# Network Orchestration: Managing the Scaling of Platform-based Ecosystems

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**Abstract**

*Multi-sided platform-based ecosystems have emerged as an important organizational arrangement and business model that sees the transformation of pipeline economies into network economies. How managers in these ecosystems approach scaling—as a means to grow their firms—is qualitatively different from what is prevalent in pipeline economies. This paper investigates how two platform companies in B2B markets scale their platform offering to users. We find that the type of platform, whether it is an innovation platform or transaction platform, involves different network effects. We show that innovation platforms need direct orchestration due to a lack of network effects, whereas transaction platforms follow a market logic which makes it easier to create network effects without direct interference by management.*

**Keywords:** Scaling, platform ecosystems, orchestrating, network effects.

## 1. Introduction

The increasing importance of multi-sided platform-based ecosystems, such as those associated with Sony with its PlayStation or AirBnB, has made them the source of considerable interest to academics and practitioners (Gawer, 2021; McIntyre et al., 2021; Parker et al., 2016). Unlike the firms based on pipeline economies (Parker et al., 2016)—i.e., those using the industrial paradigm of mass production—firms based on network economies (Parker et al., 2016)—i.e., platform-based ecosystems—seek growth through a new logic (Parker et al., 2016; Shapiro et al., 1998) (Henfridsson, 2020). The new logic sees firms in networked economies scaling in a qualitatively different way from the firms of pipeline economies (Henfridsson, 2020).

The differences in scaling arise from *supply economies of scale* in contrast to *demand economies of scale* (Parker et al., 2016; Shapiro et al., 1998). The rise of industrial firms is based on technological innovation on the *supply* side (Chandler, 1990). Scale is driven by standardization, coordination, and control exercised through vertical organizational structures (Chandler, 1990; Henfridsson, 2020; Teece, 1993). In comparison, the rise of networked economies or platform-based ecosystems is based on technological innovation on the *demand side* (Parker et al., 2016). Growth is achieved by scaling the ecosystem; the external network of contributors and users of the platform (Jacobides et al., 2018; Parker et al., 2016; Tiwana, 2013).

In these market contexts, the iconic scaling issue is one of '*the chicken and the egg':* scaling any of the market's sides requires the other side(s) to be scaled first (Parker et al., 2016; Shapiro et al., 1998). Our understanding of scaling and growing multi-sided platforms, is based on economic theories of multi-sided markets (Hagiu & Wright, 2015; Rochet & Tirole, 2003) and network effects (Katz & Shapiro, 1985; Shapiro et al., 1998). Network effects theory assumes that certain market structures—markets that are composed of several sides bound together in a network—shape the emergence of economic organizations. The implicit assumption is that market forces are the most important lens when understanding growth (Teece, 1993).

However, Chandler (1990) identified the dual roles of technology and management in how firms grow, reminding us that firms shape markets based on managers' investment decisions. This knowledge contrasts the widely shared assumption of economic theories that markets shape economic organizations (Teece, 1993). And so, our point of departure, when considering the scaling dynamics of multi-sided platform ecosystems, is to focus on the role of management. Thus, this paper aims to answer the following research question: *How is scaling managed in platform-based ecosystems?*

To answer that question, we present scaling as a management strategy labeled "network orchestration". Then, using that theoretical backbone, we undertook a comparative study of two platform firms, one a software-as-a-service platform, focusing on data generation for industrial customers. The other platform is based on blockchain technologies and distributed autonomous organizations. We found that network orchestration differs depending on the strength of network effects. In addition, we found that

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the different types of network effects present in innovation platforms compared to transaction platforms also impact network orchestration.

The paper precedes as follows. The next section presents the key concepts that make up our theoretical background. Then, we present our research design and the research settings. Our findings, including the cross-case analysis, lead to our discussion and conclusions.

## 2. Theoretical background

### 2.1. Multi-sided platforms

A distinguishing characteristic of platform-based ecosystems is multi-sidedness. A platform in the middle connects and enables interaction between the production and consumption sides of the ecosystem (Jacobides et al., 2018; McIntyre et al., 2021; Tiwana, 2013). The production side comprises actors, or complementors, who produce complementary outputs that interact to produce the platform's final offerings (Jacobides et al., 2018). The consumption side comprises actors, or end users, who consume the final offerings. The main types of these platforms are innovation and transaction platforms. Innovation platforms, such as Apple's iOS, "facilitate the development of new, complementary products and services, such as PC or smartphone apps, that are built mostly by third-party companies without traditional supplier contracts". Transaction platforms, such as Uber, "are intermediaries or online marketplaces that make it possible for participants to exchange goods and services or information" (Cusumano et al., 2020, p. 28).

