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Network management and value creation in strategic networks: Evidence from Brazil

Azevedo, A.C., Boaventura, J.M., Wegner, D., Giglio E.M., Boari, C.

Abstract

Purpose: Few studies have analysed how to actively manage strategic networks (SNs) to achieve individual and collective goals and create value. This paper aims to examine the influence of network management on the value created by SNs and the mediation role of resources and relationship quality.

Design/methodology/approach: We distributed a survey to 126 companies linked to SNs in the Brazilian information and communication technology (ICT) sector. We tested the hypothesized relationships using partial least squares structural equation modelling (PLS-SEM).

Findings: We found that network management directly influences value creation. Furthermore, the exchange and combination of resources mediate the relationship between the two constructs. Surprisingly, the quality of the relationships does not mediate the relationship between management and the value created. However, it positively impacts the exchange and combination of complementary resources.

Originality/value: This study provides a new interpretation of the determinants of value creation in strategic networks. Our results contribute to the theory by demonstrating that the relationship between network management and value creation is strengthened when the exchange and combination of resources between network participants occur. In turn, these are positively influenced by the quality of relationships established in the network, thus providing a new interpretation of the determinants of value creation in strategic networks.

Keywords: Network Management, Value Creation, Strategic Networks, Mediators

Paper type: Research paper

Introduction

Value creation in strategic networks (SNs) is a collective process of coordinated and cooperative efforts (Bridoux *et al.*, 2011; Muller-Seitz and Sydow, 2012), which involves the “sum or totality of the benefits obtainable from exchanges” (Leite and Bengston, 2018, p. 182). The ability of SNs to create value (Powell *et al.*, 1996; Dyer and Singh, 1998) is highlighted by both academia and business practice (Matinheikki *et al.*, 2017). However, researchers still debate how value is created in these collaborative agreements (Antoldi and Cerrato, 2020; DiVito *et al.*, 2021).

Network management is necessary for value creation (Markovic, 2017; Agostini and Wegner, 2018; Cepiku *et al.*, 2020) because it helps organize joint efforts (Dagnino *et al.*, 2016). A number of studies have analysed how network management is operationalized and the variables involved in this process (Heidenreich *et al.*, 2016; Markovic, 2017; Cap *et al.*, 2019), but gaps remain regarding the influence of network management on the network’s performance and ability to create value (Manser *et al.*, 2016; Klaster *et al.*, 2017). There is still a lack of knowledge regarding the determinants of value creation, specifically in relation to the intervening factors in the association between network management and the value created.

Recent theoretical approaches such as the relational view (Dyer and Singh, 1998; Dyer *et al.*, 2018) as well as value-creating systems (Hakansson and Snehota, 1995; Matinheikki *et al.*, 2017) argue that the value creation process in networks involves the exchange and combination of resources among partners (Tsai and Ghoshal, 1998; Klaster *et al.*, 2017; Dyer

et al., 2018). Therefore, we assume that network management influences value creation, relying on relational variables that enable the exchange and combination of resources among partners. Thus, we aim to answer the following research question: how does network management influence value creation in strategic networks, mediated by the quality of relationships and the exchange and combination of resources among participants?

We contribute to the theory by demonstrating that the relationship between network management and value creation is strengthened when network participants exchange and combine resources. Resource combination, in turn, is positively influenced by the quality of the relationships established in the SN, thus providing a new interpretation of the determinants of value creation in strategic networks. In addition to advancing theoretical understanding, the proposed model provides managerial guidance regarding the best practices for managing SNs at the individual and collective levels of value creation.

Explaining value creation in SNs

Value creation in SNs is a collective process that requires coordinated and cooperative efforts (Bridoux *et al.*, 2011; Muller-Seitz and Sydow, 2012). The value created is the “sum or totality of benefits that can be obtained from exchanges” (Leite and Bengtson, 2018), whether individual or collective (Cavallo *et al.*, 2021). The literature on value creation refers to the relational view (Dyer and Singh, 1998; Dyer *et al.*, 2018), as well as value-creating systems (Hakansson and Snehota, 1995; Matinheikki *et al.*, 2017). The interface between these approaches and the literature on the governance and management of intentionally organized networks (Dagnino *et al.*, 2016) defines the determinants of the value created within SNs. Therefore, value creation is determined by (i) network management, (ii) the quality of the relationships established, and (iii) the processes involved in the exchange and combination of resources.

