Disrupting the Disruptors or Enhancing Them?
How Blockchain Re-Shapes Two-Sided Platforms

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Abstract

The importance of platform-based businesses in the modern economy is growing continuously and becoming increasingly relevant. Specifically, the deployment of digital technologies has enhanced the applicability of two-sided business models, enabling companies to act not just as builders and owners of assets, but as *orchestrators* of external resources. Management research has therefore focused increasingly on the unique aspects of this model. At the center of a two-sided platform there is a platform provider that enables a transaction between the sides, reducing the relative transaction costs. However, in recent years, a new technology emerged that challenges some of the underlying assumptions of this model: the blockchain. Blockchain enables the creation of a peer-to-peer network that is able to authenticate transactions, upon which applications and services may be built. It allows users to conduct transactions *without* the need for a central platform.

We explore how blockchain technology re-shapes two-sided platforms, focusing in particular on the role of the platform provider. The research is based upon multiple case studies, using an inductive approach to explore this emerging phenomenon. Our findings show there is a significant shift in the role of

the central player that links the two sides of a transaction using blockchain. We frame this as a shift from a "platform provider" to a "service provider", leveraging the blockchain as a Platform-as-a-Service. Our work examines the peculiarities of this model, unveiling new dynamics in these businesses. Specifically, we show that different variables must be considered to classify two-sided platforms using blockchain. Furthermore, the essential characteristics of two-sided platforms must also be enlarged. For example, traditional platform theories emphasize the importance of cross-side network externalities in creating value. In blockchain-enabled platforms however, we show the use of "tokens" play a key role in creating different types of externalities between the two sides.

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Abstract

The relevance of platform-based businesses in the modern economy is growing continuously. Specifically, the deployment of digital technologies has enhanced the applicability of two-sided business models, enabling firms to act not just as builders and owners of assets, but as *orchestrators* of external resources. Management research has, as a consequence, focused increasingly on the unique aspects of this model. At the center of a two-sided platform, there is a platform provider that enables transactions between both sides, thereby reducing transaction costs. However, in recent years, a new technology has emerged that challenges some of the underlying assumptions of this model: the blockchain. Blockchain enables the creation of a peer-to-peer network that is able to authenticate transactions, upon which applications and services may be built. It allows users – both buyers and sellers – to complete transactions *without* the need for a central platform.

We explore how blockchain technology re-shapes two-sided platforms, focusing in particular on the role of the platform provider. The research is based on multiple case studies, using an inductive approach. Our findings show there is a significant shift in the role of the central player that links the two sides of a transaction using the blockchain. We frame this as a shift from a "platform provider" to a "service provider", leveraging the blockchain as a Platform-as-a-Service. Our work examines the peculiarities of this model, unveiling new dynamics in these businesses. Specifically, we show that different variables must be considered to classify two-sided platforms using blockchain. Furthermore, the defining characteristics of two-sided platforms must also be enlarged. For example, traditional platform theories emphasize the importance of cross-side network externalities in creating value. In blockchain-enabled platforms, however, we show that the use of "tokens" plays a key role in creating different types of externalities between the two sides.

Practitioner Points

- Blockchain is enabling a new type of two-sided platform, challenging the existing business models of firms operating in the modern platform economy
- Blockchain helps address traditional problems with two-sided platforms (e.g., the chicken and egg paradox, and generating trust between the two sides of a market) while creating new opportunities (e.g., the use of tokens to create additional network externalities)

- End-users (e.g., the suppliers and customers that transact in the marketplace) play a more central role in blockchain-enabled platforms, while the service provider becomes more of a facilitator, leveraging the Platform-as-a-Service offered by the Blockchain provider

- The concept of "value sharing" is central in blockchain-enabled platforms; service providers share more of the value they create with the ecosystem of market participants

Introduction

> *"How can a major business segment be invaded and conquered in a matter of months by an upstart with none of the resources traditionally deemed essential for survival, let alone market dominance? And why is this happening today in one industry after another? The answer is the power of the platform—a new business model that uses technology to connect people, organizations, and resources in an interactive ecosystem in which amazing amounts of value can be created and exchanged."*

<div align="right">(Parker, Van Alstyne and Choudary, *Platform Revolution*, 2016, p. 3)</div>

As this quote illustrates, the relative weight of platform-based businesses in the modern economy has been growing continuously and becoming increasingly relevant to academic study (e.g., Parker et al., 2016; Evans and Schmalensee, 2016). Companies like Uber and Airbnb, with their stratospheric market values making them two of the most valuable "Unicorns" (companies with a value exceeding 1-billion-dollar that are not yet public), are often used as key examples of this paradigm. This kind of digital platform (i.e., as defined above by Parker et al., 2016) is challenging established companies and disrupting industry dynamics with different business models, marketing philosophies, and supply chain configurations.

These new models create vast amounts of value while leveraging only a fraction of the assets of a traditional company. Consider that four out of the five largest Unicorns as of April 2020 are built upon a platform-based business model. Toutiao (Bytedance), the Chinese media platform that links users and contents, is valued at $75 billion. Didi Chuxing, the Chinese transportation platform that links riders with drivers, is valued at $56 billion. Stripe, the San Francisco based company that pays and receives payments online, is valued at $36 billion. Finally, Airbnb, the US-based company disrupting the hotel industry, is valued at $18 billion. As a matter of comparison, Hertz, one of the giants in the car rental industry with 100+ years of history, is valued at only $7 billion. Similarly, Starwood Hotels – with over 1,000 properties worldwide – was acquired for $12.2 billion in November 2015. Analyzing the ration of market value to revenue, we observe a 2x multiplier for asset builders, such as Starwood, compared to an 8x multiplier for platform providers (companies that set up the systems for exchange and bring on board the two sides) such as Airbnb (Rochet and Tirole, 2006). How can it be that a company that owns no property can be the world's most valuable room provider?

The concept of platforms in the management literature has a long history and has gone through various evolutions, from the concept of a "product platform," to industry-wide platforms (Gawer and Cusumano, 2014), to recent developments that focus on networks and ecosystems (Jacobides et al., 2018; Cusumano et al. 2019). Nevertheless, all the aforementioned platforms share a common characteristic: they match two (or more) groups of customers as their main value proposition; that is, they are two-sided platforms (Evans and Schmalensee, 2016).

The business model behind these companies has a long history in the economic literature known as two-sided platforms. A two-sided platform (formerly called a two-sided market) is a business "*in which one or several platforms enable interactions between end-users, and try to get the two (or multiple) sides 'on board' by appropriately charging each side*" (Rochet and Tirole, 2006, p. 645). In other words, these businesses act as match-makers between two (or more) different - but interconnected - groups of customers that play different roles in the system, usually representing a supply-side and a demand-side (Täuscher and Laudien, 2018): travelers and hosts for Airbnb or riders and drivers for Uber. They leverage *indirect* network effects, meaning that an increase in the number of customers on one side creates a higher utility to joining the platform on the other side and vice-versa (Katz and Shapiro, 1985). The peculiarities of two-sided platforms are not new. Indeed, businesses like credit cards and newspapers are based on a platform-based structure (Parker and Van Alstyne, 2005). Nevertheless, the last decade has seen such business models enhanced and become more popular. In particular, the penetration of digital technologies has enabled new companies to enter traditional industries and act as orchestrators of external resources (Sun and Tse, 2009; Amit and Zott, 2015; Magistretti et al., 2019). Management research has therefore focused on the unique aspects of this model (McIntyre and Srinivasan, 2017).

At the center of a two-sided platform, there is a platform provider that enables a transaction between two sides, aiming to reduce the transaction costs between the two parties (Evans and Schmalensee, 2016). In order to reach their goals, platform providers need to overcome a number of challenges related to their reliance on external players that create value for and through the platform (Amit and Han, 2017). For example, Airbnb and Uber have to ensure trust between both sides of the market and resolve issues that occur during service delivery. Similarly, BlaBlaCar, the European car-pooling platform, had to create a framework to enhance trust in their platform, to smooth the matching between sides (Mazzella et al., 2016).

In recent years, a new technology has emerged that may challenge some of the underlying assumptions of this two-sided platform model: the blockchain. Considering the definition of Glaser (2017, p. 1545): *"Blockchain is a transactional database, which is distributed among nodes linked in a peer-to-peer (P2P) communication network. The access to the network is based on a permission mechanism, which enables the nodes to perform transactions that hold validity based on a consensus mechanism".* Blockchain belongs to the family of Distributed Ledger Technologies (DLTs) which are digital systems for recording transactions without a central data store, the transactions and their details being recorded in multiple places at the same time. It enables the creation of a peer-to-peer network that can authenticate transactions, upon which applications and services may be built, allowing peers to engage in transactions *without* the need for a central platform (Miau and Yang, 2018). Viewed as a General Purpose Technology (GPT), blockchain promises to re-architect the ways in which users interact and exchange value, information, products and services.