### 2.2. Scale and growth

According to West (2018, p. 15): "Scaling simply refers ... to how a system responds when its size changes". It is how the different components of a system change as the system changes in size (West, 2018). In contrast, growth is "a special case of a scaling phenomenon" (West, 2018, p. 27), where a system quantitatively changes in an upward branching manner—it scales up—and can be represented by a growth curve. A firm *grows* as its components—such as the number of employees and sales, assets, revenue, market share, and expenses—in relation to each other scale up. In that sense, scaling is the relation between size-related concepts that work as growth measures (Schulte-Althoff et al., 2021). Crucially, scaling is a managerial strategy underpinned by a concern for what needs to be scaled for a business firm to realize growth goals (Chandler, 1990).

A common way to analyze the growth of firms is through "economies of scale". Economies of scale concern a firm's optimal size in revenue (Stigler, 1958), making "revenue" and ideas such as the marginal cost of production measures of size. However, as Henfridsson (2020) points out, the largest company in the world in terms of revenue is Walmart. Yet, Walmart is not even on the top 20-list of the most valuable companies in the world, a list topped by multi-sided platform companies of Facebook/Meta, Google/Alphabet, Microsoft, and Apple. This example highlights the limitations of using revenue to measure size when analyzing firm growth in network economies. In network economies, the primary measure of firm growth is usually the user base's size, which becomes the goal of scaling (Henfridsson, 2020; Huang et al., 2017; Parker et al., 2016).

This approach to scale and growth is based on network effects theory. A *network effect* arises when the value of using a product/service offering for one actor is contingent upon other actors using the product/service offering (Katz & Shapiro, 1985; Parker et al., 2016). The often-cited example is the telephone: for a phone to be useful, there must be others to call. If no one else owns a phone, the value for the one person with a telephone equals zero. Thus, generally, it is better to be part of a larger network than a smaller one (Shapiro et al., 1998), creating a strategic imperative to grow the network. The user base of an offering can be said to comprise a network structure: every user is a node, and the more connections that can be made, the more value is generated for each user, and, as an effect, the network grows (Henfridsson, 2020). This example illustrates *same-sided network effects*; they occur on the network's demand side and not its production side.

A multi-sided platform enables *cross-sided* network effects (Evans & Schmalensee, 2016; McIntyre et al., 2021; Parker et al., 2016; Tiwana, 2013), where the platform's production and consumption sides affect each other's economic behavior (Hagiu & Wright, 2015), creating a multi-sided market (Rochet & Tirole, 2003). E.g., the more customers with iPhones, the more application developers will be attracted to produce iPhone apps. Likewise, the more iPhone apps, the more customers will be attracted to buy an iPhone.

These network effects can produce positive or negative effects(Parker et al., 2016). A positive same-side effect occurs when participants on one market side benefits when the participants in the same market side grow; the more customers that buy a telephone, the more connections can be made between them. In

contrast, a positive cross-side effect occurs when actors on the one side benefit from increases in actors on the other, as in the iPhone example above. A negative network effect occurs when an increase in the size of a platform ecosystem reduces value for the ecosystem's members. For example, too many firms on the production side can increase competition and hamper the possibility of mutual value creation and collaboration. There can also be negative cross-side effects if, for example, Netflix, due to the involvement of several independent competing firms in producing their content, creates legal forms that constrain viewers' autonomy. In that case, it could lead to their migration to other platforms.

### 2.3. Network orchestration as scaling strategy

Teece (1993) notes that, for Chandler, what matters is *not* how firms exploit economies of scale; with technology-based economies of production, there is no optimal firm size arising from a market's structure. Instead, as the technology is available for all—it is a shared resource in the form of technological infrastructure (Hanseth & Lyytinen, 2016)—the firm size and market composition are explained by "how and why different industrial firms respond to and manage the opportunities afforded by new technology" (Teece, 1993, p. 213). The main contribution of Chandler was the role of management in realizing growth potential through three types of investment choices: 1) invest in production facilities of sufficient size, 2) invest in product-specific marketing, distribution, and supply networks, and 3) invest in a particular governance structure and management apparatus for coordinating activities and allocating resources (Chandler, 1990). In other words, technological infrastructures offer an action potential for management to reach growth goals through scaling.

