26th International Scientific Conference
Strategic Management and Decision Support Systems in Strategic Management

21st May, 2021, Subotica, Republic of Serbia

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BUILDING BUSINESS MODELS WITH *BLOCKS IN CHAIN*: BUSINESS MODELS IN A BLOCKCHAIN ENVIRONMENT

Abstract: Disruptive technologies of the Industry 4.0 are not only disrupting the technological field, but they are also changing the competitive environment and the sources of business competitiveness. Although the business potential of blockchain seems to be promising, the existing research on blockchain technology are in most cases focused on the technical aspects. Therefore, the aim of the paper is to explore the possibilities for wider business use of blockchain technology (apart from its implementation within the financial services context) and to map its effects on the existing business models. Moreover, the paper is dealing with blockchain-inspired digital business models in an attempt to identify the main directions of new, blockchain-based business models development. As usual for the first stages in the development of a certain research area, the paper is exploratory. Moreover, it is theoretically oriented and it presents the results of relevant literature research. As a conceptual paper, it is built around the concept of the business model and the blockchain potential to affect its functioning and dynamics. The theoretical research presented by the paper reveals that blockchain technology has the potential to affect all the elements of the existing business models, but also to inspire the development of entirely new digital business models.
Keywords: business model, blockchain technology

INTRODUCTION

Although there are different understandings regarding the constitutive elements of business models, there seems to be a general consensus that a business model is a description of how a firm creates, delivers, and capture value (Weking et al., 2020). An adequate business model is an important source of sustainable competitive advantage (Geissdoerfer, Vladimirova, &Evans, 2018), since neither the best products and services, nor technology alone can secure market success. Furthermore, business model innovation is especially valuable in volatile times. It can provide companies a way to break out of intense competition, by making technological shifts easier to achieve (Lindgardt, Reeves, Stalk, &Deimler, 2009) and by helping them to stay ahead in the product innovation game (Amit&Zott, 2012).
Disruptive technologies such as artificial intelligence, big data, cloud computing and blockchain have emerged in last two decades as hallmarks of the Industry 4.0 (Kimani et al., 2020). They are disruptive not only in a technological sense, but also because they change both the competitive environment and the sources of business competitiveness. As one of these technologies, blockchain is created in the domain of cryptocurrencies. Nevertheless, its underling idea of a decentralized database is applicable in various areas (Nowinski&Kozma, 2017). Blockchain technology can be used in logistics, music industry, in real estate trading, elections voting, public registers, etc. Although the business potential of blockchain seems to be promising, the existing research on blockchain technology are in most cases focused on the technical aspects of the technology. There is a noticeable research gap on the possibilities and limitations of blockchain use in building business competitiveness. Even papers with focus on business, often deal only with the challenges that arise from the implementation of blockchain (Chong, Lim, Hua, Zheng, &Tan, 2019).
The paper is theoretically focused and it is a result of a desk literature research. As a conceptual paper, it is built around the concept of the business model and blockchain's potential to affect its functioning and dynamics. The technical aspects of blockchain are covered to the extent necessary to bring this technology closer to readers who do not have a technical background. The remainder of the paper is structured as follows. After discussing the main elements of the business models and their dynamics, the paper is dealing with some basic technical features of blockchain technology.

Conceptually, the central part of the paper is the one presenting some of the blockchain-inspired business models typologies that can be found in the literature. Building on these, the paper provides a systematized overview of the main research directions in this field and it suggests one aggregated typology of blockchain-inspired business models developed so far. Finally, the paper is ending with certain concluding remarks.

BUSINESS MODELS

The business model concept has gained a lot of attention among scholars and practitioners. Nevertheless, it is often the object of criticism due to the lack of consensus on its definition, as well as the absence of a clear distinction from the other related terms. A variety of definitions may be a result of different methodological approaches adopted by scholars. Definitions of business model generally consist of two following elements: value-adding activities and outcomes. Geissdoerfer et al. (2018) emphasize that value proposition, value creation and delivery, and value capture elements have a central position in most of the definitions. The business model can be defined as an empirical and/or conceptual phenomenon. Regarding this dual possibility, some scholars find defining business models as an empirical phenomenon too complex and difficult to apply (Demil&Lecocq, 2010; Geissdoerfer et al., 2018; Osterwalder, Pigneur, &Tucci, 2005; Teece, 2010). Therefore, they define business models more as a formal or a conceptual framework or a tool, that offers a simplified representation of the relevant activities of a company. In fact, both approaches pay attention to how companies create and capture value using their architecture, whereas conceptual frameworks can be used as an exemplar role models in different contexts and purposes. This normative approach is used by Johnson, Christensen, &Kagermann (2008) who conceptualize the business model as a framework with constitutive elements such as customer value proposition, profit formula, key resources and key processes**.** Casadesus-Masanell&Ricart (2010) display a different point of view as they do not consider any a priori variables that business model must include. While some authors have adopted a static business model perspective, which provides a consistent view of the different components and their interactions, other emphasize the importance of the dynamic perspective, because it enables business model changes (Demil&Lecocq, 2010; Wirtz, Pistoia, Ullrich, &Göttel, 2016).
The relationship between business models and other related management phenomena is yet another important issue. The most important is the understanding of the relationship between business model and business strategy. A lack of a clear distinction between these phenomena makes their relationship difficult to understand. Some scholars are suggesting that "a business model is a reflection of the firm's realized strategy" (Casadesus-Masanell&Ricart, 2010, p. 195). The others refer to a business model as a separate field from the strategy (Massa, Tucci, &Afuah, 2017). According to Wirtz et al. (2016), it is the strategy, rather than a business model, that includes the element of competition, and therefore those two concepts are essentially different, but related. Furthermore, the strategy sets up barriers and prevents business model from being copied or imitated, while business model provides a way to analyze and communicate strategic choices (Shafer, Smith, &Linder, 2005; Teece, 2010). Strategy can also be seen as some future position or state that a company aims to achieve, while business model describes a company's current position (DaSilva&Trkman, 2014). There are also suggestions that a business model can be understood as a link between strategy and its operational implementation (Wirtz et al., 2016). Not aiming to elaborate any further on these differences, we are accepting the general understanding that a business model explicitly states how a business operates (Massa et al., 2017) and thus it is a reflection of a company's choice of the way to implement its strategy.