Network management is necessary for effective cooperation among participants (Planko *et al.*, 2017). Its importance for value creation and collaboration success is also recognized (Agostini and Wegner, 2018), as it promotes integration and coordination among participants. Manser *et al.* (2016) conducted a case study in a Dutch innovation network, analysing 11 projects to understand how network management activities are performed. The authors concluded that network management might vary depending on the project and may occur at the levels of essential as well as control- and reward-oriented coordination. However, the invariable finding is the constant need for strategic coordination to achieve objectives and create value. With a similar lens, Heidenreich *et al.* (2016) carried out empirical research on innovation networks belonging to the German mechanical engineering industry. They confirmed that employing a network manager improves network performance in achieving goals and member retention. Based on these arguments, we propose the following hypothesis:

H₁: Network management positively influences value creation in strategic networks.

Effective network management involves developing an infrastructure that enables spaces for interaction (Agostini *et al.*, 2019) within which collaboration can occur (Markovic, 2017). Moreover, network management must encourage participants to engage in collaborative activities (Bullen *et al.*, 2022). The connection between the activities promoted by network management to foster interactions and the benefits arising from these for network performance were explored by Macció and Cristofoli (2017) when studying healthcare networks created in Switzerland.

Klaster *et al.* (2017) have noted the relevance of management in mitigating tensions that may compromise the network’s effectiveness. To achieve collective results, SNs need to

ensure the individual effort of several organizations with different objectives (Lemaire and Provan, 2018), which depends on cooperative relationships based on trust and commitment (Agronoff and McGuire, 2001; Provan and Milward, 2001). Furthermore, Antoldi and Cerrato (2020) analysed 58 strategic networks belonging to Italian SMEs and found that managers promote strong relationships to generate results. The study shows that the quality of relationships plays a mediating role between network management and value creation. Therefore, we propose the following:

H₂: The influence of network management on the value created by the strategic network is mediated by the quality of the relationships among the participants.

Activities promoting relationships among participants positively affect their trust and commitment to other members (Molina-Morales and Martínez-Fernández, 2003; Klaster *et al.*, 2017). Trust and commitment are essential for achieving positive outcomes (Milward and Provan, 2006) since they create cohesion and foster joint action (Heidenreich *et al.*, 2016; Markovic, 2017). The case studies carried out by Agostini *et al.* (2019) with Italian SNs highlighted the importance of managers promoting an environment of trust with high commitment. These two elements played an essential role in the survival of the analysed SNs.

Early works revealed that the engagement of participants in decisions and tasks is positively related to their commitment and immersion in the group (Provan and Kenis, 2008; Antoldi and Cerrato, 2020). Beelen *et al.* (2022) conducted six case studies of Dutch networks in the software industry. They highlighted the relevance of alignment between partners and commitment as one of the main criteria for establishing quality partnerships in strategic networks.

Network management also involves efforts to form a collective identity (Dagnino *et al.*, 2016) that neutralizes conflicting interests (Markovic, 2017). When members internalize the network's objective, they are more willing to allocate resources and personnel, voluntarily donating their time and skills to network tasks (Milward and Provan, 2006). Thus, the mediation presented assumes the following:

H_{2a}: Network management positively influences the quality of the relationships among the participants.

Previous studies have shown that the quality of the relationships among network participants is positively associated with network performance (Kenis and Provan, 2009; Klaster *et al.*, 2017). Trust is considered the main characteristic of relationship quality, boosting dynamism, efficiency, and efficacy (Heidenreich *et al.*, 2016). Furthermore, trust implies that there is less of a need for formal controls, agreements, and contracts, thus reducing costs (Provan *et al.*, 2007). Several works addressing performance, efficacy, and value creation in strategic networks highlight the positive effects of relationships on results (Klaster *et al.*, 2017).

For instance, Lemaire and Provan (2018) investigated the Canadian Southern Alberta Child and Youth Network, which is aimed at establishing inter-organizational partnerships to improve the health and well-being of children and young people. The results showed that the quality of relationships stimulates the participation of several organizations, often with different purposes and objectives, acting towards a common goal. As such, we assume that the quality of relationships has a mediating effect on network management for value creation:

H_{2b}: The influence of network management on value creation in strategic networks is mediated by the quality of the relationships among participants.