Following those insights on the role of management vis-à-vis scaling, we define network orchestration as *making coordinated investments* in items (such as resources, assets, products, and activities) on the production side to enhance *network effects* on the consumption side. This definition extends the concept of network orchestration (Autio, 2021; Dhanasai & Parkhe, 2006) to apply to all sides of a multi-sided platform ecosystem. To create value for the platform ecosystem, the focal firm—usually, the firm that owns and provides the platform—must engage in network management to attract and keep third-party actors (e.g., hosts and guests in the case of Airbnb; or game developers and players in the case of PlayStation) (Autio, 2021; Jacobides et al., 2018; Tiwana, 2013). Thus, network orchestration (Dhanasai & Parkhe, 2006; Nambisan & Sawhney, 2011; Parker et al., 2016) requires firms to develop the capability to build and develop external networks rather than the firm's internal asset base (Nambisan & Sawhney, 2011). Network orchestration is thus useful for exposing the firm-based capacity of scaling network effects as they seek to become more economically valuable due to the size of an external network.

A crucial aspect of our definition of network orchestration is how the production and consumption sides are connected through the actions of the end users (Autio, 2021; Jacobides et al., 2018). An end user does not just choose what to buy and not buy among the different components produced by the various suppliers of the offering. Importantly, they can combine the complementary outputs from the production side into the final offering at their discretion, becoming a source of generative inputs into the ecosystem (Zittrain, 2008). For instance, returning to the example of Apple`s iOS ecosystem, the customer of an iPhone decides which apps to install and use, not Apple and the different app contributors. The iPhone does not come prepacked by the production side with a definite set of apps. This generative role of the customer produces two-sided network effects (Parker et al., 2016): the more app developers, the more customers, and vice versa.

## 3. Research setting and research design

Following Eisenhardt, we used theoretical sampling to identify two cases where the scaling phenomenon was "likely to occur, and case designs where the similarities and differences across cases" foster theory building (Eisenhardt, 2021). We selected an innovation platform and a transaction platform of similar ages to provide a nuanced understanding of scaling.

### 3.1. Cases

This research is based on case studies of two organizations: Digitize and BlockInvest. Both names are pseudonyms. Digitize is a software-as-a-service company. It produces and sells an industrial DataOps platform for business-to-business customers in heavy-asset industries. Their customers are in three market segments: 1) oil and gas, 2) power and utilities, and 3) manufacturing. Established in 2016, with headquarters in Norway, Digitize now has an international presence with over 700 employees. The Digitize platform connects existing IT systems—such as ERP systems with other data sources—in customers` organizations by extracting and copying industrial data through an API and storing it in the cloud as raw data. The

platform's value proposition is based on how data is mapped into models that can be contextualized; i.e., it is used for different business purposes, such as performance optimization and predictive maintenance, to assist companies in enhancing their operations.

BlockInvest was also established in 2016 as a 'ventures studio' providing "a platform that will create a decentralized community of digital startups, who can become successful in a world where the odds are otherwise stacked against them". Based on decentralized public ledgers (blockchains), BlockInvest is a Web3 organization. Form having 150 employees, it spun-out groups of about 50 employees as new ventures. Consequently, BlockInvest has about 50 employees, and from an initial portfolio of five ventures into over 30. Each venture is a separate company that offers one or more applications or DApps—or distributed applications.m The value proposition provided by BlockInvest has two related components. First, BlockInvest provides application developers (the ventures) with the tools, resources, education, and services required to develop DApps. Secondly, the DApps in BlockInvest's ecosystem help each other to grow by providing users with relevant services from across the ecosystem. The ventures lower their costs of scaling by sharing services, merchants, content, and users. For instance, a concert promoter (a merchant) may partner with BlockPay (a DApp venture) to allow users to book and buy concert tickets. The user might find out about the concert from their friends through BlockTalk, and—because of the various services and resources provided by BlockInvest to the DApp developers—they can seamlessly use BlockPay to book and pay for the concert tickers. The relevant transactions are validated (and incorporated) into BlockInvest's blockchain by validator nodes. The developers of BlockTalk did not need to build a payment service, as it is already available. Nor, for example, do they need to develop a login service; instead, they can rely on services from BlockID, another BlockInvest venture. Effectively, BlockInvest curates a portfolio of DApps.

