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# Capabilities and skills to orchestrate innovation networks

Capabilities  
and skills

Taisson Toigo

*Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Sul,  
Bento Gonçalves, Brazil, and*

Douglas Wegner, Silvio B. da Silva and Felipe de Mattos Zarpelon  
*Universidade do Vale do Rio dos Sinos, Porto Alegre, Brazil*

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## Abstract

**Purpose** – This study aims to present a theoretical analysis on the capabilities (at the organizational) and skills (at the individual level) of the hub organization (orchestrator) in an innovation network.

**Design/methodology/approach** – The authors conducted literature reviews on the orchestration of innovation networks; and networking capabilities.

**Findings** – This study presents a theoretical model and a research agenda.

**Originality/value** – In interorganizational relations, a central actor can stand out the role of intentionally creating, extracting and distributing value in the network, generating gains for all members. Literature recognizes this set of intentional and deliberate actions as the “orchestration” of resources in the network. Despite the increasing interest regarding the theme, the phases and specific capabilities for orchestration still lack further investigation.

**Keywords** Networking capabilities, Interorganizational relationships, Orchestration of innovation networks

**Paper type** Conceptual paper

## 1. Introduction

Literature highlights the relationship between the orchestration of innovation networks and favorable results regarding innovation (Batterink, Wubben, Klerkx, & Omta, 2010; Nambisan & Sawhney, 2011; Munari, Sobrero, & Malipiero, 2011). There is an opportunity for studies that investigate the comprehensive dynamic model of the orchestration of innovation networks and explore the characteristics of hub organizations. Literature does not sufficiently cover specific capabilities of the hub organization and individual skills for orchestrating innovation networks (Nambisan & Sawhney, 2011; Müller-Seitz & Sydow, 2021; Canning & Szmigin, 2016; Haider & Mariotti, 2016; Zhang, Gregory, & Neely, 2016).

Interorganizational relations can assume the role exercised by the central actor which intentionally seeks to create, extract and distribute value in a network, generating gains for

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all members (Dhanaraj & Parkhe, 2006). The gains associated with engaging the network might reflect the access to member-specific resources, and the achievement of exclusive resources only available through cooperation. Network resources obtained from the company's relations with other organizations are a source of valuable information (Gulati, 1999), competitive advantage (Lavie, 2006) and relational gains that an organization could not attain working in isolation (Dyer & Singh, 1998; Dyer, Singh, & Hesterly, 2018).

Resources obtained by different organizations in a network depend on their members' capability to make combinations of the resources. "Network capability" refers to the company's ability to initiate, maintain and use relationships (Ritter, 1999; Walter, Auer, & Ritter, 2006). Studies have identified other specific capabilities, such as network management capability (Möller & Halinen, 1999), interaction capacity (Johnsen and Ford, 2006) and relational capacity (Collins & Hitt, 2006; Lorenzoni & Lipparini, 1999), which are crucial to the value appropriation of a network where the organization is involved (Fang, Ma, Ren, & Zhou, 2014).

The existence of a central or hub organization tends to bring efficiency and value to the network (Dhanaraj & Parkhe, 2006; Hinterhuber, 2002; Möller & Svahn, 2003). The hub organization – or even an "orchestrator", nomenclature used in this study – stands out and empowers itself through taking a central position in the network structure, thus using its prominence and power to play a leading role in coordinating the diffuse resources and capabilities of network members (Dhanaraj & Parkhe, 2006). "Orchestration" is the set of deliberate and intentional actions carried out by this central organization that seeks to create and extract value from the network. The origin of the concept of orchestration refers to loosely coupled systems (Orton & Weick, 1990) and differs from traditional coordination models due to the lack of an imperative hierarchy.

The orchestrating organization is usually a leading innovative organization, such as a focal organization developing innovation with its suppliers – a dominant phenomenon in automobile production value chains, for example. It can also apply to projects of technological consortia and horizontal networks that have an objective or use unusual activities to generate innovation – as long as they are led by a central organization. We note that there is no difference here between innovation networks established with long-term objectives and projects with a predetermined duration, thus including collaborative projects, consortia and horizontal networks with innovation initiatives. However, even if the organization understands the advantages of coordination and actively seeks to network in this way, it may run into the problem of not knowing how to exercise leadership and coordinate with other actors. Likewise, even if the organization has favorable characteristics, the task of orchestrating will invariably fall on a person or team. If they lack the specific skills to coordinate with other network members, the possibility of success tends to decrease.

