Institutions, Middleman, and Blockchains Shuffle and Re-Start

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INSTITUTIONS, MIDDLEMAN, AND BLOCKCHAINS – SHUFFLE AND RE-START

Abstract

Blockchains have the potential to disrupt many of the assumptions that we hold about market transactions. As a result of the new technology, different forces will come into play, providing both opportunities and challenges for market agents who will be forced to redesign their interactions with each other. While due to its novelty discussions have predominately centred on the technical aspects of the technology, it is important to recognise that the impending diffusion of Blockchains will challenge well-established theories, namely the Institutional Theory, Transaction Cost Theory, and Agency Theory. The aims of this paper are to understand how Blockchains will alter the forces involved in market transactions and fill gaps in comprehensive research within this area. Specifically, we aspire to uncover Blockchains' potential implications to institutions and middlemen in an era where residual transaction costs are vast. The research highlights that Blockchains will dramatically reduce these transaction costs by extensively reducing the need for a middleman, creating significant issues for many service companies that act as transaction mediators. We also presented a discussion as to why we consider Blockchains *semi-informal institutions* and why Blockchains follow a very specific group of settings, that we coined as the *Blockchain Market* concept. We see this research in progress as a starting point for a new field of research that we term *organisational democratisation*, which embodies careful analysis of the effect on different institutional and organisational frameworks.

Keywords

Blockchains, Institutions, Middleman, Transaction Costs, Agency Theory, Bitcoin, Autonomous Organisations, Decentralization, Disintermediation.

Introduction

"Today, Blockchain - the technology behind the digital currency bitcoin - might seem like a trinket for computer geeks. But once widely adopted, it will transform the world."

Ginni Rometty, CEO of IB (Rometty 2016)

Blockchain is a technology that enables the creation of a decentralised distributed database of records that are implemented and pooled amongst different members (Nakamoto 2008). The participants can originate from an open or closed source, which in turn are associated with public or private Blockchains respectively (Pilkington 2015). Coupled with the velocity of the transaction and the low costs involved, the fact that each transaction is: 1) verified by consensus among the different members; 2) after recorded cannot be deleted or modified - integrity; 3) each transaction can be tracked and identified at any moment in time; 4) the parties involved remain private using a cryptographic proof; and 5) after coded, can only be changed with the consent of the majority of members; has led many to refer to it as a new disruptive digital revolution (e.g., Swan 2015, Wright and De Filippi 2015, Crosby et al. 2016).

Due to its nature[1], simplicity, security, and anonymity, this technology can potentially be applied to an endless number of transactions within, theoretically, any sector of activity (Swan 2015).

At this stage, some of the most prominent applications of Blockchains are within: 1) The Financial Sector: digital currency, private securities, insurance; 2) Supply Chains: smart contracts, inventory, testing; 3) Real Estate: smart property, disintermediation; 4) Public Services: public votes, notaries, public accounting, intellectual property registration offices; 5) Data Stores: Encrypted and decentralised secured databases; and the 6) Internet of Things: Machine to machine coordination.

While these encompass current usages, we should also consider, hypothetically, extreme examples of the level of disruption Blockchains can cause. For example, it could potentially be conceivable for a group of individuals to create and deploy, using Blockchain technology, a customized legal system without any formal institutional framework (Wright and De Filippi 2015). Extreme examples aside, in reality, today many firms and institutions already use Blockchain technology in their processes or in investments. The Australian Securities Exchange announced a study in 2016 to research how Blockchain technology could be used to redesign their clearing, settlement and asset registration operations (ASX 2016). Within the NASDAQ and other exchange markets in regions such as Frankfurt, London, India, Japan and Moscow, Blockchain technology has already been implemented

[1] The distribute consensus

or is in the advanced stages of deployment (NASDAQ 2017). Companies such as American Express, HSBC, ING, Deloitte, Goldman Sachs, MasterCard, New York Life Insurances, Barclays, UBS, Wells Fargo and Intel, are among firms that are investing significantly in Blockchain (Reuters 2017, Crosby et al. 2016).