Over the last couple of years, the academic literature has paid growing attention to this technology. Building on literature that considers mainly technological aspects of the blockchain (e.g., McAliney and Ang, 2019), studies about its *application* have been conducted in many fields, such as finance (e.g., Xu et al., 2019; Nasir et al., 2019), supply chain management (Sheel and Nath, 2019; George et al., 2019; Kamble et al., 2020; van Hoek, 2019) and regulatory compliance (e.g., Shanaev et al., 2020; Boreiko, 2019). In addition, management scholars have recently started considering the impact of the blockchain (e.g., Chen and Bellavitis, 2020; Leng et al., 2019; Ahluwalia et al., 2020), some of whom have identified a link between two-sided platforms and blockchain. For example, the characteristics of blockchain suggest the emergence of new configurations that can enhance the role of the supply side organization (Saadatmand et al., 2019). More generally it seems that the concept of intermediation at the center of the two-sided platform literature also represents a business model archetype for blockchain-enabled businesses (e.g., Risius and Spohrer, 2017; Weking et al., 2019).

While in some ways, blockchain (and other DLTs) fits the definition of a two-sided platform, there are substantial differences in comparison to the examples mentioned earlier: in particular, all traditional multi-sided platforms rely on a central intermediary, the owner and manager of the platform, which provides the platform as a service for a specific function. In contrast, blockchain platforms (i.e., platform-based businesses based on the blockchain technology) "*are platforms or ecosystems on which other platforms work*" (Van Eijk, 2015). In essence, they provide an infrastructure for creating platforms and more importantly, a

protocol that is not written for a specific purpose, but adaptable to many uses (e.g., the Ethereum blockchain protocol, which is used for many different services or platforms on top of it).

On the one hand, blockchain technology may change the traditional role of a platform provider in a two-sided platform, allowing a decentralized network of users to take charge of some activities, such as connecting the sides and assuring transactions between them. On the other, it appears to be a powerful technology that may challenge the status quo for two-sided platforms. Despite the early studies in this area noted above and the media hype that surrounds this new technology however, the academic literature is missing a clear understanding of the impact of this technology on two-sided platforms (Schmeiss et al., 2019). This article aims to address this gap in the literature by answering the following research question:

How does blockchain technology affect and change the main variables that are used to define and characterize two (or multi) sided platforms?

In other words, as alluded to the title of this paper, two-sided platforms have often been considered disruptors for traditional businesses (Trabucchi et al., 2019). So, is this new technology, in turn, going to 'disrupt' the business models of two-sided platform providers, or is it actually going to enhance and support their business models even more?

To tackle this goal, the paper is organized as follows. In section 2, we review the extant literature, focusing in particular on what we know about two-sided platforms and blockchain technology. Section 3 presents our research methods, which are based upon multiple case studies. In section 4 we summarize the main results, and follow with a discussion in section 5. Finally, in section 6 we present the implications of this work, for both scholars and practitioners, along with opportunities for further research.

Theoretical background

This research builds on and contributes to two main bodies of literature: two-sided platforms and blockchain. Therefore, this section proceeds as follows. First, the main definitions and previous work on two-sided platforms are presented to define the current state of the art. Second, we build a conceptual framework that informs our empirical investigation by highlighting the main variables that characterize two-sided platforms. Third, we review the state-of-the-art on blockchain technology, addressing its technological characteristics. Finally, we present work at the intersection between blockchain and two-sided platforms.

Two-Sided Platforms: the main definitions

The theory of two-sided platforms (as defined previously by Rochet and Tirole, 2003 and 2006) has a long history in the economic literature, where businesses that aim to link two different groups of customers (e.g., hosts and guests, drivers and passengers) have been defined as two-sided markets (e.g., Rochet and Tirole, 2003; Hagiu and Tirole, 2015). Such businesses are characterized by three necessary conditions: i) the existence of two (or more) groups of customers, ii) linked through *indirect* network externalities and iii) with a platform provider able to internalize (at least partially) these externalities (Evans, 2003). Network externalities refer to the effect of users' adoption on the value of a network/good. In particular, two-sided platforms are based on indirect network externalities, since the value perceived by one side of the platform (e.g., gamers that use a specific video game console) depends on the number of participants on the other side of the platform (e.g., video game developers and publishers) and vice-versa (Katz and Shapiro, 1985; Song et al., 2009).

In recent years, there has been a movement from studying two-sided platforms using the lens of economic theory to one in which the *business model* is the focus, with significant implications from a management perspective (Hagiu and Wright, 2015). Recent works highlight how the resource configurations behind these businesses are significantly different from companies based on linear value chains (Amit and Zott, 2015); and that the development processes for these platforms can be particularly challenging (Perks et al., 2017). Indeed, these platforms give rise to unique and differentiated resource configurations, where various flows (from services to money, from data to knowledge) are exchanged (Amit and Han, 2017). Even though the requirements for a business to be considered a two-sided platform are well defined (Evans, 2003), we still find heterogeneity in the types of business using this model, for example, involving different kinds of users on each side (e.g., consumers or businesses) or enabling different kinds of transactions (e.g., physical or digital) (Täuscher and Laudien, 2018).

From a business model perspective, two-sided platforms have been studied for the value creation and capture opportunities they offer to platform providers. These platforms can be scaled much faster than traditional linear value chain-based businesses due to the role of network effects (Rifkin, 2014; Trabucchi et al., 2019). Furthermore, they outsource part of the value creation to the market, having one of the two sides act as a supplier for the other. Therefore, businesses based on a two-sided structure are usually based on a wide and heterogeneous offer that can satisfy the needs of a significant user base (Parker et al., 2016).

Finally, these platforms often leverage digital tools, like smartphones, allowing the platform provider to gather a large amount and variety of data, enabling new data-driven strategies for capturing value (Rindfleisch et al., 2017; Trabucchi et al., 2017; Trabucchi and Buganza, 2019).

Notwithstanding the benefits above, two-sided platforms also face significant challenges before reaching a mature phase where the above-mentioned opportunities can flourish. Indeed, these businesses have a major hurdle to cross: the need to solve the chicken and egg paradox. In the early phases, they need *both sides* on board to make the platform viable, even if the platform has low value for one side while the other side is developed (Caillaud and Julien, 2003, Strummer et al., 2018). Furthermore, they need to build an environment where both sides can trust the other and the platform provider at the same time, representing a significant source of resistance in the early phases (Ert et al., 2016). Finally, it is important to consider that these platforms are much more complex than traditional linear value chain companies. Indeed, they need to design – at the same time – two different value propositions for two groups of customers which are related through indirect network externalities (Muzellec et al., 2015). While we see the few large successes, many efforts are doomed to fail.

Two-Sided Platforms: the main descriptive variables

Building on the definition proposed by Evans (2003), two-sided platforms can be represented through the existence of two groups of customers (buyers and suppliers – represented by the circles in Figure 1), linked by a platform provider (the central block) while creating and enjoying the effects of indirect network externalities (the dotted line between buyers and suppliers). The central platform enables a direct transaction to occur between the two sides (represented by the grey line) while capturing value through a transaction fee (from one or both sides, as the two dotted red lines represent).
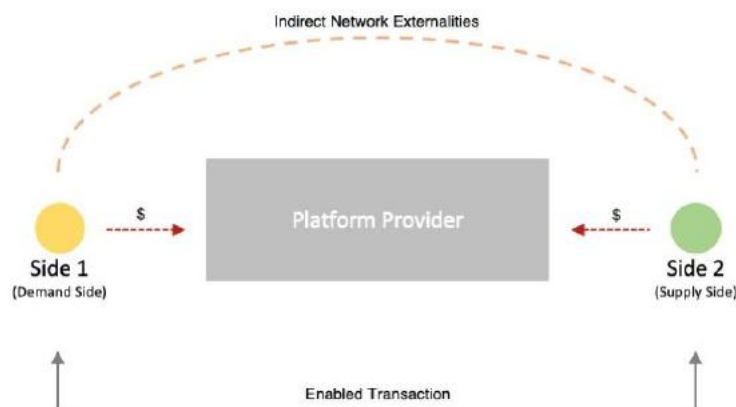
Figure 1 - The main elements of two-sided platforms

The variables mentioned in this model can have different values and enable different kinds of businesses. The type of users involved on the two sides, representing the demand and the supply side, are generally identifiable as buyers and sellers (e.g., Parker and Van Alstyne, 2005). However, there are various potential roles on both sides of the platform, and these users might have different relationships with each other. For example, characterizing the users on each side as consumers (C) or businesses (B) leads to various combinations of the platform (i.e., C2C, B2B, C2B, and B2C) (Täuscher and Laudien, 2018).

Among the users, there are *indirect* network externalities between the two sides (Katz and Shapiro, 1985), and in some cases *direct* network effects on the same side (Parker et al., 2016). The platform provider enables the transaction between the parties, internalizing these externalities (Evans, 2003) and facilitating the matching between parties (Muzellec et al., 2015). In doing so, the platform provider serves as a facilitator, for example enabling a trustworthy environment through collecting reviews, ratings, and other similar services (e.g., Parker et al., 2016; Mazzella et al., 2016).

In terms of economic sustainability, the business model of two-sided platforms is usually based on the above-mentioned transaction fees that may be charged to one or both sides (Parker and Van Alstyne, 2005). Moreover, the involvement of non-transactional sides that subsidize the system (e.g., advertisers who pay for "eyeballs") may lead to platforms where *neither* side is charged (Filistrucchi et al., 2014; Trabucchi et al., 2017).

