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Orchestrating innovation networks: the switching roles of orchestrators along startups' lifecycle

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Abstract

Innovation networks enable innovating actors to access complementary assets beyond their corporate boundaries. Subsequently, the orchestration of such networks has attracted increasing attention. Network orchestration is a dynamic activity where orchestrator roles change along the innovation trajectory. However, research on network orchestration falls short of capturing the dynamic aspects of orchestration. Moreover, gaps in the literature limit our understanding of the dynamic nature of orchestration roles and the way these roles change over time. By drawing on network orchestration theory and the Resource Based View, this study introduces a capability-dependant framework to explain how the network orchestrator roles can adapt to the evolving situational circumstances of the startup's lifecycle. Our analysis is based on a longitudinal empirical investigation of nine technological startups and their dyadic (one-to-one) relationship to an innovation intermediary as a network orchestrator in southwest Germany. Our findings reveal that orchestrators play different roles simultaneously in response to changing environments and varying startup requirements. We further identify factors associated with orchestrator role changes based on the dyadic relationship as an additional criterion for characterizing dynamic orchestrator roles. Overall, this work aims to contribute to the literature on network orchestration by moving debates about orchestration roles beyond a static setting, thus offering a dynamic and more accurate picture of evolving orchestration roles and underlying mechanisms.

Keywords: Network Orchestration, Orchestration Roles, Technology Startups, Startup Lifecycle, Innovation Intermediary

Gestió de xarxes d'innovació: el canvi de rols dels directius al llarg del cicle de vida de les startups

Resum

Les xarxes d'innovació permeten als agents innovadors accedir a actius complementaris més enllà dels seus límits empresarials. Posteriorment, la gestió d'aquestes xarxes ha cridat una atenció creixent. La gestió en xarxa és una activitat dinàmica on els rols dels gestors canvien al llarg de la trajectòria d'innovació. Tanmateix, la recerca sobre la gestió en xarxa no n'aconsegueix captar els aspectes dinàmics. A més, les llacunes de la literatura limiten la nostra comprensió de la naturalesa dinàmica dels rols de gestió i la manera com aquests canvien amb el temps. A partir de la teoria de la gestió de la xarxa i de la mirada basada en recursos, aquest estudi introdueix un marc depenent de la capacitat per explicar com els rols dels directius de la xarxa poden adaptar-se a les circumstàncies situacionals en evolució del cicle de vida de l'empresa. La nostra anàlisi es basa en una investigació empírica longitudinal de nou startups tecnològiques i la seva relació diàdica (un a un) amb un intermediari d'innovació com a orquestrador de xarxa al sud-oest d'Alemanya. Els nostres resultats revelen que els gestors juguen diferents papers simultàniament en resposta als entorns canviants i als diferents requisits d'inici. A més, identifiquem factors associats als canvis de rol del gestor en funció de la relació diàdica com a criteri addicional per caracteritzar els rols dinàmics del gestor. En general, aquest treball pretén contribuir a la literatura sobre la gestió en xarxa movent els debats sobre els rols de gestió més enllà d'un entorn estàtic, oferint així una imatge dinàmica i més precisa de l'evolució dels rols directius i dels mecanismes subjacents.

Paraules clau: gestió de xarxes, rols de gestió, startups tecnològiques, cicle de vida de les startups, intermediari d'innovació

Gestión de redes de innovación: el cambio de roles de los directivos a lo largo del ciclo de vida de las startups

Resumen

Las redes de innovación permiten a los actores innovadores acceder a activos complementarios más allá de sus fronteras corporativas. Posteriormente, la gestión de dichas redes ha atraído cada vez más atención. La gestión de redes es una actividad dinámica en la que los roles de los directivos cambian a lo largo de la trayectoria de la innovación. Sin embargo, la investigación sobre la gestión de redes no logra captar los aspectos dinámicos de la gestión. Además, las lagunas en la literatura limitan nuestra comprensión de la naturaleza dinámica de los roles de gestión y la forma en que estos roles cambian con el tiempo. Basándose en la teoría de la gestión de redes y la mirada basada en recursos, este estudio presenta un marco dependiente de la capacidad para explicar cómo los roles del gestor de redes pueden adaptarse a las circunstancias situacionales cambiantes del ciclo de vida de la startup. Nuestro análisis se basa en una investigación empírica longitudinal de nueve startups tecnológicas y su relación diádica (uno a uno) con un intermediario de innovación como gestor de redes en el suroeste de Alemania. Nuestros hallazgos revelan que los directivos desempeñan diferentes roles simultáneamente en respuesta a entornos cambiantes y diferentes requisitos de inicio. Además, identificamos factores asociados con los cambios de roles del gestor basados en la relación diádica como un criterio adicional para caracterizar los roles dinámicos del gestor. En general, este trabajo pretende contribuir a la literatura sobre gestión de redes llevando los debates sobre las funciones de gestión más allá de un entorno estático, ofreciendo así una imagen dinámica y más precisa de la evolución de las funciones de orquestación y los mecanismos subyacentes.

Palabras clave: gestión de redes, roles de gestión, startups tecnológicas, ciclo de vida de las startups, intermediario de innovación

Introduction

The value of inter-organizational relationships and networks is widely acknowledged (Valkokari et al. 2017). As innovation has evolved beyond the boundaries of single firms, its focus has shifted to the ability of firms to engage in external networks to acquire complementary resources (Powell, Koput, and Smith-Doerr 1996, Romero and Molina 2011, Ferraro and Iovanella 2015). Within innovation networks, legally independent but economically dependent firms build stable, complex, and reciprocal social interactions for the sake of innovation guided by the network's goals (Toigo et al. 2021, Duschek 2002).

Managing an innovation network is a multifaceted and complex task in environments with high transactional uncertainty where the actors are diverse and numerous (Pikkarainen et al. 2017). Due to the complexity of these relationships, this research argues the importance of understanding the key mechanisms in the management model to be adopted for innovation networks (Santos, Zen, and Bittencourt 2021). Therefore, orchestration is arguably the most appropriate approach to describe network development, management, and coordination (Dhanaraj and Parkhe 2006). As a weak organization with loose couplings, networks call for an instance that enables purposeful collaboration by orchestrating the network (Orton and Weick 1990). A dedicated entity must identify the structures and capabilities of the network's participating organizations and coordinate, manage, and govern the network's resources. In this vein, network orchestrators have the capability to enable the mobilization and coordination of the innovation network through discreet direction and influence (Dhanaraj and Parkhe 2006).

A perspective of the innovation network that has been increasing the interest of scholars and managers is the entrepreneurial ecosystem (EE) as a subtype of the innovation ecosystem (Gomes et al. 2018). An EE creates opportunities for innovation instantiated by new ventures as their ecosystem-level output (Stam and Spigel 2016). EEs are distinguished from other innovation ecosystems by their central operating agents (e.g., new ventures, startups, scaleups, investors, mentors/advisors, entrepreneurial peers) and "by the fact that the entrepreneur, rather than the enterprise, is the focal point" (Stam 2015, 1761, L. Thomas and Autio 2019). These environments, therefore, encompass cyclical flows of tangible resources, such as human and financial capital, and intangible resources, such as knowledge and information, that support the development and growth of innovative startups (Bittencourt, Santos, and Mignoni 2021, Spigel 2017).

In this study, the innovation network under investigation is related to the design of EE providing resources that help startups innovate and successfully reach the market (Stam and Spigel 2018, Gomes et al. 2018).

In this vein, nascent technology-based startups with scarce resources rely heavily on external partners to access complementary assets and increase interaction to improve their innovation capabilities (Giones et al. 2013, Fukugawa 2017, Marcon and Ribeiro 2021). Since startups are founded in a relatively short period, they usually take an agile, cyclical, and iterative approach to launch a new company or product (Silva et al. 2020). Simultaneously, startups confront a "liability of newness" (Stinchcombe 1965, 148) because their lack of performance history makes it difficult to access the resources required (Kuratko et al. 2017). During each growth phase, startups draw on different resources and need to interact with specific types of actors to access and leverage different resources in each lifecycle phase

(Fukugawa 2017, Paschen 2017).

In this regard, orchestrators of startup networks play a crucial role (Russo et al. 2019, van Lente, Boon, and Klerkx 2020) and serve as connecting links by providing startups the ability to access competencies and resources from stakeholders outside their corporate boundaries (Howells 2006). In this context, recent studies indicate that neutral, third-party intermediaries (Giudici, Reinmoeller, and Ravasi 2018, Hernández-Chea et al. 2021) without higher interests are effective at lowering barriers to collaboration and innovation among startups and network actors in innovation networks (Nilsen and Gausdal 2017, Batterink et al. 2010, Pikkarainen et al. 2017).

However, scholars still have not thoroughly examined or demonstrated intermediaries' efforts to coordinate or orchestrate networks around entrepreneurial firms (Bergman and McMullen 2021). Literature has introduced orchestrator roles in this context to describe actors' actions (Hinterhuber 2002). Orchestrators adopt specific roles and responsibilities based on the set of activities they perform and the management model they employ (Pikkarainen et al. 2017).