New sources of value are generated through exchanges and combinations of resources among participants. In the search for efficient results, participants need to allocate resources, create new ones, or produce new combinations of existing resources (Tsai and Goshal, 1998; Molina-Morales and Martínez-Fernández, 2003).

Complementary resources generate incomes higher than those obtained from each partner's endowments (Dyer and Singh, 1998; Dyer *et al.*, 2018). The resources combined by participants can foster value creation, as revealed in a case study by Leite and Bengston (2018), who examined a Brazilian network of public-private partnerships. The results highlight the importance of cohesion and resource complementarity among the network actors so that synergistic exchanges allow the creation and capture of value.

Network managers must select and incorporate relevant participants regarding resources and capabilities (Jarvensivu and Moller, 2009). Furthermore, network management can ensure fair exchange among participants (Weber and Khademian, 2008; Jarvensivu and Moller, 2009; Saz-Carranza and Ospina, 2011). That said, the exchange and combination of complementary resources also have a mediating role in the relationship between network management and the value created. Hence, the following hypothesis is presented:

H₃: The influence of network management on value creation in strategic networks is mediated by the exchange and combination of complementary resources among participants.

By developing a strategy, network management operates through the effective allocation of resources (Klijn *et al.*, 2010) and the distribution of tasks and responsibilities (Planko *et al.*, 2017). The prominent network management roles are allocating resources and capabilities (Heidereich *et al.*, 2016) and promoting knowledge transfer and integration across the network (Vătămănescu *et al.*, 2020). A case study by Heidenreich *et al.* (2016) involving German innovation networks highlights that a network management's contribution to creating, distributing and acquiring knowledge more efficiently is even more evident in highly complex networks such as the information and communication technology (ICT) networks we analyse in this paper. In addition, network managers influence effectiveness by attracting and mobilizing resources to the network (Gagné *et al.*, 2010), and vital information percolates through managers (Planko *et al.*, 2017). Thus, we propose the following hypothesis:

H_{3a}: Network management positively influences the exchange and combination of resources among network participants.

Resource complementarity represents an essential source of value creation in SNs (Håkansson and Snehota, 1995; Leite and Bengston, 2018). The combination and exchange of complementary resources foster value creation (Molina-Morales and Martínez-Fernández, 2003). Resources are combined in regionally bounded organizational environments to produce unique and synergistic combinations. The quantity and types of existing resources and the ability to make those resources flow through relationships assist in determining the value creation potential of a network. Dyer *et al.* (2018) and Leite and Bengston (2018) indicate that the exchange of resources among participants is a crucial determinant of value creation, while Molina-Morales and Martínez-Fernández (2003) have demonstrated the existence of a consistent relationship between network management and the processes of resource exchange and combination. Consequently, we propose the following hypothesis:

H_{3b}: The exchange and combination of resources among network participants positively influence the value created by the strategic network.

In addition to the hypotheses presented, we advocate that sharing information, ideas, and knowledge in the SN can make a difference in participants' performance (Vătămănescu *et al.*, 2020). The flow of these resources occurs through social interaction channels (Obeng, 2019; Cragg *et al.*, 2020). Significant resources come from interaction, so participants considered untrustworthy will have less access to these (Spigel and Harrison, 2018).

Companies participating in SNs develop an intensive exchange system and a combination of resources through social interactions and trust (Molina-Morales and Martínez-Fernández, 2003; Obeng, 2019). Furthermore, according to the authors, the intensity of these interactions favours channels for the flow of information and resources. The alignment between relationships and resources can be traced from the interdependence between companies. Leite *et al.* (2018) developed a single case study involving the network of the Swedish multinational Ericsson, and the results highlight the importance of relationship quality for cooperation and resource exchange. In this context, we propose the following:

H₄: The quality of relationships positively influences the exchange and combination of complementary resources.

Figure 1 summarizes the conceptual model and research hypotheses:

[FIGURE 1 HERE]

Figure 1. Conceptual model
Source: Developed by the authors.