Blockchain: the main characteristics

In 2008 Satoshi Nakamoto, a programmer whose real identity is still unknown, published the white paper "*Bitcoin: A peer-to-peer electronic cash system*" (Nakamoto, 2008) explaining the idea of peer to peer virtual currencies, able to operate worldwide without the use of financial intermediaries: 'The Bitcoin protocol'. The central idea was to allow people to use money in a decentralized way, without being tied to any institution, nor with the need for permissions. It was a major statement of protest against the financial industry, which had caused the biggest economic crisis since the great depression. Ten years later, its most important incarnation, Bitcoin, had reached a market capitalization of $830+ billion and together with hundreds of other cryptocurrencies, the idea had lost its anti-conformist / anti-establishment message. Indeed, what was generating most interest was not Bitcoin itself, but rather the underlying technology on which it works: the blockchain (or 'The Blockchain protocol').

Invented to "overcome the problem of double spending on the internet" (Nakamoto, 2008), blockchain had the potential to radically change the world in many ways, with the same pervasiveness that the internet had in its infancy. In the '90s, the world was not yet able to understand, manage or imagine all the possible (and impossible) applications for such a general-purpose technology (Magistretti et al., 2020) like the Internet. Once the technology began to diffuse, however, more and more researchers started to explore the possible applications of this innovation. The same is happening today with blockchain. A major breakthrough came when blockchain technology emerged as relevant not only for financial services but showed disruptive potential in many non-financial activities (Swan, 2015; Kizildag et al., 2019; Lee, 2019). These studies became increasingly sophisticated, identifying many possible applications. Recent literature describes the blockchain technology as a radical innovation that may unveil new directions in terms of enabling new services and models (Holotiuk et al., 2019).

The protocol described by Nakamoto enables the creation of a decentralized network which, relying on the computational capacity of network participants, allows the exchange of assets between untrusted actors through an online transaction, without the need for a trusted intermediary (Swan, 2015). Blockchain is not a single technology developed by a single programmer (Nakamoto, 2008), but rather provides "*a solution which unifies decades of research and is built on four main pillars*" (Antonopoulos, 2014). These are:

- **Peer-To-Peer Network**: The architecture provides the database structure for a public distributed ledger, with each transaction occurring between nodes without recurring to a central node (Omran et al., 2017). Each node stores and forwards information to all other nodes (Iansiti and Lakhani, 2017b). Thus, it does not require the presence of a central node that operates as a validator of all the activities and transactions completed on the platform. The blockchain technology allows users to have the right to access the database in real-time. Furthermore, if permissioned, they can also store a copy of the ledger. (Salviotti et al., 2018).

- **Transaction Logic**: Cryptography and a digital signature are used to secure the completion of transactions between anonymous accounts (Omran et al., 2017).

- **Immutability of data**: "*The ledger consists of consecutive data blocks individually secured and cryptographically sealed, interlinked to previous data within a chain*" (Omran et al., 2017). Moreover, to ensure a unique version of the record in all the ledgers, the process uses a set of algorithms with the specific function of making each

record permanent, chronologically ordered and available to all users (Iansiti and Lakhani, 2017b).

- **Consensus mechanism**: A consensus mechanism can be considered as a set of rules and protocols for governance that work to coordinate the execution of transactions, their validation, and their recording. (Kandaswamy et al., 2018). More practically, it is an algorithm that enables a global "election" allowing users to agree about one true systemic-state of the network for synchronizing the shared ledger (Omran et al., 2017).

There are two main variables that discriminate between types of blockchain: validation rights and assets rights (Garzik, 2015). The former pertains to defining the actors in charge of the validation and creation of transactions blocks. The validation rights, in turn, lead to distinguishing between a "permissioned blockchain," in which permissions pass through a centralized organization, which states a list of transaction processors with known identities (the network of nodes); and a "permissionless blockchain," in which the consensus algorithm is open source and no restrictions are imposed upon transaction processors. Anyone can download the code and participate in the network, turning her local device into a public node that will validate transactions, take part in the consensus process and create blocks of transactions.

Similarly, access rights classify blockchains into *public blockchains*, where everyone has access to the blockchain submitting transactions upon the network to be validated and included in the ongoing block, and everyone can be an entry point for new data; and *private blockchain*s, where the access to blockchain data and to the possibility of submitting transactions is limited to a restricted list of actors. The latter solution guarantees clients' confidentiality since the ledger system is not public and transactions cannot be read and queried by everyone openly.

Blockchain and Two-Sided Platforms

The academic literature so far has mainly focused on understanding the technical aspects of blockchain, including the protocol and its foundations, and the financial dimension of cryptocurrencies, meaning "*a comprehensive understanding regarding terms of application and use-cases is generally missing*" (Risius and Spohrer, 2017, p. 390). Nevertheless, the application of this technology has been established outside the financial system (e.g., Li et al., 2018). Over the last 10 years, the literature has moved from a focus on cryptocurrencies (to

2013) to an assessment of possible use cases (2013-2016) and finally to a focus on smart contracts and their peculiarities (Miau and Yang, 2018).

From a management perspective, it has been noted that this technology differs from traditional centralized platforms since it enables the transfer and exchange of property rights based on decentralized governance and distributed data infrastructure (Catalini and Gans, 2016). Hence various scholars have started studying the opportunities and challenges of this technology, highlighting benefits such the role of enabling trust in transactions (e.g., Ahluwalia et al., 2020), increasing transparency (Kandaswamy et al., 2018) and the immutability of data (Omran et al., 2017). These are set against challenges, such as high costs, potential threats to privacy related to high transparency, and the first-mover disadvantages that companies have experienced when moving into this field (Cong and He, 2019; Park et al., 2020).

Recent literature highlights the opportunity to develop new forms of organizations enabled by the blockchain (Beck et al., 2018). Blockchain-enabled platforms usually involve an open decision-making governance mechanism, where the community decides what changes to implement through forums, discussion groups and voting systems (i.e., it is not limited to only suggestions, as happens in other crowdsourcing initiatives with centralized platforms) (Pereira et al., 2019). While the management literature (e.g. Pereira et al., 2019; Holotiuk et al., 2019) is now starting to consider this emerging technology, we are however, still at a very early phase. Pereira et al. note, "*We are passing through an experimentation period when 'a thousand flowers are blooming', and we might be far from standardization*" (Pereira et al., 2019, p.101).

Blockchain has been mentioned as a possible enabler for new business models (Chen and Bellavitis, 2020) and more broadly as an external enabler of new venture ideas (Chalmers et al., 2019), having potential use cases also in physical markets (e.g., Leng et al., 2019). From this perspective, recent articles have focused on specific features in terms of value proposition design, such as the verifiability of data and faster and/or cheaper transactions (Morkunas et al., 2019). In addition to the existence of drivers for the usage of this technology for improving traditional competitive variables (e.g., like lower transaction costs) recent studies show how this new technology can bring opportunities to develop *new* value-added services, using smart contracts and new organizational forms (Angelis et al., 2019).

Despite the great attention that blockchain received over the last years, there is still a need for more research with a managerial perspective. Risius and Spohrer (2017) proposed a research framework building on previous articles and highlighted a high potential correlation

between blockchain and businesses acting as intermediaries or as platforms. Conceptually, blockchain has generally been considered a substitute for intermediaries thanks to the use of smart contracts (Mainelli and Smith, 2015; Glaser 2017), with implications for anonymity and privacy protection (Kosba et al., 2015) with applications in fields like healthcare (Zhang et al., 2016) or IoT applications (Hashemi et al., 2016). Potential implications for platforms have been studied, including consensus mechanisms (for example studied in the field of Bitcoins by Gervais et al. 2016, or focusing on their technical features, e.g., Watanabe et al. 2016), permissioning of writing (highlighting various levels of freedom and typologies, Walsh et al. 2016), decentralization or interoperability (for example discussing various possible forms, Danezis and Meiklejohn, 2016). All these features are considered mainly at a theoretical level (Risius and Spohrer, 2017). Similarly, other studies have provided conceptual frameworks proposing blockchain as a new platform enabler to create new digital payment systems (Lindman et al. 2017) or replace central banks (Hayes 2016). Moreover, blockchain has been studied as a technology to be integrated within software solutions (e.g., Xu et al. 2016) or within physical networks like the Wi-Fi hotspots (Sanda and Inaba 2016). All of these cases tend to consider the potential impact of blockchain on two-sided platforms, from the perspective of recent technology developments and the need of time to let companies explore and use this technology for business applications. Therefore, there is still the need to understand "*how blockchain applications can replace intermediary services providers*" (Risius and Spohrer, 2017, p. 395), enabling different kinds of platforms. As a consequence, we aim to study the research question cited above, by taking an empirical perspective driven by the data.

Research Design and Methods

Given the infancy of blockchain technology and the limited number of applications that have reached critical scale, an exploratory research approach is necessary. In particular, this exploratory research is based on a multiple case study design. The article also takes an inductive approach to explore this emerging phenomenon (Gioia et al., 2013) to allow the development of new theory on the basis of the evidence presented in these case studies.

