaviors among the companies associated with the technology parks. The interorganizational identification of the companies with their park was moderately present, thus prompting the inclusion of social and relational aspects in interorganizational studies, which remain scarcely explored in the literature. The MCSs of the parks are focused on stimulating the companies' cooperation, which is one purpose of this partnership. By not confirming the moderating effect of identification, it was verified that this construct drives cooperation in a way that is dissociated from the MCSs. A survey was conducted in organizations associated with Porto Digital and with the São José dos Campos Technology Park, and it had the participation of 187 managers. To analyze the data the partial least squares structural equation modeling technique was applied and the differences between the two parks were further analyzed. The MCSs design and interorganizational identification act as antecedents of the companies' cooperation with their technology park. On the other hand, the direct and positive effect of the MCS design on cooperation is not moderated by how much these companies identify with the interorganizational relationship established. The paper contributes by identifying ways of fostering cooperation, one of the purposes of interorganizational agreements, as well as by providing evidence in a context that is scarcely addressed in the literature.

Keywords: management control systems, interorganizational cooperation, organizational identification, technology parks.

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1. INTRODUCTION

Interorganizational relationships are established in the search for mutually beneficial results for the parties that act in cooperation (Dekker, 2004), which requires the conception of management control systems (MCSs) that provide support in these relationships (Reusen & Stouthuysen, 2017). The perception of beneficial collective results by the members of the related organizations tends to intensify cooperative behaviors (Brown et al., 2017). According to Mael and Ashforth (1992), the more someone identifies with their group, the more they will act according to the group's views instead of individual interests, which suggests that a greater level of identification can intensify interorganizational cooperation. From this perspective, the aim of the study is to analyze the influence of the MCS design on interorganizational cooperation and the moderating role of the companies' identification with their technology park.

The management literature indicates that collaborations present several challenges regarding their management (Coletti et al., 2005). As organizations interact, interorganizational information is demanded, in the search for a growing level of collaboration and commitment of those involved, as well as the achievement of shared goals and objectives (Nach et al., 2016). Xu et al. (2014) highlight that the literature presents little evidence about how different forms of control influence cooperation, especially in relationships based on innovation, as is the case of technology parks.

Technology parks provide an environment that favors cooperation relationships, embedded in a synergetic social context, constituted of groups of organizations in the race for innovation. The parks form a concentrated and cooperative industrial productive complex of science- and technology-based services, which connect companies whose production is based on technological research (ANPROTEC, 2018a). They encompass an area of intense knowledge development that aims to drive the creation of networking and economic-financial performance of businesses and their regions (Ng et al., 2021).

Cooperation in interorganizational relationships occurs when the participants operate together to achieve correlated objectives (Mahama, 2006). It is configured as an important social norm in collaborative contexts, as partnerships are formed to capture synergy gains that the relationship provides (Coletti et al., 2005). Interactions are generally motivated by cost reduction and access to technological expertise and to new markets, which leads the organizations to engage in various forms of interorganizational cooperation (Ding et al., 2010). The literature recognizes that in recent decades interorganizational cooperation has become a strategy that is widely adopted to compete in the global market (Ding et al., 2010).

Heide and Miner (1992) already highlighted the importance of studies that identify the factors that foster interorganizational cooperation. The research needs to advance to improve researchers' and managers' understanding about managing cooperation among companies (Ding et al., 2010), given that the precepts of Cooperation Theory have implications for the individual choices and configuration of organizations (Axelrod, 1984), and the structure that conducts interorganizational relationships is generally a critical factor for their success (Dekker, 2004).

Organizations that cross the boundaries of individual economic activities have implications for the management control within and particularly among companies (Dekker, 2004). Mahama (2006) and Beuren and Dal Vesco (2021) observed that MCSs, defined as socialization processes and performance measurement systems, influence interorganizational cooperation. These findings suggest an active role of the MCSs design for interorganizational cooperation, as it constitutes the structure of the relationship, which precedes the relational exchanges.

Based on empirical evidence, Mahama (2006) argues that cooperation among members of a relationship leads to the success of the partnership, and MCSs promote cooperation in the exchanges among the participants of the interorganizational relationship. According to Wee, Fong, and Tse (2014), the MCS design encompasses the information that the systems provide to assist organizational management, which can be defined by the informational characteristics of scope, timeliness, aggregation, and integration, aspects that are considered to be of great utility for the senior managers of the organizations.

The relational conception of interorganizational cooperation is determined through continuous interactions and exchanges among the partners of the cooperation, which establishes a feeling of social identification among the participants (Clauss & Spieth, 2016). The identification processes create an identity for the collective, whether a company or a network of companies, and they contribute to the participants sharing the same objective (Huemer et al., 2004). In this context, it is sustained that organizational identification theory provides support to the study, given that it enables us to visualize the motivations for the organizations' members in deciding to cooperate (Dukerich et al., 2002).

Organizational identification is "a form of social identification in which individuals define themselves in terms of their participation in a particular organization" (Mael & Ashforth, 1992, p. 105). Individual, group, and organizational identity are forms of exploring and explaining various social and organizational phenomena, which is no different in the context of collaboration among companies (Nach et al., 2016). The concept of interorganizational identification was used in the study of Corsten et al. (2011) and initially addressed in a supply chain.

In this study, to define MCSs design the Chenhall and Morris (1986) taxonomy was used, which segregates four informational characteristics: scope, timeliness, aggregation, and integration. Regarding the conception of cooperation, this is based on the premise that interorganizational cooperation is a multidimensional phenomenon that is manifested in four ways in the relationships, according to Heide and Miner (1992): flexibility, information sharing, joint problem solving, and restriction from the use of power. Finally, interorganizational identification represents how much an organization identifies with the interorganizational relationship established (Corsten et al., 2011) and refers to the perception of social identification with the formalized alliance of companies (Clauss & Spieth, 2016).

The research was operationalized through a structured questionnaire answered by managers of organizations associated with two important Brazilian technology parks, Porto Digital and the São José dos Campos Technology Park. The survey results reflect the perception of the managers of these organizations regarding the relationship established between the company and its park, as they were asked about the design of their park's MCSs and how much the manager's company identifies and cooperates with its park. The data were analyzed using the structural equation modeling technique.