An exciting gap in the literature exists between orchestration roles and their parallel, evolving, and even changing nature required in complex networked innovation environments (Pikkarainen et al. 2017). Although orchestrating roles need to evolve and change to fit the need of the network startups better, a minimal amount of research has been performed regarding the time-related role of orchestrators and how their practices might evolve. This is mainly because previous studies were based merely on static analyses without taking a time-period perspective (Pikkarainen et al. 2017).

Accordingly, there have been numerous calls for longitudinal studies to capture the dynamic nature of orchestrator roles and the evolution of practices to adapt to the changing needs of startups during their lifecycle in a manner that creates new value and allows orchestrators to compete and evolve (Reypens, Lievens, and Blazevic 2019, Bergman and McMullen 2021, Tabas, Nätti, and Komulainen 2022, Hurmelinna-Laukkanen, Möller, and Nätti 2022, Jack, Dodd, and Anderson 2008, Klerkx and Leeuwis 2009, Zeng 2020).

To support this objective, the following research questions guide our research: *How do orchestrator roles adapt to the evolving needs of startups' lifecycles in innovation networks? And how do orchestrator capabilities lead to role transitions along this relationship?*

To analyze and evaluate orchestration roles, we draw on network orchestration theory (Dhanaraj and Parkhe 2006, Hurmelinna-Laukkanen and Nätti 2018, Pikkarainen et al. 2017) and a Resource Based View (RBV) (Wernerfelt 1984, Barney 1991, Peteraf 1993), which allows for a better understanding of each role's specific differences and capabilities. Therefore, we intend to better understand the key aspects of the network orchestrator's roles through a coherent conceptual framework when adapting to the evolving needs of the startups' phases. In particular, we postulate that these roles are better understood from a dynamic perspective that considers the evolving needs of the startups when they progress in the different phases of their maturity process. We examine the underlying processes to build, reset, and integrate orchestration resources that respond to changing conditions associated with different startup phases while adopting a dynamic perspective based on the study's startup lifecycle. The proposed framework is subject to

an abductive research process using insights from a longitudinal case study of nine technology-based startups and their dyad (one-to-one) relationship to an innovation intermediary as a neutral orchestrator in southwest Germany.

Overall, the expected contribution is twofold. Firstly, our findings extend earlier research (Pikkarainen et al. 2017, Hurmelinna-Laukkanen and Nätti 2018, Tabas, Nätti, and Komulainen 2022) by providing new insights into the evolution of orchestration roles within the dyadic relationships with startups, demonstrating the resources and capabilities needed to cope with startups' requirements. Moreover, we determine which roles of third-party orchestrators are appropriate according to the different phases of startup evolution (Symeonidou and Nicolaou 2018, Marcon and Ribeiro 2021).

Secondly, we shed new light on how the orchestrator is extending its resource base and capabilities in dealing with fast-changing situations and potential role-switches, contingent on the startup growth stage. Thus, we aim to extend previous research on network orchestration by capturing the dynamic interactions between the orchestrator and each startup while responding to the startup evolution.

This article is structured as follows: Section 2 reviews extant literature on network orchestration and startup growth and highlights research gaps and relevant theories associated with the guiding research question. The research method and propositions used to collect and analyze empirical data are presented in section 3, followed by a presentation of the main findings and their discussion in section 4. Finally, conclusions are drawn along with implications for theory and practice in section 5.

Theoretical Background

Intermediation in networked innovation

Third-party "intermediaries whose goal is to bring heterogeneous parties together and co-develop innovations, not just to exploit the knowledge" is an emerging concept in network literature (Kirkels and Duysters 2010, 375). Research has consistently found that neutral and third-party innovation intermediaries can enhance interactions between parties involved in networking (Batterink et al. 2010, Pikkarainen et al. 2017, Kivimaa 2014, Giudici, Reinmoeller, and Ravasi 2018). Consequently, our research focuses on the orchestration's facilitative component and the roles that go along with it in the innovation networks of startups.

An intermediary is "an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties" (Howells 2006, 720). Various organizations, actors, and individuals can act as intermediaries that engage in long-term relationships with their clients beyond merely retrieving and distributing information (Tran, Hsuan, and Mahnke 2011, Dalziel and Parjanen 2012).

Drawing on the reflections of previous studies (E. Thomas, Balestrin, and Howells 2013, Yao, Guo, and Tsinopoulos 2022), this study illustrates the many facets of the intermediary's role (Soares, Romero, and Lopes Nunes 2020, Germundsson, Frankelius, and Norrman 2021) in various phases over time, based on the startup lifecycle in our study (Nilsen and Gausdal 2017).[1]

1 Henceforth, the intermediary will be referred to as the network orchestrator and will be abbreviated as OI (orchestrating intermediary). See Appendix A for a description. In this context, network orchestration is defined as the process of "assembling and managing an inter-organizational network to achieve common goals" (Paquin and Howard-Grenville 2013, 3).

In the literature on network orchestration, focal enterprises are metaphorically associated with managerial roles (Hinterhuber 2002). These roles may be interwoven, implying that a variety of roles are owned by one actor (Thorelli 1986, Kelley and Littman 2005). Orchestrator roles are reflected in their orchestration activities. In the context of orchestration, roles can be defined as "behaviors expected of parties in particular positions" (Nyström et al. 2014, 484). Through a comprehensive literature review (see Table 1), we identified the various orchestration roles studied in the literature and clustered them according to their contextual meanings and activities: *Architect*, *Conductor*, *Facilitator*, *Mediator*, and *Leader*.

These orchestration roles and related activities, however, are derived from studies relating to

TABLE 1. MAIN ORCHESTRATION ROLES AND THEIR KEY ACTIVITIES

Network Orchestrator Role	Description	Activities	Example literature referencing this category
Architect	Definition and coordination of activities to direct members.	· Agenda setting, · Coordination, · Attraction and selection of members	Hinterhuber (2002), Dhanaraj and Parkhe (2006), Nambisan and Sawhney (2011), Hurmelinna-Laukkanen, Moller, and Natti (2011), Leten et al. (2013), Nilsen and Gausdal (2017), Mignoni et al. (2021)
Conductor	Purposeful acquisition and dissemination of information and knowledge within the network. To support the acquisition, transmission, and sharing of information between members.	· Mobilization, · Information acquisition and transmission, · Promotion of exchanges and interactions,	Nambisan and Sawhney (2011), Nyström et al. (2014), Bittencourt et al. (2018), Hurmelinna-Laukkanen and Nätti (2018), Mignoni et al. (2021)
Facilitator	Aiming to unite disparate, even competing, members and realize that these network members are exchanging and ultimately working towards a common goal.	· Bring members together, · Maintaining collaboration, · Promotion of sharing knowledge	Dhanaraj and Parkhe (2006), Kirkels and Duysters (2010), Batterink et al. (2010), Leten et al. (2013), Nyström et al. (2014), Nilsen and Gausdal (2017), Hurmelinna-Laukkanen and Nätti (2018), Mignoni et al. (2021), Nair, Gaim, and Dimov (2022)
Mediator	Ensures that relationships and interactions between network actors are sustained. Uses culture, identity formation, values, and norms to stabilize the network and minimize individual and opportunistic behavior.	· Network stabilization, · Avoid individualism and opportunism, · Trust building, · Empowerment	Howells (2006), Hurmelinna-Laukkanen, Moller, and Natti (2011), Nyström et al. (2014), Mignoni et al. (2021), Tabas, Nätti, and Komulainen (2022)
Leader	Motivation and promotion of voluntary cooperation among network actors. It also involves guiding and directing other members to a common goal in the network and offering support.	· Plan actions, · Goalsetting, · Management and instruction of other members, · Clarifying roles, · Providing support	Dhanaraj and Parkhe (2006), Metcalfe (2010), Hurmelinna-Laukkanen, Moller, and Natti (2011), Nambisan and Sawhney (2011), Nilsen and Gausdal (2017)

Source: self-elaborated

hierarchical, hub-centric (enterprise) networks, e.g., Hinterhuber (2002), Dhanaraj and Parkhe (2006), Nambisan and Sawhney (2011), networks of SMEs, e.g., Batterink et al. (2010), Kirkels and Duysters (2010), Nilsen and Gausdal (2017), Tabas, Nätti, and Komulainen (2022), around distinct technologies, e.g., Hurmelinna-Laukkanen, Moller, and Natti (2011), Leten et al. (2013), and in regional clusters or at city-level, e.g., Paquin and Howard-Grenville (2013), Bittencourt et al. (2018), Mignoni et al. (2021).

However, the literature rarely discusses orchestration roles and activities within a non-hierarchical, neutral setting in the context of startups. In this sense, using their activities and processes as the primary conceptual reference, we aim to develop a framework entailing the roles the OI is expected to perform within the dyadic relationship with startups.

Startup Lifecycle

Different business ventures' lifecycle phases have been proposed in the literature (König et al. 2019). Each phase of the lifecycle impacts an organization's need for external resources and its ability to acquire them (Passaro et al. 2020, Nair, Gaim, and Dimov 2022). Following previous studies (Antunes et al. 2021, Marcon and Ribeiro 2021, Passaro et al. 2020), our definition of a startup's lifecycle is outlined by four significant phases from conception to establishment, namely: ideating, structuring, startup, and scalability. While the phases outline a path for growth, the boundaries between them may be ambiguous or indefinite (Marcon and Ribeiro 2021). As presented in Table 2, the startup has different needs in each phase, which change in development (Hite and Hesterly 2001, Churchill and Lewis 1983).