Sample selection and data collection

Companies were selected from marketplaces that had decided to develop their business model on a blockchain platform. To assure the literal replication of data and to have a homogeneous sample, cases with similar business platforms were considered. Hence, we decided to focus on e-commerce marketplaces relying on the Ethereum network or

comparable technologies, one of the most influential open blockchain technologies (Wood, 2014; Miau and Yang, 2018). Moreover, we decided to focus on companies past their Initial Coin Offering (ICO), in order to have access to secondary data beyond company white papers and to ensure the validity of the underlying business model had been recognized by external investors. This helped define the companies eligible for the sample, before engaging with them to leverage primary sources. On the basis of these characteristics, through the analysis of websites and secondary sources, 23 separate companies were identified and analyzed in terms of standard parameters, such as coverage of circulating supply, average transactions for holders, top holders' share, and other technical characteristics. On the basis of these parameters, the 23 companies were ranked in order. From this list, a final sample was developed by selecting companies which represented interesting cases, given they were building their business models around the concept of blockchain, while selecting this model in comparison to a standard model. They were also chosen to represent different industries and approaches to increase the heterogeneity of the sample. Finally, we considered the willingness of companies to share their data and decisions about the business model. Our final sample comprises five (disguised) marketplaces: BitBoost, CyberMiles, Soma, Vanig and Gamb. Given the sample heterogeneity, we consider five observations an appropriate number to explore for purposes of theory-building.

For all cases, data gathering was based both on primary and secondary sources. For the former, in each case, from one to four interviews were conducted with the company. We interviewed all people in key roles in the company, involved since the launch of the business and with a full understanding about the strategic choices of the company (see Table 1). To have a complete understanding of the history, in most companies two interviews were conducted with the same person. The different perspectives analyzed and the small size of the companies under investigation, allowed us to gain a full appreciation of why and how they decided to adopt blockchain technology. The interviews were focused on understanding why they decided to create their businesses on blockchain technology – instead of using traditional digital platforms – and to explore their role as matchmakers between buyers and sellers

Interviews were conducted using an open protocol developed on the basis of the research questions, asking managers open-ended questions related to their business model, the main reasons for adopting a business model using blockchain technology, the main benefits and challenges of this technology, and the variables they had to consider in design. Questions were not posed in the same order in all interviews but followed the flow of each

interview. At least two researchers participated in each interview, and interviews were recorded, upon permission, to avoid information loss. All interviews were transcribed and entered into a common database. Data collected during the interviews were then supplemented, after a preliminary analysis, with additional details from further calls or e-mail communications with company managers, to clarify questions and address missing information. Finally, a summary of primary data collection was created and, to assure completeness of analysis, was shared with the interviewees to check whether any key elements were missing. Comments received from interviewees responding to this data validation check were included in the final description of the case.

Data collected through direct interviews were triangulated with secondary data publicly available from the internet, official data provided by the company (e.g., whitepapers or official videos) and data offered by third parties, such as blogs or websites. These secondary data were used as objective sources to complete the overview of the company. Secondary data included whitepapers describing company business models and/or used for the Initial Coin Offering (or ICO, through which the marketplace on a blockchain is founded), official videos describing the companies, official blog articles, and third-party websites providing industry data. These data were used in two ways: before the interviews, to have a preliminary understanding about the company and its business model and to compare characteristics across the different cases; and after the interviews, to complete the overall description of the case study.

The sample and the sources used for data collection are summarized in Table 1.

Table 1 – Sample of analysis

Case	Direct data	Secondary data
BitBoost	4 direct interviews: with Social Media and Ambassador Program Manager (2 interviews); and COO (2 interviews) 66 e-mails of clarification	1 white paper 4 videos 28 blog articles 4 sites of ICO benchmarks
CyberMiles	3 direct interviews: with COO (1 interview); and CEO (2 interviews) 21 e-mails of clarification	1 white paper 1 video 13 blog articles 5 sites of ICO benchmarks
Soma	2 joint direct interviews with co-founder and COO 17 e-mails of clarification	1 white paper 6 videos 13 blog articles 4 sites of ICO benchmarks

Vanig	1 direct interview with Chief Solution Architect	2 white paper
		5 videos
	13 e-mails of clarification	4 blog articles
		3 sites of ICO benchmarks
Gamb	1 direct interview with the VP of communication	2 white paper
		5 videos
	10 e-mails of clarification	7 blog articles
		4 sites of ICO benchmarks

Data analysis

Data analysis involved three stages: a within-case analysis, a cross-case analysis, and a theory-building stage. Open coding was adopted in the first two stages, as labels and codes were identified on the basis of notes, annotations, and transcripts. The analysis of data for the within-case analysis involved several steps. First of all, interviews' transcripts were read once and then re-read line by line making notes of the first impressions. At this step, it was important to grasp the general meaning and the "flow" that the single interview took. Then, primary data were analyzed with NVivo Program, to identify the most frequent words per case study and to try to understand how each case was characterized. Adopting a word by word approach, labels were extracted as the most meaningful pieces of text to create. The third phase was the development of the coding tree to perform data reduction. Then, secondary data were combined with primary data for the analysis of each case for the within-case analysis. In this phase, quotations were retained, to maintain the narrative of findings. The purpose of this phase was the identification of codes for macro-areas and more specific categories. Finally, data interpretation was performed: per each case taken singularly the coding tree was described and interpreted. This consisted of examining the final results to draw a conclusion for the within-case analysis.

Categories of the coding tree were used for the cross-case analysis. The five cases were compared to each other, firstly in pairs and then all of them together, to answer the research questions. The purpose of the cross-case analysis was to identify both commonalities and differences among the cases. A cross-case analysis was performed independently by three researchers, and then results were compared to find similarities and differences and to increase descriptive validity; in the case of any misalignment, a revision of results was performed to arrive at a common classification for each case. Finally, the theory-building stage was completed to perform interpretation and abstraction. This involved iterating data

and theory with the purpose of designing the new framework for characterizing the design of decentralized two-sided platforms that are built upon blockchain technology.

Results

The analysis of the results is split into two parts: first of all, the within-case analysis of each company is presented; then, the main evidence from the cross-case analysis is summarized, integrating our findings into a new framework.

Within-case analysis

BitBoost

BitBoost is a decentralized trading platform, that aims to eliminate the high fees for traditional e-commerce platforms. Founded in 2014, it operates on the Ethereum network. Its main purpose is to create a decentralized global marketplace upon which sellers and buyers can meet each other and exchange goods and services without external interference. The implementation of a blockchain layer lowers geographical barriers, meaning that users can interact among each other independently of location. Sellers and buyers can trade directly any kind of product/service, without the need for any intermediary or bank account. In their ICO in October 2017 they offered around 5,000,000 BitBoost Tokens at an equivalent value of 2mn € in bitcoins.

The long-term aim of BitBoost is to be peripheral with respect to transactions on the network: "*Eventually, the only role that BitBoost will have is working on the interface and its features. We will not have anything to do with the exchange between buyers and sellers*" (Social Media Manager 1). This statement highlights the role of BitBoost in the management of the platform and the relationships between parties, leaving a gap regarding who manages the actual transaction between parties. The answer lies in the technology and the community. Transactions are guaranteed through the BitBoost Token: "*Every BitBoost token contains a smart contract. Therefore it is fundamental that the fees for listing are paid in BitBoost tokens. The smart contract contains the escrow that guarantees the payment till the moment in which the buyer receives it*" (Social Media Manager 1). Furthermore, there is a specific role in managing potential issues in the transactions between parties: "*In case of issues during the transaction, one of the two parties can appeal to an arbitrator. The arbitrator is a third party who is not part of BitBoost who comes from the impartial community that intervenes in favor of one or the other party. The funds are blocked, and the arbiter has*

complete access to the conversation between the two parties, deciding who is wrong and who is right" (Social Media Manager 1).

Tokens play a significant role in guaranteeing transactions, but they are also critical in defining the overall value of the business, since holding tokens may be valuable without direct use. "*Users are like shareholders, because owning tokens, they have a strong interest in seeing that its value goes up, even though BitBoost is a specific token for the payment of the listing fee and not a token for investment.*" (COO). This mechanism has an impact on the role of people, who are a part of the community, promote the growth of the system, and receive a direct return from this community, from the ownership of tokens.

To create revenue, BitBoost relies on the payment of listing fees: "*The only fee we have is for the listing, which is 1%, while other platforms often ask for 30%*" (COO). This highlights the critical role that the community and token holders play in the system: "*Here the power goes back into the hands of the sellers and buyers*" (COO). Possible future opportunities include the chance to offer dedicated e-commerce services: "*BitBoost is introducing new services, with the possibility to create your own e-commerce service by paying a monthly fee. In other words, you have the chance to resell our technology in such a way that you can create your own marketplace using our technology via an annual payment*" (Social Media Manager 1).