Two literature reviews have allowed for the identification of gaps involving the themes of this article that theorizes about the orchestration skills and capabilities of hub organization in innovation networks. The first review sought to identify advances in literature from the seminal work on orchestration of innovation networks (Dhanaraj & Parkhe, 2006). The second review explored knowledge about specific organizational capabilities regarding networking. The central argument of this article regards the existence of organizational capabilities and specific individual skills that allow hub organization to orchestrate the innovation network throughout its development. The model applied to this study is adapted from Dhanaraj and Parkhe (2006) and Batterink, Wubben, Klerkx, and Omta (2010) and considers three phases:

- (1) search and identification of opportunities;
- (2) network design; and
- (3) network orchestration process.

We present the paper in five sections, including this introduction. Section 2 outlines the theoretical assumptions regarding the orchestration of innovation networks. Next, Section 3 presents the conceptual aspects of networking capabilities. Section 4 presents and discusses the theoretical model. Finally, Section 5 presents the implications of the proposed model and suggestions for future research through a research agenda.

## 2. Orchestration of innovation networks

Innovation networks are interorganizational networks composed of innovative organizations and other actors such as government entities, universities, research centers and financial agencies focused on developing a product, process or service (Goduscheit, 2009) and involve the performance and interaction of people, ideas and organizations to create new products, processes and organizational structures that are technologically and commercially viable (Ahrweiler & Keane, 2013). Innovation networks are a form of economic coordination of innovation activities, where organizations maintain their autonomy, but, in the context of innovation, the actors establish stable, complex and reciprocal social relations (Duschek, 2002). They can be understood as interorganizational networks comprised of a defined set of actors that collaborate in favor of innovation and are governed by the interests of the network (Cap, Blauch, Kohl, von Raesfeld, Harms, & Will, 2019) or as cooperative relationships between organizations in search of innovation (Batterink, Wubben, Klerkx, & Omta, 2010).

Concerning resources, innovation networks are constituted by cooperative relationships between organizations that maintain control over their resources but jointly decide how to use them (Brass et al., 2004), with the aim of exploring new ideas to produce new products, management processes, services or practices (Pittaway et al., 2004). Innovation networks enable and support interorganizational learning and allow the exploration of complementarities between the actors (Küppers & Pyka, 2002). They present themselves as an efficient mechanism to acquire new knowledge through partners (Ahuja, 2000; Kale, Singh, & Perlmutter, 2000), to share risks and uncertainties (Bleeke & Ernst, 1991) and to deal with innovation in a systematic way (Freeman, 1991; Gilsing & Nootboom, 2005). Along with this, they promote interactions collaboratively and depend primarily on knowledge sharing (Grant, 1996; Dyer; Nobeoka, 2000).

Considering that innovation networks can be defined as links between actors who seek to use the right resources and engage in collaboration to deal with specific problems and develop innovative solutions (Van Wijk, Van Den Bosch, & Volberda, 2003), and due to the absence of rigid structures and hierarchical authority, these networks depend on “hub” organizations or strategic centers to maximize efficiency and support objectives in terms of innovation results (Hagel, Durchslag, & Brown, 2002). For Hurmelinna-Laukkanen, Olander, Blomqvist, and Panfilii (2012), there is an inherent need for coordination and governance in innovation networks due to the complexity of working with heterogeneous actors.

There exists broad terminology to describe the role played by a central actor that favors relationships in networks. “Hub firm” (Jarillo, 1988), “pivot firm” (Guilhon & Gianfaldoni, 1990), “broker” (Miles & Snow, 1992), “focal firm” (Lorenzoni & Baden-Fuller, 1995) and “flagship firm” (Rugman & D’Cruz, 2000) are terms used for organizations positioned as network coordinators. Dhanaraj and Parkhe (2006) attribute to this actor the term “orchestrator” or even “hub.” This public or private agent manages the value chain (Fulconis & Paché, 2005), exercises leadership through project management (Fabbe-Costes, 2005) and controls the flow of information through a variety of tools (Lorenzoni & Baden-Fuller, 1995). For all these duties, the hub organization is responsible for designing the network and must have the skills and abilities necessary to play this role.

Network orchestration is “the set of deliberate and intentional actions performed by a central organization intending to create and extract value from the network” (Dhanaraj & Parkhe, 2006, p.659). The orchestrating or hub organization attains prominence and power through individual attributes and a centralized position in the network structure. It uses its prominence to play a leading role in bringing together the dispersed resources and capabilities of network members (Dhanaraj & Parkhe, 2006).