During the *ideation* phase, the entrepreneur develops a potential idea based on the perception of market opportunities (Marcon and Ribeiro 2021). In addition, market research is conducted to determine consumer behaviors and validate business concepts (Picken 2017). In this phase, the startup structure may still be informal and loose and consist of a "one-person show" (König et al. 2019). At this level, preliminary information and assistance providers are non-market actors, such as higher education systems, startup competitions, and local government organizations (Reynolds and Uygun 2018, Merguei and Costa 2022). This initial phase is marked by a high degree of uncertainty (Passaro et al. 2020, Paschen 2017).

In the *structuring* phase, the entrepreneur focuses on the opportunity to turn the idea into a business (Antunes et al. 2021). As part of this process, it is indispensable to clarify the financial requirements and seek out seed capital and investors (e.g., family, friends, business angels, and competitors) (Marcon and Ribeiro 2021). During this phase, startups engage with non-market and market-oriented actors in the ecosystem (e.g., incubators, technology transfer agencies, business centers, and universities).

The *startup phase* marks the beginning of the commercial activity of the startup. During this phase, the startup launches its new product or service and generates its first recurring revenue (Antunes et al. 2021). During this phase, entrepreneurs can assess the likelihood of business success and identify the tangible and intangible resources required (Paschen 2017). Startups in this phase mainly interact with market-oriented actors and may be assigned participation in incubators, accelerators, and co-working spaces that offer additional business, technical, and physical resources (Passaro et al. 2020, Marcon and Ribeiro 2021, Bergman and McMullen 2020). Startups should be able to enter into contracts

with reliable customers and suppliers and develop ties with other external partners.

During the *scalability* phase, the entrepreneur seeks to consolidate and control the company's financial returns, the startup has to become self-sustainable (Passaro et al. 2020). In addition to diversifying the product portfolio, the company must acquire new skills such as managing higher turnover, motivating and managing a growing workforce, and interacting with new customers and suppliers (Antunes et al. 2021). Developing a network of market actors is a primary objective of startups. Moreover, entrepreneurs are expected to lead, coordinate, and identify funding sources. At this point, startups acquire customers on a larger scale, improve the back-end scalability, hire new employees and executives, and finish the selection of suppliers (Picken 2017).

Based on the orchestration roles identified in Table 1 above (i.e., architect, conductor, facilitator, mediator, and leader), entrepreneurs with limited resources rely on external partners in their innovation process for access to complementary assets and improvement of the interaction. At each growth phase, a startup draws on different resources and interacts with a specific type of actor to access and leverage

TABLE 2. STARTUP DEVELOPMENT MODEL

Phases	Ideation	Structuring	Startup	Scalability
Description	Idea development	Definition and validation of the business concept	Product and market validation	Consolidation, commercialization, and growth
Required organizational resources and capabilities	Technical resources and entrepreneurial culture	Financial, technological, and managerial resources	Financial, technological, physical, and managerial resources	Financial, technological, physical, and managerial resources
Key Activities	Product design and market understanding	Prototype development, technical and commercial feasibility, product marketing, and initial financing seeking	Business planning, marketing test, production, sales indicators, first competitive action, new design and pricing, additional funding	Leverage processes and partnerships to grow the business
External Actors	Higher education systems, startup competitions, and local government organizations	Startup initiatives, family, friends, business angels, fab labs, business centers, Technology Transfer Offices (TTOs), incubators	Incubators, accelerators, co-working spaces, crowdfunding platforms, venture capitalists, industry expert	Venture capitalists, consultants, industry experts

Source: Adapted from (Passaro et al. 2020).

different resources. Therefore, we propose that,

Proposition 1: Specific orchestrator roles are best suited to manage startup requirements in each evolution phase.

Applying the RBV perspective allows a better understanding of the orchestrator role's specific differences and capabilities which will be presented in the following chapter.

A resource-based perspective on network orchestration

The resource-based view provides a conceptual framework to assess the strategic fit of the OI's roles and associated capabilities and activities in the context of different startup lifecycle phases. The capabilities perspective has evolved within the RBV. This perspective originates from Penrose's (1959) interpretation of the firm as a bundle of resources that shape its competitive position. Business literature has given considerable support to the RBV of the firm proposed by Birger Wernerfelt (1984) and developed and refined by Jay B. Barney (1991). A central premise of the RBV is that competitive advantage is a function of the resources and capabilities of the firm (Wernerfelt 1984, Conner 1991, Peteraf 1993). Therefore, RBV emphasizes the idea of firm heterogeneity in terms of the resources possessed by the firm and its ability to manage and utilize those resources innovatively so that environmental opportunities are captured (Pereira and Bamel 2021). An organization's resources and capabilities are valuable if they enable it to exploit opportunities and counter threats. These resources can be considered bundles of intangible and tangible assets, such as management skills, organizational processes, and knowledge (Barney 2001). Resources and capabilities create a niche in the firm's market, mainly if structured differently (Wernerfelt 1984).

Adapting to significant changes will require changes in organizational structures, resources, and capabilities. Consequently, these resources should enable the organization to meet the requirements of its business environment. RBV focuses on the firm's internal resources and capabilities to improve its competitiveness (Barney 1991, Penrose 2009, Peteraf 1993). These capabilities incorporate a series of routines that allow the execution and coordination of the tasks necessary to carry out an activity. A routine can be defined here as a "repetitive pattern of activity" in a sense used by Nelson and Winter (1982, 97). The RBV, however, is considered more than an explanation of the sources of superior value generation but, moreover, “one of the most prominent and powerful theories for describing, explaining, and predicting organizational relationships” (Barney, Ketchen, and Wright 2011, 1300). In addition, the RBV provides an invaluable basis for analyzing inter-organizational relationships, such as the concept of innovation networks. Through the RBV approach, we can better understand how the OI develops roles and associated activities by supporting startups throughout their lifecycle by orchestrating the innovation network.

Network orchestrator capabilities

Orchestration is a dynamic activity (Mitrega and Pfajfar 2015). In orchestration, not all activities are equally emphasized in all situations and will be conducted differently depending on the situation (Saka-Helmhout and Ibbott 2014). Hurmelinna-Laukkanen and Nätti (2018) suggest that "orchestrator capabilities are relevant in determining whether orchestrators succeed in taking different roles and conducting the activities within them" (Hurmelinna-Laukkanen and Nätti 2018, p. 67). Different types might develop specialized capabilities depending on the orchestrator's inherent characteristics. As a result, different orchestrators have different positions and

orchestrate networks differently (Hurmelinna-Laukkanen, Möller, and Nätti 2022). In several studies, network orchestration practices change along the innovation trajectory, indicating the need for different capabilities at different stages of startup development (Reypens, Lievens, and Blazevic 2019, Paquin and Howard-Grenville 2013). Contingent to the situation, the OI may focus on exploiting and refining the resources and capabilities most relevant to the particular role.

In the context of network orchestration roles, three types of capabilities allow orchestrators to effectively adopt roles allowing them to conduct focal activities, namely role-implementation capabilities, role-switching capabilities, and role-augmentation capabilities (Hurmelinna-Laukkanen and Nätti 2018).

Role-implementation capabilities refer to the ability of the orchestrator to carry out orchestration activities on a daily basis, using the same techniques and resources to build and manage innovation networks (Tabas, Nätti, and Komulainen 2022). Role-implementation capabilities refer to the orchestrator's abilities required to perform the specific role. They appear whenever the orchestrator remains proficient in a particular role (Schreyögg and Kliesch-Eberl 2007). Within a low-dynamic environment, orchestrators remain within the specific roles they have adopted (Hurmelinna-Laukkanen and Nätti 2018).

Role-switching capabilities, however, refer to the ability to detect changes to the network, its environment, and configuration, which requires switching between or adopting additional roles. Role-switching is similar to anticipating and shaping opportunities and threats, seizing opportunities, and partially reconfiguring assets to maintain a competitive advantage (Hurmelinna-Laukkanen and Nätti 2018, Teece 2007). In other words, role-switching involves shifting the focus from one activity to another (e.g., by expanding/adapting the resource base) rather than changing the approach and how an orchestrator performs or changes its intrinsic characteristics.

While role-switching capabilities are about reacting to ordinary, natural changes with existing capabilities, *role-augmentation* capabilities evolve due to adapting, developing, or acquiring new capabilities and extending the role base in response to new challenges and with ad hoc problem-solving (Hurmelinna-Laukkanen and Nätti 2018, Aarikka-Stenroos and Ritala 2017). For the orchestrator to effectively address new situations, it may need to change itself, develop or acquire new resources and capabilities, and extend its natural role base (Winter 2003, Barney 1999).

Network orchestration must react to the evolving nature of the network members' demands, the disrupting character of the startups and the technologies they promote, and, finally, to the ever-changing competitive environment. In this vein, our research examines the orchestrator roles, the associated resources, and capabilities across the startup lifecycle and the extent to which adaptation of these resources and capabilities is required to meet startup requirements as they grow. In addition, we will examine whether these adaptations lead to a change in the orchestrator role by what circumstances and at what point.

