

# Digital Business Ecosystems as a Case of Polycentric Governance

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## Abstract

One of the phenomena which attracts increasing attention in business and academic media is Digital Business Ecosystem (DBE), a business model that departs significantly from the classic understanding of a private firm as a link within a value chain. DBEs are characterized by co-creation of value by independent participants and their co-evolution in the process. This creates challenges for applying the established approaches to the key issues of business governance like pricing or choice of technology. Up to the moment there were very few attempts to view them from the perspective of polycentric governance. Most of the existing literature views the digital ecosystems in a dichotomy of leaders and participants, which does not imply polycentricity of governance. Based on our studies of several businesses participating in DBEs we demonstrate that there is a complex structure of participation, which effectively leads to elements of polycentric governance of the whole system. The participants of DBEs collectively manage an important public good, the consumer trust, the process involves “Faustian bargains” yet leads to innovative development of both the independent actors and the system as a whole. Our paper makes a theoretical contribution through expansion of the domain of polycentric governance to a new class of economic systems, and also introduces new empiric data.

## 1. Introduction

The theory of polycentric governance was introduced to describe in economic terms the phenomena “that do not fit in a dichotomous world of “the market” and “the state.”” (Ostrom E. , 2010). It was applied to the management of public goods, characterized by being nonexcludable and nonrivalrous ( (Ostrom E. , 2010), quoting (Samuelson, 1954)). Through this, the theory seems to be, by definition, not applicable to any cases of private companies.

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Indeed, the existing literature on polycentric governance focused on the cases of public administration as applied to climate change mitigation (Petrovics, Huitema, & Jordan, 2022), water management (Schröder, 2018), and community forestry governance (Bixler, 2014). The other key aspect of polycentricity – the existence of independent actors making critical decisions affecting the system's operations—was also incompatible with the classic view of a private firm. It assumed the two-sided relationship between a purchaser (customer) and a seller (firm), with the latter being fully in charge of establishing all the characteristics of products/services that it sold (Cohen L. , 1979). A firm could purchase necessary components from other market actors, yet in this situation, it just turned into a customer buying from other firms acting fully on their own. Thus a “value chain” was created from a series of one-to-one transactions from raw materials to finished products (Porter, 1985).

However, in the early 1990s, a new view on the activities of a private firm emerged: “... I suggest that a company be viewed ... as part of a *business ecosystem* that crosses a variety of industries. In a business ecosystem, companies coevolve capabilities... : they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations” (Moore, 1993). This more complex approach implied that multiple independent actors create market value, not in a chain of transactions but simultaneously, facing the customer together at a given moment.

The ecosystem perspective remained somewhat marginal in the literature for about a decade, yet it started to expand quickly with the proliferation of digital business platforms starting from the mid-2000s. A significant milestone in the conceptualization of digital ecosystems was the memorandum written in 2002 by Francesco Nachira within the framework of the European Union project on the development of the use of information technologies by small and medium-sized businesses. There, six stages of the use of digital technologies in business were proposed, starting with the simple introduction of e-mail, and digital ecosystems were considered at the highest level, with the following characteristics: (1) dynamic aggregation of other [market players]; (2) training and knowledge sharing; (3) natural selection and evolution of services and solutions (Nachira, 2002).

Since then, it has been widely acknowledged that digital platforms and ecosystems built around them have redefined business models, disrupted established industries, helped launch new products and services, and created significant value for society (Chen, Pereira, & Patel, 2021; Cusumano, Gawer, & Yoffie, 2019; Evans & Schmalensee, 2016; Parker, Van Alstyne,

& Choudary, 2016). Business ecosystems are defined as a strategy in which business units operating independently, acting at their own risk, create joint value for consumers using common rules, tools, and knowledge (Korovkin, Belousov, Olaynikova, Sintyurikhina, & Fateeva, 2021). Therefore, Digital Business Ecosystems (DBEs) can be thought of as the meta-organization (collective of firms and individuals) around a digital multi-sided platform with a shared vision of the prosperity of the platform (Spagnoletti, Resca, & Lee, 2015; de Reuver, Sørensen, & Basole, 2018). A digital platform ecosystem consists of one or multiple platform leaders and a large number of complementors (Mukhopadhyay & Bouwman, 2019).