Figure 1 presents the model of Dhanaraj and Parkhe (2006). The model indicates two distinct moments for the orchestration of innovation networks: network design and orchestration process. In the first phase, the hub organization performs recruitment processes and in the second phase, network management activities. These two phases lead to innovation network outcomes.

Regarding network design, few studies have been dedicated to advancing this phase of the model. Innovation networks differ depending on the form of innovation implemented in terms of the characteristics of the partners involved and geographic distance (Favre-Bonte et al., 2016). Even so, the authors confirm the need for a central actor to orchestrate joint actions. Also, the nature of the hub organization may be different in countries where public actors are less engaged. In these cases, there is a need for a non-public organization to assume this role (Favre-Bonte et al., 2016).

Considering that the innovation network orchestration model proposed by Dhanaraj and Parkhe (2006) was incomplete, subsequent studies suggested adding a phase before network design. The innovation hub-organization adds value through three orchestration functions: initiating innovation, network composition and managing innovation processes (Batterink et al., 2010). Thus, the articulation of demand is an essential function of hub organizations (Batterink et al., 2010), which Dhanaraj and Parkhe (2006) undervalued. The articulation of demand refers to the diagnosis and analysis of opportunities, the “initiation of innovation” (Batterink et al., 2010). Here, we use the term “function” to describe the “process” (design and orchestration) proposed by Dhanaraj and Parkhe (2006).

This new phase extends the responsibility and attributions of the hub organization because it inserts an activity related to the initiation of innovation into the model (Batterink et al., 2010). Although it is the role of the hub organization to identify opportunities,

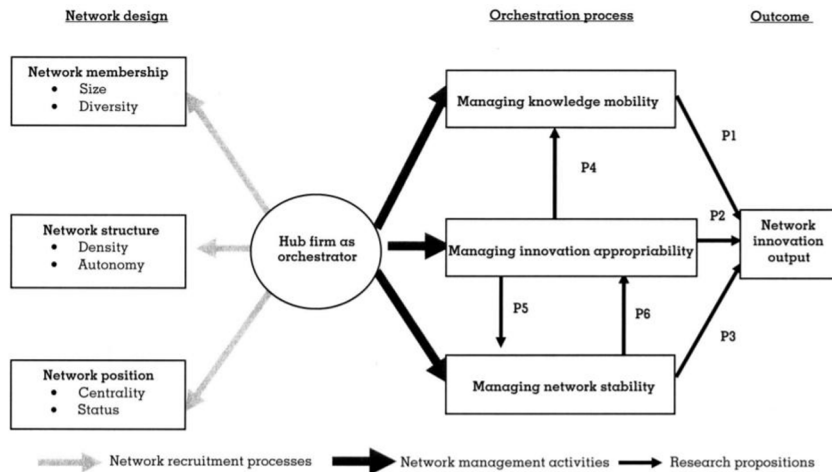


Figure 1.  
Framework for  
orchestration in  
innovation networks

Source: Dhanaraj and Parkhe (2006)

Lepistö, Mäkitalo-Keinonen, and Valjakka (2017) suggest that more studies explore the processes of recognizing opportunities in networks. The hub organization must maintain constant contact with the market and seek opportunities to create, network and implement the orchestration process. The assertiveness of the hub organization at this phase seems critical for the success of an innovation network (Batterink et al., 2010). Its importance shows up in mapping latent demands – the short- and medium-term desires of massive companies or market segments – and in the treatment of opportunities – foresight and anticipation of innovations that could be absorbed by the market (Batterink et al., 2010).

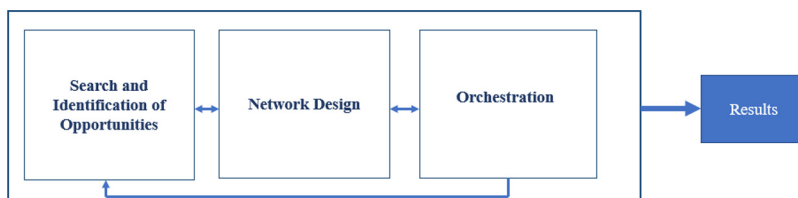
Schaeffer and Matt (2016) analyzed how a university became a hub organization and how it contributed to the development of an entrepreneurial ecosystem. In this case, the authors observed three specific functions at work: boundary spanning, network creation and orchestration. The first function refers to creating a bridge between the market and academia and seems to resemble the proposal of Batterink et al. (2010), as it reinforces the need for market analysis. This analysis favors and justifies the creation of a network. Specific demands or opportunities seem to increase the possibility of goal-oriented networks. For Paquin and Howar-Greenville (2012), such guidance is critical to the success of the innovation network.