While Blockchain has been well studied from a technical perspective, the technology's impact on business transactions and how involved agents interact are yet to be fully understood (Atzori 2015). Our aim in this paper is to advance this understanding from a theoretical perspective. We focus on outlining the main implications that Blockchain will have for market transactions and how this will influence different market agents, specifically institutions and middlemen. We see this research in progress as a starting point for a new field of research that we term *organisational democratisation*, which embodies careful analysis of the effect on different institutional and organisational frameworks. In doing so, we answer calls for greater comprehension of new systems and ecosystems within a digital economy (AOM 2017, Dodgson et al. 2015) including how these systems will challenge formal institutional settings (Lustig and Nardi 2015).

When analysing Blockchain technology in light of current well-established theories such as institutional theory, transaction costs theory and agency theory, we unearth six main consequences of the technology's expansion. The first highlights that Blockchains will dramatically reduce transaction costs, by extensively reducing the need for a middleman. This will have considerable effects on many service companies that act as transaction mediators. The second consequence involves the realisation that due to the fact Blockchains do not operate within the traditional market, the *Blockchain Market* concept needs to be introduced to accommodate the grounds in which its transactions occur. Thirdly, from an institutions' perspective, contrary to the romantic view that a decreased reliance on institutions will arise as a result of the hypothesis that Blockchains do not require an institutional framework, formal institutions will remain critical, albeit will need to undergo a dramatic transformation in relation to their scope and actions. The fourth repercussion, still within the realm of institutional theory, encompasses the suggestion that Blockchains can be considered semi-formal institutions given the fact that they act as formal institutions but do not operate under formal institutions. At the same time, Blockchains are not regarded as illegal or illegitimate, nor does the technology fall under what is considered informal from a human psychological perspective. Fifthly, agency theory and institutional theory lead us to contemplate the most important forces of Blockchain's dissemination and implementation – public legitimacy and costs reduction. Lastly, given the critical nature of institutions in regards to societal progression, the problems associated with a lack of institutional settings in developing countries could potentially be overcome efficiently by matching the needs of such countries with Blockchain theoretical constructs.

Indeed, Blockchains can be a handy solution to leap-frog the middle income trap that these country may face.

The remainder of this paper is organised as follows. The next section briefly describes Blockchain technology. This is followed by a discussion of its impact on two market agents: institutions and middlemen. The subsequent section then introduces the *Blockchain Market* conceptualization. Lastly, a discussion of potential future research avenues is presented and a conclusion is offered in relation to the aims of the paper.

Blockchain technology

Blockchain, formally conceived by Nakamoto (2008), an individual or group, was presented as the platform for Bitcoin, a peer-to-peer version of electronic cryptocurrency. Nakamoto's main objective with Bitcoin was to circumvent formal institutional frameworks, more precisely financial institution mediators. Initially, Blockchains and Bitcoin were seen as being a unique technology which many mistrusted. However, not only has Bitcoin started to be used successfully as an alternative to formal financial institutions, but Blockchains are now perceived as framework technology that could potentially be used in a breadth of settings.

As Nakamoto (2008) explains in his white paper, the concepts of Bitcoin and Blockchain are based on the Haber and Stornetta (1990) model of time-stamping procedures for record-keeping and intellectual property rights. Like Haber and Stornetta (1990), Nakamoto wanted to create an online system that could assure the authenticity of agents without the use of trust-in-the-third party mechanisms. To achieve this, for each new entry (transaction or node) a hash code is created (digital signature) and built over an archive of records (Bitcoin is recorded in a public ledger since it is an open source Blockchains) that authenticates the user and records the times of creation and execution. The next entry will need to follow the same sequence and be recorded in the same way. In simpler terms, if A has 1 Bitcoin in her wallet and wants to transfer it to B, a node is created that registers the fact that A owns 1 Bitcoin and wants to transfer it to B. The node is then broadcast to the whole network and validates that A owns 1 Bitcoin and wants to transfer it to B. Once approved, the node is registered as B owning 1 Bitcoin. Due to the number of transactions, and to guarantee that double-spending does not occur, Nakamoto created blocks that group each individual transaction in a Merkle tree and arranges them in chronological sequence using hash functions (Nakamoto 2008). To assure the validity of each node, Nakamoto introduced a mathematical puzzle that ensures each block is only accepted if the problem is solved and the chain accepts it as valid – referred to as proof-of-work.