Despite the acknowledged structural complexity of DBEs, most of the existing literature studies them from the perspective of their leaders. The key themes of research were the competition between the platforms in attracting customers (Cennamo & Santalo, 2013; Zhao, von Delft, Morgan-Thomas, & Buck, 2020) or participants (Armstrong, 2006; Jullien & Sand-Zantman, 2021), the theme of governance of the ecosystems was not an important stream of conceptualization or empiric research (though it was raised as early as 2007 in (Darking, 2007)). However, some statistics show that less than 15% of business ecosystems are sustainable in the long run and that the most prevalent reason for failure is weakness in the governance model (Pidun, Reeves, & Knust, 2021). Governance in the context of platform ecosystems refers to the structure, process, and methods for making decisions about the platform's collective activities (Tiwana, Konsynski, & Bush, 2010; de Reuver & Bouwman, 2012; Mukhopadhyay & Bouwman, 2019). Platform governance is crucial to value creation and appropriation. It determines what value-creating activities (e.g., product development, transactions, interactions) are encouraged on the platform, whom to include and when to engage in these activities, to what extent the activities can occur without interference from platform owners, and how platform owners can capture a share of the value jointly created with complementors (Hagiu & Wright, 2019; Wareham, Fox, & Cano Giner, 2014; Chen, Tong, Tang, & Han, 2022).

Certain attempts to apply the collective action theory have been made since then. In particular, the authors tried to identify the factors that impact inter-organizational collaboration (Nikayin, De Reuver, & Itälä, 2013) and study how the collaboration and competition between ecosystem partners with different industry backgrounds impact the success of the platform (de Reuver, Verschuur, Nikayin, Cerpa, & Bouwman, 2015). One of the primary challenges in platform ecosystem governance is to balance control of the platform and the generativity of the complementor. Because of the indirect network effect, heterogenous and significant quantities

of outputs from complementors can bring more consumers to the platform, but at the same time, it is important to manage the integrity and vision of the platform (Mukhopadhyay & Bouwman, 2019).

Yet some important aspects of the functioning of DBEs remain largely uncovered in the literature. The key to the competitive success is the capability of a company to deliver superior products/services with the right pricing in a dynamic environment (Porter, 1991). How can the leaders of the DBEs ensure that this condition is consistently matched by the independent ecosystem participants (who are often free to participate in several competing ecosystems)? To answer this question, we need to have insights into the behaviour of all actors that form an ecosystem. Unfortunately, here we find an important gap in the literature. The scarcity of research on participation in ecosystems was noted yet in (Selander, Henfridsson, & Svahn, 2013) ; still, little improvement has been made. It seems that most of the authors assumed that ecosystem complementors form a homogenous mass in terms of their strategies with little room for differentiation.

Our empiric study defies this view. Through interviews and case studies based on secondary research, we have come to the conclusion that complementors within business ecosystems pursue active strategies of product and price differentiation. We have also uncovered hidden layers within the DBEs – providers of solutions and services who help complementors achieve their strategic goals by providing essential technologies and services. This class of actors is not visible to the customers who make purchases on digital platforms and often goes unnoticed by the platform owners. However, their actions are important for achieving collective competitive success in a given ecosystem.

This empiric investigation brought us to the understanding that the domain of DBEs poses an interesting and important question: can the elements of the theory of polycentric governance be applied to the action of private firms? In our conceptualization, we build up on the concept of horizontal governance at the middle level between decision-making centres (platform owner and suppliers of goods) in an ecosystem selling consumer goods. We apply the concept of polycentric governance in the platform concerning the decisions on pricing and technology made by independent participants of the ecosystem and analyse how these decisions affect the competitive position. We consider polycentric governance as a form of governance system uniquely qualified to facilitate collective action towards sustaining ecosystem services in the face of disturbance and change. Therefore, the paper examines the elements of the

polycentric governance system, its characteristics, scope, and potential outcomes of its application in the field of business ecosystems. We argue that the participants of a DBE share a nonexcludable and nonrivalrous public good, the consumer trust.

The rest of the paper is structured as follows: the next section provides a literature review on the governance of business platforms; section 3 briefly discusses the methodology of our empiric study, then we move on to the resulting case studies of participation in DBEs. We conclude with the discussion of our research findings and the applicability of the polycentric governance theory to the domain of private DBEs.

## **2. Literature review**

### *Polycentric governance*

The initial use of the term polycentricity goes back to Michael Polanyi (1951) when he used it to describe a method of social organization in which the independent initiatives of individuals are self-coordinating within a set of rules, leading to achieving a common outcome. Later, the concept of polycentricity spread to different disciplines, including governance studies (Aligica & Tarko, 2012). In the 1960s, it was used by Vincent Ostrom and colleagues to describe a form of organization in metropolitan-area governance characterized by multiple overlapping political units. They described polycentric systems as having multiple independent centres of authority that overlap and coordinate through forms of cooperation, competition, conflict, and conflict resolution (Ostrom, Tiebout, & Warren, 1961). In her turn, Elinor Ostrom focused on the study of the commons and sought to understand how stakeholders achieve and maintain self-governance within complex environments. In her ground-breaking research (Ostrom E. , 1990; 2005; 2010), she formulated “Design Principles” that bring together the key factors that influence the probability of long-term success in governing common pool resources. Among these is the need for nested institutions, which is largely in line with polycentric thinking (Ostrom E. , 2005).

