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Platform based Innovation Ecosystems: Value Network Configuration Perspective

Jarno Lähteenmäki[1] and Juuso Töyli[2]

[1]Aalto University, Department of Communication and Networking, Konemiehentie 2, 02150 Espoo, Finland | *jarno.lahteenmaki@aalto.fi*
[2]Aalto University, Department of Communication and Networking, Konemiehentie 2, 02150 Espoo, Finland; University of Turku, Turku, Finland | *juuso.toyli@utu.fi*

Abstract

A platform-based innovation ecosystem links multiple markets and their corresponding stakeholders for joint value creation and innovation around a platform, and it is critical for the platform sponsor to manage the configuration efficiently for maximized value and survival. Through a multi-case study, we propose a configurational framework for platform ecosystems to analyze multi-stakeholder business structures, boundary decisions and their relationships. We define the context as for-profit business networks that leverage a digital platform to create multi-sided market circumstances and to engage partners as well as customers in joint innovation and value creation. Empirically we study five small to mid-sized digital information and communication technology platforms and their ecosystems. The discoveries elaborate on the four characteristic configurations and activities involved in the platform ecosystem management, and show configurational differences between open, semi-open, and closed innovation ecosystems. We propose the value-network configurations for the ecosystem, upstream producer, downstream consumer, and partner driven scenarios. Contradicting the existing literature, we argue that complementarities are created by two different producer actors and the consumption is influenced by two different downstream actors. We also argue that an internal production platform can be considered a platform ecosystem for innovation in the case of the extensive use of external knowledge and resource sources. The results extend the understanding of a platform ecosystem as a multi-layered configuration, and show what are the roles of different functions in the multi-layered structure.

Keywords: Platform Ecosystem; Industry Platform; Business Network; Value Network Configuration.

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1 Introduction

Digital platforms and their ecosystems have not only become the dominating business structure on the ICT markets over the past 20 years (de Reuver et al., 2018), but they have also shaped our understanding of how the structures of an industry may manifest nowadays (Gawer and Cusumano, 2014). Several platform ecosystem studies on innovation have shown that the introduction of a platform to an ICT market typically causes major change in the market structures, as well as the unique characteristics and ecosystem activities render the ecosystem distinct: the studied cases include such as, the introduction of video-on-demand platforms to television broadcasting ecosystems (Ansari et al., 2016), gaming console platforms' ecosystem evolution (Inoue and Tsujimoto, 2018) and network platform strategy emergence (Khanagha et al., 2020). However, the relationships between the ecosystem structures and the tasks of a platform innovation have remained without deeper synthesizing studies (Kapoor et al., 2021, p.104). Moreover, although the openness of platform ecosystems has been studied quite extensively (e.g., Cenamor and Frishammar, 2021; Eisenmann et al., 2009; Gawer and Cusumano, 2008; Parker and Van Alstyne, 2018; Wang et al., 2020), it has remained a question what are the subdimensions of platform openness for both actor specific aspects (i.e., roles) and non-actor specific aspects (i.e., the structures of a platform ecosystem) (Broekhuizen et al., 2021). These are found to be paramount in a network centric innovation and value creation.

Many platform scholars on the ecosystem structures acknowledge that it is mainly the value creating activities that define the innovation ecosystem, and that the profit seeking nature of commercial platform ecosystems strives them to create increasing value through an interaction between assets, activities, and business contracts (Adner, 2017, Ceccagnoli et al, 2012). Indeed, several studies have shown that the network structure of these entities hold a significant impact on the outcomes of a value-creation process (Adner and Kapor, 2010; Hein et al., 2019; Rietveld and Schilling, 2021). Consequently, the value network configurations (VNC) have been examined in several techno-economic and socio-economic studies to reveal the structure of a business network and the value creating activities among the network actors (e.g., Katsigiannis et al., 2013, Taparia et al., 2012). However, the platform ecosystem literature is silent about the consequential impact of configuration strategies for the multi-layered platform ecosystem structures.

To improve the structural understanding of these issues, this study asks: what are the value-network configurations that platform-based innovation ecosystems can adopt and what are the strategic roles of its assets, activities and actors within these configurations. This research seeks to answer these questions by analyzing the business network configurations of real-world innovation ecosystems. In practice, we analyze five small to mid-sized ICT service-focused platform ecosystems and their multi-layered configurations to extract insights to theory.

This study elaborates on the structures of platform-based innovation ecosystems. We model the ecosystem management as a network orchestrating activity consisting of characteristic stakeholders' roles and their interplay. Given the identified problem among the commercial innovation platforms, we define the context as for-profit business networks that utilize digital platforms to create multi-sided market configurations as well as to engage partners and customers for their joint innovation and value creation. We interpret an ecosystem as a latent activity and governance structure, and a platform as a market intermediary configuration rather than a technological configuration. Based on this model, we examine these network structures as strategic factors built and understood by the actors in the platform ecosystem. The empirical base of this research is a multi-case study concerning the characteristics of the platform ecosystems. The sample comprises five small to mid-sized platform ecosystems established and managed through deliberate and strategic actions. On this basis, we propose the characteristic value-network configurations of a platform ecosystem, which explain the structural business elements and their strategic design purposes. In terms of the theoretical context, the framework assumes non-monopolistic markets where both partners and customers are free to choose the best fitting innovation ecosystem for their needs and most of them seek monetary profits, as well as the platform provides digital services for the markets.

This study contributes to the platform-ecosystem research on the openness, innovation, and value-network configurations. Firstly, the proposed elaboration of the configurations complements earlier research on the openness of platform ecosystems. Existing research typically measures the impact of structure changes of a platform ecosystem to market outcomes (e.g., Boudreau, 2010) or examines the user perspectives of the structural changes to innovation (Broekhuizen et al., 2021). We propose a multi-layered model for analyzing and describing the different innovation ecosystem configurations, their actors and openness subdimensions. We also shift the focus to the links in the value network in examining platform ecosystems' openness, while the existing literature tends to flatten the openness to multiple single-dimensional factors (Broekhuizen et al., 2021). Second, our study contributes to the VNC literature by introducing the configurations of a platform ecosystem. As the VNC method has remained without further attention in the platform ecosystem literature, our study opens a novel line of research for analyzing different platform ecosystem contexts. Furthermore, we elaborate on the extant VNC model by adding the information exchange relationship link to the activity level, which explains the required innovation coordination among different actors.

2 Related Work

Platform ecosystems have not only become a vital part of modern business structures, but also of high scholarly interest (Ceccagnoli et al., 2012; Hein et al., 2020). The literature accumulated over the past 30 years provides a cornucopia of alternative conceptualizations and the tools of analysis to both platforms and to ecosystems (Gawer and Cusumano, 2015; Kapoor et al., 2021; Thomas et al., 2014), which has rendered the platform ecosystem landscape conceptually complex. Over the past decade, several meritorious reviews have synthesized research on platforms and innovation ecosystems to build stronger theoretical foundations. These reviews include areas such as digital platforms (de Reuver et al., 2018), the evolution of ecosystems (Dedehayir et al., 2018) and platforms (Tiwana et al., 2010; Facin et al., 2016), service ecosystems (Gölgeci et al., 2021), platform competition (Rietveld and Schilling, 2021), the design of an ecosystem (Tsujimoto et al., 2018), and a socio-technical view of a platform ecosystem (Kapoor et al., 2021a). A narrower stream of research focuses on the structures of industries that utilize platforms and the structures of an ecosystem interaction (Adner, 2017; Baldwin and Woodard, 2009; Jacobides et al., 2006). Thus, it has become evident that the multi-dimensional structures of platform ecosystems are increasingly gaining scholarly attention.

Within this structural line of research, a platform is typically defined as an intermediary construct of a modern business network that supports hosting multiple stakeholders and activities (Baldwin and Woodard, 2009). One of the structural special cases is a digital platform which typically combines latest digital technology enablers with a suitable and sustainable business logic (de Reuver et al., 2018), as well as it opens sharing of costs and revenues between the focal platform company and its customers (Gebauer et al., 2020). In doing so, a platform is seen to connect two or more separate product markets as a multi-sided market enabling the platform sponsor to appropriate value-creation and value-capture processes between the participating markets (Hagiu and Wright, 2015; Rochet and Tirole, 2003). However, some scholars argue that these platform-based structures are driven by the distinctiveness of a platform offering and the size of the platform's user and complementor space (Cennamo and Santaló, 2019). Thus, in this structural line of research, these relatively general definitions have allowed multiple perspectives and interpretations to these constructs.

Most of the platform ecosystem literature is unanimous that a platform ecosystem can be interpreted as a network of business actors creating innovations and value through the common activities. On the one hand, a platform that is for collective production, as well as its customers and partners, form an ecosystem in which different stakeholders co-exist in a symbiotic network relationship (Rietveld and Schilling, 2021). Generally, these relationships can be seen as the collection of affiliations, as well as the structural configuration of nodes and links (Adner, 2017) or, as some refer, an architecture (Baldwin and Woodard, 2009). In detail, a business network approach allows seeing these relationships as a social structure in the form of an ecosystem as a community of organizations operating beyond their primary industry (Kapoor et al., 2021b; Moore, 1993). On the other hand, collective production may materialize in the form of innovation, that allows interpreting ecosystems as a network of innovation to produce complements that make a platform more valuable (Ceccagnoli et al, 2012), or in the form of a configuration, that allows interpreting ecosystems as a network node and link structure in which multiple stakeholders leverage the architectural logic for improved value creation (Thomas et al., 2014). The literature also suggests that these two alternative outcomes of a value-creation process in a platform ecosystem, production vs. innovation, shape the configurations of the corresponding business network.