CyberMiles

CyberMiles was founded in Asia in 2017 to create a decentralized blockchain solution for the e-commerce industry supporting smart business contracts. Working on a smart contract platform similar to Ethereum, it aims to avoid rent-seeking monopoly behaviors, targeting a fair allocation of network rewards while achieving greater network effects through the use of economic incentives. The goal of the platform is to enhance the community around it: "*the idea is to build up a network offering business services for its members, by its members. The governance structure is open, all members have a voice in strategic decisions. In the same vein, the governance of disputes among parties will also be self-managed by users who will play the role of arbiters.*" (VP of communication). Hence the company plays a different role in comparison to traditional marketplaces; not being an intermediary, but working behind the scenes: "*The platform will move gradually to the background with respect to commerce activities, leaving the marketplace governed by the community itself.*" (VP of communication).

The main incentives for good behaviors by users are related to the use of tokens. In this case, the CyberMiles Token works as the foundation of the system. Tokens are necessary

to allow users to access all services, from payment to incentives to voting power: "*The token economy, which develops around CyberMiles Token, is a tool that creates and boosts network effects, increasing retention rate and loyalty. Incentives, given to users in tokens, in our opinion will install a virtuous circle in which higher user activity corresponds to higher rewards, and this results in a wider sense of belonging in the community.*" (VP of communication).

In terms of trade guarantees, the natural features of blockchain bring users assurances. The immutable recording and storing of all transactions, user data and other items allow CyberMiles' marketplace to offer complete traceability of data, transactional reliability, proactive fraud detection and certified user identities. User identity is directly attributable to the single user's wallet, through which also all payment transactions and smart contracts are triggered. Moreover, the platform offers users two additional forms of guarantees. First, a pre-defense service according to which CyberMiles undertakes to stop any suspicious transaction, before it actually occurs. Second, a post-recovery function that, under a consensus mechanism, will restore users' funds in case of unsuccessful trades.

To create revenue, CyberMiles model relies on commission fees for each transaction. In future, they may expand in other directions, for example licensing the technology or seeding investments in companies that rely on their underlying blockchain technology.

Soma

Soma, founded in 2016, has an overall goal to help end-users as much as possible when buying online. It integrates provenance tracking, social media functionality, and easy buying and selling. It focuses – for now – on the luxury watch segment. These include microbrands, independent watchmakers, and other sellers of fine watches. The result is a marketplace where social interaction and trading are united in a blockchain-enabled business.

The venture has been financed through an ICO that has played a significant role in the design of the overall business. "[Though the ICO] *we had a way to raise capital, because it not only solved the capital need of the company, but also gave us a global community of fans and promoters. We started to have people around the world hold tokens from the ICO.*" (Co-Founder). The founders see this process as similar to what happens in a crowdsourcing initiative: "*We have people around the world promoting us because they want to do this. They are token holders and they are very enthusiastic about what we do for the rest of the community.*" (COO). Tokens play a very relevant role, even if they do not provide voting rights: "*Our tokens don't give rights to vote and control over the company. They are utility tokens which will give access to certain functions on the platform.*" (Co-Founder). But this

still creates network effects: "*I think that creating a token ecosystem incentivizes people to stay on the platform. It increases customer engagement because it creates a sort of gamification for the platform*" (Co-Founder).

To facilitate user behavior on the platform and incentivize users to act correctly, Soma relies on two main aspects: reputation scores and a strong incentive system. All users on the network have a reputation score, which mirrors their performances and actions on the platform. The platform explicitly defines this reputation system as "users' social approval". Thus, the score users receive is certified by other members of the marketplace, and all are incentivized to be honest, since they receive rewards for content generation and negative reputation scores damage the ability to do business on the network. Tokens may be used as rewards for activities that positively affect the marketplace and contribute to increasing network effects.

Smart contracts are used to guarantee transactions, even though traditional dispute resolution mechanisms are also in place to minimize the risk of disputes. Moreover, Soma also uses this technology to prove the provenance of products: "*We can guarantee the authenticity of the product, and track the provenance of items by using blockchain as our database. Basically, we are putting critical information about items into the blockchain and hence people can be sure that the item they purchase from the platform is authentic.*" (COO). Indeed, given the immutability and encryption of data, blockchain can trace all items through their patented card, which contains a digital social identity profile of the item with photo, description, past owners and other information.

Revenues come mainly from transaction fees, but Soma is also considering an enterprise subscription model. In addition, they are thinking of leveraging the power of big data: "*Big data will definitely become a relevant source of revenue when we start to get generate more data through the enhanced network.*" (Co-founder). In particular, they see a huge potential for data regarding the second-hand market, which may be interesting to the original producers.

Vanig

Vanig is an e-commerce start-up powered by blockchain which relies on a hybrid blockchain layer. It leverages Ethereum for recording transactions and data on the public blockchain, and for storing and managing the remaining data on its private Hyperledger Blockchain. The company implemented its own token, called Vanig token. It concluded its ICO phase in August 2018.

Vanig's approach to e-commerce is related to the integration between e-commerce activities and the management of a supply chain in order to deliver a unique experience. Since the platform does not focus only on the creation of an e-commerce marketplace, the range of stakeholders it includes with its blockchain implementation is wider than other platform players. Vanig's solution addresses not only buyers and sellers, but also manufacturers, logistic providers, and other actors who form part of the companies supply chain.

In building their system, Vanig stresses the importance of identity: "*People, processes, things. Every aspect can have an identity. These identities can have stations attached to them from entities you trust, so you'll know everything from a product rating to the delivery time.*" (Chief Solution Architect). These mechanisms exist within a broader environment: "*you try to create an environment, which is an underlying theme of blockchain, that incentivizes all stakeholders to perform within an acceptable range for the ecosystem. It is different from centralized economy. You bring something to the ecosystem and you allow others to do it as well. And then they let you exchange value through their tokens for all the stakeholders. Not just the party making the purchase, in a tokenized blockchain environment all stakeholders involved need to perform properly*" (Chief Solution Architect).

Vanig believes in the power of community, giving them the right to manage the data they create on the platform. "*What if we created identities and let people own their data? Right now, we wonder who owns the product and who's the customer with a centralized approach. But, if we own the data and we can choose what to do with it, if we could monetize and see the direct benefits of this, it would create a more empowering paradigm and a powerful ecosystem*" (Chief Solution Architect).

In order to cope with the difficulty of keeping different actors in the ecosystem, the company has designed a token economy around its utility token, Vanig token. The idea is to use it as an internal currency and as the nature of reward that the ecosystem will give to users. In fact, Vanig has planned an incentive system based on its token: users are rewarded if they provide a positive contribution to the commercial marketplace, through content generation or affiliating marketing, or for example if they just use the platform (i.e., make purchases on the platform). These new forms of incentive give users a range of roles within the platform. They can perform many tasks, which traditionally have been carried out by a centralized player and they can be remunerated for this. According to Vanig's whitepaper, the value of the token is expected to grow following Vanig's market rollout. In addition, to boost its adoption within

the network, the company plans to adopt more favorable transaction fees for all users that decide to adopt the token as the chief medium of payment.

Regarding revenues, their view is clear: "*Where value is perceived in a centralized e-commerce supply chain is going to be very different than a variable and defensible blockchain-based e-commerce supply chain – the value moves where it's not so much revenue streams, but new opportunities. We move to the edges of the ecosystem and capture smaller value entities*." (Chief Solution Architect). This highlights how companies working on this kind of technology must search for new paradigms: "*if you are an established player, you move from where value is captured today to where you think it's going to be captured tomorrow. If you are a new disruptive player, not knowing all the answers for tomorrow, but possible understanding directions and what this new ecosystem may enable, you need to think about how it is going to change value network structure*" (Chief Solution Architect).

Gamb

Gamb is a decentralized marketplace that aims to give decision-making power to the owners of a marketplace, who are participants in the marketplace itself. Gamb has been funded by a software provider for e-commerce with more than 25,000 merchant customers: "*[Our original company] was known in the trade market for having a good relationship with their merchants, and, by this, you know and you learn about their pains, and one of the pains they have is… it is very difficult to generate traffic in your own shop and you enter into a competition with marketplaces. […] We thought "What about leveraging our customer base and offering them something they can control themselves.*" (COO). This led to the creation of Gamb.

Gamb is based on an innovative governance model. Through smart contracts, users have the power of trading and contributing to the governance of their marketplace, unlike centralized e-commerce platforms. In order to gain the right to participate in the governance of the marketplace they have to hold tokens. Thus, token holders from all over the world become the owners of the marketplace, and they propose decisions, rules and regulations for trading. This is particularly attractive for merchants, since they have a great interest in setting and defining the trading rules for their own marketplace. Indeed, they have their own tokens, known as a utility token: "*The main purpose is for voting and in governance*" (COO), which facilitates the engagement of merchants in governance. On the consumer side there is a Council: "*In the Council we want to represent the stakeholders of the marketplace and consumers are definitely one of the most important parts, because if they do not buy it will be very difficult for the merchant - with the best governance in the world – to sell. And if they do*

not sell, they leave. So, it is important to involve customers and listen to their needs. And when you do this, and you integrate it into the strategy, you create a better result for the ecosystem as a whole" (COO).