Building on this work, the following years have witnessed several studies assessing some of the themes, primarily common pool resource dilemmas, through the lens of polycentricity (Aligica & Tarko, 2012; Bixler, 2014; Carlisle & Gruby, 2018; da Silveira & Richards, 2013; Nagendra & Ostrom, 2012; Pahl-Wostl & Knieper, 2014; Petrovics, Huitema, & Jordan, 2022; Schröder, 2018; Thiel, 2017). Studies cover climate change governance

(Petrovics, Huitema, & Jordan, 2022), water (Schröder, 2018), forests (Nagendra & Ostrom, 2012), and fisheries (Carlisle & Gruby, 2018). Important lines of debate in current research on polycentric governance include the emergence and evolution of polycentric governance (Galaz, Crona, Österblom, Olsson, & Folke, 2012; Morrison, 2017), the traits, structures, and varieties of polycentric systems (Aligica & Tarko, 2012; Oberlack, et al., 2018; Thiel, 2017; Villamayor-Tomas, 2018); and the functions and performance of polycentric systems (Carlisle & Gruby, 2019; Pahl-Wostl & Knieper, 2014).

By addressing topics related to public administration, most of the literature on polycentric governance has, theoretically or empirically, emphasized the importance of this type of governance. Compared to more centralized hierarchical systems of governance or fragmented decentralized governance arrangements, polycentric governance allows greater access for citizens to decision-making, better institutional fit because institutions can be tailored to specific issues, more opportunities for policy experimentation and adaptation, and a reduced likelihood of institutions failing due to diversity in institutional design (Carlisle & Gruby, 2019; Cole, 2015; Folke, Pritchard Jr., Berkes, Colding, & Svedin, 2007; McGinnis & Walker, 2010; Ostrom E. , 2010; Pahl-Wostl, 2009).

On the other side, there is no agreement among scholars on a specific template for polycentric governance, as differences exist in terms of structures and/or processes as well as “a nonhierarchical, institutional, and cultural framework” (Aligica & Tarko, 2012, p. 251); in terms of the degree of autonomy or independence of actors to be considered as decision-making centres (formally independent, de-facto independent, relatively . . . semi, substantive, Etc.); in terms of diverse types of organizations, and different scales and levels; and in terms of overlapping and redundancy (Schröder, 2018).

This is not considered a defect or deficiency in polycentric governance. On the contrary, it indicates the great flexibility that this concept possesses, which opens the door to apply the idea of polycentric governance to issues outside the interest of public administration and to suggest governance centres that differ from traditional ones (i.e., the state, municipalities and non-governmental organizations).

### *DBEs and platforms*

The terminology of business ecosystems was initially used by Moore (1993; 1996) and has been developed over the following years through its application in different research scopes and approaches. The idea of business ecosystems has been adapted from biology, where

ecologically homogeneous units form a community of living organisms that interact as a system with various components of their environment (Scaringella & Radziwon, 2018). Projecting this onto the business world, different definitions of business ecosystems mainly emphasize the interconnectedness of economic agents and the fact that they depend on each other for their success and survival (Peltoniemi, 2006; den Hartigh & van Asseldonk, 2004). Following this understanding, several other applications of ecosystem terminology have appeared in the literature, such as social ecosystem (Mitleton-Kelly, 2003), entrepreneurial ecosystem (Cohen B. , 2006), technology ecosystem (Adomavicius, Bockstedt, Gupta, & Kauffman, 2006) and digital ecosystem (De Tommasi, Cisternino, & Corallo, 2005; Seigneur, 2005). Thus, the DBE is an extension of Moore's business ecosystem in which digital platforms play a dominant role (Suuronen, Ukko, Eskola, Semken, & Rantanen, 2022). Digital platforms, in turn, are technological infrastructures that allow member firms to develop, configure, and deliver advanced services efficiently and on an unprecedented scale (Franco, Ortiz Bas, & Lario Esteban, 2009; Yoo, Boland Jr., Lyytinen, & Majchrzak, 2012). According to (Nachira, 2002), a DBE has the following characteristics that set it apart from traditional business organizations: dynamic aggregation of independent participants, education, and knowledge sharing between them, and evolution and natural selection of services and solutions. Further, essential concepts of "co-creation of value" (Le & Tarafdar, 2009) and "co-evolution" of participants and platforms (Chi, Holsapple, & Srinivasan, 2008) emerged in the literature.