The extant literature on platform ecosystems is somewhat segregated on what constitutes a platform, since some of the scholars categorize the platform designs into three archetypes and some have a more fine-graded approach. On the one hand, in the first archetype, internal production platforms are seen as a closed architecture within a firm that prevents external parties from joining the platform (Facin et al., 2016). Secondly, supply chain platforms and industry platforms, in turn, are seen as semi-open architectures allowing industry partners to produce value through complementarities and standardized interfaces (Gawer and Cusumano, 2014; Rolland et al., 2018). And the third archetype, multi-sided platforms are seen as open intermediaries connecting several industries and markets as well as exploiting network externalities (Hagiu and Wright, 2015). On the other hand, some scholars suggest that the dynamic social context of a platform ecosystem renders the architecture of an ecosystem to be more nuanced than these three characteristic business structures indicate (e.g., Inoue and Tsujimoto, 2018; Thomas et al., 2014). For example, it has been evidenced that it is not only the innovation strategy and the division of labor implied by platform ecosystem roles that influence the firm and platform boundaries, but also platform sponsor's ability to balance the competition and cooperation among ecosystem participants (Cenamor and Frishammer, 2021). Furthermore, an understudied aspect that has been identified recently is the degree of the relationships between the ecosystem structures and the tasks of a platform governance and innovation as a continuum rather than archetypical categories (Kapoor et al., 2021a, p.104).

A closely related line of research that contributes to the understanding of platform ecosystem structures has emerged in parallel. Some of the related concepts are; the openness of an ecosystem configuration (Nambisan and Baron, 2021; Wang et al., 2020); the types of configuration changes (Eisenmann et al., 2009; Dedehayir et al., 2018), and the structures of ecosystem governance (Chen et al., 2021; Nambisan and Sawhney, 2011). In addition, the extant literature on business networks has supported platform ecosystem scholars to gain, first, understanding of ecosystem entity relationships (Anderson et al, 1994; Holm et al., 1999) and, later, the formation of these relationships (Möller and Halinen, 2017). Despite these contributions, it has remained a question how the structural design of a platform ecosystem intertwines with ecosystem participant's ability to produce innovations and to shape a value capture logic, and what are the inter-organizational mechanisms for actor integration (Kapoor et al., 2021b). Moreover, the extant platform literature tends to consider partners as complementors without making categorical differences between different platform participation strategies (Wareham et al., 2014).

The literature on platform-ecosystem structures has grown significantly both in breadth and depth over the past 20 years explaining not only various network configurations and their changes in the specific contexts, but also linking them to adjacent disciplines. In this line of research, it is well understood that the elements of an ecosystem structure consist of activities, actors, positions, and links (Adner, 2017). However, it has remained a question that *what are the network configurations of a value-creation process a platform ecosystem may adopt and what are* *the characteristic strategic roles of its actors as well as their linkages within these multi-layered configurations*. This is important because the conceptual foundations of the platform-ecosystem network configurations have become both highly diversified but also ambiguous, and the literature calls for stronger conceptual ground for platform ecosystems (de Reuver et al., 2018 ; Tsujimoto et al., 2018). Stakeholder roles, for example, have been referred to in various studies (Dedehayir et al., 2018 ; Kapoor et al., 2021b; Viglia et al., 2018 ; Xu et al., 2021), but those have remained case specific.

Review of the techno-economic and socio-economic literature on digital platforms and innovation ecosystems indicates that there are three distinct layers in a platform ecosystem that form a value network configuration; the layers of a property, an activity, and a business. On a property level, the physical and digital assets of a platform manifest as properties and the links between each property pair manifest as a property relation, i.e., technical interoperability and functionality (Casey et al, 2010). These properties may turn into a competitive advantage in innovation of its holder (Katsigiannis et al., 2013) if one possesses high asset specificity in terms of physical location (or proximity), exclusive access to data (or quality of data) or proprietary interfaces, for example (de Reuver et al., 2018). However, it can be assumed that the technology alone does not produce any value, but it is also the knowledge of utilizing underlying properties that may become an asset (Clarysse et al., 2014). It turns out that both technology choices and knowledge of it are crucial for the innovation activities, and that is why it is important to make a distinction between underlying properties of a platform and the organizational activities that utilize them because underlying assets can be leveraged in multiple ways (Casey et al, 2010), for example, based on the asset ownership, access to knowledge, or strategy, the activities may take different configurations on how they are positioned and what are the linkages between them. The extant research identifies some of the activities that may appear in a platform ecosystem. The included activities in the literature are: platform design and management (e.g., Fürstenau et al., 2019); ecosystem management (e.g., de Vasconcelos Gomes et al., 2022); service development and delivery (e.g., Kapoor et al., 2021-b); platform market governance (e.g., Boudreau and Hagiu, 2009); resource development and knowledge development (e.g., Clarysse et al., 2014); and service acquisition and deployment (e.g., Jaworski and Patel, 2020). Although all these constructs exist in the current literature, there is no study that focuses on inspecting the relationships and structures between these constructs. The common context of a platform ecosystem among the above-mentioned activities allows us to unify these constructs.

Continuing with the review of the techno-economic and socio-economic literature, it has been found out that it is important to differentiate an activity in an ecosystem and the actor that executes it (Adner, 2017, p.44). While activities describe the innovation and value creating processes in an ecosystem, business actor roles define how the activities are governed. The extant literature provides following actor roles: a platform owner (e.g., Baldwin and Woodard, 2009) or a platform sponsor (e.g., Hagiu and Wright, 2015); a complementor (e.g., Baldwin and Woodard, 2009 ; Wareham et al., 2014); a producer or an upstream company (e.g., Roy and Sivakumar, 2010); a consumer (e.g., Inoue and Tsujimoto, 2018) or a downstream company (e.g., Roy and Sivakumar, 2010); a regulator (e.g., Boudreau and Hagiu, 2009 ; Wareham et al., 2014); a horizontal partner (e.g., Kortmann and Piller, 2016); a vertical partner (e.g., Helfat and Raubitschek, 2018). The ecosystem literature also includes other names for these actor roles, but they are found to be redundant for the above-mentioned constructs. It can be assumed that each actor pair has a one-to-one bi-directional relationship, which manifests as a link in the innovation network, and it is the link that represents their business relationships.

Literature review of the methodology of platform research reveals that a subset of studies utilize a value network configuration (VNC) method. The VNC model itself can be considered the layer map representation of a business network (Baldwin and Woodard, 2009, p.32). The VNC method helps scholars to identify business entities, define interdependencies among them, and link them to the innovation and business activities as well as to technical structures (Casey et al, 2010). The motivation of these studies has been to identify different business-network-configuration scenarios given the underlying technological components (Katsigiannis et al., 2013 ; Kivekäs et al., 2020 ; Taparia et al., 2012 ; Vesselkov et al, 2018). The method builds on the top of value network theory (Stabell and Fjeldstad, 1998) by extending a value creation logic from a linear supply chain to multi-lateral linkages. In addition, it provides a way to interpret relationships and dependencies between socio-technical layers (Lyytinen and Newman, 2008). Although Adner (2017) makes a move from an ecosystem as an affiliation to an ecosystem as a network structure, and by doing so moving to the direction of VNCs, however, the platform ecosystem research has not yet utilized the VNC method for interpreting the business and activity structures.

The review also reveals that multiple perspectives and methodological paths have been taken in examining the characteristics of platforms and ecosystems. For example, the statistical analysis of the effect of technology replacement (Adner and Kapoor, 2016); process modelling of the emergence of a disruptive innovation using qualitative data analysis (Ansari et al., 2016); the statistical analysis of various effects to value cocreation in a platform ecosystem (Ceccagnoli et al., 2012); and the qualitative examination of the path to become a platform leader through innovations (Gawer and Cusumano, 2008). It seems that the literature contains a fair share of explorative qualitative studies and hypothesis driven theory testing studies.

The literature review reveals that research on platform-based innovation ecosystems and value-network configurations have remained separate. Furthermore, it remains a question what are the subdimensions of platform openness for both actor- and non-actor specific aspects, and the extant literature also asks further studies on the relationships between the ecosystem structures and the tasks of a platform governance.

3 Method

We examine through a value network configuration (VNC) analysis the structures of a platform ecosystem for innovation. Five real-world ecosystems form the empirical base for our analysis. In practice, first we identify stakeholders and their activities in each ecosystem as well as the relationships among them. Secondly, we map the identified stakeholders to a VNC model and compare different cases to identify the configurations that a platform ecosystem may adopt.

3.1 Case selection and data collection

Given the identified problem in the domain of digital platforms, we define the context as platform-based innovation ecosystems. By the definition, a platform ecosystem as the network of organizations seeks innovations to produce complements that increase the value for the ecosystem through a digital platform (Ceccagnoli et al., 2012; de Reuver et al., 2018). In this context, we examine actors, their positions, and activities, as well as their linkages. We assume non-monopolistic markets in which both partners and customers are free to choose the best-fitting innovation ecosystems, and thus digital platforms, for their needs, as well as the collective action of the ecosystem customers is to make profit through innovations. However, this context does not constrain the role of an individual stakeholder, thus some stakeholder may adopt a non-profit strategy as long as the ecosystem as whole seeks financial outcomes.