### 3.2. Data collection

In investigating Digitize's ecosystem, we conducted 31 interviews from 2019 to 2022. Of these, 25 were done in Digitize, five with customers, and two with partners. We interviewed senior managers, middle managers, and employees working with the platform, the partners, and the customers. The interviews focused on the establishment of Digitize, its platform development, and the ecosystem evolution, both retrospectively and in real-time. The interviews were semi-structured, lasting between 1 and 1.5 hours, and transcribed verbatim. In addition, 119 press releases have been read, 28 documents analyzed, and 14 webinars watched concerning Digitize's platform ecosystem development. To discuss the research and validate the findings, we have had meetings with middle managers every six months, which enhances the trustworthiness of the analysis (Lincoln & Guba, 1985)

Primary data on BlockInvest's ecosystem was gathered from 2021 to 2022 through 10 interviews, comprising: two founders and the chair of BlockInvest; two founders and two community managers from two of the five initial ventures; one founder from a newly created venture; and one founder and the CFO from a venture that had pivoted. In addition, data was collected from the observation of, and participation in, an 'away day' for a technology roadmapping retreat with eight other members of one of the newest ventures. The interviews typically lasted an average of 1.5 hours. Primary data was augmented with secondary data, including company records, white papers produced by BlockInvest and its ventures, promotional videos used during funding rounds, publicly available presentations, and papers given by members of BlockInvest and its ventures. In addition, public and private Internet groups used by all members of the BlockInvest community (including end users) were reviewed, e.g., public and private Discord groups, as well as Twitter feeds.

### 3.3. Data analysis

The authors examined and discussed the empirical material in relation to existing theory in several rounds. The inference that guided the data analysis can be referred to as abduction (Pierce, 1978). The data were first analyzed using a top-down approach using thematic analysis, i.e., theory-informed identification of data-related themes regarding scaling. Discussion between the authors was used to test the emerging themes, culminating in three major themes: the nature of scaling, how scaling is managed, and the role of network effects.

## 4. Findings

### 4.1. Scaling at Digitize

To reach the growth ambitions of acquiring thousands of industrial customers globally, Digitize recognizes the need for an ecosystem consisting of partner firms. Consequently, Digitize scales by co-developing the platform with customers and managing

the scaling according to an ecosystem model while addressing network effects.

**4.1.1. Scaling.** Data that becomes information about industrial reality is the item of economic value that scales. Connecting industrial data to creating value for industrial customers was highly innovative, attracted several investors, and made Digitize a unicorn (a company with a valuation of over $1 billion). Hence, "information about industrial reality" is the size-related concept that Digitize is measured against in terms of growth, i.e., the more information the Digitize platform can produce on industrial reality, the more valuable Digitize becomes.

Digitize co-developed the platform with a few industrial customers engaging in joint project organizations to co-create value in developing the platform, the industrial solutions, and the applications. Based on these co-developments, the platform and the solutions are offered as a standardized software-as-a-service subscription. The co-creation of value takes place on the consumption side due to the novelty of the platform offering. As a manager in Digitize explained: *We are making a new product category, so it is not always easy to know exactly what and how to make it. Our approach to this has then been to work closely with a lot of the customers to understand the problem areas and the data that they use to understand the possibilities that our product gives ... we develop the product in line with our customers*.

The outcome of this, which has important implications for scaling, is a diversity of use cases that are used as reference cases and success stories of how the platform was put into use at a particular customer site. Digitize uses these cases to acquire potential customers and partners. One manager noted: *at the same time, our product gets better and better*. Hence, the more customers that work on improving the business value of the platform, the more overall value the platform creates for each customer that already uses the platform.

The real potential for growth is found in enhancing the number of industrial customers using the platform. As one manager in Digitize put it: *So, our goals as a product company that delivers Software-as-a-service is to deliver a product that we run, and that makes it very simple for our customers to use our product. We have very high ambitions for growth, and we think and hope that many want to buy this product and use it. In order to sell this product to as many as we want, it (the platform) eventually needs to be more and more like an off-the-shelf product that the customers can buy and use themselves*

**4.1.2. Managing the scaling.** Digitize manages the scaling of its platform through investing in co-selling and co-implementation with partner firms. A vital part of Digitize's scaling strategy is to create a multiorganizational ecosystem model around their platform offering. Such an organizational model consists of dyadic co-sell and co-implementation agreements between Digitize and partner firms that make up the overall ecosystem. A partner firm becomes engaged in co-sell and co-implementation through evaluating strategic fit and the level of relational investment. This is based on how well partners perform and deliver actual projects with Digitize, where—if the proper measurements are reached—the result is an official go-to-market model. Attractive business partners have either a global reach to potential customers or possess vital firm-based resources and capabilities. Examples are consultancy firms that help customers develop business strategies alongside a better data image of business operations or IT integration. The critical role of Digitize is to invest in relation-building with these types of partners at both an operational (product workshops etc., where the aim is to provide the partner with knowledge of the platform) and at the strategic level (discussing the experience with sales opportunities in terms of long-term goals).