The last three decades have witnessed various conceptual and empirical studies that have examined platforms from different angles, such as the growth of platform-based ecosystems (Jha, Pinsonneault, & Dubé, 2016), the adoption of platform strategies (Hagiu & Wright, 2015) and the impact of digital platforms on society (Chan & Ghose, 2014). Platform governance has also been a part of the research effort (Boudreau, 2010), albeit not an intense one. Most studies on platform governance take the perspectives of platform owners and focus on identifying governance mechanisms that can help these owners achieve their goals (e.g., (Boudreau, 2010; Kyprianou, 2018; Reischauer & Mair, 2018; Rietveld, Schilling, & Bellavitis, 2019; Wareham, Fox, & Cano Giner, 2014)) while paying less attention to other stakeholders (Jacobides, Cennamo, & Gawer, 2018) . Moore himself did not stray too far from this trend. His idea on governance is by comparing ecosystem governance to markets and hierarchies. He indicates that the ecosystem internalizes the systems of firms and the markets that connect them under the guiding hands of community leaders (2006) (Anggraeni, den Hartigh, & Zegveld, 2007).

Clearly, when the governance rights and control are concentrated, the platform owner can make decisions more quickly and take more decisive action to ensure effective governance processes and outcomes. Without sufficient checks and balances, however, platform owners may be tempted to neglect the interest of the other stakeholders by making decisions with only their interests in mind (Hurwicz, 2008; Mookherjee, 2006; Rahman, 2012; Chen, Pereira, & Patel, 2021). Some studies have pointed to cases where platform owners have abused their power and taken actions that harm users and third-party businesses (Cohen J. E., 2019; Srnicek, 2017; van Dijck, Poell, & de Waal, 2018; Zuboff, 2019). Additionally, while command-and-control structures work well in traditional organizations because both sides accept the legitimate hierarchical authority of managers over employees as a condition of employment, there is no such direct authority in a platform ecosystem, as complementors are not employees of the platform owner. They are often free agents specializing in niche domains outside of the platform owner's (Tiwana, 2014).

Therefore, to raise the efficiency of platform governance, a stream of research has emerged calling for more decentralization of platform power. Through decentralization, digital platforms can enhance the power of platform participants while reducing that of platform owners (Wright & De Filippi, 2015; Voshmgir, 2017; Beck, Müller-Bloch, & King, 2018; Perscheid, Ostern, & Moormann, 2020). It enables the creation of a structure through which platform participants can influence, monitor, and engage with the platform owner (Cheibub, Gandhi, & Vreeland, 2010; Hurwicz, 2008), motivating him to pursue activities and outcomes that may be more acceptable to all. Furthermore, platform participants can participate in goal setting and decision-making through decentralized governance, allowing them to represent their perspectives and protect their interests (Chen, Pereira, & Patel, 2021).

However, in cases where governance is fragmented or decentralized, challenges still emerge. One problem is that consensus can become too difficult to achieve, as platform participants may hold vastly diverse perspectives and interests (De Filippi & Loveluck, 2016). Platform participants may not be able to reach a consensus on platform governance and evolution issues, resulting in fragmentation and deadlocks that may hurt all (Wareham, Fox, & Cano Giner, 2014).

In our opinion, the existing literature on DBE has yet to develop a concise theory of their governance. While the crucial concepts of co-creation of value and co-evolution imply that the locus of governance of such ecosystems is not entirely on their leaders and that

participants have an essential role in critical operational decisions, the existing literature does not explore the mechanisms of such participation. Instead, it views digital platforms as simply a case of intermediation (e. g. (Brousseau & Penard, 2007)). There is little empiric literature on the decision-making by the contributors to the ecosystems; as a result, the conceptualization of their functioning largely ignores the issue (Selander, Henfridsson, & Svahn, 2013), (Bygstad & Dulsrud, 2020).

We think applying the polycentric governance theory to the functioning of DBEs can close this gap in the literature. Studying the functioning of both leaders and contributors of the ecosystems, their co-operation, co-evolution, and struggle for power can reveal complex governance mechanisms which are the hybrid approaches associated with public administration and private firm management. Understanding them is important from a theoretical perspective and can contribute to practical decision-making in public and private sectors.