The study contributes to investigating an interorganizational relationship using a sociological approach, in particular, consequents of the MCSs in these relationships. It provides evidence of a theoretical model that includes interorganizational identification as a moderating variable. It innovates by adding findings on the relationship of companies associated with technology parks to the literature on MCSs, given that aspects related to the management of technology parks are scarce in organizational studies, but have already been shown to benefit the results of the organizations linked to them. As observed in the study of Ng et al. (2021), the managers of companies associated with technology parks highlighted the relevance of this bond, as it was beneficial for developing partnerships with other companies and fostering innovation. Thus, this study contributes by providing evidence of antecedents of the cooperation of companies in technology parks in the dispute for innovation.

2. THEORETICAL FRAMEWORK

2.1 Management Control Systems and Interorganizational Cooperation

In the literature on MCSs, different frameworks and taxonomies are disseminated, with effects on their design and use. The MCS design determines the information that the system should provide to the organization, while the use indicates how the information provided by the MCSs is used (Wee et al., 2014). Chenhall and Morris (1986) highlight four useful informational characteristics for management: scope, timeliness, aggregation, and integration of the information. These characteristics were subsequently embedded in MCSs and considered as components of the design (Wee et al., 2014). Studies that have used this taxonomy have verified the presence of the informational characteristics in the MCSs in a particular context.

Scope refers to the dimensions of focus, quantification, and time horizon of the information provided (Chenhall & Morris, 1986). A narrow scope includes information with an internal focus, financial data and data geared towards the past, while an MCS with a wide scope adds information from the external environment, such as economic or non-economic measures and information geared towards the future (Chenhall & Morris, 1986; Wee et al., 2014). The timeliness of MCSs refers to the ability to quickly respond to situations likely to be influenced by the punctuality of the system, and information with high timeliness is collected and provided quickly (frequency and periodicity) (Chenhall & Morris, 1986). The level of aggregation refers to the way the information is provided by the MCSs, ranging from the provision of raw and unprocessed data to a variety of compiled information (aggregated in various time periods or from different areas) (Chenhall & Morris, 1986). Integration encompass informational characteristics that can help in the coordination of the various subdivisions of companies. Integrated information includes specific divisional goals and information about the global impact of decisions (Chenhall & Morris, 1986).

Regarding the role of control, in the study of Das and Teng (1998) it is found that alliances of companies use control to ensure the achievement of their objectives. Effective control promotes the creation of a sense of trust regarding cooperation among partners. Based on Cooperation Theory, it was identified that relationships should be structured with the purpose of promoting frequent and lasting interactions (Axelrod, 1984). These arguments lead to the conjecture that the MCS design, as a determinant of the structure, influences the cooperation in interorganizational relationships. Interorganizational cooperation was measured based on Heide and Miner (1992), considering four cooperation patterns, and it was observed that the relationship among companies can be cooperative in some domains and not so in others and can differ in intensity.

In information sharing, it is evaluated how much each party provides information that can facilitate the activities of the other party in the relationship, instead of retaining information for itself (Heide & Miner, 1992). Flexibility refers to how much a company and its partner normally adjust (regulate) their own behavior to cover the needs of the other (Heide & Miner, 1992). In joint problem solving, the perception regarding how much the parties share the responsibilities of the relationship is evaluated (Heide & Miner, 1992). Restriction from the use of power reflects the level at which the parties in an interorganizational relationship abstain from exploiting each other, when given the opportunity to do so (Heide & Miner, 1992).

The literature presents a variety of evidence regarding the control that can lead to interorganizational cooperation. For Xu et al. (2014), in restricted terms, the control is the formality that exists in these agreements, which enables the limits of the cooperation to be identified, while the broader definition of control covers measures that go beyond formal contracts, which may seek to create a culture of cooperation. The authors observed that in university-company cooperation behavioral control prevails over the result controls. In contrast, Das and Teng (1988) found that formal and social controls promote cooperation in company alliances. In an intraorganizational experiment, Coletti et al. (2005) verified that a more rigid control system can increase the cooperation induced by the control in environments where there was already cooperation, and that the participants cooperated more when the control system was present, suggesting that this provides incentives for cooperative behaviors.

The informational characteristics were addressed in the interorganizational context by Velez et al. (2015), when investigating export businesses. The scope and timeliness of the information had a positive effect on the interorganizational cooperation, conceived as a dimension of quality of the relationship. The authors concluded that the informational characteristics of the control perform an important role in the development and maintenance of interorganizational relationships in the long run. For Beuren and Dal Vesco (2021), interorganizational relationships involve coordination among the related parties, which may have divergent objectives and interests, revealing the importance of the control to ensure that the global objectives are pursued.

Mahama (2006) investigated the relationship between MCSs and interorganizational cooperation. The results indicate a direct and positive relationship between the use of performance measurement systems in three dimensions of cooperation (information sharing, joint problem solving, and flexibility) and of the socialization processes with information sharing in the supply chain. Transposing the findings of the aforementioned literature to the interorganizational relationship established between technology parks and the companies associated to them, which can exercise different cooperative levels and behaviors regarding the relationship, the first hypothesis of the study is postulated:

> **H_1:** There is a positive influence of the MCSs design on interorganizational cooperation (flexibility, information sharing, joint problem solving, and restriction from the use of power).

2.2 Management Control Systems, Identification and Interorganizational Cooperation

According to the relational view, in company alliances, the results of the cooperation are determined by the interactions and exchanges between the partners, which establish levels of social identification with the alliance (Clauss & Spieth, 2016). According to Turner (1984) and Ashforth and Mael (1989), based on Social Identity Theory, a member's identification with their group reflects their perception of being part of it and makes them embrace the status of being a member. The literature indicates the possibility of developing feelings of identification at different levels of analysis. Recognition of the existence of bonds in an interorganizational relationship builds the identity of the relationship and establishes comprehensive communication networks among the partner companies (Mahama, 2006). Interorganizational identification represents how much the organization identifies with its interorganizational relationship, a term integrated by Corsten et al. (2011). In the same sense, Huemer et al. (2004) address the concept of identification with the network. For the authors, the governance mechanisms of the relationship act in promoting the members' feelings of integration, since when the goals are perceived by its members as compatible, they will cooperate to achieve them.