Research design

Data and sample

For three reasons, we have chosen companies from the Brazilian information and communication technology (ICT) sector for our research context. First, this sector comprises several highly interdependent participants (e.g., hardware manufacturers, software developers, and service providers), generating a favourable environment for examining strategic collaboration among companies (Afawubo and Noglo, 2022). Second, product life cycles in the ICT sector are short, making the environment extraordinarily dynamic and highly interdependent, which leads companies to develop coordinated cooperation. Third, the ICT sector is one of the fastest-growing industries globally, with a high potential to generate profits if businesses master network development (Partanen and Möller, 2012). These conditions of task complexity, interdependence among participants, innovation pressure, and the necessity of joint action indicate the importance of network management in our study context.

We have defined the sample size with the assistance of the G* Power 3.1.9.2 software, which indicated a minimum sample size of 77 respondents (n=77). The questionnaire was sent to 175 companies participating in SNs in the ICT sector, and we received 126 returned questionnaires. This number represents a return rate of 72% and corresponds to 165% of the minimum sample calculated.

Since a single key informant provides information on all constructs, we were faced with the possibility of incurring common method bias. So, we have applied procedural and statistical measures to address this issue. Thus, we have separated the dependent and independent variables in the questionnaire with clarity at the procedural level. We have reduced the ambiguity of each item and kept the assertions as simple as possible. We have also applied Harman's one-factor test (Podsakoff *et al.*, 2003). After modelling all items in an exploratory

factor analysis (EFA), we found that the first factor did not carry a high value of extracted variance (approximately 47%). These procedures allowed us to infer that the standard method bias did not significantly affect our results.

Measures

Whenever possible, we have used existing validated scales to operationalize the constructs of interest. As such, we have applied a seven-point Likert scale, with (1) indicating “strongly disagree” and (7) “strongly agree.”

The second-order construct named “quality of relationships” reflects the network’s internal integration (Provan and Milward, 2001) and the perceived quality of relationships between members (Klaster *et al.*, 2017), measured based on the first-order construct “trust” (six reflexive indicators) and “commitment” (five reflexive indicators).

The construct “resource exchange and combination” (composed of six reflexive indicators) is a first-order construct and consists of the practices that reveal how network participants effectively exchange, combine, and utilize their complementary resources (Tsai and Ghoshal, 1998; Molina-Morales and Martínez-Fernández, 2003).

The dependent variable “value created” is a second-order construct composed of the first-order constructs “individual gains” and “collective gains” (each of which have six reflexive indicators). The value created refers to the sum of the benefits/gains obtained from exchanges (Leite and Bengston, 2018), the result of coordinated and cooperative efforts performed by multiple participants to mutually explore the value creation potential of their resources (Bridoux *et al.*, 2011).

The construct “network management” was defined based on a full literature review in which we surveyed the main emerging management functions, compiled them, and associated them with specific operational activities. This association was validated by academic experts who study the topic and then by practitioners (SN managers), who analysed how relevant these activities are and how often they are included in their managerial routines.

These validations indicated a distribution of activities in two distinct stages of the network. The initial stage involves activities to promote the development of the network, and the advanced one prioritizes activities for the maintenance of the network’s performance (Dagnino *et al.*, 2016). Due to their characteristics, these two dimensions were named *ex-ante* activities and *ex-post* activities, respectively. Thus, the construct “network management” is a second-order construct measured by the following first-order constructs: “*ex-ante* activities” (with six reflexive indicators) and “*ex-post* activities” (with 11 reflexive indicators).

We used structural equation modelling (SEM) to examine the interrelationships proposed in the conceptual model. This technique allows for the simultaneous examination of interrelated dependency relationships among constructs represented by several variables while accounting for measurement errors (Hair Jr *et al.*, 2016). We opted for a partial least squares (PLS) estimation within the SEM technique, and the data were treated and analysed using the SmartPLS® 3.0 software. The results are presented in the following section.

Results

The SEM was developed based on the model’s measurement and structural analysis steps. In the measurement model evaluation, we have considered the analysis of (i) factor loadings, (ii) the reliability of internal consistency and convergent validity, and (iii) discriminant validity (Hair Jr *et al.*, 2010). Seven items were excluded from the factor loading analysis as they presented unsatisfactory factor loading values lower than 0.70 (Hair *et al.*, 2016). Regarding internal consistency reliability and convergent validity, we have considered

Cronbach's alpha (CA), composite reliability (CR), and the average variance extracted (AVE) as parameters, and the results are presented in Table I.