In case of open Blockchains, Nakamoto's main objective was to overcome the power of a single entity, in the case of Bitcoin, the financial establishment. This was accomplished by transferring power, in a decentralized manner, to all users (Nakamoto 2008). Each user has the incentive to become and operate as a gatekeeper since there is ongoing competition.

Although the simplicity, security, cost reduction, decentralization and records of open Blockchains are attractive, many organisations have chosen to adopt only part of this technology by creating private Blockchains (Pilkington 2015). In such cases, the organisation acts as the sponsor and gatekeeper, capitalising only on the enforcement of the system created, its security, cost reduction and the ability to record. However, as gatekeepers, they have the ability to change the conditions of a specific Blockchain.

More recently, a middle ground has emerged, referred to as *permissioned* Blockchains, where the role of gatekeeper is reserved for a group of persons of interest (Pilkington 2015). The Blockchain, in such cases, can only be altered with agreement of the majority.

Proposed by Back et al. (2014), Another middle ground between private and public Blockchains are *sidechains*. With regards to sidechains, private or permissioned Blockchains use public Blockchains during specific periods to overcome intrinsic debilities.

Even if the technology is formed and controlled by formal institutions, as is the case with the experiments conducted by the Australian Stock Exchange, and gatekeepers have a pecuniary objective, open sources can build Blockchains that are solely used for the common good and do not reward financial interests. Theoretically, Blockchains can be seen as a non-pecuniary open innovation ecosystem that will help to circumvent opportunistic behaviours that are frequently exercised by a smaller group of individuals in a society, a classic example being Ethereum. The same technology can be used in private or semi-private settings where the main objective is to diminish market uncertainties and asymmetry of information between agents. This results in a reduction of transaction costs and a reformulation of the role of the middleman agent.

While Blockchain technology has existed for less than a decade, it has become a tremendously disruptive force from a technological perspective, as seen by the immense intrigue into the development of its initial application – Bitcoin. Only recently has focus centred on the potential applicability of the technology to alternative operations and hence the spread the Blockchain is still in its infancy. Although past discussions have been of a technical nature, we believe that it is time to open the discussion to the implications of the technology to different business systems.

In this paper, we are particularly interested in public Blockchains given they utilise the full capabilities of the decentralized business architecture.

Institutions

In society, different types of institutions serve different objectives. However, in principle, they exist to diminish the uncertainty of societal agents. This in turn reduces transaction costs by reducing opportunistic behaviour and uncertainty, whilst promoting cooperation and information among agents (North 1990). Such institutions, which can be formal or informal, create a set of rules regarding behaviour that serve to predict others' behaviour as well as inform our behaviour within such societies. Specifically, in economic terms, institutions are a fundamental pillar of society. Even within societies that have a strong market environment, the replacement of the state is still inconceivable (Bandelj and Sowers 2013). The state is seen by most as a crucial driver of coordination within an economic system, designing and upholding the regulatory structure that edifies different economic agents in a society (Amable 2003, Whitley 1999). In some societies, institutions can be more than market arbitrators (as Ingram and Silverman (2000), North (1990, 2006) explain), and can be highly influential in terms of economic arrangement and the economy itself. This can be seen when a state is directly and actively involved in the investment, production, and allocation of resources, and hence becomes an active economic agent. A prime example is China and its state owned enterprises' role in the overall economy. Even when the state is only a market arbitrator, it influences transaction costs in different dimensions, such as in the labour market and financial, legal, taxation and licenses sectors. Additionally, the state can encourage or protect specific industries or resources. Business associations, inter-personal relations and policy systems (Zhang and Whitley 2013) are some of the areas that the state can leverage between private entities and state actors (Atkinson and Coleman 1989).

As noted previously, not all rules that influence transaction costs between agents are formal. Informal rules are important in markets where transparency is low. Developing countries, for example, usually exhibit high transaction costs due to the frequency of reliance on informal institutions given the lack of developed institutions within the country, as is the case of *guanxi* in China.