According to Turner (1984), individuals identify and tend to increase intragroup cooperation. Brown et al. (2017) confirmed that greater identification with the group has positive effects on the propensity of individuals to engage in intergroup cooperation. Ireland and Webb (2007) and Corsten et al. (2011) found that the identification of suppliers in relation to their buyers positively influenced information sharing. Martinangeli and Martinsson (2020) found that the intensity with which the individuals identify with the group determines how much they cooperate inside and outside their group, that is, the cooperation varies depending on the strength of the group identity. These results are aligned with the precepts of Social Identity Theory.

Lewis (2009) identified explanatory variables for companies seeking to cooperate with their competitors, including recognition of the competence of the other company's management, benevolence in the management, reciprocity or exchange behaviors, as well as identification with the other company and its management model. Porck et al. (2020), in turn, triangulated strategy with the identification of teams, under the assumption of the difficulty of creating a shared understanding of the strategy of the relationship, denominated as strategic consensus, and they found that organizational identification promotes a greater consensus.

Chua and Mahama (2007) found that MCSs can act in building identities within an interorganizational relationship. Under the assumption that accounting helps in building social identities, linked to the development of social metrics of accounting, they concluded that the identity shared among companies leads to greater cooperation and cohesion in the interorganizational relationship. For Ireland and Webb (2007), identification is the force underlying the cooperation among the partners to overcome the challenges that emerge. Dukerich et al. (2002) suggest that individuals define themselves by their participation in groups and not all members contribute in the same way, this contribution varies depending on how much the organization serves as a social group for the member. This suggests that identification with the interorganizational relationship intensifies the relationship between the MCSs of the relationship at the level of cooperation exercised by the partners, which in this study refers to the MCSs of the technology park in relation to the identification and cooperation of its companies. Based on these arguments, the following hypothesis is proposed:

> **H_2**: There is a positive moderating effect of interorganizational identification on the relationship between the MCSs design and the interorganizational cooperation (flexibility, information sharing, joint problem solving, and restriction from the use of power).

Based on the theoretical-empirical support described above, Figure 1 presents the theoretical model of this investigation.

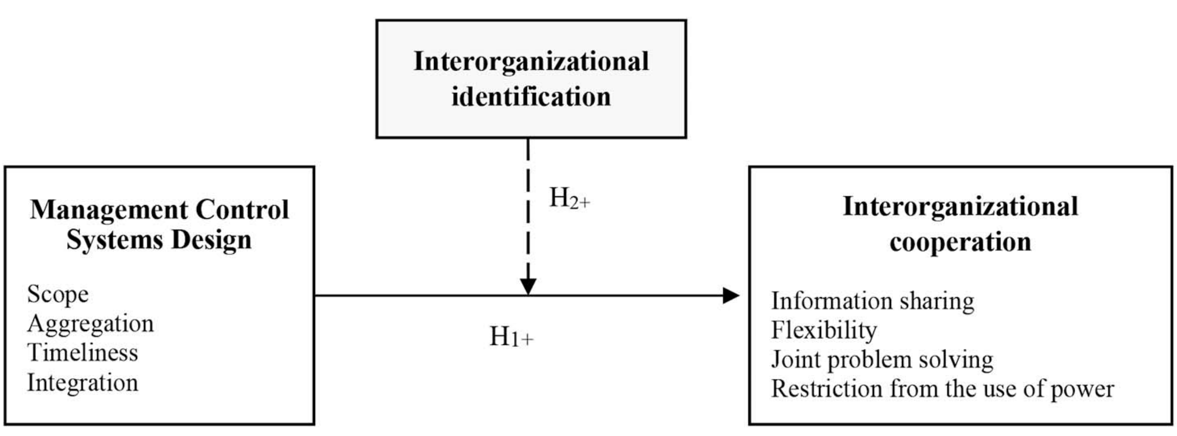

Figure 1 *Theoretical model of the research*
Note: *The dashed line indicates the moderating effect of the interorganizational identification variable.*
Source: *Elaborated by the authors.*

3. METHODOLOGICAL PROCEDURES

3.1 Population and Sample

The population of the research encompasses companies associated with two Brazilian technology parks. Technology parks constitute a science- and technology-based productive complex of services that is formal, concentrated, and cooperative by nature, connecting companies whose production is based on research and development (ANPROTEC, 2018a). They are complexes that establish partnerships with education entities, research institutes, organizations, new entrepreneurs, and government bodies in their region. We chose to investigate Porto Digital in Recife and the São José dos Campos Technology Park (PqTec SJC) as they are among the biggest in the country, in terms of quantity of companies. The population covers 506 organizations, 298 associated to Porto Digital and 208 associated to PqTec SJC.

We sought to establish contact with managers of these companies via the LinkedIn professional network. We managed to send a connection invitation to at least one manager of 459 companies (90.71%). The questionnaire was sent to multiple informants in each company. We sent 2,397 invitations to the companies' managers, 1,071 from Porto Digital and 1,236 from PqTec SJC. In the period from November of 2018 to January of 2019, we obtained a total of 204 answers, of which 17 were incomplete, resulting in 187 valid questionnaires, 97 from Porto Digital and 90 from PqTec SJC. This enabled the statistical procedures to be carried out, based on an effect size of 0.15, a significance level of $\alpha=0.05$, and sampling power of $1-\beta=0.8$ (Faul et al., 2009). Among the research respondents, 96 indicated that they were an owner/partner, president, or director of their company and 91 said that they held the position of manager, supervisor or coordinator.

Regarding the characteristics of the technology parks in the sample, Porto Digital, founded in 2011, features more than 300 associated companies, it has the concept of an urban and open park, and it forms part of a historically and culturally valuable neighborhood of Recife. The park is managed by the Porto Digital Management Center, a social organization that receives goals aligned with the municipal and state governments to consolidate a system of local innovation, focused on information and communication technology companies (ANPROTEC, 2018b). PqTec SJC has more than 250 companies and is maintained by the municipal government that manages the park with a non-profit entity. The park hosts and has the support of the Technological Institute of Aeronautics and the company Embraer, with a broad focus on the aerospace industry, and it features mechanisms such as business incubators and a shared business center for consolidating innovative companies (ANPROTEC, 2018b).