We critically selected the sample among platform ecosystems using a theoretical sampling rather than statistical sampling (Eisenhardt and Graebner, 2007). The selected platform ecosystems represent the archetypical ecosystem configurations, i.e., open for all, open for producers, open for consumers, and closed for all configurations. The theoretical sampling, we applied, was carried out in practice by engaging with companies that provided services on several digital markets and had reached a significant position on those. We especially wanted to find ecosystems that utilized different business network configurations, and that found innovation activities paramount. We ended up selecting five cases, which we think represent the four theoretical ecosystem configurations well.

All selected platform ecosystems operated on different digital markets. We will use the pseudonyms of EcoCrowd, InnoCity, MediaLab, Locality, and TechMove to refer to the real-world platform ecosystems and their corresponding platform companies and ecosystem partners. We conducted several semi-structured interviews with the company representatives to gather data about the platform ecosystems and their innovation activities. In line with our research questions, the discussed topics included subjects related to ecosystem participant roles and activities, network configurations (i.e., business and collaboration linkages between the focal company and partners) and the role of a platform. Each interview lasted one hour on average. In addition, we collected all other comments and insights that the representative gave us. When available, we also collected internal company materials and other secondary data to support our analysis. Data collection took place between Nov 2019 and May 2021. Table 1 summarizes the collected data and means.

Each of the five ecosystems examined in this study had its own origin and characteristics. The platform company of EcoCrowd operated mainly in the escalator and elevator industry. At the time of data collection, its annual revenue was almost $10Bn USD and the company had more than 60 000 employees. The company had realized that crowd-movement in buildings produces data that contains implicit value, and the value can be harnessed through innovation network partnerships and a common data platform. Initially the company started with an internal venture that strived to create added value for customers and to increase the competitiveness of the company. The company lacked knowledge and suffered the slow pace of innovation, which motivated it to set up an open innovation ecosystem.

On the other hand, the platform company of InnoCity was corporatized from a city operations unit 10 years before data collection. Local city authorities struggled with the inability to engage local companies to joint innovation, and they were not able to experiment with novel technologies and business opportunities in an agile way. At the time of data collection, the platform company had around 60 employees and ran about 50 innovation projects annually.

The third case ecosystem, MediaLab was established 10 years before data collection. At the time of data collection, the platform company had over $1Bn USD in revenue and more than 4 800 employees. The platform company had struggled with the slow pace of business acquisitions and the low success rate of internal innovation initiatives. After failed internal ventures, it decided to launch an open accelerator and innovation program.

Locality ecosystem instead was formed five years before data collection. The platform company had more than 20 000 employees and had almost $9Bn USD in revenue at the time of data collection. The platform company wanted to leverage positioning data it had collected from its infrastructure. However, it lacked insights on the use-cases the data can be leveraged, hence it established an ecosystem for innovations.

The platform company of TechMove had more than 4 000 employees and almost $2Bn USD in revenue at the time of data collection. The company had several technology solutions for its various services. Target was to gain a new core competence on an ecosystem approach to the digital cloud platform. The former operation mode did not suit well for multi-stakeholder innovation and that is why the company decided to establish an ecosystem.

Table 1. Collected data

Case	Data collection
EcoCrowd	Semi-structured interviews (n=10), secondary data (ecosystem documents, workshop discussions).
InnoCity	Semi-structured interviews (n=6), secondary data (press releases, project publications, company web pages).
MediaLab	Semi-structured interviews (n=5), secondary data (media releases, investor reports and annual reports).
Locality	Semi-structured interviews (n=2), secondary data (service materials, public materials, press releases).
TechMove	Semi-structured interviews (n=9), secondary data (company internal archives and memos, public materials - annual reports).

3.2 Data Analysis

We mainly used qualitative data analysis and qualitative comparative analysis (Schneider and Wagemann, 2012) methods to reveal common characteristics and case specific differences among our data. We started by building a case matrix (see Appendix A, Table A.1). The table summarizes the key information collected during the data collection and the main observations. In each case, we mapped each ecosystem participant to the theoretical business roles. In practice, we coded the interview transcripts to reveal actors in a business network, their positions, and activities, as well as the linkages between them. We also differentiated the business activities from the innovation activities. For example, TechMove representative said, "[software vendor management] contains the creation of a platform specification, thus [giving the] requirements an application must meet to be compliant with the platform. The team operating the platform is responsible for this specification and responsible for communicating this specification to user organizations.". This resulted in three codes: (i) Platform management signals the platform specifications to downstream and upstream segments, (ii) the platform management process selects the complementarities based on their strategic fit to the platform from upstream segments, and (iii) a platform specification regulates who can participate the ecosystem and the corresponding innovation activity. The codes allowed us in the next phase to identify the assets, the processes, and the actors, as well as their linkages in a network.

3.3 The analysis of value network configurations

We then analyzed the information exchange relationships among the activities. In practice, we identified the codes that related to innovation, communication, and decision making among different stakeholders. Table A.2 in Appendix A summarizes the identified activities. This information exchange relationship analysis was the base for the following step, that was to apply the value network configuration method (Katsigiannis et al., 2013) to visualize the network of a platform ecosystem by defining the generic properties and activities in a network. In practice, we linked the nodes that shared an information exchange relationship. The links between the above-mentioned activities form an information exchange relationship between each activity pair (Gill, 2021), as illustrated in Figure 2. In defining VNCs, we assumed that some of the relationships may be stronger than the other, and the information flow can be bi-directional. In addition, we

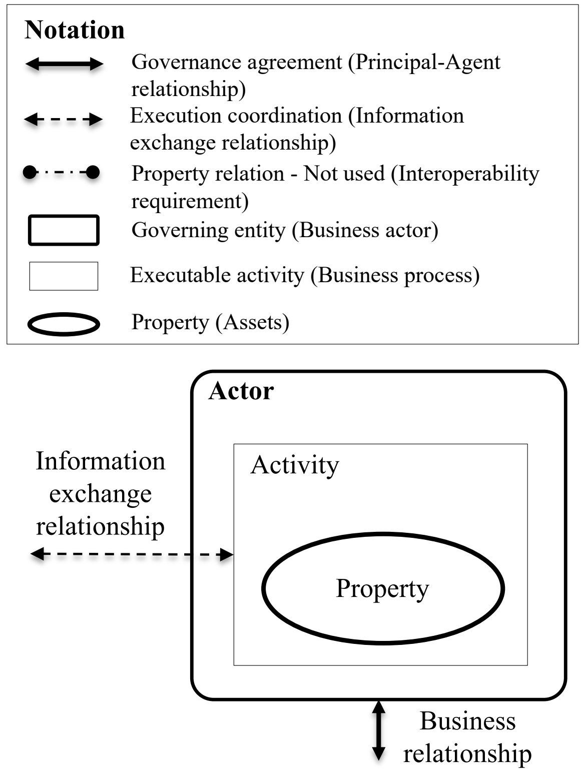

Figure 1. The value network configuration notation consists of three layers of entities and three types of relational links (adapted from Casey et al., 2010).

assumed that some relationships enable activities while some constrain. The next step was to define the base-case for the VNC business actors (i.e., the case in which all actors are separate). Figure 3 illustrates the base-case value network configuration.

The final analysis step was to identify alternative VNCs on the business actor level. In theory, any combination of relationships between activities and business actors are plausible, but in practice only a subset of configurations is utilized. We analyzed the ecosystems by identifying the business actors of the ecosystem and the borders of entities to reveal some of the configurations utilized in real-world platform ecosystems. Table A.1 in Appendix A exhibits the summarized results of a platform ecosystem configuration and stakeholder analysis. Based on these insights, we were able to formulate alternative value network configurations seen through our data. These analysis steps gave us the understanding of the structural differences between the platform ecosystems. These configurations are further elaborated in Section 4, and it also provides the description of the empirical results.

3.4 Value-network configuration modelling of a platform ecosystem

We extend the VNC method by interpreting the links between activities as information exchange relationships, which itself is crucial for innovation. Figure 1 depicts the basic building blocks of a VNC notation.

3.5 Validating trustworthiness

We utilized several methods to overcome the factors that may render the results less rigor. To ensure credibility of the results, we used triangulation by collecting data from multiple sources and comparing those (Flick, 2004, p.178-183). For example, whenever available, we utilized public and company archival data to cross-check interview statements.

In the data collection phase, we interviewed multiple representatives of the ecosystem by asking the same questions allowing us to compare the statements between informants. We asked the questions in such a manner that we were able to discuss the activities and relationships on the organizational level. We wanted to avoid evaluating the actions of a single manager to decrease the risk of informant bias seen in behavioral studies (Kumar et al., 1993).

The validation phase functioned as a post-hoc analysis for us. We carried out five additional one hour post-study member checking interviews in which we presented the results and our interpretations to the selected representative of each platform ecosystem (Birt et al., 2016 ; Carlson, 2010). As all interviewed persons were official representatives of the platform companies, their support for the interpretations gave us high confidence that our model reflects the actual situations seen in different cases.

4 Results

The analysis of the cases allowed us not only to gain deep insights into the structural factors of the platform ecosystems and the dynamic nature of relationships, but also to the latent factors, such as openness and the sources of innovation. Although each studied platform ecosystem utilizes different ecosystem configurations, they all utilize similar activities and actor roles. As expected, platform sponsor's company borders are found to diverge in different configurations, which has allowed them to adopt their unique value capture and value sharing logics. However, the company borders are not found to influence how the knowledge and innovation flows take place. In all the examined cases the role of a platform company was to facilitate collaboration among customers and partners, as well as to provide the base for joint development activities. In most cases, this required both dyadic one-to-one collaboration and multilateral workshops together with the customers and the partners. Table A.1 in Appendix A summarizes the key characteristics of each examined platform ecosystem.