We consider the theoretical model of orchestration in three complementary phases Search and Identification of Opportunities, Network Design and Orchestration Process, according to Figure 2. The initial phase (Search and Identification of Opportunities) is fundamental to portraying a broad understanding of the orchestration of innovation networks. Also, the literature has not sufficiently developed this phase. Thus, the proposition of Batterink et al. (2010) adds the prior phase to the steps of Network Design and Network Orchestration (Dhanaraj & Parkhe, 2006).

The analysis of the initial phases adds dynamism to the orchestration of innovation networks. This essay suggests recursion between the three phases. Thus, the hub organization could return to some earlier phase for different reasons. For instance, it might need to redesign the network to include or remove members, or it may revisit the search and identification phase to redefine or refine demand. The literature has not yet sufficiently discussed these initial phases, so there is a gap in understanding the activities, organizational capabilities and individual skills necessary to perform each of these processes.

### 3. Networking capabilities

As a theoretical lens, dynamic capabilities (DCs) reflect the company's ability to integrate, construct and reconfigure internal and external competencies to resolve rapid changes in the environment (Teece, 1997). The DC perspective may explain how organizations that orchestrate their resources achieve a superior advantage over those that do not (Ozcan & Eisenhardt, 2009; Zaheer & Soda, 2009; Schreiner, Kale, & Corsten, 2009). The dynamism – as well as the dimensions of sensing, seizing and transforming – present in the model of orchestration of innovation networks justifies the choice of the theoretical perspective for DCs.



Source: Adapted from Batterink et al. (2010) and Dhanaraj and Parkhe (2006)

**Figure 2.**  
Proposed model for  
orchestrating  
innovation networks

Specific capabilities to create, maintain and explore interorganizational relationships are broadly discussed in the literature (Ayv ari & M oller, 2008). At the organizational level, these capabilities reflect both networking architecture – Networking Ability (Hakansson, 1987), Network Competence (Ritter, Wilkinson, & Johnston, 2002) – and relationship dealing – Relationship Management Capacity (Havila & Medlin, 2012). Nonetheless, individual skills capable of maintaining and animating the interaction between organizations for distinct purposes exist in the literature, such as Cooperative Competency (Sivadas & Dwyer, 2000), Alliance Capability (Kale, Dyer, & Singh, 2002; Swaminathan and Moorman, 2009; Frels, Shervani, & Srivastava, 2003) and Relational Capability (Capaldo, 2007).

This article adopts the term Networking Capabilities and defines it as the ability to initiate and develop inter-organizational relationships to access and create resources. This definition fits the dynamism of the model presented in the previous section. The term “capabilities” comes from the DC framework. It describes the skills organizations must have to integrate, build and reconfigure internal and external resources, in response to rapidly changing environments (Teece, Pisano, & Shuen, 1997). The DC theory seeks to understand how organizations achieve sustainable competitive advantage in environments of constant technological change and rapidly moving markets (Teece & Pisano, 1994; Teece et al., 1997; Zahra, 1999; Eisenhardt & Martin, 2000; Teece, 2009). Teece et al. (1997) use the term “skill” at the organizational level. In this essay, we use the term “capabilities” to refer to the organizational level and the term “skill” at the individual level.

DCs split into three categories:

- (1) Sensing: detecting opportunities in the environment.
- (2) Seizing: catching opportunities by creating products, processes or businesses.
- (3) Transforming: managing threats and, whenever necessary, reconfiguring tangible and intangible resources to adapt to changing market conditions (Teece, 2007).

The categories adhere to the phases of the network orchestration model presented in Section 2. Sensing presents similar characteristics to the phase of Search and Identification of Opportunities because it involves the complementarity of innovation with partners and identifying market segments and changes in consumer needs. Seizing, like Network Design, involves creating new models, structures and procedures and designing value capture mechanisms. Transforming parallels the Orchestration Process, as it brings the development of integration and coordination skills, including assets, learning and knowledge transfer.