The companies in the sample cover more than 30 economic segments, with approximately 60% focused on service provision, 31% on product development, and 9% on research development. Of the total sample, 63% are companies located within the technology park, that is, the company is placed in the region of the park in approximately 68% of the answers from Porto Digital and 49% from PqTec SJC. The time the companies have been associated with the park presented a sample variation from half a year to 18 years, and the mean duration of this interorganizational relationship is 7.7 years, with a mean of 9 years in Porto Digital and 5.3 years in PqTec SJC. The companies are of different sizes (sample mean: 43% small; 35% medium-sized; 22% large). In Porto Digital 48% are small, 30% are medium-sized, and 22% are large, while in PqTec SJC 38% are small, 40% are medium-sized, and 22% are large.

3.2 Measurement of the Constructs and Analysis Procedures

The data collection was carried out through a questionnaire sent to managers of companies associated with the technology parks, in order to assess their perception about the established relationship, with statements on a seven-point Likert-type scale (Appendix A). MCS design was measured based on four informational characteristics: scope (SC), timeliness (TI), aggregation (AG), and integration of information (IN). This taxonomy was defined by Chenhall and Morris (1986) and the informational characteristics were subsequently conceived as components of the MCS design (Wee et al., 2014). The original instrument was adapted to the interorganizational level of analysis, as previously used by Velez et al. (2015) in the relationship between exporters and intermediaries. MCS design was embedded into the model as a second-order variable that encompasses its four components, with the two-stage methodology, based on the scores of each latent variable (informational characteristic) in the modeling, given that the variables of this construct have a different quantity of indicators (Hair et al., 2017).

Interorganizational identification (IID) was measured based on the research instrument from Mael and Ashforth (1992) and on adaptations from Corsten et al. (2011), which evaluate how much the organizations identify with the interorganizational relationship established with the technology park. For example, the manager's level of agreement was evaluated regarding situations such as: "when we (my organization) talk about the technology park we reside in, we generally refer to 'us' instead of 'them' (the park); the technology park's conquests are also a conquest of my organization."

Interorganizational cooperation is a multidimensional construct. It was measured in four dimensions outlined by Heide and Miner (1992), whose scale reflects how much the company cooperates with the interorganizational relationship (with its technology park). Cooperation emerges in different ways, in the case of: flexibility (FL) in the relationship established with the park; the level of information sharing between the parties (IS); joint problem solving (JPS); and restriction from the use of power in the relationship (RP).

In the SmartPLS3 software, three tools were used for the partial least squares structural equation modeling (PLS-SEM): (i) the PLS algorithm, to estimate the path coefficients; (ii) bootstrapping, to evaluate the statistical significance of the paths; and (iii) blindfolding, which provides the model-fit indicator through the predictive relevance (Q^2) (Hair et al., 2017). In the structural model, moderation is confirmed if the moderating variable alters the strength or direction of the relationship between the two variables (Hair et al., 2017). As the moderating variable is continuous, the effect of the moderation is obtained through the interaction term (Hair et al., 2017).

As the sample encompasses data from companies associated with two technology parks, a complementary analysis was conducted with the subgroups from the two parks, that is, a multigroup analysis by control group. Multigroup analysis enables to test differences of results from the same structural model to be tested, to verify the existence of different results in the subgroups (Hair et al., 2017).

To verify common method bias, which occurs when variables are derived from the same source, Harman's one-factor test was applied (Podsakoff et al., 2003). In the exploratory factor analysis, the principal component represented 35.77% of the total variance, below the 50% threshold (Podsakoff et al., 2003), which suggests that the data are not affected by common method variance. Possible distortions were also verified through the non-response bias test, in which, by testing differences between the answers of the first and last respondents, it is interpreted that the late ones are similar to those who chose not to participate (Wåhlberg & Poom, 2015). The answers from the first 20% of the respondents were compared with those of the last 20% and the results did not present any differences (5% significance), indicating that non-response bias is not representative through the first-last method.

4. ANALYSIS AND DESCRIPTION OF THE RESULTS

4.1 Measurement Model

For structural equation modeling, first the validity of the measurement model is verified, by analyzing the individual and composite reliability and convergent and discriminant validity of the constructs (Hair et al., 2017). In this model, MCS design is assessed as a second-order variable, which encompasses the four informational characteristics proposed by Chenhall and Morris (1986) (scope, timeliness, aggregation, and integration). The results of the measurement model are presented in Table 1.

Table 1
Validity of the measurement model

	AVE	CR	α	Est.*	1	2	3	4	5	6
1. MCSs design	0.712	0.908	0.865	3.8(4)	**0.844**					
2. Interorganizational identification	0.630	0.910	0.881	4.9(5)	0.419	**0.794**				
3. Flexibility	0.734	0.892	0.822	4.5(4)	0.425	0.480	**0.857**			
4. Information sharing	0.708	0.906	0.861	4.9(7)	0.401	0.461	0.741	**0.841**		
5. Joint problem solving	0.755	0.902	0.838	4.8(5)	0.405	0.475	0.687	0.804	**0.869**	
6. Restriction from the use of power	0.713	0.881	0.796	5.3(7)	0.313	0.309	0.533	0.654	0.680	**0.845**

Note: *N = 187. The diagonal elements represent the square roots of the average variance extracted (AVE). The elements outside the diagonal represent the correlations between the latent variables. AVE = discriminant validity (>0.50); CR = composite reliability (>0.70); Cronbach's alpha (α>0.70).*
Legend: est. = descriptive statistic: mean(mode).*
Source: *Data from the research.*

Initially, the reliability of the indicators was verified, where a value higher than 0.70 is recommended, but the loadings that present values between 0.40 and 0.70 should only be removed if the exclusion leads to an increase in the AVE and CR (Hair et al., 2017). Thus, all the indicators remained in the study, given that the lowest loading was 0.66, and we conducted the analysis of the multidimensional variables composed of all the questions of the research instrument. The reliability of the internal consistency was verified, through the intercorrelations of the statements analyzed (Cronbach's alpha > 0.70), and the composite reliability (CR > 0.70) of the variables, which indicates that the questions that compose it are, on the whole, reliable.