The analysis of value network activities and their relationships results in an information exchange matrix, as discussed in Section 3. Table A.2 in Appendix A exhibits primary information flows between activity pairs as one-way communication evidenced by the data of our multi-case study. An activity diagram was defined based on the identified properties and the activity matrix. Figure 2 illustrates the generic entities in a platform ecosystem. In the following subsections, we elaborate on each identified value-network configurations as the sources of innovation in the platform ecosystem.

4.1 Ecosystem driven VNC (open)

The value network analysis of InnoCity and EcoCrowd reveals that by opting for an open value-network configuration, a platform sponsor externalized most of the innovation activities to the ecosystem members. Hence, such a value-network configuration can be classified as ecosystem driven. At the same time, the upstream and downstream actors opted for opportunistic strategy selection as the rivalry among companies in the segment drove them to balance expected return-on-investment and the risks. In these cases, platform companies permitted anyone to join the ecosystem, thus the ecosystems can be considered as open. In this setting, a platform company took an intermediate role between different customer segments. InnoCity, for example, allowed anyone to participate who wanted to do so. The platform sponsor did not control who can become a member, and thus participate in innovation, but it had relatively strict contractual terms and

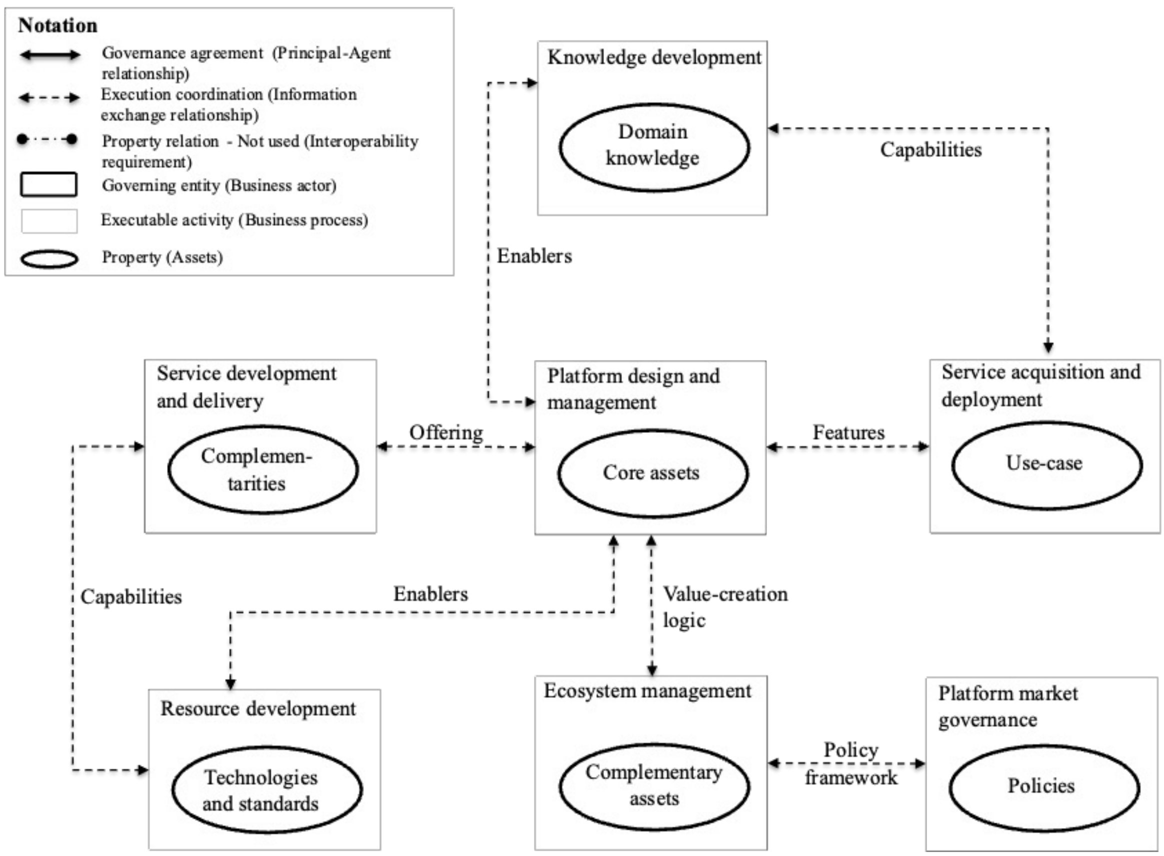

Figure 2. The activity diagram depicts relationships between the core business processes in a platform ecosystem (Source: Authors' own work).

conditions in some cases. Let us take EcoCrowd as another example. In addition to the roles of the platform owner and the ecosystem orchestrator, EcoCrowd also had taken the partial role of a vertical partner. It strived to coordinate how downstream customers leverage and utilize the services provided by the ecosystem. This situation had emerged when the downstream markets were novel and suitable vertical partners were not available to join the platform.

Although the ecosystem driven VNC was found to be open for innovation partners, some of the platform sponsors kept strict control on how activities are pursued. The representative of EcoCrowd stated, for example, "We need to proactively innovate and figure out next generation products together [with our upstream partners], rather than reacting to what other members of the ecosystem are doing. We have this ecosystem development process for that, but the real customer cases are driven through projects. There is an overlap". This indicates that the platform sponsor built certain safeguards as part of ecosystem management activities to limit emergence of solutions that may undermine its core businesses. These safeguards also steered the innovation activities. However, due to these constraining factors, some of the customers started to seek adjacent ecosystems that can provide better matching counterparty as they felt the environment too constraining and their ideas were not always heard. Strategically this implies that the platform company not only needed to be aware of the competition landscape within the ecosystem and between ecosystems, but it also needed to be aware of any underserved customer needs and underutilized offerings. This awareness was eventually achieved through active collaboration with both upstream and downstream customers and through inquiry of their preferences. EcoCrowd representative stated, "It is challenging to know or decide who is leading coordination and communication [in partner and customer companies]. There are global challenges as the firms possess global customers and a global offering. We operate globally and partners and customers are spread out across the world which can cause difficulties. We need to actively discuss with them.". Figure 3 illustrates the ecosystem driven VNC of an open platform ecosystem.

4.2 Upstream producer driven VNC

The value network configuration analysis of MediaLab reveals that by closing the downstream segment of the ecosystem, the platform sponsor externalized some of the innovation activities to the upstream markets. Such a value-network configuration can be considered as upstream-producer driven. In this ecosystem, the upstream actors were found to opt for partnering strategy as the rivalry among the companies in the segment drove them to balance how many platforms the participant can participate and how to access the potential downstream markets.

Before MediaLab opened the upstream segment, it struggled with innovating new digital businesses due to the failure in building effective organization. The transition enabled the platform company also to gain access to appropriate horizontal partners and their complementarities. However, the platform company wanted to ensure tight integration with downstream markets, thus it kept the downstream segment closed. Moreover, the degree of openness was not always a clear-cut line as the platform company also allowed partly-owned and peripheral subsidiaries to participate in a downstream customer role. MediaLab representatives recalled, for example, "It was a great idea to launch the Startup Challenge for engaging with potential innovation partners and [upstream] acquisition targets. However, our own organization functions in silos which isn't always the best for external liaison". Hence, the activities remained separate between the platform management process and the downstream service acquisition and deployment activities in MediaLab. Figure 4 illustrates the upstream driven VNC of a semi-open platform ecosystem.