Gamb developed a rating system for both sellers and buyers. Both actors are incentivized to rate the other party, in exchange for Gamb tokens. Incentives are another important feature of the Gamb marketplace. Through the token economy, the platform provides a powerful Loyalty and Reward System, increasing the attractiveness of the marketplace. Users can earn tokens by carrying out multiple activities. Buyers are remunerated if they share reviews, commerce experiences, and if they make referrals and participate in content generation, thereby making Gamb a more trusted marketplace. Merchants are rewarded if they provide product offerings at a lower price than in other marketplaces. Users get discounts buying products directly on Gamb, using Gamb tokens as a medium of payment, or storing tokens in their personal wallet. Furthermore, they can be arbiters in dispute resolutions and remunerated in tokens for such service. Thus, the Gamb token facilitates the creation of a community, which is active and self-governed. Finally, regarding the guarantee mechanisms for transactions, they leverage a payment gateway: "*you have an escrow account, with money in, and if somebody does not deliver the goods, then money will not be released. Similarly, if the goods are damaged there are ways of resolving this through arbitration*" (COO).

Regarding revenues, they use a standard approach: "*We looked at what is already working today, and you have a transaction and a revenue-based stream here. And you know that will obviously work when you have lots of transactions, a lot of merchants and consumers coming to the marketplace. In the end it is a commission-based business model*" (COO). However, the CEO states: "[For this project] *We are not profit-oriented. The income streams from commission and third-party transaction fees are only to cover maintenance and new developments*" (CEO).

Cross-case analysis

Comparing the results of each case study, it is possible to identify the existence of differences between these different blockchain-enabled platforms, while highlighting both commonalities and differences with *traditional* two-sided platforms (Table 2).

Table 2 – Main variables defining Blockchain-Enabled Two-Sided Platforms

Variables	**Possible Values for Blockchain-enabled Two-Sided Platforms**

Type of Users	Buyers (Demand Side)	Sellers (Supply Side)	Validator	Arbiter	Token Holder
Type of Relationship	P2P				
Platform Externalities	Same Side Effects		Indirect Externalities		Token-based externalities
Transaction Guarantees	Smart reviews		Certified reputation system		Smart contracts
Revenue Sources	Transaction fee from Side 1	Transaction fee from Side 2	Third Parties	Token reselling	Technology rental

Regarding the type of users involved, the interviews reveal new roles. Users are not only buyers or sellers, but in some platforms, they take an active role in the transaction between various parties, acting for example as *validator*, *arbiter* or simply as *token holders*. A validator is an economic agent that verifies transactions triggered by users. An arbiter is a user that has a role in resolving conflicts between two peers engaged in a transaction. They are selected by the system and are an impartial supervisor of the transaction. Finally, a token holder is a role that all participants in the network take, based upon participation in the platform's currency. Whereas users in two –sided platforms usually have two roles (one linked to the demand side, the other to the supply side), in blockchain-based two-sided platforms there are various roles for users that join the platform. On the one hand, the interviews show that blockchain-based two-sided platforms have users who can be on the demand or supply side, according to what is needed in that moment. This creates a de facto *Peer2Peer* system. Moreover, there are other roles that each user can play, related to being token holders. They can earn tokens to be used on the platform, by performing activities such as a validator or as arbiter. They can also bet on the value of tokens, by holding them in anticipation of a higher future value.

In terms of externalities, tokens seem to play an important role that goes beyond the exchange between buyers and sellers. For example, BitBoost and Soma stressed the role that the tokens play in the ICO phase, setting up the network and the business. Similarly, other platforms leverage tokens during service delivery, using them as rewards for various

activities. For example, Vanig uses tokens as a way to reward the usage of the platform. The chance to create and deliver tokens is therefore more than a payment method in these systems. They become a *revenue source* to finance the entire system, as highlighted by BitBoost, through its ICO. This revenue is usually complemented by more traditional flows, such as commission fees on purchases, advertising and so on. The chance to rely on a proprietary technology can become a revenue source in this open-source environment enabling different kinds of value capture. We refer to this as "token-based externalities," defined as the direct network effect derived from the diffusion of tokens in a blockchain-enabled platform, which increases the value of the entire system. For these reasons, they are particularly important and an additional element beyond the *indirect* externalities and *same-side* network effects, that remain important, even in this decentralized platform.

Moving attention from the externalities to the transactions taking place in the network, the interviews reveal a common view on the role of the blockchain. This technology acts as a trust enabler between the parties, thanks to the immutability of the data, the chance to record the transactions in the blockchain and the opportunity to rely on *smart contracts*. *Smart contracts* are presented as fundamental transaction guarantees, as mentioned by Soma: "*We cannot reduce the risk of legal disputes in a manner that is 100% sure, so we need to create a system which minimizes the risk of any kind of disputes. We can do this by utilizing smart contracts as first layer to preclude disputes from happening*" (COO). Beyond smart contracts, reviews are also used, but thanks to the technology are now managed in a smart way, and so are labelled as *Smart reviews*. Smart reviews are used as a way to reward actors. For example, Gamb stated: "*Buyers are remunerated if they share reviews, commerce experiences, and make referrals and participate in content generation*" (COO). Beyond Smart Reviews, a traditional system of Ratings is still adopted in some cases, to encourage trustful trades. An additional transaction guarantee mentioned by BitBoost and Soma pertains to the importance of a *Certified Reputation System*. Soma states: "*all users of the network have a reputation score, which mirrors their performances and actions. The platform defines this as the "users' social approval. Thus, the score users receive is certified by other members of the marketplace*" (COO).

In terms of revenue sources, transaction fees and third parties' fees are still widely used. However, two additional sources are suggested by the five cases, specifically *Technology rental* and *Token reselling*. The former pertains to the fees achieved from renting the technology to a third party and represents an additional fee paid; the latter concerns the money achieved by the platform in reselling and transacting tokens used in the system.

Indeed, all of the platforms used their own token as a monetary solution for payment and for transactions within the platform.

On the basis of this evidence, the framework presented earlier, of a traditional two-sided platform, must be revised significantly in order to accommodate the use of blockchain technology. In particular, our results point to several *new variables* that should be present in this conceptual framework, that have to be explicitly managed when blockchain technology becomes the underlying foundation for a two-sided platform (See Annex 1).

Discussion

This work aims to understand how the main variables describing a two-sided platform change when the blockchain represents the technological foundation of the system. The analysis of five case studies based on blockchain technologies has led to a framework that more clearly illustrates the main variables that describe a blockchain-based two-sided platform, highlighting differences in comparison to the previous literature addressing this topic.

In particular, our discussion is structured as follows: i) the role of the platform provider in this new setting is discussed, providing an updated version of a generalized two-sided platform based on the blockchain, and ii) the relationships between the parties involved and their mutual influences are discussed on the basis of network externalities.

The role of the platform provider

We find that blockchain technology seems to facilitate a significant shift in the role of the platform provider that links the two sides of a market. We may frame this shift as a move from a "platform provider" to a "service provider" that links two groups of customers, since the underlying architecture of the platform already exists (i.e., the blockchain architecture), making the Blockchain a provider of Platforms-as-a-Service (PaaS). In other words, the "old" notion of a platform provider is now displaced by a Blockchain provider of PaaS (e.g., Ethereum) and by a service provider (e.g., one of the five companies described in our research).

The previous literature on two-sided platforms clearly highlights the role of the platform provider as a matchmaker (Evans and Schamlansee, 2016), enabling a transaction between parties that would otherwise experience frictions in finding one another in the market (Rochet and Tirole, 2003; Parker and Van Alstyne, 2005). On the one hand, the basic mechanisms for these kinds of business are still in place for blockchain: the case studies are

all marketplaces that aim to link – or "matchmake" – buyers and sellers, just as in other marketplaces studied in this literature (Täuscher and Laudien, 2018). On the other hand, significant differences are in place. The platform provider does not have to *create* the platform and overall structure with which the two sides interact. It acts as a service provider that sits on top of an existing network (i.e., the blockchain protocol, being a Blockchain provider of PaaS), and recruits customers to this platform through a set of coordinated activities that leverage preexisting technology.

This shift in the platform model has significant implications for those companies acting as "platform providers" in a world without the blockchain. Scholars highlight how, on top of the chance to reduce frictions in the market, companies that set up such platforms need to take into consideration many perspectives. First, they need to design proper value propositions for all parties involved (Muzellec et al., 2015), enabling a trustworthy environment between parties (Mazzella et al., 2016) and solving the chicken and egg paradox (Caillaud and Julien, 2003). The separation of a PaaS provider (the blockchain provider) and a Service Provider changes this status quo significantly. The Service Provider still needs to design a proper value proposition for all parties involved (as in classic two-sided platforms, Muzellec et al., 2015), but while doing so it does not have to pay attention to many other dynamics. For example, the trustworthy environment, an essential feature in two-sided platforms (Ert er al., 2016; Mazzella et al., 2016) is now built into the blockchain, via smart contracts, consensus mechanisms and other technical dimensions examined by prior literature that has studied the impact of these features (Risius and Spohrer 2017). Further, our empirical evidence shows that the five cases rely not only on smart contracts – an intrinsic feature of the blockchain (Nakamoto, 2008) – but also on smart reviews (e.g., meaning that the system can ensure that a review is given by someone that completed a transaction with that seller) and certified reputation scores (i.e., the blockchain is certifying the reputation of a user based upon what happened previously). All of these technical dimensions, enabled by the new technology, are substituting for part of the main responsibility of a platform provider in a traditional two-sided platform.