This essay focuses on the level of micro-foundations of DCs, i.e. on the skills, processes, procedures, organizational structures, decision rules and distinct disciplines that shape the organization through the detection, seizure and configuration of capabilities (Teece, 2007). These micro-foundations also constitute the actions at the individual and group level that shape the strategy, the organization and broadly the DCs (Eisenhardt, Furr, & Bingham, 2010). The analysis of the micro-foundations of DCs seeks to reveal their role at a lower level, that of individuals or organizational processes (Feller, Finnegan, Hayes, & O’Reilly, 2012; Wilden, Gudergan, Nielsen, & Lings, 2013). This applies to this study because it supports the understanding of organizational capabilities and individual abilities as antecedents of the DCs identified in each of the model’s stages.

The literature presents some organizational capabilities intrinsic to the orchestrating organization and some individual skills for orchestrating innovation networks. Ritala, Armila, and Blomqvist (2009) examined organizational capabilities and individual skills exclusively for the orchestration process of innovation networks (the third phase of the



model presented in Section 2) based on [Dhanaraj and Parkhe's \(2006\)](#) framework. [Table 1](#) presents organizational capabilities and individual skills for orchestration.

[Ritala et al. \(2009\)](#), in addition to exploring specific skills and abilities during the Orchestration phase, also propose four mechanisms by which to understand the relationship between the organizational and individual levels. These mechanisms are as follows:

- implementation of organizational capabilities through individual actions;
- institutionalization of organizational capabilities through individual actions over time;
- replacement of organizational capabilities by individual actions; and
- complementation of organizational capabilities with individual actions.

The rationale for a two-level organizational and individual analysis is that skills at the individual level play a vital role in the process of orchestrating innovation networks ([Ritala et al., 2009](#)). Such skills favor network management ([Ritter & Gemünden, 2003](#)), promote the creation of relationships with a diversity of stakeholders ([Birkinshaw, Bessant, & Delbridge, 2007](#)) and act as catalysts for cooperation ([Morris & Barnes, 2006](#); [Eisenhardt & Schoonhoven, 1996](#)). In addition, mechanisms present at the individual level might leverage capability development at the organizational level ([Bendig, Strese, Flatten, da Costa, & Brettel, 2017](#); [Mäkelä, Sumelius, Höglund, & Ahlvik, 2012](#)).

Except for those proposed by [Ritala et al. \(2009\)](#), the other capabilities found in the literature do not exclusively cover the hub organization as an orchestrator of an innovation network. It is possible to identify some capabilities that seem to be in line with the phases of the orchestration model presented in Section 2.

The first phase, Search and Identification, corresponds to the vision capability proposed by [Fang et al. \(2012\)](#). It is about the ability to perceive opportunities in the network, and it helps the hub organization to create motivation and commitment throughout the network. The ability to search correlates to the search that an organization conducts to recognize valuable opportunities and resources, analyze the network architecture and identify the individuals or organizations with whom it wants to interact ([Mu & Di Benedetto, 2012](#)). Despite having the ability to recognize opportunities, these capabilities do not fully comprise the first phase of the model for orchestrating innovation networks, the Search and Identification of Opportunities.

Network Design contains the ability to initiate a relationship, which refers to the set of activities and routines implemented at the organizational level for this purpose ([Mitegra et al., 2012](#)). Similarly, the capability of constructing new relationships brings a more

	Activities specific to the Network Orchestration Process		
	Knowledge mobility	Innovation appropriability	Network stability
Individual Skills	Interpersonal communication and social skills	Balancing skills Negotiating skills Entrepreneurial skills	Influencing skills Visioning skills Motivating skills
Organizational Capabilities	Operational capability Collaboration capability Competence leveraging capability	Legitimizing capability Balancing capability Entrepreneurial capability	Visioning capability Influencing capability

**Table 1.** Individual skills and organizational capabilities related to network orchestration process activities

Source: [Ritala et al. \(2009\)](#)

dynamic view, which considers the value achieved through a network relationship to depend on the ability to initiate new relationships (Parida, Pesämaa, Wincent, & Westerberg, 2017). Partner knowledge refers to how well the organization knows the market, partners and competitors (Walter et al., 2006). The ability to construct refers to the ability of the hub organization to create and maintain an adaptive network structure (Fang et al., 2014). Centralization capability allows the company to occupy a central position in the network (Fang et al., 2014).

Each phase demands specific capabilities to recognize opportunities, take advantage of them and reconfigure resources to protect the organization from the threats inherent in dynamic or turbulent environments. The phases in the orchestration model include the three categories of DCs, as the first phase of the model involves the detection and capture of opportunities and the other phases involve transformation. For this reason, the capability to orchestrate the innovation network might be a DC.