Scaling is based on partner firms being relatively independent channels for sales and implementation. The partner ecosystem manager explained: *We expect the partner firms to go with us towards the customers so we can co-sell. It is still we who run a lot of the sales, but we position the partner as implementation partners, and that I see as the first investment towards the state where the partner eventually can sell themselves … we are completely dependent on getting a well-functioning partner ecosystem that can help us with scaling of both sales and implementation.*

**4.1.3. Network effects.** The network market context of Digitize consists of four sides. One side is the customer organizations consisting of the three market domains of oil and gas, power and utilities, and manufacturing. Two sides are connected to the production and delivery of the platform: 1) the firms and other actors that can produce applications that will enhance the core functionality and value of the platform, and; 2) firms that produce services together with Digitize on implementing and generating business value from the Digitize platform.

However, before these three sides can be matched and positive network effects can be generated by the Digitize platform, a fourth side consisting of the suppliers of existing systems to potential customers needs to be integrated with the platform. A manager in Digitize explains the situation as follows: *The market is not that broad. So I think we are just "biding our time" in a way…the more customers that buy the Digitize Platform, the bigger chance there is, I think,*

*for partners out there that want to build dedicated applications on top of the Digitize Platform…So that is not an area that we have shut down; we just focus more on system integrators and consultants within digitalization that we see are the most important now ... then there is another interesting partner area that we want to focus more on now … and that are the traditional industrial partners … called Original Equipment Manufacturers, that deliver equipment to the industry. There, we think there is a big possibility for collaboration, and we see more interest from them as we are becoming famous in the market".*

Thus, there are positive same-side network effects between different customers and positive cross-side network effects between customers and suppliers. Specifically, application partners on the production side have not yet been enticed by positive network effects, neither same-sided nor cross-sided.

## 4.2. Scaling at BlockInvest

BlockInvest's business model is described as being "*Transaction Driven—helping to create the Internet of value; through a Shared Application Framework—Our unique blockchain UX [user experience] obscures the hard-technical parts of blockchain;* that produces an *Equitable Exchange of Value—DApps across different use cases work together to acquire users, data, merchants, and content".*

BlockInvest's business model is "*not trying to create a unicorn. We're trying to create a heard of zebras. We have more of a $50 to $100 million sort of size businesses; businesses that are owned by the employees*". Rather than trying to have one big win, a unicorn, they would rather "*have 100 ventures worth $100 million each",* or $10 billion in total.

**4.2.1. Scaling.** Technologically, at the core of BlockInvest's platform is a blockchain provisioned through one of its ventures, BlockNet. Transactions by BlockInvest's various ventures (and hence by its merchants and users) are recorded on the blockchain through 'smart contracts'. Smart contracts are, effectively, programs that are embedded into the blockchain. The cost associated with each transaction is a function of the computational intensity of each smart contract, and these costs are built into the underlying blockchain.

To enable interworking between ventures, BlockInvest initially provided six protocols to enable: the (1) blockchain, (2) communication, (3) identity management, (4) payments, (5) data sharing, and (6) permissions. As the use of each protocol is associated with transactions, and because the cost of transactions—and hence the use of protocols—has a cost (or revenue depending on which side of the transaction you are), these protocols eventually morphed into being ventures. E.g., the payments were monetized as a venture called BlockPay.

Overall, value is created on the supply side when users undertake transactions. However, as a metric, the number of users is not tracked. If ventures 'owned' their user data, that was seen as promoting centralization and inhibiting BlockInvest's ability to create a 'herd of zebra'. To mitigate that, it was decided that—unlike Facebook/Meta—users would own their own data. Consequently, BlockInvest "*does not have access to that data [on users]. That is one of the value propositions, as it's a privacy-centric [and distributed] technology. We can get access to some statistics in certain parts of the ecosystem, but it's not the same level of end-user data that you'd get out of a normal kind of [SaaS] setup*".