### **3. Methodology**

Our interest in the governance of DBEs came from the work on a practice-oriented report focused on the strategies of their leaders (Korovkin, Belouskov, Olaynikova, Sinyurikhina, & Fateeva, 2021). Some of the business practitioners we interviewed during the work stated that the quality of an ecosystem was an important factor and pointed out that this quality is dependent on the actions of the participants with limited space for direct action of the ecosystem leader. As we found out, the topic was not elaborated on neither in academic nor in business literature; thus, we undertook an exploratory study through a series of interviews with participants of business ecosystems.

The respondents participated in the leading digital business platforms operating in Russia - Uber, AirBnB, and Wildberries – and also used international platforms (Amazon and WeChat) to export to China and the Middle East. The size of operations varied from several hundred dollars a month (supporting individual consumption) to full-scale operations with up to 100 employees. As our study was exploratory in nature, we did not aim at a significant sample, trying to uncover instead as broad a specter of business practices as possible (Flick, von Kardoff, & Steinke, 2004, p. 169). In total, we performed 7 interviews (semi-structured, 40 to 70 minutes). As our study was exploratory, we did not aim at a significant sample, trying to uncover as broad a spectrum of business practices as possible.

One interview was particularly insightful. Damira, 27 years old, started her private business about 6 months before the interview, selling children overcoats through Wildberries.ru platform. She had prior experience in marketing in an international company, and her operations were well organized. She was constantly searching for ways to expand her business and brought our attention to a number of tools that were not visible from outside the ecosystem. This interview allowed us to understand the operations of a DBE not as a simple “platform – participants” dichotomy but as a complex system with several “hidden layers” of operations.

Guided by this understanding, we undertook additional search for relevant examples through secondary research that resulted in several critical case studies. The cases of international start-ups Plaid, Tink and Truelayer were particularly interesting<sup>2</sup>. We have also paid attention to the cases of ecosystem leaders developing similar services as additional lines of operations (Sber in Russia). Overall, we have elaborated 5 cases through secondary research based primarily on business media reports and companies’ self-presentation materials like websites and presentations for potential investors.

As noted above, our empiric work was exploratory; though we had some triangulation throughout of our work (Flick , von Kardoff, & Steinke, 2004, pp. 178-183), we did not aim at developing a representative sample. Still, we think that the richness of new phenomena in operations of DBEs uncovered by our research justifies the approach.

In analyzing the results of the interviews and case studies, we followed the approaches of the grounded theory as outlined in (Glaser & Strauss, 1967) concerning its modernizations (Heath & Cowley, 2004; Martin , Scott, Brennen, & Durham, 2018).

#### **4. Empiric results**

The classic view of the digital ecosystems presents platforms as intermediaries between producers and users (Brousseau & Penard, 2007). Nevertheless, here is the description of business operations run by Damira, one of our respondents. She is not a producer, as she buys her merchandise (overcoats for children and younger teenagers, a highly demanded product in the Russian climate) from a small factory in Kyrgyzstan. She is not an exclusive buyer; many

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<sup>2</sup> We are grateful to Alina Fateeva for suggesting these companies as examples of operations on hidden layers of an ecosystem.

of her competitors use the exact source of merchandise, though they may prefer somewhat different product items<sup>3</sup>. She organizes the logistics from the factory to the warehouse run by Wildberries, the digital platform she sells on. Wildberries charge for warehouse use yet provide the services of packing and sending the goods to the customers immediately upon selling. The alternative way for outbound logistics is delivering to Wildberries collection points each time a sale is effected; this saves some cost yet is more time-consuming.

Damira's key focus is merchandise marketing, which includes creating catchy descriptions and illustrations of the products, promoting them, and pricing. The latter activity is of utmost importance: marketplaces compete between themselves mainly by offering a constant stream of attractive price offers to the end customers, so they encourage the sellers to discount their products heavily; thus, deep discounting is an inherent part of competitive strategy of the leaders of the digital ecosystems in many markets (Gulati & Puri, 2022). However, the contributors of the ecosystems are well aware of this strategy and try to use it to their own benefit. Damira puts the list price considerably higher than the actual selling price she expects; this allows her to offer "discounts" as deep as 70-80% without actually sacrificing her margins. The platform operators, in turn, understand the tactics and try to discourage it; putting an unrealistically high list price would lead to forced delisting of the item.