Detecting external opportunities and threats, or Sensing, refers to the recognition of trends and business opportunities that might be relevant to network creation (Teece, 2007). Consumer desires, competition and technology evolve continuously, so the organization must identify these trends (Teece, 2010). Once the organization has mapped opportunities and threats, it must be operationalized by developing or creating a new model, which relates to the concept of Seizing. Because Sensing and Seizing are profoundly interconnected and interactive, transformation allows for the reconfiguration of resources and skills.

This study posits that the model phases fit the three categories proposed by Teece (2007). It aims to contribute to the literature at the level of micro-foundations, antecedents of DCs which are the processes, procedures, structures, rules for decision making and the distinct disciplines that support DCs.

#### 4. Theoretical model

The method used was bibliographical research through literature reviews. At first, we made a review on the theme of orchestrating innovation networks based on articles that cited Dhanaraj and Parkhe (2006). The review adopted the following selection criteria:

- research on the Scopus, Web of Science and Google Scholar platforms for articles that cited the seminal work; and
- articles cited the seminal text at least two times.

Criterion b is justified by the fact that articles with only one citation (not considering the references) could hardly have made any relevant theoretical contribution to the seminal work. We analyzed 310 articles according to criterion a and 75 articles for criterion b. The final selection of articles contained these 75 articles that met criterion b.

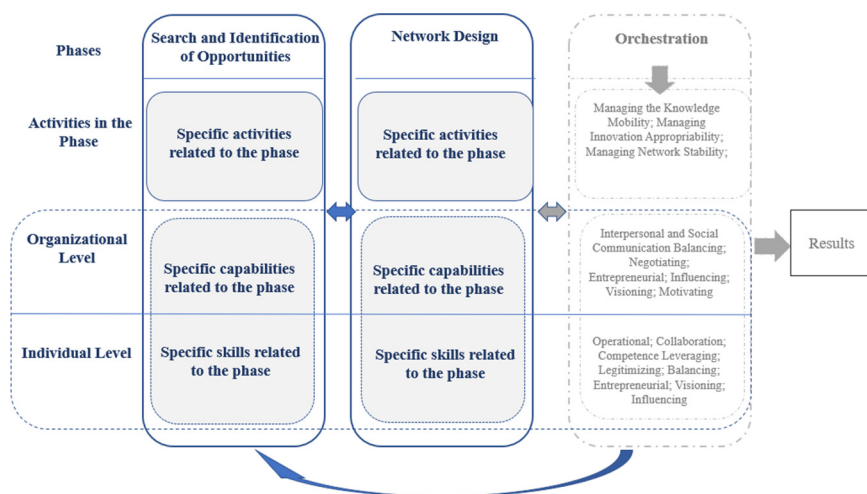
In the second review, the objective was to deepen knowledge on topics involving network capabilities. We researched databases with the following keywords in the title: “network competence,” “network capability,” “network ability,” “relational competence” and “relational capability.” Afterwards, 68 articles were selected and accessed, considering thematic area criteria and document type (article). It was possible to identify five authors that proposed their own definitions of network capabilities. We adopted the concept of network capabilities to build the theoretical model, considering that the definitions brought by the authors are those that approximate the theoretical model of orchestration of innovation networks. This approach is justified by the existence of capabilities linked to the vision of the future, search, coordination. The authors, concepts and capabilities were identified according to Table 2.



Author(s)	Concept	Capabilities
Walter et al. (2006)	The company's ability to develop and use inter-organizational relationships	Coordination; Relational Skills; Partner Knowledge; Internal communication
Fang et al. (2014)	The company's ability to assemble, integrate and implement network resources in combination with internal resources in order to gain a competitive advantage	Visioning; Construction; Operationalization; Centralization
Mitrega et al. (2012)	The set of organizational activities and routines that are implemented at the organizational level of the focal company to start, develop, and end relationships for the benefit of the company	Starting Relationships; Developing Relationships; Ending Relationships
Mu and Di Benedetto (2012)	The company's ability to exploit its existing ties and explore new ties with external entities to achieve (re)configuration of resources and competitive advantages	Search; Manage; Leverage
Parida et al. (2017)	The company's ability to develop and use the current and potential network of interorganizational relationships to access resources maintained by other actors and the ability to develop these capabilities	Coordination; Relational Skills; Partner Knowledge; Internal communication; Building new relationships

**Table 2.** Authors, definitions and capabilities

We present the theoretical model in Figure 3 and summarize the discussion in the three-phase model, suggesting specific processes at each stage. In the same vein, specific capabilities and skills required to execute these processes; however, even if the literature presents some specific networking capabilities, in this study, it is not possible to state or



**Figure 3.** Proposed model to orchestrate innovation networks – phases, activities, capabilities and skills

**Source:** Adapted from Dhanaraj and Parkhe (2006), Ritala *et al.* (2009) and Batterink *et al.* (2010)

even propose which ones these could be. Thus, we suggest that future studies carry out this investigation.