The convergent validity tested by the average variance extracted verifies how much, on average, the statements are correlated with their respective variables, where a value higher than or equal to 0.50 is recommended (Hair et al., 2017). The convergent validity of the variables is confirmed, indicating that, on average, the variables explain more than half of the variance of their indicators. Discriminant validity is generally assessed using the Fornell and Larcker criterion, in which the values of the roots (in bold) should be greater than the correlations between the variables (Hair et al., 2017), which was verified in all the variables of the study.

The values in Table 1 provide a preliminary analysis of the data, such as the correlation coefficients and the descriptive statistics. There are various levels of magnitude of the correlations between the variables of the study, but what is observed is that all the coefficients are positive, results that already indicate positive associations between the variables. The high correlation coefficients found between joint problem solving and information sharing and between information sharing and flexibility stand out, which suggests that some dimensions of interorganizational cooperation are strongly associated with each other and high levels of one form of cooperation create the potential to drive another cooperative behavior of the organization in relation to the technology park.

The descriptive statistics of the distribution of the variables on the seven-point Likert-type scale illustrate some characteristics of the context investigated. When asked about the availability of information on the MCSs of the park with which the organization is associated, measured by the four informational characteristics that compose MCS design, on average, the managers reported moderate to low indices (mean = 3.8 and mode = 4), which may indicate a relationship in which the MCSs are not so present, which is a characteristic of innovative contexts and of mostly middle-sized and small organizations. Identification and interorganizational cooperation, in turn, showed moderate tendencies. It warrants highlighting that, for the sample mode of the cooperation dimensions, a high dispersion among the responses from most of the respondents was verified within the dimensions. Flexibility was shown to be less present in the perception of most of the managers (mode 4), while joint problem solving and restriction from the use of power appear to be highly present in the sample (mode 7), however, the latter ones showed a high sample variation.

4.2 Structural Model – Hypotheses Test

In the structural model, which reveals the path coefficients, to examine the research hypotheses we chose the bootstrapping technique with 5,000 resamples (Hair et al., 2017). First we tested the relationship of the moderating variable as independent in the dependent variable, and then we tested the relationship of the interaction term with the independent variable (Henseler & Fassott, 2010). Table 2 presents the results of the structural model.

Table 2
Results of the structural model

Path →		Coefficient	t-value	p-value	f^2
MCSs design →	flexibility	0.271	3.512	**0.000**	0.088
MCSs design →	information sharing	0.253	3.408	**0.001**	0.073
MCSs design →	joint problem solving	0.250	3.518	**0.000**	0.076
MCSs design →	restriction of power	0.222	2.717	**0.007**	0.048
Identification →	flexibility	0.366	4.743	**0.000**	0.160
Identification →	information sharing	0.355	4.406	**0.000**	0.145
Identification →	joint problem solving	0.371	4.777	**0.000**	0.167
Identification →	restriction of power	0.216	2.423	**0.015**	0.045

Table 2
Cont.

Path →	Coefficient	t-value	p-value	f^2
Moderation: MCSs*IID → flexibility	-0.145	0.722	0.470	0.028
Moderation: MCSs *IID → information sharing	-0.130	0.670	0.503	0.023
Moderation: MCSs *IID → joint problem solving	0.207	0.916	0.360	0.066
Moderation: MCSs *IID → restriction of power	-0.122	0.665	0.506	0.017

Note: *n = 187. R^2 = flexibility (0.310); information sharing (0.281); joint problem solving (0.322); restriction of power (0.151). Q^2 = flexibility (0.180); information sharing (0.186); joint problem solving (0.182); restriction of power (0.089). Maximum VIF = 1.213. SRMR = 0.066.*
Legend: f^2 = Cohen's effect size (1988): f^2 = 0.02 small effect; f^2 = 0.15 medium-sized effect; f^2 = 0.35 large effect.
Source: *Data from the research.*

In hypothesis H_1 a direct effect of the MCS design on the dimensions of interorganizational cooperation is assumed, a relationship that is confirmed for the interorganizational cooperative behaviors addressed. Therefore, hypothesis H_1 is accepted by confirming that MCS design (measured by scope, timeliness, aggregation, and integration) positively influences all the dimensions of cooperation of the companies in relation to their technology park, reflected by the flexibility in the relationship, information sharing between the parties, joint problem solving, and restriction from the use of power ($p < 0.10$). With regards to the effect size of these relationships, the influence of the MCSs on each dimension of cooperation, despite being significant, presents a small effect (f^2) (Cohen, 1988).

To test hypothesis H_2, the moderating variable is treated as an independent variable in the structural model and its direct influence on cooperation is verified before the moderation by the interaction term. A positive and significant influence of interorganizational identification on the four dimensions of cooperation was found ($p < 0.10$). The influence of identification on restriction from the use of power and on information sharing showed a small effect size, while its influence on predicting flexibility and joint problem solving was greater, with a medium-sized effect (f^2). We proceeded to analyze the moderating effect of interorganizational identification on the relationship of the MCS design in the four dimensions of cooperation. The results denote that this relationship did not present statistical significance and therefore hypothesis H_2 is rejected, as the positive effect of the MCSs on cooperation was not intensified by the companies' identification regarding the interorganizational relationship established with their technology park.

The R^2 values show the predictive power. The results indicate that flexibility is explained by the model (its antecedents) by 31%, information sharing is explained by 18.6%, joint problem solving is explained by 32.2%, and restriction from the use of power is explained by 15.1%, results which substantiate the predictive validity of the model. The predictive relevance (Q^2) of the model evaluates how close the model comes to what was expected of it (accuracy). The values show they meet adequacy criteria, as values higher than zero should be obtained (Hair et al., 2017). The absence of multicollinearity is verified, given that the highest variance inflation factor (VIF) of the independent variables was 1.213, below the threshold stipulated by Hair et al. (2017). Finally, the model's fit is revealed by the standardized root mean square residual (SRMR), given that the coefficient is lower than the threshold of 0.08 (Henseler et al., 2016).

4.3 Complementary Analysis: Results of each Technology Park

With the aim of identifying possible differences in the results of the group of companies from each technology park, the results of each equation of the study were controlled for the subgroup. Table 3 presents the results of the research in Porto Digital and in PqTec SJC.