[TABLE I HERE]

The CA and CR values are higher than 0.7, and the AVE values are greater than 0.5. Such results were obtained from the exclusion of nine items, and this validation was considered satisfactory in the analysis of the constructs that make up the model (Hair Jr *et al.*, 2016).

The last step in the measurement model analysis was to assess discriminant validity. For this purpose, we have applied the Fornell-Larcker criterion (Table II). The square root of the variance of each construct should be greater than the correlations with the other constructs.

[TABLE II HERE]

Based on the Table II analysis, we can confirm discriminant validity, since the diagonal values (in bold) are higher than the others in the table, i.e., each first-order construct exhibits a low shared measurement variance with the other constructs.

After the measurement model analysis, we evaluated the structural model, assessing the following criteria: (i) the multicollinearity analysis, (ii) determination coefficients, (iii) f^2 effect and predictive relevance Q^2 , and (iv) path coefficients of the structural model. We performed a multicollinearity evaluation using the variance inflation factor (VIF). We verified that the values were lower than 5.00 (Table III), so they are considered acceptable and indicate the non-existence of multicollinearity (Hair Jr *et al.*, 2016).

[TABLE III HERE]

Regarding the complete model explanatory power (R^2), the dependent variable named "value created" presents a result of $R^2 = 0.531$, indicating that the three latent variables tested can explain the value created in the network by 53.1%. Furthermore, in assessing the predictive relevance of the model (Q^2) (Table IV), which analyses how close the model is to what was expected of it, all constructs presented Q^2 values greater than 0, demonstrating that the model holds accuracy (Hair Jr *et al.*, 2016).

[TABLE IV HERE]

Regarding the effect size of the constructs (f^2) (Table IV), the results demonstrated that the constructs are relevant for the overall model fit since the values of f^2 are all higher than 0.35 (Cohen, 1988). Finally, we performed the analysis of the path coefficients and the evaluation of their statistical significance. Table V presents the results obtained to evaluate the direct relationships established in the model.

[TABLE V HERE]

The evaluation of the statistical significance of the coefficients demonstrates that except for the following relationship: quality of relationships \rightarrow value created ($p > 0.05$), all other coefficients are statistically significant at the 5% level. Given these results, this relationship was excluded, and a new test was performed. Thus, all the coefficients in the latest round were considered statistically significant at the 5% level, and the path coefficients are shown in Figure 2.

[FIGURE 2 HERE]

The analysis of the direct relationships presented in the structural model enables the evaluation of the hypotheses. However, before showing these results, we considered assessing the mediation hypotheses (H₂ and H₃) using specific procedures and tests. For this purpose, we used: i) Baron and Kenny's (1986) path analysis, ii) Sobel's (Sobel, 1982), Aroian's (Aroian, 1947) and Goodman's (Goodman, 1960) tests, and iii) the variance accounted for (VAF) (Hair *et al.*, 2016).

For H₂, we found that the relationship between the "quality of relationships" and "value created" was not significant in its direct effect ($B = 0.051 \mid t < 1.96$), so we discarded the possibility of the mediation relationship proposed in H₂. The results of the mediation analysis of H₃ are presented in Table VI.

[TABLE VI HERE]

By the end of the path analysis, the results indicated that when the exchange and complementary resources combination was inserted into the equation, the relationship coefficient between network management and the value created remained significant. Still, its value was reduced ($B = 0.337 \mid t = 3.750$); that is, the partial mediation effect of exchange and complementary resources combination on the relationship between network management and the value created was confirmed, with an R² higher (53%) than the direct relationship (40.1%). Furthermore, regarding the Sobel, Aroian, and Goodman tests, we found that all were statistically significant at the 5% level, reinforcing the mediation hypothesis H₃. Finally, the VAF of 51.8% confirmed that the exchange and combination of complementary resources partially mediate the relationship between network management and the value created (Hair Jr *et al.*, 2016).

Lastly, Table VII summarizes all the proposed hypotheses considering the structural model with the direct relationships and the mediation tests.