While in developed countries institutions are seen as advantageous because they ground a set of important guidelines for effective transactions (Meyer et al. 2009), in developing countries, institutions may be associated with disadvantages as they may be less successful in establishing transactions (Marinova, Child, and Marinov 2011). Institutions are often composed of individuals with varying interests. In countries where transparency is low, but institutions have high levels of power, officials are able to maintain significant influence. This occurs due to the fact that those officials command a group of agents who hold a critical product, service or piece of information that is important in terms of securing forms of coordination between private-private, private-public, or

public-public agents. For these reasons, it is generally accepted that market-supporting institutions are necessary and desirable as increasing reliable information and sanctioning agents that deviate from the established rule of the game can lead to a decrease in transaction costs. Despite previous arguments, it is debatable as to the extent to which institutions are influencing and shaping the agenda of firms and vice-versa. Worthy debates still exist as many institutionalists try to identify such extensions (e.g., Aguilera and Jackson 2003, Tan and Tan 2005). This problem is even more relevant in the context of developing countries, which generally have powerful institutions but yet are poorly institutionalised.

Overall, institutions have a central role to play in the organisation of societies and are used as an explanation for the different strategies and operations that firms undertake. We can expect that institutions in a developing country, as well as having higher transaction costs between economic agents, would not support transactions in the same way as they are supported in developed countries. Moreover, even if developing countries were eager to see an enhancement of their institutions in order to decrease transaction costs and improve economic growth, changing institutions is a Herculaneum task that needs to confront many installed interests and usually cannot be carried out by central structures.

In line with the previous arguments, and with knowledge that Blockchain can dramatically decrease transaction costs between different agents, lower institutionalised countries may see Blockchains as a an easy and controllable way to become more institutionalised without the pitfalls of a traditional institutional transformation. At the same time, private firms in developing countries can utilise Blockchain as an alternative to informal institutions and the formal market as, by doing so, they decrease uncertainty, give confidence to agents involved in the transaction, and reduce their service costs. As Yermack (2017) explains, these arguments work well in developing countries for another reason – the large penetration of informatics technology, in particular smartphones. We should also consider open innovation another characteristic that will allow Blockchains to gain ground in developing countries, where, and once again, China can be seen as a leader. We argue that if firms and formal institutions in developing countries start to use Blockchain technology in a recurrent and systemic manner, they could potentially leap-frog over the middle-income trap that many are currently entering. This, however, does not mean that institutions of developing countries will disappear.

In his white paper, Nakamoto explains that the main objective of Bitcoin is to reduce transaction costs by decreasing the prevalence of disputes which in turn reduces the dependency on traditional institutional frameworks (Nakamoto 2008). It can be argued that this situation might be applicable to any institutional framework if all transactions occur on a Blockchain platform. The problem with

this theoretical construct appears to be the potential for individuals to create an illicit public Blockchain program that computational peers will not realise is illicit, and thus will run despite the fact that it is against the law. Another problem involves a situation where a computationally licit transaction occurs based on the protocol of a Blockchain but is related to an illicit activity. Institutions will be required to continue to exist to enforce a group of values and laws in society. Nonetheless, and contrary to Atzori's (2015) arguments, we foresee many formal institutional changes, particularly within the state, as many will disappear or undergo massive transformations. If we hold true that many formal institutions, such as notaries, voting systems and accounting services among others, serve to diminish opportunistic behaviour, we foresee that Blockchain technology can automate these activities and reduce such institutions to a group of informatics systems controllers, thus making these institutions redundant.

Finally, it is important to situate Blockchain technology in institutional literature. The *organisational democratisation* that Blockchain technology represents cannot be seen as belonging to formal institutions. However, Blockchain technology is not dependant on psychology, which differentiates it from informal institutions as well. The applicability of the semi-informal institutional concept (Torres de Oliveira and Rotting 2017) seems appropriate since Blockchains are in fact in-between the two classic institutional extremes and their democratisation represents a critical dimension.

The Middleman

Agency theory (Jensen and Meckling 1976) is based on resolving two main problems: 1) the existence of different objectives amongst principals and agents; and 2) the difficulty and/or expense involved in terms of the principal controlling the agent (Eisenhardt 1989). The principal-agent relationship is exemplified by lawyer-client, buyer-supplier or employer-employee relationships (Harris and Raviv 1978). The theory explains that at a specific time principals and agents hold different information, and subsequently foresee different outcomes which promotes opportunistic behaviour (Fama 1980). This conflict is mitigated by the use of contracts (Eisenhardt 1989).