For BlockInvest, its ventures, and its validator nodes, revenue is a function of the number of transactions that take place. In the earlier example, alongside the ticket cost, each transaction incurs a cost distributed between the venture, the validators, and BlockInvest. The payment scheme is built into the blockchain through smart contracts and is thus fully automated.

Consequently, BlockInvest and its ventures are more interested in the number of transactions undertaken. Their logic is that BlockInvest will scale "*as more users join the network and generate more activity in the form of transactions*". They argue that "*Providing an ecosystem for different applications to share in the user pool, the data pool, the merchant pool, and the content pool across the platform to overcome traditional 'chicken and egg' scale issues*".

**4.2.2. Managing the scaling.** There are four types of actors that make up BlockInvest's ecosystem. First are ventures that create DApps. These ventures are often referred to within BlockInvest as 'friends and family'. Secondly, there are the validator nodes. These nodes validate transactions "on the blockchain" and are, in many ways, the blockchain. Thirdly, there are merchants; these are (often large) businesses that integrate with one of BlockInvest's ventures. Finally, are the users. They are typically the merchants' customers but may also be direct customers of one of BlockInvest's ventures. Each of the four types of participants in the ecosystem is managed in different ways to achieve scale.

As 'friends and family', the ventures are managed organically as a community. Although the ventures are legally independent, BlockInvest usually has a material shareholding in each one, alongside interlocking directorships. Furthermore, amongst these 'friends and family', information, knowledge,

and expertise are freely shared between all levels and across all the ventures. For example, once one venture has successfully implemented 'minting of non-fungible tokens' (a relatively complex technological task), other ventures then have access to the programming and developers of that feature. This enables ventures to implement 'minting' themselves rapidly. The lessons learned from one venture are thus transferred to other ventures, including learning about keeping the size of ventures below 50 people.

Aside from the initial portfolio of five ventures, growth in the number of ventures occurs through two main mechanisms. First, new DApp developing organizations can choose to adopt BlockInvest's tooling and blockchain. For a stake in the blockchain, the new DApp developing organization may sell equity to BlockInvest. This has been fostered through running an incubator to create non-organic growth. Secondly, as previously mentioned, when one venture becomes too large in terms of headcount, it will split into a new venture. This often occurs when a venture begins to develop a new DApp. For example, BlockPay may seek to add inventory management to the payments system. In this case, BlockPay could spin off BlockStock, a DApp that uses BlockPay to allow customers to buy physical goods tracked by BlockStock. That is organic growth. As with any portfolio of new ventures, some may also fail; and in these cases, employees often move to other ventures in the portfolio. Overall, the creation of new ventures occurs ahead of increasing numbers of users and transactions.

Growth in the number of merchants occurs through individual ventures pursuing individual merchants. However, the close relationship between ventures sees them treating merchants as a resource to be shared. Indeed, BlockInvest seeks to have ventures "*find and create these connections between their applications and to create actions that join them together in new degrees of closeness.*" As with the growth in the number of ventures, growth in the number of merchants occurs ahead of an increase in the number of users and transactions.

The situation with validator notes is different. The mechanism by which the validator nodes are paid means that the revenue they receive from transactions is a function of supply and demand and is built into the blockchain. If there are too few nodes, the revenue per transaction increases, attracting new validator nodes to the blockchain. In many ways, the number of validator nodes is left to Adam Smith's invisible hand. Because of this, the number of validator nodes lags behind the increasing number of users and transactions.

Groups of users associated with specific ventures—i.e., where a venture pursues its own users rather than interacting indirectly with a merchant's users—are fostered as communities. These ventures tend to have someone responsible for managing users and community development. As with other resources, expertise and insights into user community management are shared amongst the ventures.

Overall, given the independence of the ventures (friends and family) and users, mechanisms based on 'command and control' cannot be used to manage scaling. Hence, indirect methods of community building (amongst the ventures and separately amongst user groups) are used. Thus, those decisions that are non "baked into" the blockchain as smart contracts often involve questions such as "What would the community think if we did X"?

**4.2.3. Network effects.** There are four-sided network effects of importance for BlockInvest to scale. On one side, there is its portfolio of ventures producing DApps. On the second side are the merchants who provide pathways to customers and content (albeit physical goods such as concert tickets, digital goods such as non-fungible tokens, or financial services such as banking). On the third side, there are the validator nodes that, in many ways, can be seen as providing the distributed ledger (the blockchain). Finally, there are the customers who are the source of transactions.