Pricing is inherently linked to the visibility of Damira's products on the platform. Digital ecosystems create intensely competitive environments due to low entry barriers (for example, the Wildberries platform list over 30 000 items in the category "children overcoats"<sup>4</sup>). Some filters are available for the customers to facilitate their search; still, it will result in dozens of items. Having the product presented in the top rows of the search results is believed to be essential for generating sales volume. The platform sorts the items through its proprietary

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<sup>3</sup> This observation brings in an interesting question from the economics of a firm: the factory owners are perfectly aware that their merchandise is bought for reselling on digital marketplaces. Why do they not use this channel themselves to gain a more significant margin, preferring to use multiple intermediaries? If the additional margin does not justify the associated operational costs, then the intermediaries would not have incentives to operate; if it does, then the producer should, in theory, integrate forward into selling online. The conventional business theory would state that intermediaries are either bigger than suppliers (gaining value through economies of scale and market power) or command strong relationships with the clients that the producer cannot quickly build. Neither happens in the case under discussion: factory sells to individual entrepreneurs with smaller turnover, and those resell through a digital platform that is open to all possible new entrants.

<sup>4</sup> Accessed August 15, 2022. The figure is in line with some research literature, e. g. according to (Korovkin, 2018), digital marketplaces in India feature 2500 – 3000 fashion brands, each with a range of hundreds of items.

algorithms, which are not transparent to contributors, yet it is known that the key factors are the size of the discount and the number of items sold in the past few days<sup>5</sup>.

As a result, sellers of similar products play a constant game of price changes trying to ensure product visibility without sacrificing operating margins. Damira changes prices for her products by offering bigger or smaller discounts several times a day. She believes that she has found a pattern that allows her to gain higher positions vis-à-vis competitive products, yet it requires constant attention – to the point of getting up at 6 am to make necessary adjustments.

There are also instruments for boosting turnover. With the help of a marketing agency Damira uses tools like social networks to promote her merchandise, which is not an unusual practice for any business selling online. However, other instruments are more exotic and apparently go against the platform rules. One of these instruments is the practice of “self buy-back”: Damira simulates high turnover by actually paying for her own products; after that, an intermediary returns “sold” products to her for a commission. There is a belief that this is a widespread practice, and the internet is full of offers of such services (e. g. swinner.ru or mpboost.pro).

The latter observation unveils the existence of what we call “hidden layers” of DBEs. Besides the platform and the sellers that operate on it, there is a plethora of solutions that facilitate sales (or, in some cases, purchases – e. g., taxi metasearch software that compares prices in real-time and recommends the service with the best offer); some of them seek to “hack” the rules of operations established by the platforms. Other examples include software for Uber drivers that change the car coordinates in the system, increasing the chances of picking up lucrative trips<sup>6</sup>.

Another example of hidden layers in DBEs is technology integrators. For example, companies like Tink (tink.com), Truelayer (truelayer.com), or Plaid (plaid.com) develop API-based<sup>7</sup> solutions for online payments, which allow businesses to easily use payment platforms like PayPal, American Express, or proprietary systems of the leading banks. As such platforms are the foundations of their own business ecosystems, the integration software allows multi-platform strategy for their participants. Sometimes there is also a customer-side technology

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<sup>5</sup> Apparently, they are not independent and are likely to create a positive feedback loop, with heavier discounting leading to bigger sales, resulting in higher visibility that would trigger more sales.

<sup>6</sup> <https://vc.ru/flood/17321-fake-gps>; <https://www.vedomosti.ru/business/articles/2016/08/02/651358-pogone-zakazami-voditeli-pitayutsya-vvodit-servisi-onlain-taksi-zabluzhdenie>

<sup>7</sup> API is an Application Programming Interface that allows independent software developers to easily use a piece of software, integrating its functionality into their own systems.

layer represented by meta-search engines that compare prices in real-time for services like taxi (e. g. taxinf.ru), air tickets (kayak.com), hotels (trivago.com) or online marketplaces (price.ru). Such technology providers effectively dilute the efforts of ecosystems leaders to “lock in” suppliers or customers and provide a counterbalance to their technological monopoly.

## 5. Discussion

In line with Nachira’s idea of evolution and natural selection of business models within a DBE, our empiric research shows the constant stream of innovative ideas developed by their participants. While business literature ( (Oxford Economic and Google Cloud, n/a), (IDC, 2019)) often puts the locus of innovation primarily on the ecosystem leaders who own core platforms, some academic authors took a more nuanced approach recognizing the pivotal role played by the contributors to the ecosystems (Eaton, Elaluf-Calderwood, Sorensen, & Yoo, 2011). The actual functioning of DBEs is more complex than the dichotomy of sellers and platforms, with many important services developed on the hidden layers (see Fig. 1).