Thus, we argue that having practices and routines that enable the orchestrator to meet such new and changing requirements is necessary for a successful, long-term orchestration process. In the context of our research, we propose that,

Proposition 2: Due to the different needs and contexts surrounding startups, network orchestrators need to develop capabilities to cope with different startup demands associated

with their lifecycles and the challenges surrounding them.

Methodology

Based on an extensive literature review, this study introduces a capability-dependant framework to explain how the OI (i.e., third-party network orchestrator) can adapt to the distinct orchestration roles to meet situational circumstances of startups taking into account the different phases of their lifecycle. To derive the capability-dependant framework, we propose an abductive approach by comparing the existing conceptualization of the orchestrator roles obtained from the extant literature with the empirical data of a cross-case analysis of nine dyadic relationships between one orchestrator and the startups in all phases of the startup's lifecycle.

This work adopts Perren and Ram (2016) "multiple stories milieu" approach to explore how the OI develops different roles responding to environmental changes and how these roles evolve within the dyadic relationship with startups. Inter-organizational relationships tend to evolve in a lifecycle pattern that includes establishing a new relationship, collaborating more closely, expanding commitment, collaborating less closely, and terminating or sometimes cooperating closely after termination (Giuliani 2013). We chose a cross-case study design with a comparative setting to elucidate the evolution of orchestration roles by studying the dyad relationships between nine technology-based entrepreneurial firms from several high-tech industries and one orchestrating innovation intermediary based in southwest Germany (see Table 3 in Appendix B).

In light of the scant literature on the dynamic nature of the roles of network orchestrators, we chose a qualitative multiple-case study approach to investigate the mechanisms of orchestration (Yin 2003, Eisenhardt 1989, Perren and Ram 2016). We track the OI's relationship with startups from the surrounding network longitudinally to understand the dynamic nature of orchestration roles (Tabas, Nätti, and Komulainen 2022, Hurmelinna-Laukkanen, Möller, and Nätti 2022, Bergman and McMullen 2021, Hernández-Chea et al. 2021, Pikkarainen et al. 2017).

Sample

The case selection rationale followed an information-oriented selection strategy (Flyvbjerg 2006). This strategy aims to maximize the utility of information from case studies by selecting cases based on expectations about their information content (Flyvbjerg 2006). Thus, the sample was not random but reflected the selection of specific cases to extend the theory to a broad range of organizations. We sought to select startup companies where extensive access could be obtained, thus making the cases reported also conveniently sampled (see Table 3 in Appendix B). All cases had their business location in southwest Germany and entered the innovation network around the focal OI early in their business development process. This ensures that a sufficient amount of data is available for long-term analysis, given that the startups went through most of their business development phases in conjunction with the OI. The selected companies are technology-based and operate in different industries with business models geared toward business customers (B2B). This heterogeneity ensures that excessive sector focus does not distort the observations. Furthermore, this is intended to mitigate the contextual factors influencing individual industries.

Data Collection

Our longitudinal investigation is based on different data sources related to startups and the OI (see Table 6 in Appendix C). Therefore, a range of data was collected from different sources following best practice case study research (Welch et al. 2010). Due to the multi-year relationships between the startups and the OI, which lasted between 22 and 85 months, with an average of 49 months in our sample, a large amount of internal data per case was available for analysis.[2] Mostly confidential documentation has been used in our analysis (see Table 6 in Appendix C). We could triangulate the data by applying multiple data-collection techniques in reviewing different documents (Jick 1979). Following Miles and Huberman (1994), Eisenhardt (1989), a case study protocol and database have been developed to enhance reliability, transparency, and replication (see Tables 4 and 5 in Appendix C). We further develop an analytical framework for cross-case analysis (See Figure 3 in Appendix D) (Ebneyamini and Sadeghi Moghadam 2018).

Data Analysis

In line with previous studies (Schepis, Purchase, and Butler 2021, Nilsen and Gausdal 2017), we utilize process research (Langeley 1999) to understand how activities and occurrences within the relationships evolved and how they influenced orchestration resources, capabilities, and roles. We use a context-oriented perspective (Bamberger 2008, Welch et al. 2010) to cope with the complexity of this study (Weick 1989). In parallel to the data-iteration process, we sustained a regular contrast between data-driven findings and literature sources that could provide support and refine our interpretation of the data.

Results and Discussion

The results of our comparative analysis of the nine business relationships are presented and discussed in four sections along the life cycle of the startups: (a) ideation, (b) structuring, (c) startup, and (d) scalability.

(a) Ideation phase

The data we collected shows that a central vehicle for the OI to attract and engage with (potential) founders is to host non-committal, free offers, such as "startup"-specific events for entrepreneurs and the community. According to an employee of the OI: “regular events with different focus topics are crucial for raising awareness, sensitizing upcoming founders to the network, and bringing interested parties together.” Further, by hosting events associated with ecosystem partners, the OI aims to increase network density and foster a well-connected community with diverse stakeholders and regional familiarity. Additionally, to promote team building and to connect people with different skills to complete or initiate a startup team, the OI organizes informal open meetings, hackathons, and startup weekends, mainly with university partners. In our sample of startups, the core members of their teams were already complete when the startups began interacting with the OI. Within the ideation phase, our data shows that the OI’s core mission is to guide early-stage technology startups by providing a roadmap on appropriate steps in business development, e.g., through holding free monthly venture development workshops and periodical roadshows on company building and business planning. All nine companies in our sample

2 For data collection, we had access to the OI's internal management platform, documents, and servers, which captured all information and interactions between the companies and the OI since the beginning of the relationship between startup and OI.

participated at least once.

Additionally, an annual business plan award for technology ventures is a central element of the OI's support for entrepreneurs in this phase. The award is mainly sponsored by corporates who intend to gain access to innovative technologies, trends, and talents according to sponsoring agreements. Mentors, venture capitalists, and industry experts provide systematic feedback and guidance to applicants during the award. In our sample, all startups applied, of which *beta*, *theta*, and *yota* each made it to the finals, and *beta* was ultimately awarded in 2018. In an online statement, *beta*'s CEO and Co-founder considered: "The participation in the award and the feedback from the coaches and experts from the jury was a great experience and an important milestone for the company's development and a cornerstone for establishing first contacts to investors, partners and customer to develop my personal network."

In most cases we studied, previously presented offers represent the startups' first point of contact with the OI. In our sample, *alpha*, *beta*, *gamma*, *delta*, and *yota* first attended an event, and *epsilon*, *zeta*, *eta*, and *theta* participated in the abovementioned workshop. Our analysis revealed that the dyads between the OI and the startups in the ideation phase are predominantly informal and somewhat loose (see Figure 1 and Appendix E). The interactions are sporadic and ad hoc, with occasionally longer gaps between them. All decisions are made independently with little communication. In our sample, the average time between the first touchpoint or initiative of the startup and the OI and the consequent follow-up exceeded four months.

We identified relationship characteristics associated with weak ties, which are common when forming a new relationship (Giuliani 2013). Based on our data, the OI could carry out orchestration activities within the dyads using the same resources remaining within the specific role adopted, indicating role-implementation capabilities (Hurmelinna-Laukkanen and Nätti 2018).

In light of these outcomes, enabling the OI to coordinate and set thematic focuses for events, select partners to increase (regional) awareness, and assist entrepreneurs in building their businesses, we conclude that the OI's role during the ideation phase is most consistent with an *architect*.

(b) Structuring phase

The structuring phase represents the beginning of a focused, direct collaboration between the case companies and the OI. At this phase, startups and the OI interact through standardized formal agreements such as association memberships (*beta*, *gamma*, *delta*, *epsilon*, *zeta*, *eta*) and brokerage agreements (all cases). Our results suggest that entrepreneurs mostly rely on permanent contacts from the OI's staff to develop direct personal ties and exchange early thoughts and information on the initial idea representing an effectuation perspective (Sarasvathy 2001). Hence, weekly or biweekly meetings between startups and OI employees are evidenced by seven (*alpha*, *delta*, *epsilon*, *zeta*, *eta*, *theta*, *yota*) of the nine firms. According to a print article, the founders of beta and gamma are experienced entrepreneurs, so we assume that such assistance was not required.

Previous research has highlighted the potential influence of an entrepreneur's networks in conceptualizing opportunities (Wood and McKinley 2010). The mismatch between the entrepreneur's personal knowledge and the opportunity-related needs in our sample triggered a targeted matching of the startups and network actors through the OI. In the case

of *delta*, the OI initiated a roundtable with representatives from politics and industry to discuss individual needs and to assess the extent to which delta's legal and feasibility aspects need to be considered.

Likewise, *beta*, *delta*, *theta*, and *yota* leveraged the opportunity to participate in funded projects conveyed by the OI in collaboration with research institutions in the network and local public agencies.

Further, *theta* requested access to complementary hardware providers to assess technical feasibility, after which the OI established contacts with suitable network partners. In addition, the OI initiated several Special Interest Groups (SIGs) within the network to facilitate an intensive exchange of information on specific topics or technologies. This ability to adapt to network, environment and composition changes indicates the role-switching capabilities of the OI.