Literature deals extensively with the activities of the Orchestration Process (Dhanaraj & Parkhe, 2006) and the organizational capabilities and individual skills of that phase (Ritala et al., 2009). Thus, the model proposes theoretical development by thoroughly presenting the phases, activities, organizational capabilities and individual skills. The filled rectangles illustrate the gaps identified and which might represent a research agenda.

The phase of Search and Identification of Opportunities precedes the design and formation of the network. In the initial phase, the hub organization must search for and identify potential market opportunities, consumer trends, or even medium and long-term demands. The hub organization must have the capability to analyze the market, looking for opportunities that can lead to the second phase of the orchestration process, Network Design. The hub organization can also receive and centralize market demands, as would be the case for technological institutes or government or promotion agencies. It is up to the hub organization to develop selection criteria to determine whether it is opportune to follow up with the phase of Network Design.

The first phase is similar to the Sensing proposed by Teece (2007). It refers to internal processes involving R&D, complementarity of innovation with suppliers and identification of scientific and technological advances. It also refers to processes aiming to identify changes in the needs of consumers, leading to the capability to identify, seize and measure opportunities. These activities, capabilities and skills have not been explored in the literature thus far and depend on further research. It might be reasonable to question why the first phase comprises activities, capabilities and skills that characterize an organization – hub or not, participant in a network or not – even under the view of Sensing (Teece, 2007). This study assumes that the hub organization may decide not to form the network for some reason. However, this will only occur if the hub organization can somehow fully enjoy the opportunity without external partners. This study proposes that this phase deserves investigation because, regardless of the hub organization's nature, if an orchestrated innovation network exists, this phase must have occurred. This phase composes the model of Batterink et al. (2010) and Lepistö et al. (2017).

The second phase of the model refers to network design and formation. Studies have analyzed the structure and configuration of networks relative to performance in innovation (Cannels and Romijn, 2008; Zeng, Xie, & Tam, 2010) but have not examined the capabilities required by the organization for the formation and operation of this network (Canning, 2016). In addition to network design, the ability to seek and persuade members can also constitute the hub organization's specific capability. This capability depends on two characteristics:

- (1) knowledge about the potential partners; and
- (2) network centrality.

The hub organization must be capable of occupying a central position in a network and building an architecture that fits the type of result and the types of actors involved. The hub organization is responsible for defining the distribution of relationships inside the network and the appropriate governance. Finally, the form of centrality is also relevant, varying from proximity (being close to all members of the network) or intermediation (connecting all members of the network).

In the third and last phase of the model, the Orchestration Process, the hub organization coordinates the actors, manages conflicts, absorbs and distributes knowledge. It is at this stage that the network produces its innovative outcomes. The contributions of Dhanaraj and Parkhe (2006) and Ritala et al. (2009) thoroughly map the organizational capabilities and

individual skills of this third phase. The hub organization could be a leading company that participates and also appropriates knowledge, innovation and network results. A focal firm in a supply chain to produce outcomes from innovative activities could constitute an example of this situation. However universities, institutes or governmental organizations, or even technological consortia or horizontal networks, can become hub organizations, representing the full spread of the orchestrator and the innovation network. This study argues that, in any of these interorganizational forms, the same organizational capabilities and individual skills are necessary and manifest in each of the phases of the orchestration model of innovation networks. These specific capabilities are the networking capabilities of the hub organization in network orchestration.

Finally, the mapping of the orchestration model of an innovation network brings gaps for future studies. The research agenda might include the following:

- Specific activities related to the Search and Identification of Opportunities and Network Design phases.
- Organizational capabilities to the execution of these activities.
- Individual skills to implement these activities.