Contracting is a method in transaction cost economics theory (Williamson 1975) used to solve asymmetry of information, even if different independent variables are used[2]. Transaction cost economics focuses on 'transactions and the costs that attend completing transactions by one institutional mode rather than another' (Williamson 1975: 1-2). The theory asserts that the principal and the agent[3] will try to minimize the cost of a transaction. The same author identified three

[2] For a more thoughtfully discussion on this matter please refer to Eisenhardt (1989).

[3] It is important to distinguish the difference between agent and agents. Agent is herewith refer as the agent in a principle-agent transaction. Agents, on the other hand, refers to the different market agents in a market transaction – buyers, suppliers, institutions, among others.

different forms of transaction governance: market, hybrid, and hierarchy (Williamson 1991). In each of those forms of governance, a contract needs to be in place to employ its own coordination and control systems (David and Han 2004). By market governance, Williamson (1991) refers to classic contract law and the relationship between different agents is characterised by usual bargaining between parties. A standard example is outsourcing where a supplier produces a good or fulfils a service for a buyer. In a hybrid form of governance, agents keep their independence but are jointly dependent in a non-formal way, an example being a strategic alliance. In a hierarchical form of governance, agents primarily resolve disputes internally, which can be seen, for example, in employer-employee relationships.

Both theories are centred on the fact that different agents hold asymmetric information that is contextual and temporal. This leads to the use of a middleman to decrease such asymmetries or resolve disputes. In both cases, issues are resolved by the use of contracts. In transaction cost economics theory, the principal attributes of transactions are, apart from uncertainty, asset specificities and frequency (David and Han 2004).

We previously explained that Blockchains allow market agents to transfer information and/or goods in a secure, recorded, immutable, and transparent way. Furthermore, this occurs with residual transaction costs and within pre-established terms and conditions between the transaction agents that, in principle, [4] cannot be altered. In comparison to traditional markets, Blockchains operate within quite a different sphere, leading to the introduction of the *Blockchains Markets* concept. In this virtual market, a bare minimum level of negotiation exists, all transactions are secured, immutable and recorded, there is large connectivity, asymmetries of information tend to be negligible and there is democratisation of the decision process as it is based on pre-accepted conditions and a residual cost of execution.

In a world where digital contracts are self-enforcing and execution requires no human aspect, it is possible to theoretically dismiss any intermediary from the equation given that the grounds for the transactions are created without uncertainty. Consequently, the need for an intermediary (the middleman) agent is unnecessary.

A relevant example to support our arguments can be found in supply chain management through the use of *smart contracts*. A *smart contract* was a concept created by Szabo with an intention to create digital contracts where its conditions would be verified and enforced automatically by computer protocols and without the need for human mediation (Szabo 1997). However, Szabo's idea could only fully be utilised using Blockchain technology as it allowed for legal provisions to be formalized in nodes and ensured that applicability and enforcement would happen automatically,

[4] Please refer to the above discussion between public or private Blockchains.

transparently, and in a recorded way. Even more interestingly, contracts in a Blockchain system do not need to be immutable. By the contrary, contracts can evolve and be altered over time if prescribed conditions are met. Valid changes of one document will automatically be made available to all the other documents that are either supported by or support it, everyone in the chain having access to the amendments. Thus, each participant of the chain owns an equal copy of the agreement even if the agreement experiences continuous changes. Moreover, smart contracts not only can have the same level of detail as physical contracts, but they also have the ability to achieve objectives that traditional contracts cannot, including negotiating price and/or monitoring inventory levels (Cognizant 2016). Due to the large number of contracts and conditions within the framework of supply chain management, it can easily be understood why firms such as Mercedes-Benz's parent company, Daimeler, have recently launched a US$ 110 million chain pilot project (Daimler 2017).

"The entire transaction — from the origination, distribution, allocation and execution of the loan agreement to the confirmation of repayment and of interest payments — was digitally carried out via blockchain technology in cooperation with the IT subsidiaries TSS (Daimler) and Targens (LBBW)"

(Daimler 2017)

Another example is explored by Cognizant:

"Imagine, for example, a commodity seller publishing a smart contract on a Blockchain platform such as Ethereum that includes exact terms and conditions for product specifications, delivery and payment. Any buyer on the Blockchain can find and act on the contract, acquire the needed product or service and pay for it without the processing overhead of the early digital marketplaces."