As already noted, growing the number of ventures and merchants occurs ahead of—and is considered to lead to—the scaling of the number of users and transactions. This situation is unlike that with the validator nodes; growth in the number of validator nodes will typically trail the number of users and transactions. These network effects increase the number of transactions and hence the revenue to each of the four sides of the transactions.

## 4.3. Comparing the platforms' scaling

Digitize aims at scaling a platform that generates data about industrial reality, with information being the economic item to be scaled (Shapiro et al., 1998). In contrast, BlockInvest aims at scaling transactions on its platform. Thus, Digitize's platform is an innovation platform, whereas BlockInvest's platform is a transaction platform (Gawer, 2021). The critical difference is how data is treated: The data generated through BlockInvest's platform is information regarding whether a transaction has happened or not; in contrast, data generated on Digitize's platform is treated as an informational resource for innovation and value creation. This difference has implications for the network effects.

To create network effects, Digitize makes coordinated investments in both the production and

consumption sides of the ecosystem. On the production side, Digitize invests resources and capabilities in creating co-selling and co-implementation arrangements with a selected set of partner firms. On the consumption side, Digitize engages in co-development with a specific set of customers. Digitize's deliberate choices of what type of partners will be engaged for co-selling and what kind of customers will be engaged for co-development constitutes Digitize's network orchestration. Hence, Digitize plays a direct role in shaping the network effects in the ecosystem, leaving little to chance, a form of orchestration that constrains truly generative innovation (Zittrain, 2008). Generative innovation in an ecosystem depends upon the customer choosing which components of the product to assemble or not. This combination leads to positive feedback loops in terms of enhanced platform functionality. Digitize as an organization grows while undertaking co-development of the product with customers. Hence, the more they co-develop the product, the more Digitize grows at the expense of the external network of application providers and implementation partners. This scaling is based on the logics of heavy asset companies operating in Chandler's pipeline industries, so-called supply economics of scale (Parker et al., 2016). This is evident when sales and implementation partners are involved in direct marketing campaigns, which Parker et al. (2016) referred to as push strategies; a distinctive awareness around the platform offering is created. In Digitize, this is evident since use cases are scaled as reference cases of successful implementation and use, positioned in the market to attract more customers and partners on the production side.

The industrial reality comprises heavy assets: oil platforms, plants, rigs, pumps, etc. The Digitize platform generates digital representations of such physical assets using data. These representations aid customers` digital transformation journey by optimizing production and enabling better decision-making. However, in these B2B markets, customers are not unitary actors but organizations with large, heavy asset companies. A fully integrated platform for such an industrial company requires integrating many different information systems connected to vendors and suppliers. This complexity requires considerations and careful management on Digitize's part as to what type of data the various customer organizations are to share. For example, data deemed proprietary or with a competitive advantage poses the biggest challenge of reaching complementarity on the consumption side and positive network effects.

BlockInvest creates network effects differently. They orchestrate their ecosystem more indirectly, relying on community relationships with the different sides. This approach to scaling is a consequence of the decentralized nature of the ecosystem and reflects the decentralized nature of the underpinning technology. BlockInvest approaches the production side of the ecosystem by developing ventures. As with any start-up, the venture must demonstrate that customers do exist; but conceptually, the venture is created ahead of the customers and their transactions. With a venture in place, it pursues its own merchants or customers. The more ventures, the more merchants; from them, the potential of users is generated and envisioned. The more transactions, the greater the demand for validator nodes. Thus, the increase in validator nodes follows a purely market logic of increasing returns and positive feedback (Hanseth, 2000). BlockInvest has successfully created networked interactions that resemble a clan structure (Ouchi, 1980). The different ventures act as independent organizations while at the same time are coordinated according to the governance structures of informal organizations; coordination is based on indirect orchestration mechanisms.

## 5. Discussion

We answer "How is scaling managed in platform-based ecosystems" in two parts. First, network orchestration differs depending on the strength of network effects. Second, the different types of network effects present in innovation platforms compared to transaction platforms also impacts network orchestration. Together, the network effects' strength and type impact how scaling is managed in a platform-based ecosystem.

### 5.1. Network effect strength

Literature on scaling in network orchestration regards the challenge of cross-sided network effects as a "chicken and egg" problem to be overcome by management, achieving ecosystem momentum by enabling "first commitment" to the ecosystem (Autio, 2021; Dattée et al., 2018). Furthermore, this problem is assumed to be a launch issue (Parker et al., 2016), and that network orchestration is only needed during the early stages of platform ecosystem development (Autio, 2021). In contrast, our findings suggest strong network orchestration is needed whenever weaker cross-sided network effects exist, which may continue well beyond the start-up phase. Our findings also show that indirect network orchestration was undertaken when stronger cross-sided network effects were present.