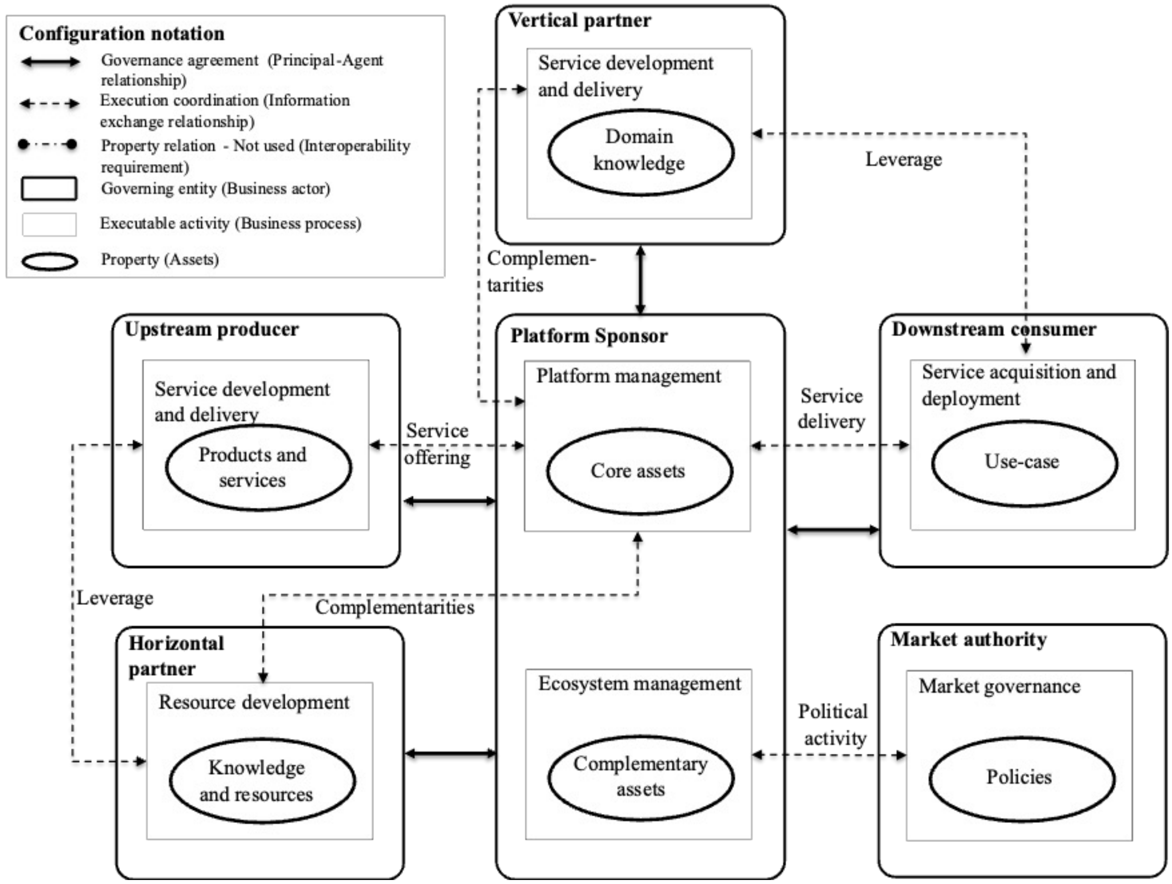

Figure 3. Upstream and downstream segments are open in an Ecosystem driven VNC (Source: Authors' own work).

4.3 Downstream customer driven VNC

The value-network configuration analysis of Locality reveals that by constraining the upstream producer segment, the platform sponsor moved most of the innovation activities to the downstream customer and vertical partner segments. This semi-open value-network configuration can be considered downstream-customer driven. In the case of Locality, the complementarities emerged from the internal sources of the platform company. However, restrictions in the upstream segment had a crucial impact on the downstream markets as it put constraints on the domain knowledge and innovations that the upstream markets provide, thus limiting what a downstream market can acquire as well. Moreover, this selection steered the availability of vertically integrated partners resulting in a situation where only the partners that did find the use-cases of the downstream market segments feasible wanted to join the platform. Locality representative recalled, for example, "Nowadays we want to build industry solutions for specific use-cases through our platform and it requires us not only to engage with the right customers but also with the right industry partners. It has not always been easy". Locality also identified that defining the value creation and value sharing logic in the network was challenging. The unique configuration of the ecosystem members and the products offered indicated to Locality that similar multi-sided markets did not exist. Hence, the platform company needed to experiment and innovate with customers to find the model for value creation and value sharing. Figure 5 illustrates the downstream driven VNC of a semi-open platform ecosystem.

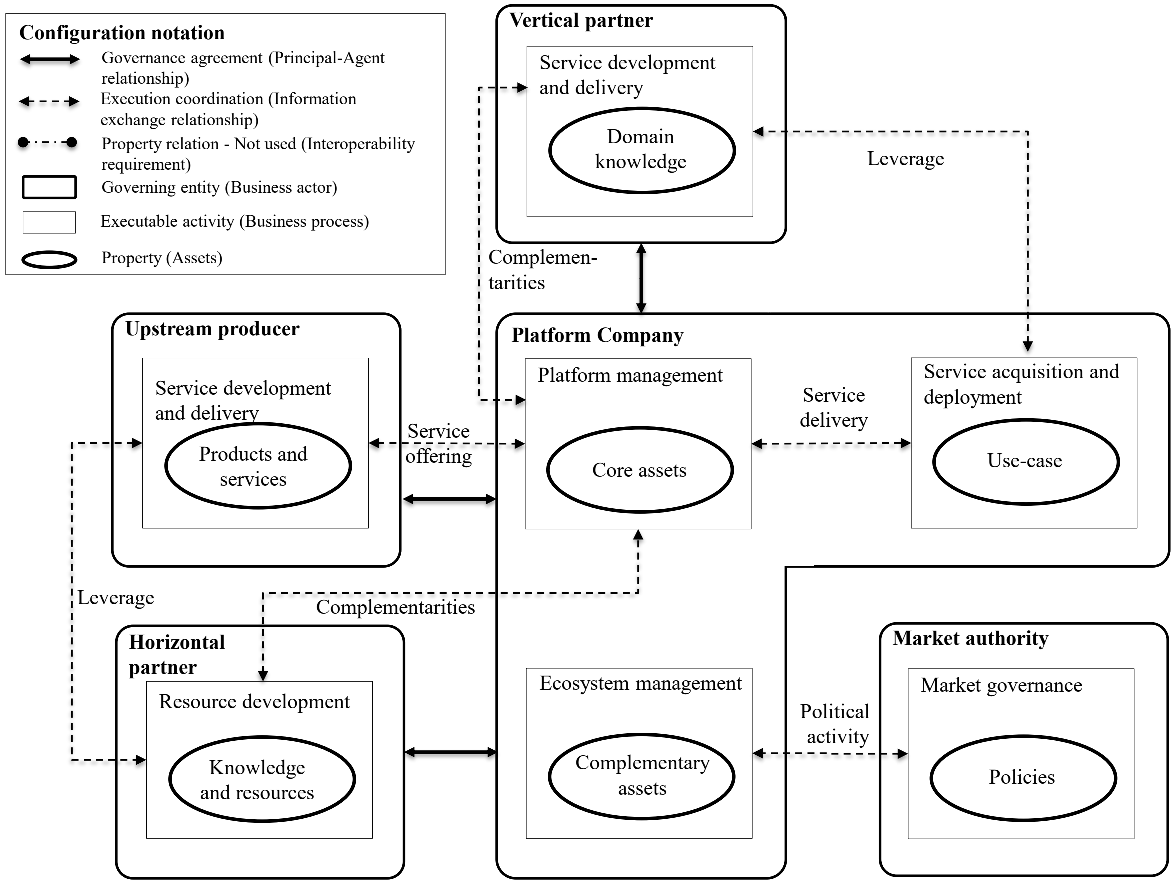

Figure 4. The upstream segment is open in an Upstream driven VNC (Source: Authors' own work).

4.4 Partner driven VNC

The value-network configuration analysis of TechMove reveals that by closing both the upstream producer and the downstream consumer segments, the platform sponsor internalized most of the innovation activities, as well as externalized resource sourcing to the horizontal and vertical partner segments. In this configuration, the horizontal and vertical partners were forced to opt for a supplier strategy as the platform sponsor prevented them from becoming upstream producers or downstream customers. However, the roles were not always especially clear as some of the partners did strive to seek a position that was closed by the platform company. The representative of TechMove stated, "Cooperation between organizations is becoming a critical factor. We have to agree who is communicating with whom and how responsibilities are divided. We have to build a layered thinking model. If something happens, we have to know who must act. ... This [internal customer and external partner] on-boarding process changes the way of thinking". To overcome this challenge, the platform company had differentiated the operations of technology management, partner collaboration, and business management in their operations.

Before establishing the platform ecosystem, the platform company had a strong linkage between the upstream services and downstream use-cases, hence they followed a linear innovation model. Moreover, the lack of replicable components and complementarities prevented the company from achieving scale benefits of the platform. This constraint motivated the platform company to liaise with vertical partners for innovation, which in turn allowed it to identify similarities in different downstream use-cases and to map demands into categories and then shaping the upstream services as well. Hence, the intermediate role of a platform was crucial in transforming the operation