Cognizant (2016)

A self-executing contract eliminates the ambiguity of traditional contracts, which poses the question as to the necessity of middlemen after contracts are coded.

When using smart contracts, not only are effective contracts standardized and executed at a negligible cost, but they are executed in real-time and without discussion (Wright and De Filippi 2015). However, the lack of breach mechanisms can be seen an issue given society's current perception of the function of law[5].

[5] For a more thoughtful discussion on this topic please refer to Wright and De Filippi (2015).

Blockchain Dynamism

Following theoretical analysis, it can be seen that the implementation of Blockchain technology will be impacted by two main drivers. Interestingly, both of them are still yet to be seen. As currently we are observing firms in the vanguard of understanding and creating Blockchain systems, we believe that large-scale dissemination of the technology will happen from a user perspective.

The first driver is related to the legitimacy that grounds the technology. Legitimacy is achieved from the fact that an organisation's means and ends appear to obey social norms, values, and expectations (Dowling and Pfeffer 1975). Being a decentralized *modus operandi*, legitimacy is conferred upon, or credited to, the organisation or institutions by its constituents (Perrow 1970). Legitimacy can be seen as an umbrella evaluation that it is based on a cadence of historical events, where such actions '*are desirable, proper or appropriate within some socially constructed system'* (Suchman 1995, p. 574). Hence, it can be understood that after preliminary user friendly Blockchain applications, its dissemination will become a societal requirement.

The second driver refers to the decrease in transaction costs that in competitive markets are normally transferred to the final users. For example, individuals not being required to fill out an annual tax return can exemplify how individuals will push for Blockchain dissemination.

Future Avenues

This research aims to bring the Blockchain discussion to the business level and should be seen as a starting point for a new field of research that we term organisational democratisation. Given the technology's disruptive nature, we are positive that it will challenge a variety of business dimensions, providing a range of avenues for future research into the technology's role within the scope of business systems.

A number of avenues are of particular importance. The first, relates to research on service companies, such as accounting firms, whose core business is market mediation. Efforts must be made to understand how such firms can evolve given the competition that Blockchain will create. Secondly, a greater understanding must be developed as to how developing countries will be able to overcome potential resistance to the implementation of Blockchains across different institutional settings. Additionally, empirical research on Blockchains' role as a source of economic and social development in developing countries is necessary. On another note, analysis is required as to how formal institutions will need to adapt to ensure that Blockchain systems comply with the law.

Furthermore, another area of research should focus on the organisational arrangements that private versus public Blockchains will require.

Finally, there is still much to uncover regarding the connection between open innovation mechanisms and open source Blockchains. In the same line, we foresee that Blockchains will transform the way that firms engage in open innovation projects with high skill individuals. Some research will be necessary in this field as well.

Conclusion

Blockchain technology has been a significant part of the informatics systems lexis for some time due to the prevalence of Bitcoin. However, given that firms have only recently started to test applications of Blockchain within their business systems, the technology is yet to have had a large-scale impact within industry. As this disruptive technology gains momentum, it has many implications for firms and institutional settings. The way that firms interact with each other and the role of employees, shareholders and institutions all have the potential to change radically. This is why we believe that now is the moment to bring the discussion from a technical perspective to the business theoretical context.

In this preliminary research, we demonstrated that Blockchains would transform the function of transaction costs by largely reducing them. This overwhelmingly leads to a decrease in the need for mediation services. We also presented a discussion as to why we consider Blockchains semi-informal institutions and why Blockchains follow a very specific group of settings, that we coined as the *Blockchain Market* concept, as opposed to traditional market approaches. From an institution's perspective, our research explained that institutions would need to adapt to the implementation of Blockchains in many of its services. While formal institutions are not doomed to disappear, Blockchain technology will force many of them to transform their processes. An exploration was also undertaken into the two most important forces impacting Blockchains' dissemination and implementation – public legitimacy and costs reduction. Finally, it was illustrated how, in developing countries, Blockchain technology could act as a solution to overcome the middle-income trap.

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