Table 3
Results of the structural model by technology park

	Porto Digital (n = 97)			PqTec SJC (n = 90)		
Path →	**Coef. (t- value)**	**p-value**	**f^2**	**Coef. (t- value)**	**p- value**	**f^2**
MCSs design → flexibility	0.291(2.668)	**0.008**	0.108	0.153(1.543)	0.123	0.030
MCSs design → information sharing	0.286(2.775)	**0.006**	0.100	0.136(1.469)	0.142	0.022
MCSs design → joint problem solving	0.274(2.764)	**0.006**	0.091	0.162(1.674)	**0.094**	0.031
MCSs design → restriction of power	0.202(1.431)	0.153	0.042	0.187(1.931)	**0.054**	0.035
Identification → flexibility	0.320(3.060)	**0.002**	0.130	0.540(6.447)	**0.000**	0.373
Identification → information sharing	0.308(2.976)	**0.003**	0.116	0.511(5.298)	**0.000**	0.306
Identification → joint problem solving	0.345(3.190)	**0.001**	0.144	0.480(4.913)	**0.000**	0.267
Identification → restriction of power	0.153(1.090)	0.276	0.024	0.343(3.204)	**0.001**	0.116
Moderation: MCSs * IID → flexibility	0.247(0.975)	0.329	0.088	-0.203(0.664)	0.507	0.062
Moderation: MCSs * IID → information sharing	-0.229(0.834)	0.404	0.063	-0.198(0.758)	0.448	0.056
Moderation: MCSs * IID → joint problem solving	0.126(0.600)	0.549	0.021	-0.215(0.710)	0.478	0.064
Moderation: MCSs * IID → restriction of power	-0.220(0.798)	0.425	0.057	-0.246(1.498)	0.134	0.073

Note: *R^2 = Porto Digital (flexibility: 0.313; information sharing: 0.284; joint problem solving: 0.276; restriction of power: 0.135); PqTec SJC (flexibility: 0.437; information sharing: 0.387; joint problem solving: 0.379; restriction of power: 0.273).*
Legend: f^2 = Cohen's effect size (1988): f^2 = 0.02 small effect; f^2 = 0.15 medium-sized effect; f^2 = 0.35 large effect.
Source: *Data from the research.*

The results of the modeling for the subgroups present empirical evidence from each technology park. A direct and positive effect was identified of MCS design on cooperation in both contexts, however, statistical significance was not found in the four dimensions. Porto Digital confirmed the influence of the MCSs on flexibility, information sharing, and joint problem solving, with a greater effect size than those identified in PqTec SJC, a context that only revealed a significant influence of the MCSs on joint problem solving and restriction from the use of power ($p < 0.1$). Moderation of the companies' identification with their technology park was not confirmed in any of the contexts observed, contradicting what was foreseen in hypothesis H_2, but aligned with the results found in the global analysis. It warrants highlighting that interorganizational identification was confirmed as positively influencing cooperation in both parks, except in restriction from the use of power in Porto Digital. The direct relationship of interorganizational identification in the dimensions of cooperation showed a greater effect size in PqTec SJC (f^2), a context that gives greater predictive power to the model in all the dimensions of interorganizational cooperation (R^2) if compared to Porto Digital.

4.4 Discussion of the Results

Hypothesis H_1 confirmed the positive relationship of the design of the technology parks' MCSs in cooperative behaviors exercised by the associated companies, in relation to the interorganizational relationship. MCS design, which encompasses the scope, timeliness, aggregation, and integration of the information provided (Chenhall & Morris, 1986), leads to cooperative behaviors, so as to drive the flexibility in the relationship (0.271, $p < 0.01$), the companies' sharing of information with the park (0.253, $p < 0.01$), behaviors regarding joint problem solving (0.250, $p < 0.01$), and restriction from the use of power in the relationship (0.222, $p < 0.01$). Among the possible conjectures for the effect of MCSs with a more comprehensive scope of information, greater timeliness, and more integrated and aggregated information on cooperation, the results may be related to the dynamic environment of innovative businesses. For example, the comprehensive scope may provide external information, from the market and other parks, and timeliness in providing information on the events occurring may be crucial for businesses that develop more disruptive innovations.

The results of H_1 are complementary to what has been revealed in other interorganizational relationships. The results are partially aligned with the study of Velez et al. (2015), who found a significant effect of scope and timeliness among the four informational characteristics on exporter-intermediary cooperation. In the buyer-supplier relationship, Mahama (2006) verified the effect of the performance measurement system on three dimensions of cooperation, except to the restriction from the use of power. In a way, the results of the relationship in technology parks differ in confirming an effect of the MCS design on all the dimensions of cooperation. It is inferred that the MCSs of the parks are focused on stimulating organizational cooperation and that the companies associate with the parks with the aim of cooperating. The technological advances and the innovation structure promoted in the parks encourage the partnership of new entrepreneurs to take advantage of the opportunities provided by the park (courses, structure and resources) and to immerse in a synergistic environment of innovation, offering interactions with hundreds of innovative companies.

Evidence was found to sustain the proposition that the MCSs directly affects the cooperation of the companies with their technology park. Thus, the study contributes by providing evidence of a different interorganizational relationship to in the control literature, and the results found corroborate with previous studies in different contexts. In an investigation of the industry-university relationship, Xu et al. (2014) found that cooperation is stimulated by the use of control mechanisms. Ding et al. (2010) found that managers generally use information about the performance of the relationship and information received with a certain amount of frequency to manage interorganizational cooperation; informational characteristics addressed in this study as components of the MCS design. The results are also consistent with studies that use an experimental approach, such as that of Coletti et al. (2005), in which cooperation was induced by the control in collaborative contexts.

We investigated the possibility of the organizations identifying with the interorganizational relationship (Corsten et al., 2011) and discovered how much the associated organizations identify with the relationship established with their technology park. Hypothesis H_2 postulated a positive moderating effect of identification on the relationship between the MCSs and cooperation, in order to intensify it (positive moderation). The relationships were not shown to be statistically significant in any dimension of cooperation, therefore, H_2 is rejected. This indicates that companies with greater levels of identification with their technology park were not shown to intensify the influence that the MCS design exercises over how much they cooperate with the park. By observing that the moderating effect was not found, but only the direct effect of the MCSs and of identification, it is denoted that these constructs do not interrelate to drive cooperation in the relationship, but rather act as independent antecedents.