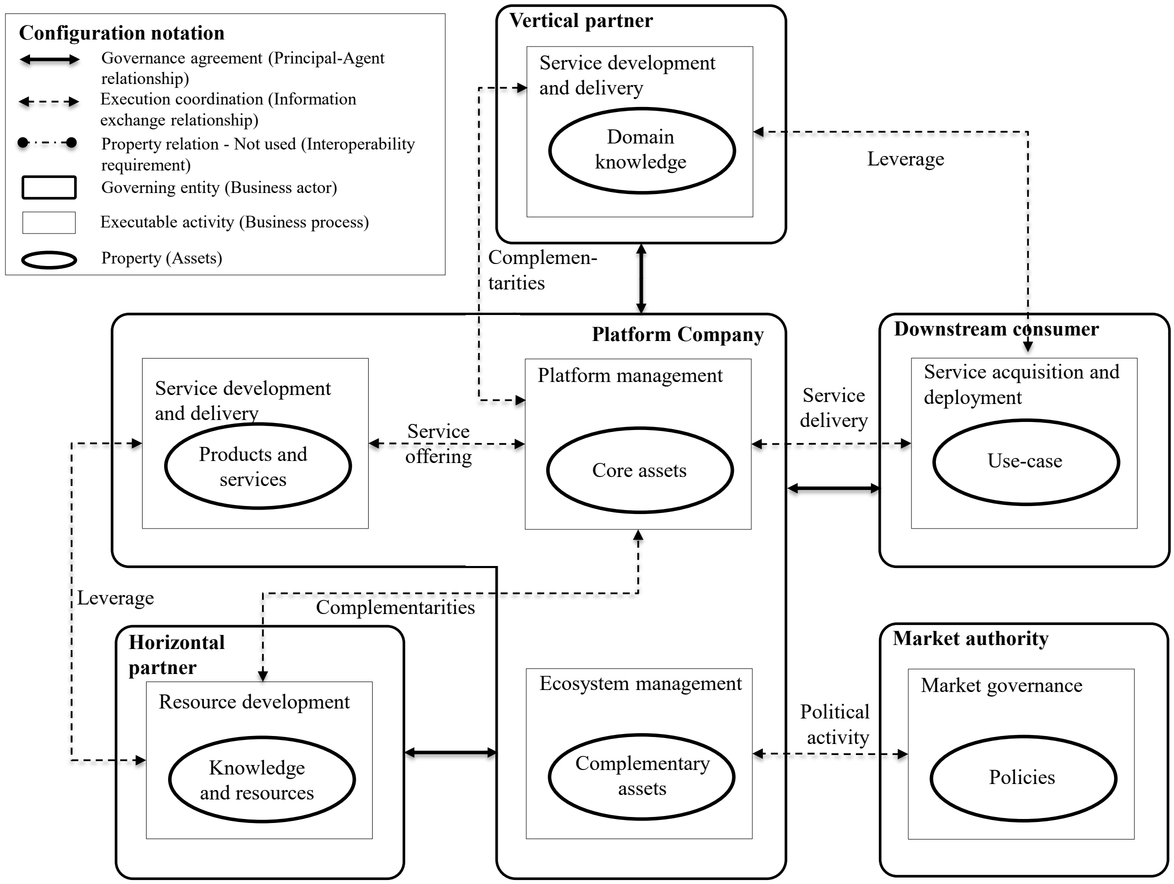

Figure 5. The downstream segment is open in a Downstream driven VNC (Source: Authors' own work).

model in the platform company. TechMove's platform unit representative told us, "To be able to learn differences and similarities [between different use-cases], we want to be part of this building phase so that we can observe how external [partners] are building solutions for us. The challenge is that, at the moment, practically there is no standardization available for a platform ... The idea is that we provide the platform for providers, and they provide solutions that comply with the specification". Figure 6 illustrates the partner driven VNC of a closed platform ecosystem.

4.5 Configuration changes

For these four characteristic configurations it appears that the configuration of an ecosystem is dynamic. As expected, if the ecosystem was closed, it could be opened in the upstream direction to increase the rate of supply-side innovation, or it could be opened in the downstream direction to allow the monetization of platform assets and to increase the flow of demand-side innovations. To illustrate this point, we will use TechMove as the first example. Initially TechMove started with a closed partner-driven VNC, although it had already started planning to open both the upstream supplier and downstream consumer segments. The plan was to outsource some of the internal units in the upstream segment and to allow external companies to provide services in the platform, and to open downstream markets to new external customer segments. In doing so, the platform company wanted to become more driven by downstream customers and the ecosystem rather than being driven by partners. However, these changes were expected to take several years to complete.

Continuing with MediaLab as the second example. The platform for starting new businesses was established in a closed mode, however, the focal platform company struggled with the slow

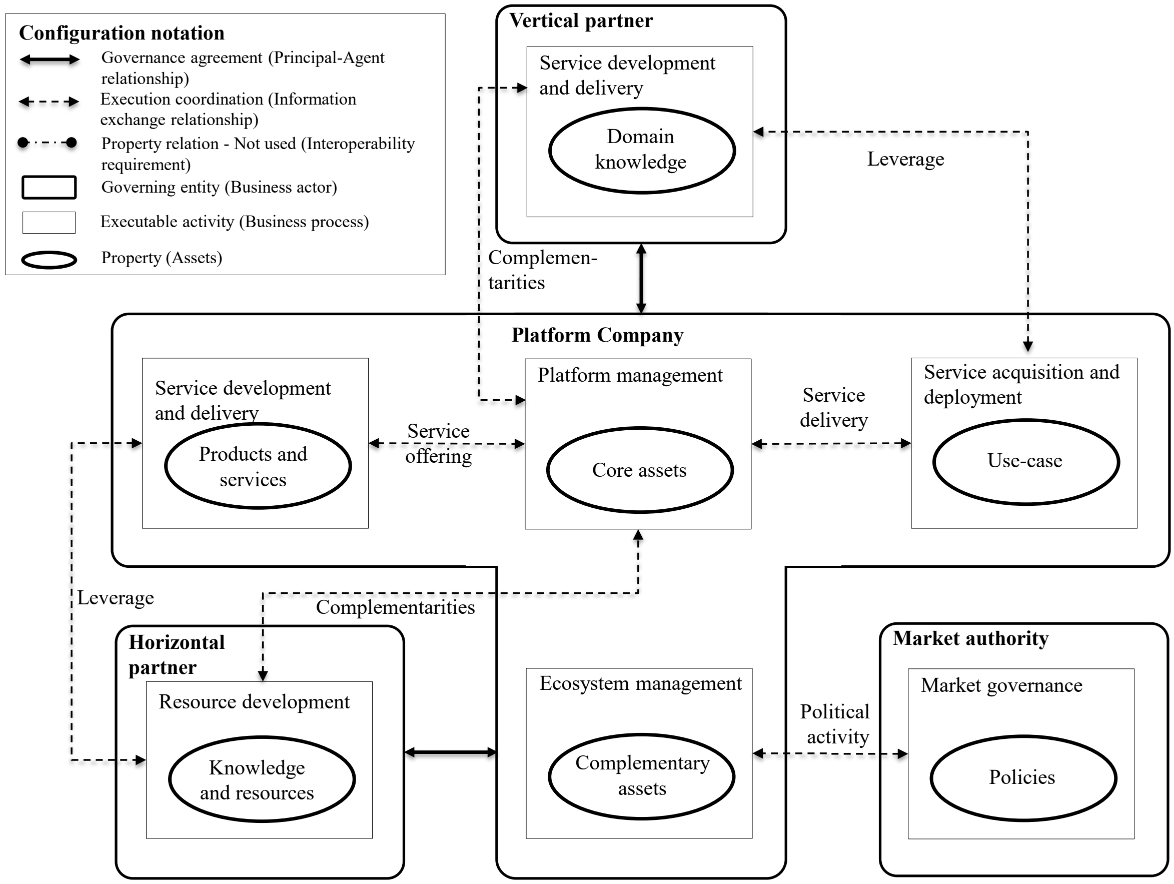

Figure 6. The upstream and downstream segments are closed in a partner driven VNC (Source: Authors' own work).

pace of business acquisitions and the low success rate of innovation in the internal ventures. These factors motivated the company to open the upstream segments and to innovate with horizontal partners. Transition was relatively fast as the company had already identified potential partners and upstream participants in their earlier initiatives.

EcoCrowd, in turn, was established in a closed mode. The platform unit, as an internal venture, strived to create added value for customers through innovations and to increase the competitiveness of the company. However, right from the beginning, the company lacked knowledge and suffered the slow pace of innovation, which motivated it to seek tighter links to the ecosystem participants for the accelerated rate of innovations. Hence, the ecosystem got opened to all directions quite soon after the establishment of the platform to enable the emergence of wider industry solutions.

As these examples illustrate and the results indicate, the strength of the links between actors and activities, as well as the power balance between the entities vary. In one extreme, a platform company may take a passive role in governing innovation activities, and by doing so, the platform company transfers most of the power relating to the activities to the partner and customer segments. In this case, ecosystem participation and the partner activity are purely market driven, meaning that only those partners and customers contribute to the ecosystem innovation who truly believe that they can bring in novel innovation items in that only those can also enable value capture. InnoCity, for example, has opted for a passive role in defining the value capture logic due to the non-profit nature, as well as it has transferred the decision-making power to the partners and motivated several novel organizations to join and to innovate. It appears that in the other extreme, a platform company holds strong control over the value creation logic and innovation, however, none of the case ecosystems in this research represent such an extreme case.

The configuration change analysis of the ecosystems suggests that the configuration changes required a platform company to collaborate with the key stakeholders from each customer and partner segments and to plan how the deployment activities and innovation initiatives were carried out. One of TechMove representatives recalled after the establishment, for example, "[when transferring services to the new model], the major issue that must be resolved is the understanding of who is doing and what. Also, the organization model that is running [platform services] needs to be sorted out". These points suggest that, in the early phase of evolution, the TechMove ecosystem required the clear roles of internal customers and external partners not only to run operations smoothly, but also for communicating responsibilities and processes appropriately. Hence, the changes in the business layer also cause changes to the activity layer in the VNC.

In addition, the business level analysis of the ecosystems indicate that the configuration changes required strategic alignment within the platform sponsor organization to ensure resources and organizational commitment. For example, one of the TechMove top managers recalled after the establishment project, "A lot of time is required to build the platform [ecosystem]. It is not a fast process. It takes big actions and commitment and vision on all levels. Currently there is a potential set up, themes are widely discussed in the strategy, and it is introduced to the company wide architecture steering. There is also top management support for this". Hence, the platform turned out to be much more than just a set of technological components and processes, but it required strategy and cultural changes in the company as well to help innovation to materialize.

5 Discussion

This study began by asking two core questions: *what are the value-network configurations that platform- based innovation ecosystems can adopt;* and *what are the strategic roles of its assets, activities and actors within these configurations*. To answer these questions, we studied five real-world business-to-business digital-platform innovation ecosystems and their structures. The evaluated cases generated several insights that help us to elaborate the configurations of a platform ecosystem and then contribute to the platform ecosystem literature.