[TABLE VII HERE]

Discussion

Our study investigated network management from two dimensions, involving ex-ante and ex-post activities. Following the measurement of the ex-ante dimension, we have noted the predominance of activities of a relational nature, involving the development of a collective identity (Saz-Carranza and Ospina, 2011). We also observed that activities promoted integration among network partners (Weber and Khademian, 2008), in addition to resolving conflicts and mediating interests (Markovic, 2017). These aspects are paramount for network formation and development in their early stages (Dagnino *et al.*, 2016). In turn, the ex-post dimension was represented mainly by activities of a more strategic nature. These include mapping strategic opportunities for the network (Mesquita, 2007), as well as defining an action plan to achieve these, scaling the results achieved, and controlling them by evaluating and reviewing the scope and goals set for the network (Heidenreich *et al.*, 2016).

A significant contribution of this study is showing that the value created in SNs depends on the network management, which is performed through different activities that operationalize managerial functions, thus extending the few empirical applications that test this relationship (Klijn *et al.*, 2010; Maccio and Cristofoli, 2017).

Beyond the direct relationship between network management and the value created, we have proposed a mediation analysis through the quality of relationships and exchange and

combination of complementary resources constructs. The first hypothesized relationship was that the quality of relationships mediates the influence of network management on value creation. Therefore, we first analysed the direct relationship between network management and relationship quality (H_{2a}), as well as relationship quality and value creation (H_{2b}). The results demonstrated that network management positively influences the quality of relationships, corroborating the idea that effective management impacts trust and commitment (Mesquita, 2007), two characteristic dimensions of relationship quality (Milward and Provan, 2006). On the other hand, although there is evidence for the relationship between the quality of relationships and network performance at multiple levels (Klaster *et al.*, 2017), this association was not identified in the present study. Thus, the hypothesis that the quality of relationships mediates the relationship between network management and value creation (H₂) is not supported.

Although the quality of relationships does not directly impact value creation, this does not mean that this construct is irrelevant to network outcomes. We found that the quality of relationships favours the exchange process and combination of resources, assuming a relevant role in the value creation process (Matinheikki *et al.*, 2017). Previous studies have already demonstrated that interaction between partners and access to different resources allows new solutions to be developed and value created (Leite and Bengtson, 2018).

Therefore, our second contribution consists of presenting a new perspective through which to assess the role of the quality of relationships in the value creation process, which partially differs from previous studies (Agranoff and McGuire, 2001; Provan and Milward, 2001; Klaster *et al.*, 2017). Network management is essential for promoting the quality of relationships (Markovic, 2017), and these, in turn, are the beacons of the processes involved in the exchange and combination of resources (Leite and Bengtson, 2018; Spigel and Harrison, 2018), which contribute to value creation in the whole network (Provan *et al.*, 2007).

Still aiming to verify the mediation relations, the second hypothesis is that the exchange and combination of complementary resources mediate the relationship between network management and value creation (H₃). Following the previous steps, we first verified the direct relationships between network management and resource exchange and combination (H_{3a}), as well as between the latter and value creation (H_{3b}). Both hypotheses were supported and proved the mediation proposed in (H₃). These results corroborate studies highlighting network management's role in allocating resources and capabilities effectively (Dagnino *et al.*, 2016; Heidenreich *et al.*, 2016) and the distribution of tasks and responsibilities among network members (Planko *et al.*, 2017). In this sense, the exchange and combination of resources are enabled by network management activities (Weber and Khademian, 2008; Saz-Carranza and Ospina, 2011).

Our third contribution demonstrates that the value creation process, triggered by the network management activities, is superior when mediated by the exchange and combination of complementary resources. This result extends the understanding of the direct relationship already advocated in the literature (Klaster *et al.*, 2017; Maccio and Cristofoli, 2017). The value created in SNs involves the coordinated and cooperative efforts of multiple participants to mutually explore the value creation potential of their resources (Bridoux *et al.*, 2011). That said, our results support the proposition that network management plays a dual role in this process, influencing it directly and indirectly through the quality of the relationships established and the processes involved in the exchange and combination of complementary resources, which also contribute to value creation in SNs.