Considering targeted collaboration and structured and moderated collaboration of network members, we may conclude that the orchestrator corresponds with several activities of the *facilitator*'s role. Orchestration activities further include mobilizing network actors, identifying actors' needs, and facilitating the transmission of information. The dyadic relationships in this phase are characterized by closer cooperation through repeated, more intense interactions. Further, the OI promotes exchange between network actors, enforces communication, and encourages mutual interaction. This corresponds primarily to the activities that the literature assigns to the role of the *conductor*.

By reacting to ordinary, natural changes with existing capabilities, we identify the role-switching capabilities of the OI within the structuring phase. We recognized frequent communication and shared decision-making. Based on our findings, startup requirements within this phase culminated in the adaption of OI activities due to the closer relationship and startups' ability to express requirements. Thus, the OI must extend resources and partially reconfigure assets to adapt to these changing requirements of the startups.

(c) Startup phase

Startup activities in this phase focus on gaining access to capital, funding, customers, and strategic partners. Startups and the OI interact through standardized framework consultancy agreements (*all cases*) and brokerage agreements (*all cases*).

Accordingly, to enable the transmission and sharing of experience, the OI organized boot camps with experts to provide feedback on business strategy and plan of action, which were attended by *alpha*, *gamma*, *delta*, *epsilon*, *zeta*, and *theta*.

Additionally, the OI assisted in developing business-relevant documents (namely, business plan, pitch deck, and financial planning) to prepare for contacting external capital providers. The OI operates on several levels in this context. In each of the nine companies studied, the OI provided support within their first round of funding.

During fundraising, the OI appears to play a crucial role by successfully linking the startups with investors and capital providers from the network. The OI supported all nine startups by compiling long and short lists of private and institutional investors with suitable profiles and personally known contacts from the ecosystem, and, in the case of *alpha*, *delta*, *epsilon*, and *eta*, the OI also took the lead in approaching them. In the case of *beta*, *delta*, *epsilon*, *zeta*, and *theta*, the OI was also involved in their second capital-raising process.

We consider that the OI's track record, reputation, personal contacts, and network knowledge significantly impact the chances of startup and capital provider collaboration, acknowledging the value of reputation in an early phase (Fischer and Reuber 2007). In the words of an OI manager: "We [the OI] know these people [Investmentmanagers] personally for years and foster a close interaction on various levels, moreover, some of our former employees are now working in their ranks. Besides, we [the OI] have become very good at assessing which startup could be a good match for a certain investor. This is why we [the OI] always manage to arrange a personal meeting between the startup and the investment manager."

In technology-based entrepreneurship, achieving a technology assessment and an acceptable fit between an initial idea and a dynamic market represents a significant challenge for startups. To advance, startups need to gain legitimacy. Public or private institutions' formal involvement mitigates stakeholders' perceptions of uncertainty within this phase (Giones et al. 2013). Our results confirm this realization since the OI assisted *alpha*, *gamma*, and *yota* in developing collaborative research and grant projects to raise confidence in the technology by having an experienced third party evaluate it. The OI was instrumental in assembling the consortium and coordinated with the public sector and funding agencies to evaluate the proposal before applying. The high significance of research and funding projects for technological startups resulted in the OI's decision to institutionalize knowledge and expand and condense capabilities by creating a dedicated non-profit research unit, where skilled employees engage with network members on funding and research projects.

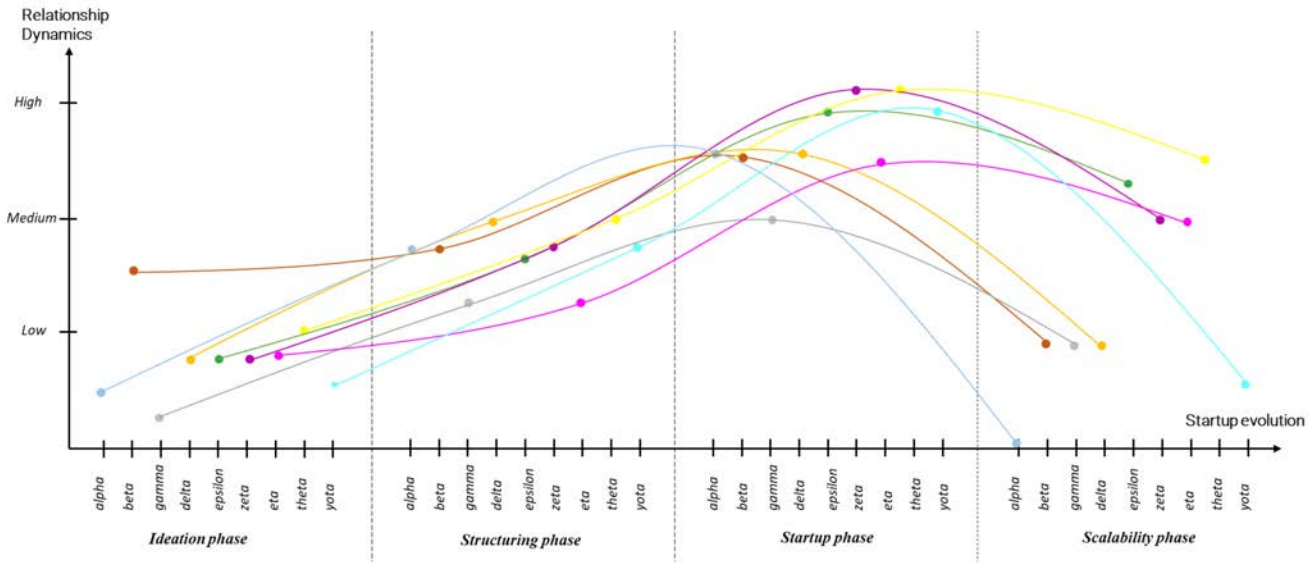
During the startup phase, our findings revealed the impeded access to external sources of financing due to startups' liability of newness. Following the initiative of the OI and other stakeholders in the ecosystem, a semi-public early-stage funding program was developed together with the federal state government. The OI was designated as a partner to assist startups within this program. In addition, the OI provided administrative support for the application process by communicating with the ministry, the state bank, and co-investors. Further, in the case of *alpha*, *delta*, *epsilon*, *zeta*, *eta*, *theta*, and *yota*, the OI assisted in finding co-investors, which is mandatory to be eligible for the program.

Our analysis revealed the multifaceted nature of the startup phase, which requires the OI to detect changes within the network, reconfigure assets, or acquire new capabilities and extend the role base indicating the role-augmentation capabilities of the OI.

In this vein, the OI has established an early-stage accelerator with industry, government, and research representatives to help participants to obtain future funding and acquire pilots and customers. According to the accelerator's former project manager, several capabilities are necessary for this program to succeed: "The difficulty with such a program with stakeholders from different backgrounds is to find the balance to meet the expectations of all the stakeholders, which can be very different. We must ensure that the program generates added value for everyone that justifies the effort involved in participating without compromising the startups, whose support is the program's overarching goal. For this to succeed, tact and excellent knowledge of the individual players are crucial."

We identified frequent and prioritized communication, shared decision-making, and

FIGURE 1. RESULTING PATTERNS ASSOCIATED WITH THE OI STARTUP RELATIONSHIP DYNAMICS AND THE STARTUP EVOLUTION PER CASE



Sources: Self-elaboration.

shared resources. Driven by the incidents and developments within the startup phase, we have recorded activities related to the *facilitator role*. In contrast, on the other hand, we have compiled activities that can most likely be assigned to the *mediator role* of the orchestrator.

(d) Scalability phase

Based on our data, the dyads between the OI and startups in this phase are highly formalized by custom contracts with limited scope, defined activities, and targeted results. In addition, OI's activities in this phase are most individualized, as specific requirements of the startups must be met.

In this vein, *alpha* introduced a business model previously unknown in the market, requiring specialized market knowledge and support in rolling out data-driven business models. Besides, the OI conducted industry and market analyses to assist delta in identifying relevant market niches, including interviews with industry, science, and government stakeholders. With the support of a research group within the network, the OI's supported beta's service-oriented, data-driven business model.

However, due to specific startup requests, the OI felt compelled to expand its portfolio with offerings tailored to startups during this later phase, indicating role-switching capabilities. By offering boot camps, workshops, and mentoring sessions with international partners, mature startups gain new insights into tailored strategies to build a global network. *Beta*, *delta*, and *zeta* joined to receive tailored advice. Subsequently, beta visited international partners and laid the foundation for the company's future on the international stage. Finally, the OI partnered with an international family office and global VCs to support startups in the later stage in subsequent funding and capital acquisition.

This phase signifies the start of a company's growth phase, so the startups' underlying requirements are predominantly market-oriented and focus on scaling and organizational readiness. According to our analysis, the OI in this phase has increasingly concentrated on empowering network

members, managing strategic initiatives, and building visions.

As a result, the role of the *leader* is most appropriate. Considering the complexity and interdependencies among regional, national, and international actors, we have also emphasized the role of the mediator.