5.1 Contributions

It was shown in the four characteristic VNCs that the active relationships on the business, activity, and property layers make a VNC unique. In the studied cases, it was found out that the business actor who provides the platform with complementarities tends to be a non-integrated business actor (i.e., a stand-alone platform company). This intriguing characteristic also indicates that a potential merger and acquisition activity tend to shift the source of complementarities to a new customer segment. Implication to innovation is that the extension of a platform scope (e.g., new product category or technology) also implies the change in a platform configuration due to the changes in the required horizontal or vertical knowledge sources. Our study contributes to the understanding of platform boundary choices (Boudreau, 2017; Gawer, 2021) by pointing out that the scope of a platform firm, the configuration and composition of the platform sides and the interfaces the platform utilizes are interlinked through the three layers in a VNC. And by doing so, theoretically, we build the linkages between the theories of property rights, information exchange and transaction cost, which are the core theories of the VNCs in our study.

Two of our cases represent the type of an ecosystem-driven VNC, i.e., the open configuration. We argue that the intermediary role of a platform sponsor in the ecosystem driven configuration drives the platform sponsor not only to choose the best value-creating partners, but also to allow peripheral and lower value-creating customers and producers to participate in innovation in the ecosystem. This condition also motivates the ecosystem participants to seek other platforms to avoid platform lock-in and to manage competition within the segment. Most of the extant platform ecosystem studies (e.g., Ansari et al., 2016; Inoue and Tsujimoto, 2018, Karhu and Ritala, 2021) have examined cases that fall into the ecosystem-driven VNC category. Moreover, typically the cases have examined the dominant platform companies on the markets. Our examination exhibits the similar ecosystem configuration but for the smaller and non-dominant platform ecosystems. In particular, it was found to be crucial in the ecosystem driven configurations that upstream producers were able to leverage horizontal partners' resources in their innovation activities. This also applied for the downstream consumers in that they were able to leverage the domain knowledge of the vertical partners. However, this information exchange relationship on the activity level is not clearly visible on the business actor level due to the intermediating role of a platform sponsor.

One of our cases represents the upstream producer driven VNC. In this configuration, a platform company closes the downstream markets by limiting who can participate in the platform as a consumer, thus it also puts constraints on the information of the different use-cases and deployment scenarios. Hence, the rate of innovation decreases due to the limited information. The extant literature has shown the constraining effect of vertical integration (Rietveld and Eggers, 2018), but what it hasn't shown is how the interdependency between upstream and downstream industries has implications for value network configurations (Adner and Kapoor, 2016). We illuminated this topic by illustrating a scenario in which a platform company extends its business scope to novel downstream consumer segments by engaging with adjacent upstream producers. Although the downstream segment is closed in the upstream driven VNC, we argue that the platform company can reach the required domain knowledge through vertical partners' complementarities. However, it is required that the downstream segment use-cases are somewhat established in order to make sure that also vertical partner knowledge has been created.

Our study also examined the configuration of a downstream customer driven value network – mirroring the case of an upstream driven VNC. A platform sponsor in this configuration not only can utilize the assets it has, but also can shape the downstream consumer segment by selecting the contexts and use-cases that fit well into its strategy. While the extant strategy research tends to examine the platform entry as an entrant decision (Gawer, 2021; Karhu and Ritala, 2021), our study supplements this stream by illustrating the constraints of a platform entry as a platform sponsor decision. By acquiring and integrating new upstream producers to the platform, a platform sponsor also enters to new downstream markets and introduces new vertical partner segments and their partners into the platform.

Finally, the configuration of a partner-driven value network, also exhibited in our study, is variably understood in the existing literature. Some refer to this configuration as an internal platform (Gawer, 2009; Gawer and Cusumano, 2014), but we argue that the inclusion of the horizontal and vertical partner segments as well as the market regulator to the ecosystem renders the configuration more multifaceted than being purely internal. The studied case exhibits that the downstream units provided services to the subsequent linear downstream markets and the upstream units extensively leveraged external knowledge sources in the form of horizontal partners' complementarities. This took place through the innovations that partners were able to provide. This interplay in turn increased the value of the whole platform.

5.2 Implications to theory

Our study exhibits that the platform itself, the interfaces of it, its design rules and the configuration of the ecosystem may change over time, allowing the structure to evolve and develop. The existing literature is divided into what parts of a platform ecosystem may change over time. For example, largely cited Baldwin and Woodard (2009) posit that in a platform architecture only some of the components may change over time and it is the platform logic and design rules that remain "a set of stable constraints" over time, as well as the interfaces need to be stable. We argue that, although the different configurations can be categorized into static theoretical archetypes, in practice, none of the platform-ecosystem-configuration attributes remains static over time. Instead, the change on all levels is an inherent feature in the evolution of platform-based innovation ecosystems.

We also find the actor role of a platform owner, presented in the current literature (Tavalaei and Cennamo, 2021; Wen and Zhu, 2019), too constraining as it is not always the ownership which defines the underlying innovation activities, but it is also the wider value-network configuration of a platform ecosystem that dictate how platform activities are managed. Hence, the use of a platform owner should be utilized only when referring to the property layer of a platform ecosystem. We support the use of a platform sponsor (e.g., Hagiu and Wright, 2015; Parker and Van Alstyne, 2018) when referring to a business actor or an innovation governing entity as it better exemplifies actor's contribution to the introduction and emergence of platform innovations among the ecosystem participants rather than focusing on the property rights gained through ownership.

Also, our study exhibits that the producers in a platform ecosystem form the sector of upstream business actors (Roy and Sivakumar, 2010). Their role as complementors (e.g., Baldwin and Woodard, 2009; Wareham et al., 2014) has not been especially clear in the platform ecosystem literature, but typically the platform literature considers an upstream business actor and horizontal partner roles similar in that they both are positioned on the upstream side of the platform (e.g., Ceccagnoli et al., 2012; Gawer, 2021). Our examination not only reveals the crucial difference between the participation strategies of these two segments, but also highlights the intriguing factor of knowledge leverage between them, which has a strong impact on innovation in itself. The role of a horizontal partner as an enabler in a platform ecosystem has been partly identified in the existing literature (Kortmann and Piller, 2016). We point out the information exchange relationship between horizontal partner's resource development process and upstream producer's service development and delivery process. By leveraging the provided knowledge of a horizontal partner, the upstream producer becomes more capable of innovating and offering services to the platform.

Consumers in a platform ecosystem form the sector of downstream business actors (Inoue and Tsujimoto, 2018; Roy and Sivakumar, 2010). Their role as a service acquirer and deployer was found to be crucial for defining the actual context for the services being deployed. This context also influences the selection of vertical partners as their knowledge resources were found to be highly context dependent. On the other hand, the network link of a vertical partner (e.g., Helfat and Raubitschek, 2018) to the platform was found to be relatively weak, or a loosely coupled (Orton and Weick, 1990). This implies that vertical partners are somewhat peripherals to the platform innovation despite their important role in shaping the downstream markets.

5.3 Implications to practice

The description of relationships between different entities in the VNCs will assist managers in identifying the platform and ecosystem configurations of real-world innovation ecosystems. Business managers may utilize our platform ecosystem model further when identifying the strategic roles of their partners, the interplay of innovation activities, and the emerging market structures. This is especially important when organizations are building business networks and ecosystems through collaboration (Jacobides et al, 2018, p.2263).

In seeking an improving market position through innovation, the value-network-configuration model allows managers to better analyze multi-market industry-structures. The generalized model allows utilizing the framework in various contexts and it may help identifying redundant or missing factors and ecosystem stakeholders. In addition, the dynamic phases of the VNC model guide managers in restructuring their business networks over the evolution. Managers can use the openness configurations and their various scenarios in designing their business networks and corresponding entity borders.

Managers establishing new platform ecosystems may face market legitimacy issues during the high-innovation era when the multi-sided market configuration or one of the participating markets is new. For example, Locality needed to work on the public image as the utilization of positioning data suffered privacy concerns from the public. Some of the Locality's novel business model innovations were found to erode the public image and they had to be rejected. By engaging with right partners and customers that reinforced a positive and socially legitimate image of the data usage, the platform company managed to overcome the market legitimacy problems. Our model can guide managers in engaging with the right partners at a right time to the legitimacy work in parallel with innovation. Our findings also support the view that through a coopetition between a platform company and incumbents, platform ecosystems may find market legitimacy sooner than in pure competition (Cozzolino et al., 2021).

As some of our empirical cases evidenced, the platform company's inability or unwillingness to separate its partner and customer segments causes ambiguity in the ecosystem roles. One of the EcoCrowd's upstream customer representatives stated during the interviews, for example, "...one of the challenges we see in the long run is that partner offerings are becoming more and more overlapping, and partners are becoming competitors". In the same ecosystem development workshop, the platform company representative stated, for example, "It is the different interests of partners and the strive to keep the solutions aligned that make the ecosystem management challenging". The platform company strived to control a significant portion of innovation and value creating activities by managing each individual relationship among partners. Hopefully these insights motivate the managers of platform companies to identify the timing when to segregate partners and customers and when to disintegrate the adopted roles of partners for greater innovation and knowledge sharing.

It may appear to be an impossible task to find a full alignment of innovation strategies within a platform ecosystem. We argue that the multi-stakeholder nature of platform ecosystems implies multiple business roles and multiple underlying participatory strategies. This multiplicity renders the overall platform ecosystem strategy to consist of several simultaneous and dynamic innovation strategies. Hence, due to this complexity, the platform ecosystem hardly ever finds strategic alignment with all its stakeholders, but instead it needs to survive in an equilibrium of partial alignment. The results suggest that this complexity may motivate ecosystem stakeholders to also join other ecosystems, hence become multi-homed.