## 5. Concluding remarks

Although the literature explored some specific capabilities for network innovation (Helfat & Raubitschek, 2018; Chen, Hu, Gao, Wang, & Liu, 2019; Hurmelinna-Laukkanen et al., 2012; Klerkx & Aarts, 2013; Munari et al., 2012), it lacks studies that explore specific capabilities related to the orchestrating organizations in innovation networks (Batterink et al., 2010; Cap, Blaich, Kohl, von Raesfeld, Harms, & Will, 2019). Considering that the model has been expanded, adding the stage of searching and identifying opportunities, it is essential to explore the processes in the other stages of the orchestration model.

Literature served as the basis for proposing a theoretical model in response to persisting demands. Dhanaraj and Parkhe (2006) emphasize the importance of the hub organization in the process of orchestrating the innovation network. This process (the last process or “phases” in the model) demands activities that are responsible for maintaining the interaction between members that leads to the exchange and generation of knowledge. This process concludes with the innovation outcomes produced by the network. Ritala et al. (2009) highlight the activities that existed in an earlier process, namely, Network Design. These activities are, likewise, the responsibility of the hub organization. The model proposed here includes a new phase before Network Design. This phase comprises activities of identification of market opportunities that might be responded to through innovation.

The proposed model contributes to the theoretical literature on network orchestration (Dhanaraj & Parkhe, 2006; Ritala et al., 2009), as it broadens the view on the role of the hub organization during the whole process. It positions the hub organization as occupying a role that extends beyond the routine maintenance activities of the innovation network. This model suggests that the hub organization is both responsible for the search for and selection of market opportunities for the development of innovation and for the configuration of the best network architecture that might respond to these market demands. The model has its foundations in organizational capabilities and individual skills arising from the hub organization. However, this study does not thoroughly explore these characteristics. On the other hand, this study opens a research agenda pointing to the evolution of knowledge about the orchestration of innovation networks.

A capability is a particular and nontransferable type of resource embedded in the organization; this resource increases the efficiency and effectiveness of other resources owned by

the organization (Eisenhardt & Martin, 2000; Teece et al., 1997). When orchestrating a network, the company expands its resources to configure and reconfigure them whenever necessary. Future studies should seek to capture multiple levels of analysis within the context of network orchestration, especially the organizational and individual levels (Müller-Seitz & Sydow, 2012), or further investigate the characteristics of the hub organization (Nambisan & Sawhney, 2011).

A possible way to contribute to the orchestration of innovation networks lies in the investigation of other phases of the model, in addition to those already explored by Dhanaraj and Parkhe (2006). The opportunity deals with the exploration of the Network Design phase – highlighted as a possible object of future studies by the seminal authors – and exploring the initial phase of Search and Identification of Opportunities, a phase emerged from the literature review. Exploring these two phases brings dynamism and completes the orchestration model of innovation networks. Furthermore, although the literature has already explored some specific capabilities for network orchestration, such as the absorptive capability (Hurmelinna-Laukkanen et al., 2012; Klerkx & Aarts, 2013; Munari et al., 2012), there exists a persistent gap in the characteristics that the orchestrating organization must have to fully support the orchestration model (Batterink et al., 2010). Since this article proposes complementary phases to the orchestration model, it opens the opportunity for future analysis of the activities that these phases might comprise.

The research agenda suggests advances:

- in the understanding of the orchestration of innovation networks, especially in the phases before the orchestration process (Dhanaraj & Parkhe, 2006); and
- in knowledge about networking capabilities.

The agenda foresees the identification of organizational capabilities and individual skills in a complete orchestration model view. In this way, future research might fill gaps in the theoretical and empirical fields (Dhanaraj & Parkhe, 2006; Ritala et al., 2009; Batterink et al., 2010). This agenda also emphasizes researching at two levels, organizational and individual, as antecedents of DCs exist at both of these levels (Eisenhardt & Martin, 2000).

For the managerial field, our study presents a few recommendations regarding the characteristics an organization must have to play the role of the orchestrator of an innovation network. At the individual level, it demonstrates desirable skills for the people involved in the orchestrating organization. From this baseline, qualifications and training can be enriched, as well as self-assessment models for innovation networks. Thus, it will be possible to increase the chances that organizations will innovate through collaboration and succeed in these partnerships to ultimately innovate in products, processes and business models. Our paper might also provide recommendations on how to create and develop these skills and capabilities. These responses will increase the chances for organizations to innovate through collaboration and achieve success.

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**Corresponding author**

Taisson Toigo can be contacted at: [taisson@terra.com.br](mailto:taisson@terra.com.br)

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