Our exploration of the conditions under which stronger or weaker network orchestration occurs revealed two types of network orchestration: direct and indirect. Direct network orchestration is predicated on a central organization having one-to-many relationships where ecosystem members are often more interdependent and less independent. The focal organization creates system-level goals for the ecosystem members. In this way, the focal organization takes more of a controlling role. Indirect network orchestration uses a clan-based approach (Ouchi, 1980), with ecosystem members being more independent and less interdependent. Cooperation occurs between organizations rather than controlled by a focal organization through trust and reciprocity. The various ventures share resources, knowledge, and lead-on potential customers through many-to-many relationships. Strong and weak network effects and direct and indirect network orchestration extend the literature on network orchestration (Autio, 2021; Dattée et al., 2018; Dhanasai & Parkhe, 2006).

The difference between indirect and direct orchestration arises from strategic choice (Child, 1972) based on infrastructure. Transaction platforms have a clear market logic. A transaction platform is a multi-sided solution to demand where some sides are not matched. The different sides are already there, and the required type of network effects are clear. Consequently, to grow a user base, a transaction platform draws on digital infrastructures in a more clear-cut way than innovation platforms. The emerging digital transaction platform is significantly more "infrastructured" (Constantinides et al., 2018) than innovation platforms, which by definition implies that the underlying technology is more shared and open through standardized interfaces (Hanseth, 2000; Hanseth & Lyytinen, 2016). Thus, economies of scale work for growth and market forces as a scaling strategy, where managers do not need to interfere, which we found as indirect orchestration. On the contrary, innovation platforms aspire to create novelty through third-party development and generativity on the consumption side. Our findings show that in such a platform ecosystem, the distinctions between sides are blurry and dynamic – customers might pose as application developers and the other way around. Thus, strategic action of managers in shaping a market context, as Chandler (1990) argued, is needed; the technology works as an enabler, and the network orchestrator needs to create the sides in the network market that needs to interact for value to be created.

### 5.2. Types of network effects

Our findings align with the literature on the type of network effects found in innovation and transaction platforms (Cusumano et al., 2020; Gawer, 2021). However, we identified that network orchestration was different in the two types of network effects; differing types of network effects require different approaches to scaling. For innovation platforms, complementarity is required in creating network effects for innovation platforms; users worry that there may be no complementary products or services. For transaction platforms, increasing the number of users increases network effects directly. Consequently, scaling transaction platforms is easier, involving increasing users rather than increasing 'complementarities'. Thus, it is harder to scale innovation platforms than transaction platforms. Hence, we extend theories on network effects (Katz & Shapiro, 1985, 1994) and how their externalities contribute to scaling platform-based ecosystems.

This finding has implications for network effects theory. To achieve network effects, the first user(s) of a networked product or service must believe others will also use it in the future (Katz & Shapiro, 1994). With innovation platforms, users understand that the platform enables complementarities without having an initial expectation that other users on both sides of the ecosystem will use the platform in a way that creates a networked economic benefit. This uncertainty happens due to the novelty of the innovation platform. Whereas transactions platforms scale according to users initially believing that other users are using the platform, thus taking part in a network that is already "there", even if it is not the case. Thus, we also extend the literature on the scaling of multi-sided platforms (McIntyre et al., 2021) by considering the different scaling strategies needed by transaction and innovation platforms (Gawer, 2021) due to the difference in the source of network effects. For a transaction platform, there is the possibility of reaching positive cross-sided network effects faster than in an innovation network.

## 6. Conclusion

This paper shows how orchestration and scaling need to take into account the strength and type of the network effects. With transaction platforms, indirect network orchestration is effective as the consumption side governs the actions of the production side of the platform. Whereas, with innovation platforms, there is a need for direct orchestration on both the production and the consumption side. For hybrid platforms, one might assume that an evaluation of the strength and

type of network effects is required to guide network orchestration.

This leads to the first limitation of this study, we only investigated two ecosystems, each of which was based on, stereotypical innovation and transaction platforms. Future studies could include a more extensive set of comparative case studies of different platforms and industrial settings (B2B, B2C, and B2B2C). Future studies might also perform a single-case study to acquire in-depth knowledge on what makes orchestration necessary for innovation platforms and the related processes and practices.

## 7. References


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