This differs from arguments from former studies that MCSs can act in building identities within an interorganizational relationship (Chua & Mahama, 2007). It also differs from arguments that the effectiveness of the MCSs depends on the level of the team identity developed by its members (Towry, 2003). Some speculations for this result are that, in general, the relationships between the associated companies and the parks are not so close, therefore the information from the MCSs may not encompass and neither have a great impact in the everyday activities carried out by the companies, if compared to partnerships with higher levels of interdependence (e.g. supply chains, joint ventures), not showing strong interrelationship of the systems with relational perceptions, such as how much the companies identifies with their technology park.

Standing out among the results is the confirmed direct influence of identification on interorganizational cooperation, which showed statistical significance in the four cooperative behaviors. Thus, it is confirmed that how much the organization identifies with its technology park explains how much it cooperates with the relationship, characterized by the willingness to adapt to possible changes in the relationship (flexibility), to share information, to share the responsibilities to resolve problems, and by the moderate use of power in the relationship. Among the possible explanations, there is agreement with the argument of Mael and Ashforth (1992) that the feeling of social identification leads people to psychologically perceive themselves as connected to the goals of the group, sharing the same final objective.

The influence of interorganizational identification on cooperation has already been observed in other studies. In a supply chain, Ireland and Webb (2007) found effects of the common identity among the companies, with greater cooperation and cohesion within the group. In the buyer-supplier relationship, Corsten et al. (2011) found that interorganizational identification leads to the creation of positive behavioral patterns, with information sharing, which highlights the importance of managers seeking ways to influence interorganizational identification processes.

The results substantiate the predictive validity of the model, and the predictive power indicator (R^2) suggests some inferences. Altogether, MCSs and identification explained a variation of 32.2% in cooperation through joint problem solving, which reflects how much the parties of the relationship (companies and the park) share the responsibilities of the relationship. The antecedents explained 31% of the variations in flexibility, which indicates how much the two sides of the relationship (companies and the park) adjust to the new needs that the partnership requires. The MCS design and interorganizational identification explained 18.6% of the how much the associated companies share information with the technology park. Finally, restriction from the use of power was explained by 15.1% by the antecedents of the model, which refers to the park's abstention from opportunistically using power in relation to the associated companies. This information illustrates the nature of the exchanges and the prevalent characteristics in the interorganizational relationship maintained in technology parks. This denotes that MCSs and identification more strongly explain the companies' cooperation for joint problem solving and flexibility in the relationship.

The analysis per control group was conducted in a complementary way to verify differences in the results of each technology park. The results reveal that the influence of the MCSs on the companies' cooperation with Porto Digital (n = 97) is significant for flexibility, information sharing, and joint problem solving, while in PqTec SJC (n = 90) the MCS design only influenced joint problem solving and restriction from the use of power. It is noted that the dimensions of cooperation are complementary and the MCS has different influences. It is also noted that the effect of the MCSs on joint problem solving was present in both contexts, and that this objective may be the main focus of the MCS design in the technology parks.

The second hypothesis, which proposed a moderating effect, was also not confirmed with the segregated sample, which reaffirms the previously found results. The direct influence of identification was confirmed in Porto Digital, except regarding restriction on the use of power, and verified in all the dimensions in PqTec SJC. The effect size (f^2) shows that the MCSs design more strongly explains cooperation in Porto Digital and the identification has a greater effect on cooperation in PqTec SJC. The inferences are limited, but it warrants mentioning that Porto Digital was founded a longer time before, which may contribute to the park's MCSs being more focused on promoting cooperation, while PqTec SJC shows a major focus on a single segment and shared spaces to develop idea businesses (incubatees) that primarily cover the needs of the aeronautical segment, which may be one of the factors that explain the greater effect size of interorganizational identification on those companies' cooperation.

5. CONCLUSIONS

This study proposed and tested a theoretical model focused on antecedents of interorganizational cooperation, motivated by the rising number of collaborative ties in organizations and due to the difficulty of managing such collaborations. Cooperation is the purpose of interorganizational agreements and, by identifying factors that have the potential to promote such behaviors, greater possibilities of them being successful are presumed. We investigated the relationship established between technology parks and the businesses associated with them, according to the perception of 187 managers of companies from two Brazilian technology parks. The parks form a collaborative configuration that is growing in Brazil, but its research is still in initial stage. Despite interorganizational relationships being quite contextualized, making each context unique (Das & Teng, 1998), the study managed to build premises based on findings from research conducted in different contexts and at different levels of analysis, and it was ultimately able to corroborate some of their results (e.g. Towry, 2003; Huemer et al., 2004; Coletti et al., 2005; Mahama, 2006; Corsten et al., 2011; Xu et al., 2014; Velez et al., 2015).

The first hypothesis of the study indicated that MCSs configured by informational characteristics precede the companies' cooperation with their technology park. It is concluded that, in interorganizational relationships whose focus is on promoting cooperation, maintaining MCSs with more comprehensive information (a wider scope) and timely and integrated information reported in an aggregated way leads the partner companies to carry out cooperative behaviors. From comparing the results of the study with those of Mahama (2006) and Velez et al. (2015), the relationship between the companies and the technology park surprises by confirming the interorganizational cooperation in the four dimensions elucidated by Heide and Miner (1992). It is noted that the context investigated reflects MCSs configured with a focus on the companies' cooperation with the park, which is the ultimate goal of technology parks, and the motivation for the companies to associate with the technology park in their region, to seek synergy and social relationships (interpersonal and partnership-based), and due to the fact that the information provided by the park is more focused on innovation. In relationships with the purpose of supplying goods and with a stronger economic motivation, such as in the research of Mahama (2006) and Velez et al. (2015), the influence of the control is less present, as it did not influence all the dimensions of cooperation.

The empirical evidence led to the rejection of the second hypothesis of the study. Despite the companies' identification with the park influencing cooperation directly, this did not influence the relationship of the MCSs in cooperation. It is presumed that the MCSs of the relationship are not interrelated with the companies' level of interorganizational identification in relation to the park in the process of promoting cooperation. In other words, the MCSs of the technology parks investigated are not associated with social aspects such as the companies' organizational identification, which may be a particularity of the field studied. One possible explanation may derive from the fact that in a relationship in which one side (the park) features hundreds of ties, the information provided is more global and generic, if compared to the relationships of dyads.