Although our sample did not specifically contain any multi-platform ecosystems, the results suggest that an ecosystem with multiple platforms can be presented as horizontally integrated partner relationships, because in some cases the horizontal partners function as a bridge between adjacent platform ecosystems. For example, some of MediaLab's horizontal partners had their own business accelerator programs MediaLab collaborated with. This was the case with InnoCity as well in that it collaborated with other smart-city programs. Mukhopadhyay and Bouwman (2018, p.52) called studies to address governance and control challenges of these multi-platform cases. In response, we argue that the increased complexity of multi-platform ecosystem innovation can be controlled through appropriate governance agreement and information exchange relationships. However, the cyclical nature of technology evolution brings in a temporal dimension that may disrupt the governance agreements in these multi-platform ecosystems.

Finally, our research contributes to the methodology of platform ecosystem studies. Baldwin and Woodard (2009) list layer maps, design structure matrices and network graphs as the primary means of representing platforms and their complements. We argue that these three can be combined and we propose the value-network configuration method for analyzing the dynamic structures of platform ecosystems.

5.4 Boundary conditions

Although our empirical analysis suggests that the platform ecosystem model can be applied in various contexts, it turns out that the model has two major boundary conditions. Firstly, our model is rooted to the business world as well as to the contexts where a partner and a customer can freely choose the best matching platform ecosystem for its needs. Hence, it becomes the boundary condition that our model can explain structures in competitive markets, but not in the monopolistic or monopsony markets. The reason is that in these corner cases the market power has become so unbalanced that one sub-organization can dictate the rules and norms. Secondly, the model assumes that ecosystem participating organizations are there to make profit for their owners. This argument implies that non-profit ecosystems, for example, do not necessarily function in the same way in innovation. Hence, the boundary condition requires that the innovation and value creation processes yield not only social welfare for the society, but also monetary profits for some of the participating companies.

5.5 Limitation and further research

Although we carried out an extensive literature review and we evaluated five different empirical cases from different ecosystems and business contexts, our study has some limitations which open opportunities for further research. Firstly, our study solely focused on the business, management, and economic literature, hence some excluded fields may handle the same topic, but from different perspectives. Especially technology related literature may provide some technology innovation management related insights for the platform management. As was also the case in our study, digital platforms have become the dominant mode of platforms in recent years, but it remains a question how different digital platform models compare in terms of technology structures and strategies. Secondly, all five empirical cases were selected based on the head-office proximity to the authors. Hence, all in-person interviews and all data collection took place in Finland. There may be some cultural or business environment related factors that remain to be revealed that our empirical base did not provide, hence other scholars are urged to replicate the empirical evaluation in various regions and contexts. Thirdly, being qualitative in nature, our study did not provide any statistical support for our propositions. Hence, further hypothetico-deductive studies are needed to find more rigor support for our model. For example, the quantitative aspects of the actor relationships may reveal new perspectives to the topic.

6 Conclusion

Theoretically, the attempts of a platform sponsor to shape its supplier (upstream) relationships and its customer (downstream) relationships for improving value-capture through innovations explain only a half of the truth of the emergence of different value-network configurations. To understand a platform-based innovation ecosystem's design, the article examined four characteristic value-network configurations, namely, ecosystem driven, upstream producer driven, downstream customer driven, and partner driven VNCs. These network graph diagrams capture the information exchange considerations (Gill, 2021) and business network relationship considerations (Möller and Halinen, 2017) in platform ecosystems' innovation and value creation. The article then examined the dynamics of the value-network configurations in the multilateral business-to-business ecosystems. Collaboration for innovation in a business network was found to be not only complex, but also effective in differentiating from other adjacent ecosystems. However, the managers of platform sponsors need to understand the structures and roles of the ecosystem in order to effectuate the opportunities of a platform.

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Appendix A.

Table A.1. The case comparison of different real-world platform ecosystems

Case name	EcoCrowd	InnoCity	MediaLab	Locality	TechMove
Ecosystem age / Platform type	5 years / Data platform for building automation	10 years / Innovation project platform	10 years / Business development platform	5 years / Data platform for positioning	less than 1 years / Cloud platform for telecom services
The pre-establishment situation	An internal venture strived to create added value for customers and to increase the competitiveness of the company. The company lacked knowledge and suffered from the slow pace of innovation.	Local city authorities struggled with the inability to engage local companies to joint innovation, nor were they able to experiment with novel technologies and business opportunities in an agile way.	The focal platform company had struggled with the slow pace of business acquisitions and the low success rate of internal ventures.	The platform company wanted to leverage their positioning data for novel markets. Market legitimacy issues motivated the company to choose transparent and open collaboration practices.	The company had several technology solutions for its various services. Target was to gain a new core competence on an ecosystemic approach to the digital cloud platform.
Situation at the time of data collection	The ecosystem governance routines and value creating activities have developed, but the platform company still sees that the ecosystem configuration is not deliberately managed.	The platform company has chosen a project-oriented mode to drive innovation, in which partners and customers are chosen per project basis.	The platform company has two upstream start-up segments. Ties to other accelerator programs and companies utilizing similar programs for horizontal integration.	The platform company limits a partner and downstream customer entry to avoid eroding legitimacy.	The platform company liaises with horizontal partners for technology sourcing and vertical partners for deeper knowledge on service transition.

DS=Downstream consumer, US=Upstream producer, HI=Horizontal partner, VI=Vertical partner

Table A.1. (continued) The case comparison of different real-world platform ecosystems **(continued)**

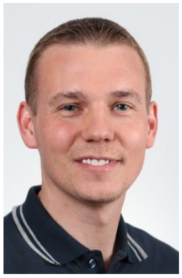
Case name	EcoCrowd	InnoCity	MediaLab	Locality	TechMove
Ecosystem mission	The ecosystem brings more value to customers through improved movement in buildings and through the availability of additional value-added services.	The ecosystem solves public sector problems through the solutions developed and offered by private companies and residents.	The ecosystem finds new external business opportunities for existing internal business units and functions as a platform for M&A and start-up activities.	The ecosystem improves public and private sector services through the increasing awareness of people movement.	The ecosystem enables the strategic and operational transition of legacy telco services to cloud-based technologies.
Platform Ecosystem configuration and stakeholders	Semi-open (partly closed VI). A few HI. Several US and many DS.	Open to all. All parties are welcomed. The platform company acts in an intermediary role.	Semi-open (closed DS). Selective on who can become a partner or a customer. Internal business units of the platform company (DS). Start-ups (US).	Semi-open (closed US). Critical selection of upstream customers. Partly internalized US. Industry specializing (VI).	Closed. A few internal US and multiple DS. Partly open for external HI and VI partners.
Distinctive stakeholder roles	Product partners (US) provide complementary offerings for increased utility. Liaison with regulatory authorities.	HIs provide technologies and standards, decreasing the time needed to innovate. VIs support the identification of innovation areas and seeking of funding. Regulatory authority collaboration is a project and ad-hoc based.	The platform company coordinates collaboration between different partners (HI, VI, DS, US). Collaboration with market authorities on a case-by-case basis.	Scalable technological components provided by global partners (HI). Collaboration and information exchange with other regional peers. VIs help DS to utilize the information and to build local platforms. Active collaboration with market authorities.	Technology providers (HI) offer scalable and replicable components for upstream units. VIs offer pin-point solutions for specific needs. Collaboration with regulatory authority to keep the ecosystem closed (a seek to prevent infrastructure sharing)

DS=Downstream consumer, US=Upstream producer, HI=Horizontal partner, VI=Vertical partner

Table A.2. The information exchange matrix

Destination	Source: Knowledge development	Service Development and delivery	Platform design and management	Service acquisition and deployment	Resource development	Ecosystem management	Platform market governance
Knowledge development	-	-	Provides information of contexts the services are being deployed	Provides the information of use-cases that are being solved	-	-	-
Service Development and delivery	-	-	Provides offering information and platform rules	-	Provides access to resources in technologies and standards	-	-
Platform design and management	Announces domain knowledge being offered	Announces the offered complementarities	-	Provides the information of use-cases that are being solved	Provides access to resources in technologies and standards	Signals constraining factors to value-creation logic (markets)	-
Service acquisition and deployment	Provides access to knowledge	-	Provides the features of the platform	-	-	-	-
Resource development	-	Indicates required technologies in developing complementarities	Indicates the technologies and standards are required to build core platform assets	-	-	-	-

Biographies



Jarno Lähteenmäki. Jarno Lähteenmäki is a Post-Doctoral Researcher in Network Economics at Aalto University. He received his MSc in Communication Engineering from Aalto University in 2015, and he received his DSc (tech) in Network Economics from Aalto University in 2023. His research explores how ecosystems are transforming due to disruptions, new business models, and novel technologies, focusing on strategy, M&A, and venturing. He has worked for more than 20 years in business development roles in communications companies.
CRediT Statement: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Roles/Writing - original draft, Writing - review & editing.

Juuso Töyli. Juuso Töyli is Professor of Operations and Supply Chain Management at Turku School of Economics at University of Turku and Adjunct Professor of Network Economics at Aalto University. His research interests include policy issues and the diffusion of mobile technologies and their effects. He is further interested in business games and their development. Within operations and supply chain management, his research is mainly focused on firm and supply chain performance (financial, logistics cost, and operations performance) and how these are related to various issues like strategy choices, outsourcing, low-cost sourcing, geographic dispersion, and sustainability.
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