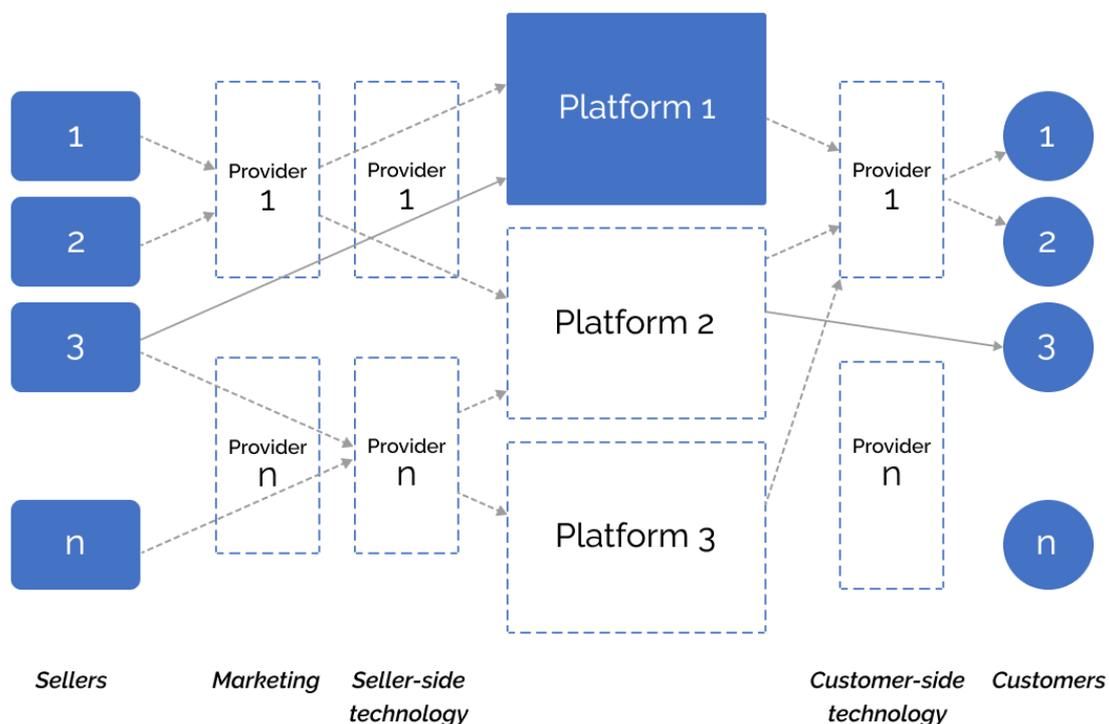


Fig. 1. Structure of a DBE including the hidden layers. Filled boxes match the traditional representation of structure in literature (Brousseau & Penard, 2007). Dashed lines represent the structural elements and links uncovered by our empiric research. Both supply- and

*demand- side participants can choose to use one platform (being “locked-in” in its ecosystem) or pursue a multi-platform strategy, operating directly or through providers of services that operate on the hidden layers.*

The companies operating on the hidden layers play an essential role in the balance of power within an ecosystem. The ecosystem leaders typically strive to have significantly more extensive operations compared to the contributors. This asymmetry allows them to dictate important rules and coordinate the functioning of the ecosystem to gain a competitive advantage vs. rivals, which is often described as “winner takes all (or most)” (Cusumano, Gawer, & Yoffie, 2019). A classic case of the power struggle between an ecosystem leader and a key contributor is Facebook vs. Zynga (which at a certain point generated almost 20% of the platform’s revenues<sup>8</sup>) that ended to the disadvantage of Zynga (Runge, 2014); it demonstrates the reluctance of the leader to share power in business operations despite the idea of “value co-creation.”

The companies operating in the hidden layers are typically larger than the sellers within an ecosystem, and they create value for the latter by empowering them to build independent strategies that may even seek to challenge the rules established by the leader (as in the case of product self-buy-back that explicitly “hacks” the algorithms of sorting offers on a digital marketplace web site). Though they do not perform explicit bargaining with the platform on behalf of the sellers, their functioning may effectively represent a sort of collective action against the platform’s dominating role.

The complexity of interactions within DBEs has important implications for their governance. A key issue in business is pricing, which has not only an operational dimension (defining the immediate profit margins) but also strategic importance, the positioning of product/service within the competitive landscape with the aim to signal particular “value” delivered to the customers (Piercy , Cravens , & Lane, 2010). However, the leaders of the ecosystems are limited in their abilities to establish and maintain desired prices.