Since the research covered two technology parks, in supplementary analyses by control group it was possible to observe different results, which may derive from the specificities of each technology park, and not only from the type of relationship investigated. In general terms, the relationships covered in the first hypothesis of the study were partially corroborated in the segregated samples and the moderation was not confirmed. While in Porto Digital a greater effect of the MCSs on the dimensions of cooperation was found, in PqTec SJC a greater effect of interorganizational identification on the companies' cooperation with their park was observed.

This study has implications for the literature by examining the constructs MCS design, interorganizational identification, and interorganizational cooperation altogether. The configuration of the MCSs of technology parks in the perception of the associated organizations raises the possibility of fitting this construct into interorganizational relationships, which remain scarcely explored. It contributes to the literature on collaborative contexts by verifying the validity of the research instruments of Chenhall and Morris (1986) and Mael and Ashforth (1992), adapted to the interorganizational level of analysis. It also contributes by exploring the multidimensionality of the elements of cooperation theory in contemporary arrangements of organizations, that is, technology parks. It expands the findings of the study of Coleti et al. (2005), who investigated the relationship of MCSs in cooperation, simulating an intraorganizational context, by providing evidence of the interactions observed in real situations and in an interorganizational relationship, as recommended by Luft (2016).

The results have practical implications for the organizations investigated and for their technology parks, as well as for interorganizational relationships founded in the search for innovation. It is revealed that the MCS design has a direct impact on the companies' cooperation, therefore it is suggested that the parks configure their MCSs in this sense, promoting a wide scope of information (greater quantity of information, communication), a timely system (greater frequency and speed of provision), with more integrated information provided in a more aggregated way. Nach et al. (2016) argue that, by promoting interorganizational communication through different environments (seminars, forums or events), the perception of interorganizational identification is broadened, which can align organizations' interests with cooperation and favor the performance of the relationship.

Future studies could investigate these themes in various contexts, to verify whether the proposed relationships are confirmed. We recommend investigating closer relationships, in which there is direct contact between the parties in operational activities, with a greater degree of interdependence, such as the relationship between an incubator and its incubatee. Future studies could investigate the MCSs of relationships established by more traditional and large-sized companies, given that the context of technology parks and small and medium-sized companies are generally characterized by more informal management and less consolidated control. Case studies could identify aspects that intensify the MCS-cooperation effects, as interorganizational identification did not confirm a moderating effect. Finally, we recommend investigating and comparing both sides of the relationship (company-park).

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APPENDIX A – QUESTIONNAIRE

MCSs design (Chenhall & Morris, 1986)

Indicate your perception regarding the availability of the following information from the management control systems (information and control systems) of the technology park where your organization resides and/or is associated with. Scale: 1 = very low to 7 = very high.

SC1. Information about possible future events.

SC2. Probability estimates of the occurrence of future events.

SC3. Non-economic information, such as client preferences, participant attitudes, working relationships, actions of the government and government bodies, competitive threats etc.

SC4. Information about factors outside the relationship, such as economic conditions, population growth, technological developments etc.

SC5. Non-financial information related to the market, such as market size, increase in market share etc.

TI1. Information is provided as soon as it is processed.

TI2. Reports are frequently and systematically provided to your organization on a regular basis, for example, daily or weekly reports.

TI3. There is no delay between the occurrence of an event in the park and the relevant information reaching your organization.

AG1. Information is provided about the different organizations or areas of the park, such as marketing and production, sales, costs, among others.

AG2. Information is provided about the impact of events in the park in particular intervals (for example, summaries, trends, monthly/quarterly/yearly comparisons).

AG3. Information is provided about the influence of events on the different organizations and areas of the park.

AG4. Information is provided via reports about the results of activities of the park's relationship with your organization.

AG5. Information is provided in order to enable your organization to conduct analyses of different scenarios.

IN1. Information is provided about the impact your organization's decisions will have on the relationship with the park.

IN2. Objective goals are established for the activities of all the organizations associated with the park.

IN3. Information is provided related to the impact your organization's decisions have on the park's performance.

Interorganizational identification (Mael & Ashforth, 1992; Corsten et al., 2011)

Indicate your level of agreement with the statements below, considering your perception regarding the interorganizational relationship of your organization with the technology park where it resides and/or is associated with. Scale: 1 = totally disagree to 7 = totally agree.

IID1. When someone criticizes the technology park my organization is part of, I feel like it was an insult against my organization.

IID2. My organization is quite interested in knowing what people think about the technology park.

IID3. When we (my organization) talk about the technology park we reside in, we generally refer to "us" instead of "them" (the park).

IID4. The conquests of the technology park are also a conquest of my organization.

IID5. When someone compliments the technology park in which we reside, we feel as if it were a compliment for our organization.

IID6. If a media report were to criticize the technology park in which my organization resides, I would feel uncomfortable.

Interorganizational cooperation (Heide & Miner, 1992)

Indicate how much the statements below describe the interorganizational relationship between your organization and the technology park where it resides and/or it is associated with. Scale: 1 = totally incorrect description to 7 = totally correct description.

FL1. Flexibility of response to requests for changes by the park is a characteristic of this relationship.

FL2. When some unexpected situation arises, the parties (your organization and the park) prefer to elaborate a new agreement instead of maintaining the initial agreements.

FL3. The parties are expected to be willing to modify their agreements if unexpected events occur.

IS1. In this relationship, any information that may help the other party is expected to be provided to them.

IS2. The exchange of information in this relationship arises frequently, including informally, and not only according to some pre-established agreement.

IS3. The parties are expected to provide private information if it can help each other.

IS4. We are expected to keep each other informed about events or changes that can affect the other party.

JPS1. In most of the aspects of this relationship, the parties are jointly responsible for carrying out what is required of them.

JPS2. Problems that arise throughout this relationship are treated by the parties as joint and not individual responsibilities.

JPS3. The parties of this relationship do not mind owing favors to each other.

JPS4. The responsibility to ensure that the relationship works for both is shared between the parties.

RP1. The parties feel it is important not to use any private information that can cause a disadvantage for the other party.

RP2. One characteristic of this relationship is that it is expected that none of the parties will make demands that may be prejudicial to the other.

RP3. The most powerful party is expected to restrict the use of its power in an attempt to get what it wants.