Across all phases, our findings suggest that a key differentiator in distinguishing the dyadic relationships between startup and OI is the character of their relationship during each phase of the startup lifecycle. Therefore, Figure 1 shows the course of relationship dynamics (determined by the level of formalization, intensity, and frequency within the dyads (White 2012, Pritzl and Bronder 1992, Child, Faulkner, and Tallman 2005) for all cases between OI and startups within the individual startup lifecycle phases (for a more detailed analysis see Appendix E).

Initially, entrepreneurs seek support selectively, but their interaction increases when they get to the structuring and startup phases. The peak of these factors occurs during startup and declines as the scaling progresses.

According to our findings, this progression may be explained by the startup's ability to articulate needs and demand support as it progresses. Thus, our findings align with earlier orchestration studies (Dhanaraj and Parkhe 2006, Pikkarainen et al. 2017), which found that constant exchange between OI and startups is crucial in scenarios with an elevated level of perceived uncertainty for the startups.

Even so, we found that certain aspects of orchestrator roles could be assigned to individual phases of the startup lifecycle. That is, we can confirm proposition 1. In line with previous research (Nilsen and Gausdal 2017), we conclude that the roles of orchestrators and their activities may change as the startup grows. Furthermore, orchestration roles partially overlap, and transitions are blurry. Several roles may become relevant simultaneously, as the dyadic relationship always determines the orchestration role (Tabas, Nätti, and Komulainen 2022, Davis and Eisenhardt 2011).

In this sense, our findings indicate that the focal OI must be able to perform various roles simultaneously to deal with technology

FIGURE 2. A LIFECYCLE-BASED FRAMEWORK OF ORCHESTRATION ROLES
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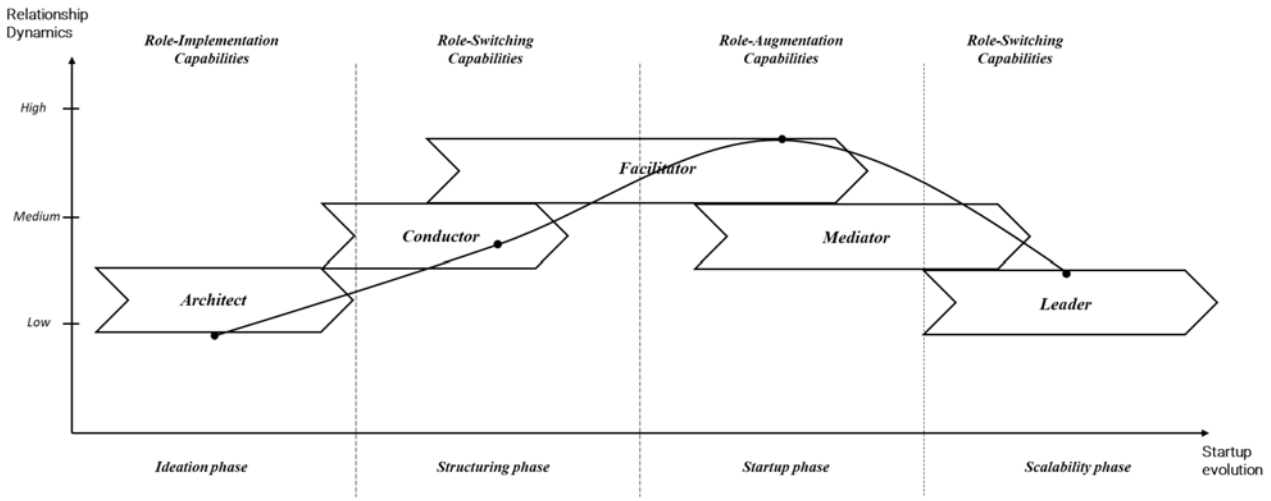

Sources: Self-elaboration.

startups' demands throughout their lifecycle effectively.

To characterize orchestrator roles, we propose the dynamics of the relationship between orchestrator and startup as an additional differentiation criterion. Hence, our findings can be considered a complementary contribution to this stream of literature (Hurmelinna-Laukkanen and Nätti 2018, Mitrega and Pfajfar 2015, Mignoni et al. 2021, Hinterhuber 2002, Leten et al. 2013).

Overall, based on an abductive research approach, we propose a conceptual and temporal framework to highlight the relationship between orchestrator roles, their evolution, and the underlying characteristics of the relationship in different phases of technology-based startup evolution (see Figure 2). The proposed framework is grounded in the themes and dimensions identified in the empirical analysis. Figure 2 depicts the relationships among the emerging constructs in an innovation network context to create a lifecycle-based framework illustrating the interdependence of orchestration roles, relationship dynamics, and startup phases.

In particular, we outline and explain a neutral, third-party network orchestrator's capabilities to enable orchestration mechanisms for technology-based startups within a specific orchestration role and at the transition between orchestration roles along the startups' growth cycle.

As a result of our analysis, orchestrators need to provide phase-specific assistance to startups, all capabilities, activities, and routines must be present and functional, especially during intense collaboration and high uncertainty. Therefore, we can confirm proposition 2.

Conclusion

Overall, our study contributes to the literature on network orchestration by critically investigating the time-related role of orchestrators and how their practices evolve throughout the startup growth. We used a qualitative longitudinal study design to capture the dynamic aspects of networking processes as well as illuminate the dynamic nature of orchestrator roles, as requested by Reypens, Lievens, and Blazevic (2019), Bergman and McMullen (2021), Tabas, Nätti, and Komulainen (2022), Hurmelinna-Laukkanen, Möller, and Nätti (2022), Jack, Dodd, and Anderson (2008), Klerkx and Leeuwis (2009), Zeng (2020), Barney, Ketchen, and Wright (2011).

Our findings emphasize that orchestrators play different roles in response to changing environments and varying startup requirements during their evolution. Consequently, our findings provide guidance on when specific orchestration roles appear appropriate. Additionally, we detail how the OI operates along different innovation phases and how its activities relate to them. We also show when the orchestrator's role changes and under what circumstances, which supports previous research that role-switching and role-augmentation capabilities are required, depending on the magnitude of the change the orchestrator faces.

According to our research, one explanation for the changing roles of orchestrators is the characteristics of the relationship between orchestrators and startups. The orchestrator's ability to grasp and adapt to changing environmental conditions, reflected in the various roles and activities, requires identifying and evaluating (latent) startups' needs and potential threats as early as possible (Teece 2007). Consequently, to capture innovation impulses and consistently build a basis for

relevant offers, the orchestrator must have immediate and proactive accessibility to the startups.

In our study, the dynamics during the relationship take on a curvilinear course, initially increasing and then steadily decreasing relationship dynamics between OI and the startups along their lifecycle. Therefore, we propose the relationship dynamics between orchestrators and startups as an additional differentiation criterion for characterizing orchestrator roles.

In addition, our findings emphasize fundamental orchestration mechanisms utilized simultaneously at several levels by the OI in line with related practices, activities, and outcomes. Thus, we contribute to earlier studies of network orchestration that examined orchestration mechanisms on single levels or phases (Paquin and Howard-Grenville 2013, Reypens, Lievens, and Blazevic 2016, Schepis, Purchase, and Butler 2021, Hurmelinna-Laukkanen and Nätti 2018).

Finally, we also acknowledge that our study has several limitations, which have implications for future research. The limits of our study, situated within the same innovation region, are acknowledged. Our study is based on an ecosystem around one orchestrating intermediary in southwest Germany. The orchestrator involved does not differ in this respect. Therefore, multiple-case research examining several orchestrators needs to be done in this area to provide more powerful arguments for the soundness of the theory. Our study is also limited because not all startups worked with OI over the same period. Therefore, the length of dyadic relationships varies.

Additionally, the various phases of the startup lifecycle cannot be strictly separated. Moreover, the length of each phase of a startup differs and is affected considerably by the startup itself. While we focused on technology B2B startups, we did not distinguish between hard- and software-based ventures, which could be considered in future research. In addition, all startups in the study are currently in the scalability phase. Accordingly, this phase is still ongoing. Future research may generate additional insights by investigating startups beyond the scalability phase up to the level of SMEs.

The results of this study are, however, limited in terms of their generalizability. Our explorative research instead aims at analytically generalizing our set of results through replication logic, where future research could also investigate how OIs activities relate to startup performance.

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Appendix A: Description of the Focal Orquestrating Intermediary

The OI, which serves as a data provider and unit of analysis in our investigation, is the core of the most significant technology association in southern Germany, which connects more than 700 companies and research institutions with a total of more than 6000 stakeholders. The OI describes itself as "a platform for transferring experience, knowledge, and ideas. In this context, the added value resides in the opportunities created by new cooperation and networking." The OI houses three business units with different focuses, extending the activities along the entire value chain, from startup ideas to SMEs to the enterprise level. The first and oldest business unit is an independent network association with around 700 members from different technology domains (including private people, companies, research institutions, and cities and municipalities). Founded as an economic initiative in 1997, the association's mission is to promote strategic technologies for southern Germany's business and living environment. The association is politically independent and aims to create Europe's most substantial cross-technology business network. Another subsidiary was founded in 2014 to offer network members continuous assistance in innovation. This subsidiary acts as an economic, profit-oriented unit and carries out, e.g., supporting activities, consulting projects, and assignments from the industry. In addition, the association includes a non-profit research organization whose purpose is to implement applied research and funding projects with network partners. Across all units, the OI employs 40 people in seven locations spread over southwest Germany.