Even in the case of relative structural simplicity – like in taxi services - where the prices are centrally suggested by the platform based on the current demand, to make the transaction happen, the price should be attractive to both customer and seller, who have opposite interests

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<sup>8</sup> <https://www.bbc.co.uk/news/technology-20554441>

regarding it. This creates a two-dimensional space, adding the factor of the probability of a nearby driver picking up the suggested order. In our report on DBEs, we have demonstrated that the relative price positioning of two leading Moscow taxi services varies across the days of week and time of day (Korovkin, Belouskov, Olaynikova, Sintyurhina, & Fateeva, 2021). The strategic business parameter becomes not the price but the rate of its dispersion in response to the real-time demand: higher prices decrease the waiting time for an order, yet they may trigger some of the customers to turn to a competitive platform. The price comparison services we mentioned above make the trade-offs explicit, further complicating the task of developing a consistent price positioning for the platforms. To address the problem, the platforms may punish drivers for rejecting too many offers (interview with Uber driver in Moscow), yet the measure brings the risk of pushing some drivers to work with competitive platforms.

The situation with online marketplaces presenting products sold by independent sellers is even more complex. The prices are established by the sellers and can only indirectly be influenced by the platforms. The practices of stimulating deep discounting through better representation of the discounted products lead to the game of constant price moves by the sellers. As we have demonstrated, the services providers working on the hidden levels facilitate these moves, often working against the strategic intentions of the platforms.

This brings us into the domain of polycentric governance. In line with (Ostrom, Tiebout, & Warren, 1961), we see that pricing decisions within DBEs are made by independent centres of authority that overlap and coordinate through forms of cooperation, competition, conflict, and conflict resolution. Another area where the same understanding applies is the choice of dominant technology: the solutions that independent players provide create additional technological layers that overlap with the core platform of an ecosystem and undermine the efforts of its owner to establish it as the sole standard. The independent technological solutions also typically facilitate multi-platform strategies for ecosystems contributors, with further implications on their pricing decisions.

This understanding is crucial: DBEs, being private companies and pursuing goals like profits, market share, or investors' valuation, have to act differently from a classic firm described in management literature. The nature of their business model – co-creation of value with many independent participants – makes them a peculiar case of a phenomenon that does not fit “in a dichotomous world of “the market” and “the state.”” (Ostrom E. , 2010), blending the strategic approaches of public and private governance. We would further argue that they

actually manage the important public good (nonexcludable and nonrivalrous as per (Ostrom E. , 2010), quoting (Samuelson, 1954)) for their participants. This good is the trust of the end consumers of the ecosystem.

Early in the literature on e-commerce, it was noted that customer trust is the key barrier to buying online, especially from relatively small and unknown vendors (Olsson, 2002; Papadopoulou, Kanellis, & Martakos, 2001; Brendon, 2002). The advent of a limited set of platforms that consolidate vast ecosystems largely solved the issue, stimulating fast growth in online purchases of all kinds of goods and services. Consumer trust is mainly established by the ecosystem leader to the benefit of all its participants, yet the actions of each contributor also have an impact on it. While individual sellers have incentives to act unscrupulously and find ways around the established set of rules (practices like establishing unrealistic list prices to create an impression of deep discounting or self-buy-back of products for achieving a higher position in search results), such actions will be ultimately detrimental to the business of all the participants. Here is the case of the Faustian bargain, when “the use of instruments of evil associated with coercive force is necessary to the achievement of the common good associated with the rule of law” (Ostrom V. , Faustian bargains, 1996): the providers acting on the hidden layers of the ecosystems are facilitating the practices that go against the strategic intention of the leaders (“instruments of evil”), yet they help the contributors to achieve desired business goals stimulating them to commit to a given ecosystem. To the best of our knowledge from our interviews, this important issue has not been recognized by the leaders of the DBEs, nor has it been effectively addressed by their policies.

As was noted in the methodology section, our empiric work was exploratory. It is likely that we have just started uncovering an essential phenomenon of the structural complexity of DBEs and the polycentric elements in their governance. There is a need for more empiric work on strategies and tactics of sellers and providers acting on the ecosystems’ hidden layers, both qualitative and quantitative. For example, the detailed analysis of the pricing dynamics by particular seller or group of sellers of competitive products may bring important insights. Another important direction is finding more examples of “hidden” services (and possibly uncovering other hidden layers than the marketing and technology we have mentioned). It may present a specific research challenge, as these services become apparent only through the immersion into the business operations of various ecosystems’ participants. Applying action research methodology looks like a promising approach here.

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