Proposition 1: Blockchain-based platforms decouple the platform provider into two different players: the blockchain provider (offering Platforms-as-a-Service) and a service provider. In doing so, the blockchain providers embed some of the responsibilities usually undertaken by the platform provider (such as the creation of a trustworthy environment) while leaving the service provider in a position to focus on designing a better value proposition for users.

The relationship between parties and the new roles

In discussing the re-structuring of a two-sided platform model based upon blockchain technology, we have highlighted the existence of indirect network externalities between parties. Indeed, the overall value of the service is still linked to the number of users that join the network on the other side (Katz and Shapiro, 1985). Nevertheless, the five case studies also reveal different dynamics related to the type and presence of externalities.

The blockchain platform provider generates direct network externalities, which means that the more it is diffused the more valuable it is to join (Katz and Shapiro, 1985). Two-sided platforms exist to create smoother transactions in the market while reducing friction between players searching for each other (Evans and Schmalensee, 2016), and blockchain technology make this process even smoother. By doing this, and relying on the intrinsic characteristics of the technology, issues of trust can be solved. Indeed, a single service can benefit from the trust generated by a player that provides *other* services in the same blockchain network, generating *direct* network externalities in the system (Katz and Shapiro, 1985), and addressing the chicken and egg paradox when launching a two-sided business model. These dynamics increase the alignment between the interests of various parties, provide incentives for users to behave responsibly and reliably, and increase the overall value perceived by network participants due to the tokens that reinforce the above-mentioned network effect. These externalities are enhanced by the new roles that users play, for example, validators, arbiters and token holders. This has a dual impact on the platform ecosystem. On the one hand, it facilitates the creation of a community around the new service offered by the Service Provider, since users join the service knowing that on top of making transactions they can have other roles, usually related to token-based compensation. On the other hand, the fact that the same user may be a buyer in one transaction, but an arbiter in another, enhances the feeling of community, in which users play different roles in different moments. This chance to have a greater role in the system increases the engagement of users, while giving power to those who have an active role in the service.

Proposition 2: Blockchain-based platforms benefit from direct network externalities generated by the presence of multiple Service Providers and by the multiple roles that users can play in the network across these multiple providers.

Token-Based Externalities

Finally, there exist "token-based externalities". Tokens are the fundamental mechanism upon which a blockchain works, representing the operating currency in the system. Nevertheless, they represent more than just a way to pay the transaction costs between parties if we model the service as a two-sided platform. On the one hand, they facilitate the transaction fee that the service enabler gets to keep. On the other hand, they play a significant role in setting up the platform and maintaining its operations.

The process of the Initial Coin Offering (ICO), when the tokens are offered to the market as a new currency, offers new insights about the launch of such businesses. Indeed, traditional two-sided platforms suffer from the chicken and egg paradox (Caillaud and Julien, 2003; Stummer et al., 2018), since the platform has no intrinsic value without both sides on board. Tokens provide the first incentive for customers to join the network, even though the other side may not yet exist: the tokens provide intrinsic value to the system. This first phase may also help from the perspective of value proposition design (Muzellec et al., 2015). While the difficulties of designing a double value proposition for each side remains, tokens enable a "pre-market" phase, where the value can be offered by means of this newborn currency.

This observation prompts a deeper insight into network externalities in the system, and the role that tokens play in creating, reinforcing or disrupting the existence of such mechanisms. Specifically, the more a token is used by the first or the second side, the more value it attains, attracting new service providers to the same blockchain or to the same currency and vice versa. This mechanism helps to align goals of the various parties, facilitating new and virtuous cycles in a system, that – once critical mass is reached – may speed scale up (Parker et al., 2016).

Of course, the externalities between the demand and the supply side – as conceived in the original model of two-sided platforms (Rochet and Tirole, 2006) are still present. They are however, enhanced by the dynamics that we describe above.

Proposition 3: Blockchain-based platforms benefit from token-based externalities, which facilitate the solving of the chicken-and-egg paradox, and enhance users' engagement in the daily operations through sustaining new roles and responsibilities.

### A revised framework for blockchain-based platforms

Figure 2 presents a re-interpretation of the traditional framework of a two-sided platform, showing the differences that emerge from our empirical case study analysis.

The blockchain technology – such as the Ethereum network upon which our case studies were founded – represents a wider space (or market) in which a service provider decides to build a two-sided structure. The grey border represents the blockchain network, which is closer to the concept of an ecosystem (Jacobidies et al., 2018), rather than a two-sided platform (Rochet and Tirole, 2003). In this ecosystem, there are a number of users that are interested in the native currency, or other services based upon the same network (the grey dots). These service providers convince users to join on the demand side (yellow dots) or on the supply side (green dots) and enable transactions between them (i.e., the double arrows between users).

Note, these service providers still match the necessary conditions to be defined as two-sided platforms (Evans, 2003), having two groups of customers, linked by network externalities with a central player that can internalize them. In this situation however, the externalities are partially internalized by the *service provider*, which helps get the two sides on board, and partially internalized by the *blockchain provider*, which set up the original network. In this respect, the platform provider moves from a pure intermediator to a service enabler.
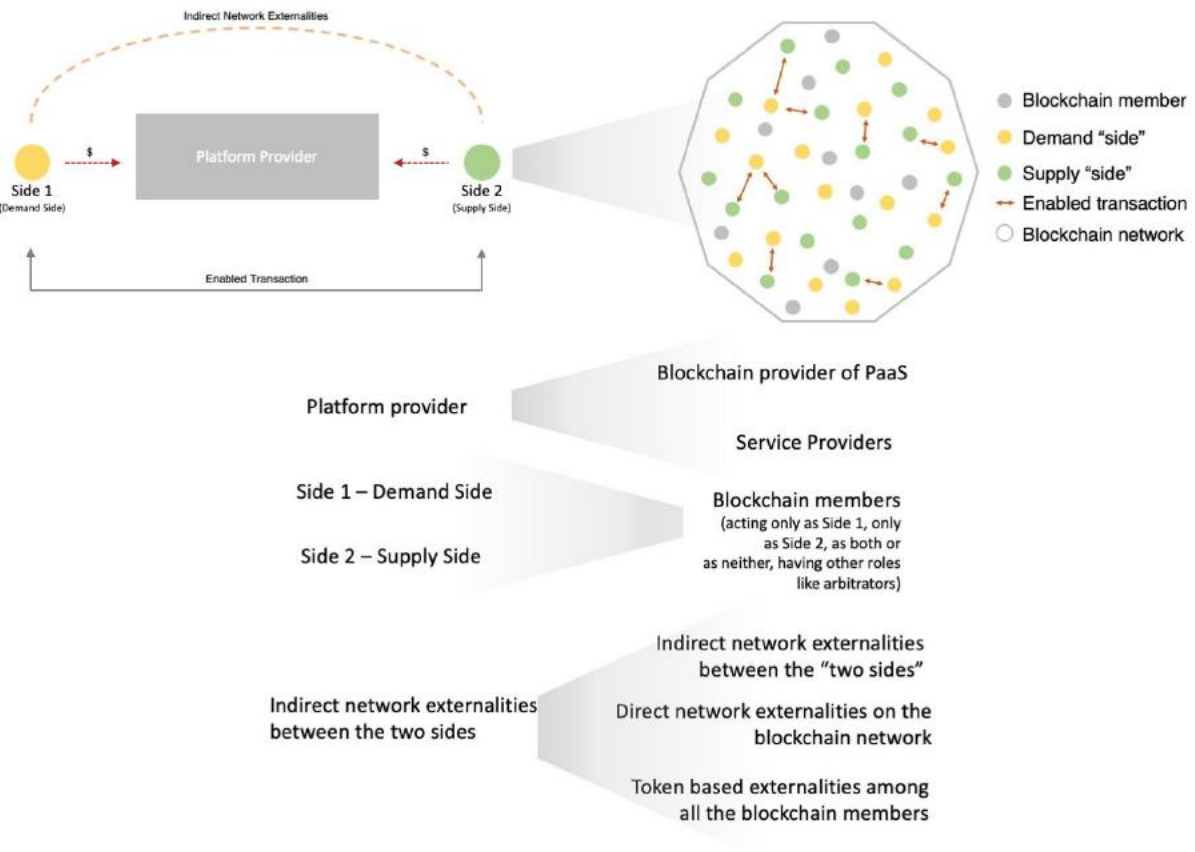
Figure 2 – Implications of blockchain on two-sided platforms

The figure reveals a more complicated model as compared to the previous literature on two-sided platforms (Figure 1). This overview of the changes that blockchain brings to platform businesses helps us to better understand the impact of this technology on the model under observation. In other words – as the title of our article suggests – does blockchain disrupt or enhance the power of a business model based on two-sided platforms? Specifically, two-sided platforms have been directly (Parker et al., 2016) or indirectly (Downes and Nunes, 2014) mentioned several times as the underpinning structure behind some of the most disruptive companies of the last decade. *The results of our research suggest that blockchain does not disrupt the model of two-sided platforms, but may actually enhance it.* The multi-sided structure appears to reinforce the basic mechanisms of externalities, bringing our focus to a higher level, with implications in terms of the broader ecosystem required to launch and sustain a marketplace (Jacobides et al., 2018). When the marketplace reaches a mature phase,

the various cycles of embedded externalities facilitated by blockchain can increase the reliability of the entire system. Still, there are many risks apparent for current leading multi-sided platform firms. Most importantly, if this technology quickly becomes a dominant design (Anderson and Tushman, 1990) any decision not to shift to this new architecture might disrupt existing players still competing with older business models (where, for example, transaction fees are much higher). The conclusion is clear for these players. They must actively invest in and deploy new technologies, in order to ward off the competitive threat that these technologies embody.