We recognize that the objectives and underlying logic of value creation can differ depending on the type of network and the context in question (Hurmelinna-Laukkanen *et al.*, 2022). Previous studies analysed SNs in technology-intensive industries in developed countries such as Germany and the Netherlands (Manser *et al.*, 2016; Heidenreich *et al.*, 2016; Beelen *et*

al., 2022). Other works examined Italian SNs composed of SMEs (Antoldi and Cerrato, 2020; Agostini *et al.*, 2019) and networks consisting of partners in different countries (Leite *et al.*, 2018). Our research focused on SNs which operate in a technology-intensive industry but in an emerging economy. Therefore, our results extend previous findings and contribute to theory and practice by analysing how network management fosters value creation in an emerging country.

Hurmelinna-Laukkanen *et al.* (2022) argued that there are generally applicable dimensions of network management that may be used in different settings. These dimensions provide practitioners with a useful analytical tool for managing networks. This allows us to extrapolate our results to other strategic networks beyond the ICT sector and the Brazilian context if they are united by a common strategic objective and composed of independent partners that share resources and know-how. Nevertheless, we highlighted that the more complex the network's activities in terms of size, diversity and technological aspects, the greater its demand for network management activities.

Conclusions and remarks

In this study, we analysed the direct and indirect influence of network management on value creation in SNs by considering the following question: how does network management influence value creation in SNs, mediated by the quality of relationships and exchange and combination of resources among participants?

The results show that network management directly influences value creation (H₁). Furthermore, exchange and resource combination mediate the relationship between network management and value creation (H₃). On the other hand, the quality of relationships does not mediate the relationship between network management and value creation (H₂) but positively impacts complementary resource exchange and combination (H₄).

We emphasize that the mediation tests do not invalidate the influence of network relationships on value creation. However, our findings demonstrate a different path from the social network approaches (Tsai and Goshal, 1998; Dyer and Singh, 1998; Dyer *et al.*, 2018). We show that an indirect relationship for value creation percolates the exchange and combination of resources.

Based on these results, we highlight the relevant role of network management activities in the value creation process, explaining their direct and indirect relationships with the results generated within SNs. We thus offer theoretical implications by adding new insights to the previous literature (Heidenreich *et al.*, 2016; Manser *et al.*, 2016). The attribution of activities that operationalize the network management contributes to creating and measuring this construct from the previously presented dimensions (*ex-ante* and *ex-post* activities). In managerial terms, the organization of these activities consists of a descriptive guide for advising network managers; that is, it answers the question raised by Provan and Kenis (2008) and Manser *et al.* (2016) regarding what should be undertaken to create value in SNs and how it should be accomplished.

This study's main contribution was to provide a model that explains the process of value creation in SNs from a relational (Dyer and Singh, 1998; Dyer *et al.*, 2018) and systemic (Hakansson and Snehota, 1995; Jarvensivu and Moller, 2009; Matinheikki *et al.*, 2017) perspective. In addition, we highlight the importance of network management, its role in network performance (Dagnino *et al.*, 2016; Manser *et al.*, 2016; Markovic, 2017) and the value creation process (Antoldi and Cerrato, 2020). Moreover, previous works have mainly focused on strategic networks in developed countries (Manser *et al.*, 2016; Heidenreich *et al.*, 2016; Beelen *et al.*, 2022; Antoldi and Cerrato, 2020; Agostini *et al.*, 2019). Since we have analysed

strategic networks in an emerging country, our study helps expand the comprehension of how network management matters for value creation in different contexts.

Future studies can refine the model, extend it for other strategic networks, and analyse longitudinal data that allow us to understand the evolution of network management in network performance and its relationship to individual and collective value creation. We also suggest that subsequent works compare strategic networks operating in developed and developing countries to identify the influence of culture and institutional context on network management and value creation.

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Network management and value creation in strategic networks: the mediation role of resources and relationship quality

TABLES:

Table I. Reliability of internal consistency and convergent validity

Variables	AC	CC	AVE
Ex_ante Activities	0.851	0.899	0.697
Ex_post Activities	0.936	0.946	0.662
Commitment	0.901	0.927	0.720
Trust	0.939	0.952	0.767
Collective Gains	0.870	0.906	0.661
Individual Gains	0.890	0.920	0.700
Exchange and Combination of resources	0.925	0.940	0.694

Source: Survey data.