Our analysis focuses on the single case of the OI as the data provider and analysis unit for our research because it exhibits three desirable characteristics. Firstly, its three business units, each with its expertise, enable the OI to provide startup companies with the support they need from the moment they have an idea through to scaling. As a result, we can analyze different roles and underlying activities within the context of a single orchestrator. In addition, a heterogeneous network structure surrounds the OI, enabling direct tracking of intermediary activities without involving any third parties. Further, the OI works independently and is not dependent on politics, industries, or universities, which might exert influence based on their targets.

Source: Self-elaboration.

Appendix B: Description of the Case Study Companies

TABLE 3. CASE STUDY COMPANY BACKGROUND

Case Company	*Date of incorporation*	*Main products and services (Lifecycle phase)*	*Start of the business relationship*	*Employees **
1. Alpha	April 2018	Online car subscription platform (Scalability)	February 2019	50
2. Beta	June 2016	Autonomous professional service robots (Scalability)	June 2018	15
3. Gamma	March 2019	Electric Water zero-emission Jet propulsion system (Startup)	March 2018	17
4. Delta	March 2015	Distributed operating system for autonomous driving (Scalability)	July 2019	20
5. Epsilon	September 2016	Digital, intelligent bicycle parts (Startup)	June 2017	3
6. Zeta	February 2018	Online procurement platform for shared manufacturing resources (Startup)	February 2018	3
7. Eta	May 2019	Personalized skill and career development platform (Startup)	August 2020	4
8. Theta	December 2017	IoT platform for energy data-based smart services (Scalability)	February 2016	8
9. Yota	May 2017	Logistics platform for rural areas (Scalability)	November 2017	12

* As of May 2022

Appendix C: Case Research Structure and Content Protocol

To increase reliability and enhance transparency, as well as the possibility of replication, a case study protocol was constructed along with a case study database. The study's primary research question is: How does the orchestrator role adapt to the evolving needs of startups' lifecycles in innovation networks, and how do orchestrator capabilities lead to role transitions within this relationship?

Sub-research questions were formulated like:

Subquestion A: What are the natures of interactions between the actors in different phases?

Subquestion B: What were the activities, and what resources and capabilities were requested?

Subquestion C: What is the nature of outcomes that are part of the orchestration process?

Subquestion D: What are the implications of changing demands and environments?

To interpret empirical data, we used a four-step approach: preparation, exploration, specification, and integration (PESI) (Rashid et al. 2019). By utilizing the PESI approach, we could interpret empirical data in a systematized, systematic manner and report it more effectively.

To interpret empirical data, we used a four-step approach: preparation, exploration, specification, and integration (PESI) (Rashid et al. 2019). By utilizing the PESI approach, we

Table 4. Empirical material Discussion Pointers

Focus (Research Questions and Subquestions)	What were we looking for?
What are the natures of interactions between the actors in different phases?	° Process of collaboration during startup lifecycle ° Who is involved? ° Characteristics of relationship dyads?
What were the activities, and what resources and capabilities were requested?	° Types of resources, capabilities, and activities as well as their impact on the orchestration process ° Relevance in the single lifecycle phases
What is the nature of outcomes that are part of the orchestration process?	° Collaboration outcomes ° Impact of outcome ° Network vs. Orchestrator's achievement ° Magnitude of change
What are the implications of changing demands and environments?	° OI stays in a particular role, role-switching due to minor changes or role-augmentation due to significant changes ° Adaption of resources and/or capabilities? ° "Make or Buy" ° Startup vs. environmental trigger?

Sources: Adapted from Rashid et al. 2019.

could interpret empirical data in a systematized, systematic manner and report it more effectively.

In qualitative research, data processing is considered one of the most challenging phases (Jandaghi and Matin 2010). Step one involves preparation. This involves familiarizing yourself with the empirical data. After organizing, sorting, and analyzing empirical data, an interpretation frame was developed. This step is called "playing with the data" (Yin 2003, 129). It included getting familiar with the document platform, reviewing field notes, organizing and reading documents, and referring to the literature review. Four interpretation frames were developed based on the sub-research questions accompanying these tasks.

1. Nature of interactions
2. Resources, capabilities, activities, and actors' classification
3. Nature of outcomes
4. Consequences of change

The four frames offered a unified approach to the interpretation of the documents. This way, we focused on addressing our research questions rather than detracting from them while interpreting the data. Furthermore, the frames served as a screening technique to focus on only that part of the data that dealt with the research questions.

Exploration is the second step. We developed initial focus themes and finalized concepts

TABLE 5. CASE STUDY FRAMEWORK

	Preparation	Exploration	Specification	Integration
Purpose	Identifying key concepts of the empirical context to create a unified approach to interpretation	Delineating and selecting orchestration intermediary and technology startups to be analyzed	Analyzing the dyads of orchestrating intermediary and each startup	Revealing orchestration patterns
Steps	1) Select network orchestration domain case, 2) Investigate in-depth one orchestrator and two cases 3) Create an interpretation frame based on (sub)research questions 4) Validate interpretation frame	1) Delineate and select representative cases 2) Collect data 3) Organize the data	1) Analyze in parallel the intermediary and four startups 2) Determine interrater reliability, resolve issues, adapt interpretation frame 3) Finalize the analysis of the five remaining startups	1) Perform structures analysis and comparison of the data 2) Elicit patterns and contributions to the orchestration process and evolution
Data Sources	Participative observations, Documents	Documents	Documents	Collected Data
Output	Understanding orchestrator and startup domain and the first four interpretation frames of cases (see chapter 3 and Appendix D)	Primary case selection (see chapter 3)	Primary case analysis: 9 cases (see Chapter 4), Revised interpretation frame	Findings and critical lessons (see chapters 4 and 5)
Who	Research team + employees, management of orchestrating intermediary	Research team	Research team	Research team
When	January 2020 – August 2020	September 2020 – January 2021	February 2021 – August 2021	September 2021 – March 2022

Source: Self-elaboration.

during this step. Different concepts were developed based on the similarities and differences among the identified issues.

Step three is the specification step, where the purpose of the interpretation is to develop categories consisting of various concepts and look for connections between these concepts. Based on these patterns and an understanding of the literature, categories were developed.

Integration is the final step. This step involved comparing the empirical material analysis of one case to another case to uncover cross-case patterns. Setting a framework for a concept is the outcome of this step.

Documentation

The documentation ranged from presentation documents and event registrations to detailed business plans, investor-related documents, discussion protocols, and confidential agreements and contracts. Additional information, such as annual reports, protocols, and reports from joint projects and underlying applications, was obtained from the employees of the OI to provide context and validate our findings. We further obtained information from emails, internal (strategy) reports, media announcements, websites, and news articles, thus, enabling empirical triangulation.