Concluding remarks and implications

The phenomenon of two-sided platforms has been extensively explored in the literature, and its contribution to both practice and theory clearly stated. Insofar as many companies use this approach, new technologies could potentially challenge this business model, with the potential risk of destroying value in the long term. Among the technologies that might be disruptive for these industries, blockchain has risen to prominence. While this technology shares common elements with two-sided platforms, it is based on a decentralized rather than a centralized model. Given the potentially disruptive impact of blockchain on these markets, the academic literature is missing a systematic analysis of how blockchain technology might re-shape two-sided platforms. Two-Sided Platforms have often been considered disruptors (e.g., Trabucchi et al., 2019), but are they themselves being disrupted by this emerging technology. This article aims to shed light on the impact of blockchain on the role of platform providers in Two (or Multi-) Sided Platforms. Despite its exploratory nature, it yields insights on a number of topics that are relevant both for research and for practice.

Implications for researchers

From an academic perspective, we explore the peculiarities of this new model, unveiling new dynamics in these businesses. First of all, this research provides an exploratory answer to a call for research that asks to merge the conceptual implications of blockchain with empirical studies that tend to focus on how blockchain works (Risius and Spohrer, 2017). Indeed, this research highlights implications for researchers, building a conceptual framework of blockchain-based platforms, starting from a base of empirical evidence from companies that relied on this emerging technology to create new platforms.

Three propositions emerge from the discussion of our results, which have important implications for researchers. First, the chance to decouple the platform provider into a blockchain provider (working as a Platforms-as-a-Service provider) and a service provider (offering valuable services to buyers and sellers) expends our previous classification and characterization of platforms (Tauscher and Laudien, 2018). From this perspective, our research expands upon the meaning of the term "platform ecosystem" (Jacobides et al., 2018), as laid out in the framework (Figure 2).

Second, the detachment of the two roles of blockchain and platform providers and the enablement of new roles for users have other implications regarding externalities. Traditional theories emphasize the importance of cross-side network externalities (Katz and Shapiro, 1985). In our work, we find that the tokens used in these systems play an enhanced role in creating *new and different kinds of externalities*, and in fostering participation on both sides.

Recent literature on two-sided platform has pointed out how platform-based companies generate new forms of resource configurations that generate new kinds of value creation and capture opportunities (Amit and Han, 2017). Indeed, they are based on network effects that generate Winner-Takes-All configurations, creating a growing debate on Hub-companies, and highlighting the need to talk about value *sharing* in a business model, and not only value *capture* (Iansiti and Lakhani, 2017a). Our research has strong implications for this emerging topic of value sharing in a business model. Specifically, *blockchain-enabled platforms clearly aim to give back power to users, being consumers or sellers*, in contrast to the power of large tech companies that operate exchange platforms, such as Amazon. Each user can have multiple roles within the community, based on the high transparency provided by the technology, and gives users the chance to be recognized for contributions to the community (for example through tokens when they act as arbiters or validators). This research may therefore represent one of the first contributions regarding the role of value sharing within a business model, in that this feature emerges as one of the primary goals of such marketplaces. This contribution, in turn, leads us back to the historical foundations of blockchain technology as an alternative structure to the traditional financial system which caused the global financial crisis in 2008, with the consequence of huge economic losses (Nakamoto, 2008).

Finally, the use of tokens promotes another kind of externality. Token-based externalities reinforce the evidence from recent literature that highlights the role of community in this type of decentralized platform (Catalini and Gans, 2016; Pereira et al.,

2019). The importance of having a more engaged and participative community on blockchain platforms very much aligns with the main findings of this paper.

Implications for practitioners

From a managerial perspective, this research offers an initial understanding of the key differences between traditional platforms and blockchain-enabled businesses. First, this shift may reduce some of the traditional challenges of two-sided platforms, such as the chicken-and-egg paradox of which side should be cultivated first (Caillaud and Julien, 2003; Stummer et al., 2018) and the need to create trust between the two sides (Mazzella et al., 2016).

Second, from an operational perspective, various benefits may be related to the choice to opt for a blockchain-enabled platform. One of the most significant features of blockchain technology is the ability to enable trusted relationships between unknown parties, making privacy and data access critical features. On top of these, other intrinsic characteristics of blockchain technology provide an opportunity to empower customers, giving them a more active role in the ecosystem, and reducing the transaction fees that they must pay.

Third, blockchain is opening new opportunities from a business model perspective. Indeed, two-sided platforms often rely on data-driven business models (Sorescu, 2017; Trabucchi et al., 2017; Troilo et al., 2017). However, the chance to empower platform users may stimulate more rapid and pervasive innovation through new data-driven business models conceived of by customers themselves (i.e., and not by the platform providers). In other words, it may shape new kinds of business models where the role of end-users is more central than in traditional platforms, not only in creating value but also in capturing value, increasing the level of sharing across the entire system. This finding mirrors recent trends in the innovation literature regarding the democratization of innovation (von Hippel, 2017).

Limitations and Future Research

This research has several limitations, which open up avenues for further research. First of all, the sample is small and composed of young ventures. This is a major limitation of the paper, reducing the generalizability of the results, even though it is consistent with the exploratory nature of our work. First of all, we picked for our sample those industries where blockchain would be relevant, but it may have a different impact in other fields (e.g., the hospitality). We would encourage future work to explore the validity of our results also in

other fields. The case replication in our sample increases the robustness of our findings, but there is a clear need for a confirmation study to reinforce and extend the results of this study.

Blockchain is a growing phenomenon, where many companies are investing but the speed of change and the evolution of ventures is still very high. Hence this article does not mean to be exhaustive in terms of presenting a new model, but to offer a first fresh view on a technology that seems to have the necessary characteristics to significantly challenge the dominant design of platform-based businesses. The framework presented in this study is also a call for further studies to test this new conceptual configuration in different settings and in different cases. Finally, we note that our current analysis is qualitative in nature and captured data only at a single point in time. In future, the use of longitudinal case studies promises to allow us to observe how marketplaces, firms and business models evolve over time.

Future studies may explore more extensively blockchain-enabled platforms to study the emerging business models and offer a taxonomy that may build on and expand the insights presented here. Furthermore, it may be interesting to study the interaction between a blockchain provider (e.g., Ethereum) and the service providers that leverage it, a relationship that is not present in traditional two-sided platforms. Finally, it would be useful for future studies to explore the various kinds of new externalities associated with this model, highlighting possible interactions between them, and developing strategies to properly leverage them.

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Acknowledgment

Appendix A – Cross-case analysis (in italics specific variables of the blockchain model)

Variables	BitBoost	CyberMiles	Soma	Vanig	Gamb
Type of Users	Buyers (Demand Side) Sellers (Supply Side) *Arbiter* *Token Holder*	Buyers (Demand Side) Sellers (Supply Side) *Arbiter* *Token Holder* *Validator*	Buyers (Demand Side) Sellers (Supply Side) *Arbiter* *Token Holder*	Buyers (Demand Side) Sellers (Supply Side) *Token Holder*	Buyers (Demand Side) Sellers (Supply Side) *Arbiter* *Token Holder* *Validator*
Type of Relationship	*Peer-to-Peer (P2P), as the sum of C2C, B2C, B2B, without any form of continuity*	*Peer-to-Peer (P2P)*	*Peer-to-Peer (P2P), mainly C2C and C2B*	*Peer-to-Peer (P2P), as the sum of C2C, B2C, B2B, without any form of continuity*	Mainly C2C
Platform Externalities	Indirect Externalities *Token-based externalities*	Indirect Externalities *Token-based externalities*	Indirect Externalities *Token-based externalities*	Same side effects Indirect Externalities *Token-based externalities*	Indirect Externalities *Token-based externalities*
Transaction Guarantees	Ratings *Smart contracts* *Certified reputation system*	Ratings *Smart contracts* *Smart reviews*	*Smart contracts* *Smart reviews* *Certified reputation system*	Ratings *Smart contracts*	*Smart contracts* *Smart reviews*
Revenue Sources	Transaction fees from Side 2 *Technology rental* *Token reselling*	Transaction fees from Third parties	Transaction fees *Technology rental*	Transaction fees *Token reselling*	Transaction fees from Side 2 *Technology rental*