Table II. Discriminant validity of reflective constructs - after refinement

	Commitment	Trust	Ex_ante Activities	Ex_post Activities	Collective Gains	Individual Gains	Resource Exchange and Comb.
Commitment	0.848						
Trust	0.630	0.876					
Ex_ante Activities	0.589	0.680	0.831				
Ex_post Activities	0.500	0.605	0.828	0.871			
Collective Gains	0.542	0.400	0.578	0.538	0.859		
Individual Gains	0.641	0.497	0.666	0.529	0.802	0.875	
Exchange and Combination of resources	0.796	0.626	0.637	0.587	0.588	0.684	0.866

Source: Survey data.

Note: The diagonal values are the square root of the AVE.

Tabela III. Values of Variance Inflation Factor (VIF).

	VIF
Network Management -> Quality of Relationships	1.000
Network Management -> Exchange and combination of resources	1.904
Network Management -> Value Created	2.006
Quality of Relationships -> Exchange and combination of resources.	1.904
Quality of Relationships -> Value Created	3.032
Exchange and combination of resources. -> Value Created	2.696

Source: Survey data.

Table IV. Predictive Relevance (Q²) and Effect Size

Construtos	Q²	f²
Commitment	0.533	0.517
Trust	0.618	0.609
Ex_ante Activities	0.584	0.464
Ex_post Activities	0.675	0.556
Collective Gains	0.606	0.442
Individual Gains	0.679	0.576
Network Management	*	0.539
Quality of Relationships	0.273	0.491
Exchange and Combination of resources	0.447	0.600
Value Created	0.336	0.518

Source: Survey data. (*) *Exogenous Variable*.

Tabela V. Summary of results of the complet model

	Path Coefficient	Standard Deviation	T Statistics	P Values
Network Management → Quality of Relationships	0.689	0.053	12.887	0.000
Network Management → Exchange and Combination of Resources	0.195	0.080	2.446	0.014
Network Management → Value Created	0.324	0.094	3.432	0.001
Quality of Relationships → Exchange and Combination of Resources	0.646	0.069	9.417	0.000
Quality of Relationships → Value Created	0.051	0.123	0.415	0.679
Exchange and Combination of Resources → Value created	0.433	0.113	3.842	0.000

Source: Survey data.

Table VI. Mediation Analysis – Hypothesis 3

	Independent Variable	Dependent Variable	β	t	R²
Path Coefficients	<i>Network Management</i>	<i>Exchange and Combination of Resources</i>	0.640	11.057	0.409
	<i>Network Management</i>	<i>Value Created</i>	0.633	8.991	0.401
	<i>Exchange and Combination of Resources</i>	<i>Value Created</i>	0.682	12.389	0.465
	<i>Network Management</i>	<i>Value Created</i>	0.337	3.750	0.530
	<i>Exchange and Combination of Resources</i>	<i>Value Created</i>	0.464	5.727	
	Test	Test Statistics	Standard Error	p-value	
	Sobel test	5.084	0.058	0.000	
	Aroian test	5.068	0.059	0.000	
	Goodman test	5.100	0.058	0.000	
	VAF			0,518	

Source: Survey data.

Tabela VII. Hypothesis Test Summary

Hypothesis	Path Coefficient	<i>t</i>	<i>p-value</i>	Outcome
H1: Network management positively influences value creation in Strategic Networks.	0.324	3.432	0.001	Confirmed
H2: The influence of network management on the value created by the strategic network is mediated by the quality of the relationships among the participants.	*	*	*	Not confirmed
H2a: Network management positively influences the quality of the relationships among the participants.	0.689	12.887	0.000	Confirmed
H2b: The quality of relationships between network participants positively influences value creation.	0.051	0.415	0.679	Not confirmed
H3: The influence of network management on value creation in strategic networks is mediated by the exchange and combination of complementary resources among participants.	*	*	*	Confirmed
H3a: Network management positively influences the exchange and combination of resources among network participants.	0.195	2.446	0.014	Confirmed
H3b: The exchange and combination of resources among network participants positively influences the value created by the strategic network.	0.433	3.842	0.000	Confirmed
H4: The quality of relationships positively influences the exchange and combination of complementary resources.	0.646	9.417	0.000	Confirmed

Source: Survey data.