Table 6. Overview of Documents Available for Data Analysis

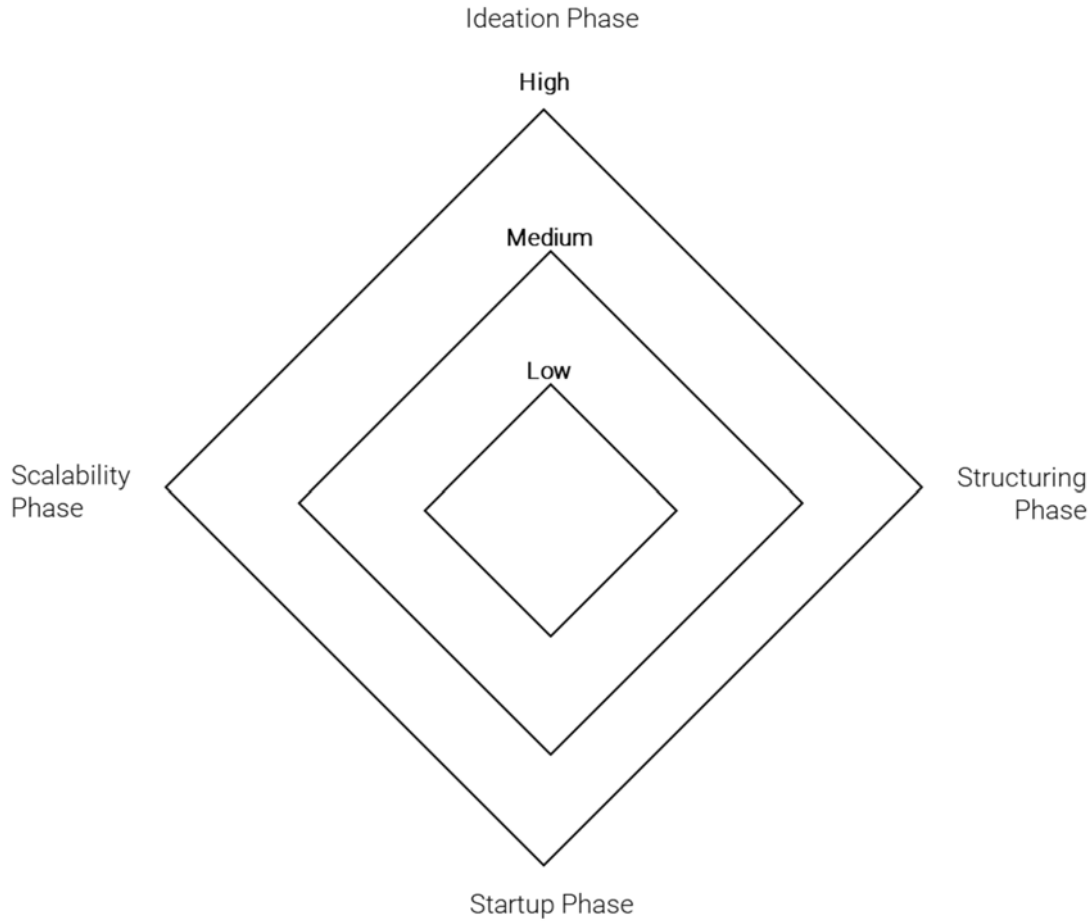
Case / Company / Documentation	*Alpha*	*Beta*	*Gamma*	*Delta*	*Epsilon*	*Zeta*	*Eta*	*Theta*	*Yota*
Business Plan(s)	X	X	X	X	X	X	X	X	X
Pitch deck(s)	X	X	X	X	X	X	X	X	X
Marketing material	X	X	-	X	X	X	X	X	X
Event Registration	-	-	X	X	X	X	X	X	X
Keynote Slides	-	X	-	X	X	X	-	-	X
Financial plan(s)	X	X	X	X	X	X	X	X	X
Strategy report	X	X	X	X	X	X	X	X	X
Protocols of collaboration	-	X	X	X	X	X	-	X	X
Relevant email traffic	X	-	X	X	X	-	X	X	X
Economic Evaluation	X	X	X	X	X	X	X	X	X
Application support formats	X	-	X	X	X	X	-	X	X
Awards	-	X	X	X	X	-	-	X	X
Evaluation of the OI	X	X	X	X	X	X	X	X	X
Application for research/funding projects	-	X	X	X	-	X	X	X	X
Project reports	-	X	X	X	-	-	X	X	X
Co-investors contract	X	X	X	X	X	X	X	X	X
Term sheets	X	X	X	X	-	X	X	X	X
Capitalization table	X	X	X	X	X	X	X	X	X
Proof of use report	X	X	X	X	X	X	X	X	X
Annual reports	X	X	X	X	X	X	X	X	X
Shareholders agreement	X	X	X	X	X	X	X	X	X
Balance sheet	X	X	X	X	X	X	X	X	X
Operating statement	X	X	X	X	X	X	X	X	X
Brokerage Agreement	X	X	X	X	X	X	X	X	X
Consultancy contract	X	X	X	X	X	X	X	X	X
Membership Agreement	X	X	-	X	X	X	X	-	X
Newspaper article	X	X	X	-	-	-	X	X	X
Website	X	X	X	X	X	X	X	X	X

Source: Self-elaboration.

Appendix D. Analytical Framework for Cross-Case Analysis

We operationalize relationship dynamics by the level of formalization, intensity, and frequency within the dyads of interactions (White 2012, Pritzl and Bronder 1992, Child, Faulkner, and Tallman 2005). The evaluation of the relationship dynamics is based on a numerical scale with values ranging from 0 to 3 (representing low for 0-1, medium for 1-2, high for 2-3) in 0.25 steps (de Vaus 2002). The value of 0 indicates an informal relationship with no discernible pattern of a continuation between the OI and startup in the respective lifecycle phases. In contrast, the value of 3 indicates the most prominent degree of formalization with a stable enduring relationship in the respective lifecycle phases.

Figure 3. Analytical Framework for Cross-Case Analysis



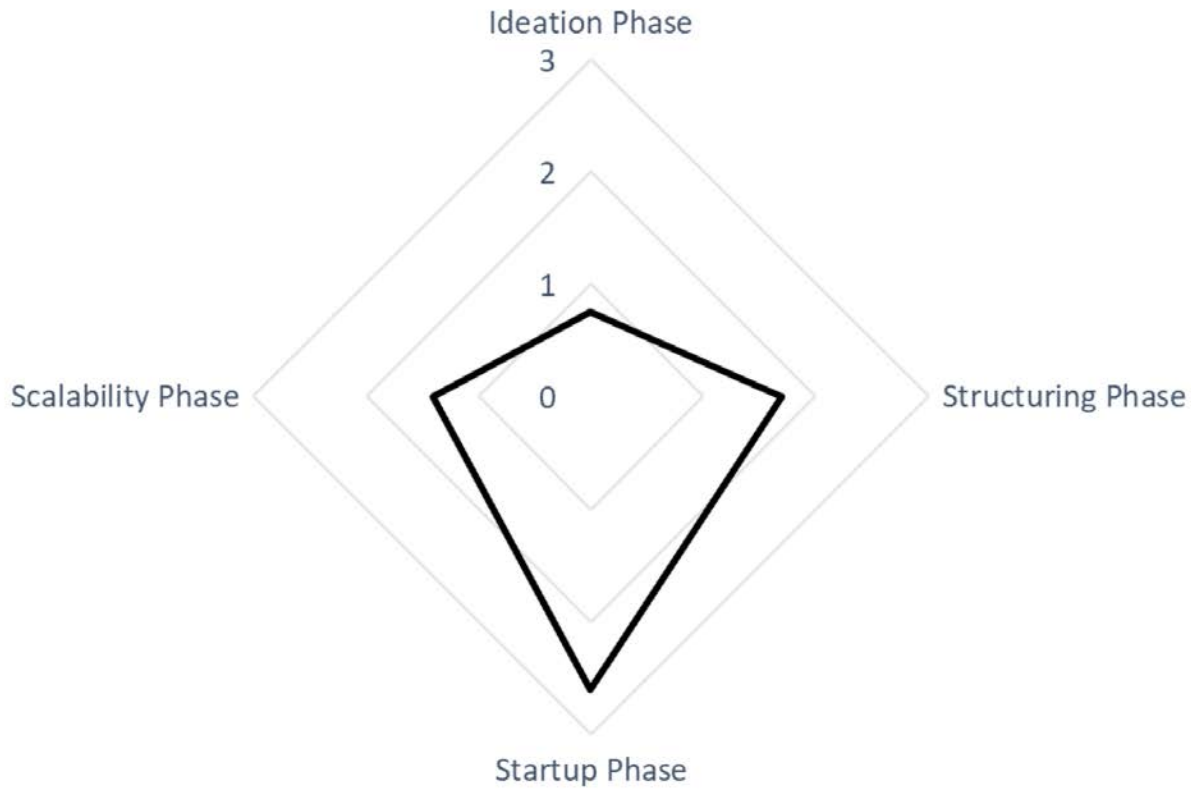
Source: Self-elaboration.

Appendix E. Resulting Patterns of the Relationship Dynamics within the Dyad between OI and Cse Study Startups

Figure 4. Results of the Analysis of the Relationship Dynamics Startup Using the Analytical Framework

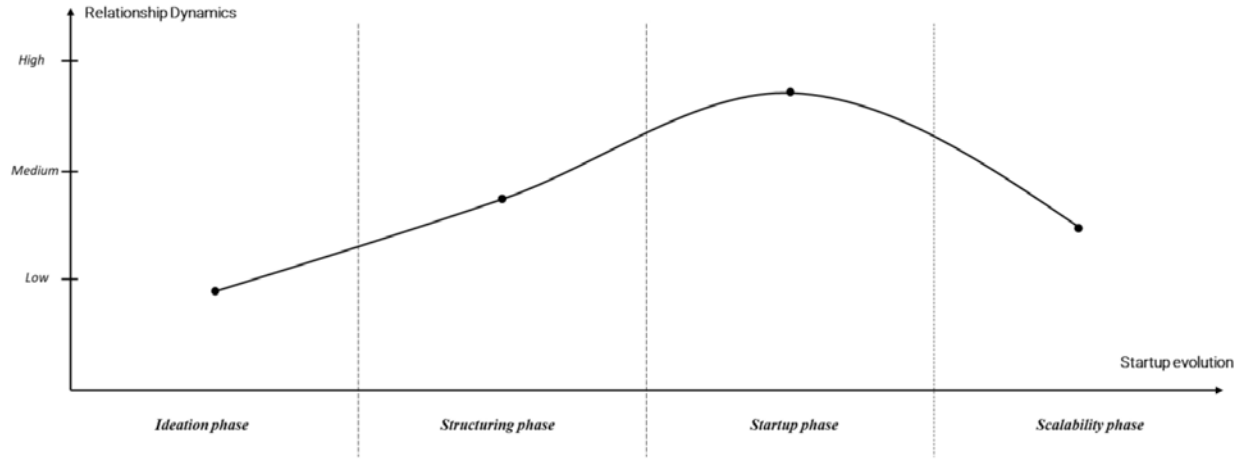
Source: Self-elaboration.

Figure 5. Results of the Analysis of the Relationship Dynamics Across All Startups Using Average Values



Source: Self-elaboration.

Figure 6. Resulting Patterns Associated with the OI Startup Relationship Dynamics and the Startup Evolution Across All Startups Using Average Values



Source: Self-elaboration.