BUSINESS MODELS' DYNAMICS

Designing a business model is a complex task, but recognizing the need for a new business model is even more challenging as it requires a dynamic approach. Business model's innovation changes the business logic and core elements of a firm's competitiveness (Bucherer, Eisert, &Gassmann, 2012). Many companies pursue it as a defensive move to protect a dying core business or defend against aggressive competitors, but it can also be approached proactively to explore new avenues of growth (Lindgardt et al., 2009, p. 3).
Business model innovation can be accomplished either by changing some elements or creating the entirely new model. Business model innovation can occur in a number of ways, such as adding new activities or linking them in a new way, or by changing the subject who performs the activities (Amit&Zott, 2012). According to Lindgardt et al. (2009, p. 2), a business model is innovated when two or more of its elements are reinvented to deliver value in a new way. Changes to business model design, can be subtle and yield benefits to the innovator, or radical that can either create a new market or allow a company to create and exploit new opportunities in existing markets (Amit&Zott, 2012). Although much of the literature focuses on radical changes, Demil&Lecocq (2010) believe that incremental and continuous business model changes are much more common. Business model evolution represents the sequences that include both determined and emergent changes, and thus the business model is permanently in a state of transitory disequilibrium. On the other hand, Geissdoerfer et al. (2018) see business model innovation more like a transformational, rather than evolutional process. This process can take one of different forms, such as: development of entirely new business model, diversification into additional business model, the acquisition of new business model, or the transformation from one business model to another. If both the current and the new model coexist, it is necessary to preserve the efficiency of the current model until the new one is ready to take over completely (Chesebrough, 2010, p. 362). In this way, the company can experiment with the new model while the old one still provides revenues (Ibarra, Ganzarain, &Igartua, 2018, p. 9).

Business model innovation is important because even successful business models at some stage may be renewed, or possibly abandoned (Teece, 2010). Nevertheless, companies should not pursue business model innovation unless they are sure that they can achieve it and have certain benefits. As for the starting impulse for a business model change and innovation, it is commonly understood that a business model innovation can be triggered by internal or external factors. One of these factors is the emergence of new technology. A new technology can be a significant determinant of business model innovations, as it can impact value creation, value delivery and cost structure (Teece, 2010). Moreover, when new technology does not have a matching business model, it generates less than expected value (Chesebrough, 2010) which is why a new business model is needed. New technology can shift the basis of the competition, which is also an important reason for business model change to occur (Johnson et al., 2008). One of the new technologies which is gaining more attention in the business world is blockchain technology. The technology itself and its potential for the business model dynamics will be discussed in the following sections of the paper.

BLOCKCHAIN TECHNOLOGY

Initially, blockchain technology was created as infrastructural support for cryptocurrency transfer (Chong et al., 2019; Nowinski&Kozma, 2017). It all started with Nakamoto's (2008) seminal work which proposed an alternative mechanism of payment over communication networks that does not involve a trusted third party. Instead of trust, the proposed technology involves value transfer based on cryptographic evidence and the impossibility (or at least difficulty) of changing the transactions, once they have been recorded.

Today, the application of blockchain is dominantly discussed in the context of financial services. However, it has a potential to be used in every activity where there is a contact between two parties (Morkunas, Paschen &Boon, 2019). Blockchain enables the authentication of a transaction, eliminates intermediaries, and improves operational efficiency (Weking et al., 2020; Zhu&Zhou, 2016). By reducing costs, this technology lowers the threshold for an economically justified transaction which, for example, can affect the inclusion of smaller suppliers in the supply chains of larger customers (Nowinski&Kozma, 2017). Therefore, it is considered that this technology has a potential to influence the improvement of existing business practices, but also the creation of completely new business models (Chong et al., 2019; Iansiti&Lakhani, 2017; Weking et al., 2020). Describing the field of blockchain technology application, Zhao, Fan, &Yan (2016) suggest the existence of three blockchain technology generations, where the blockchain 1.0 refers to the cryptocurrencies, blockchain 2.0 is about digital finance, while the blockchain 3.0 is tackling the digital society. The potential of blockchain technology is getting greater as it can be used together with other technologies, such as encrypted tags for smart tagging which can be used to authenticate luxury products, food, drugs and the like (Nowinski&Kozma, 2017). However, in addition to these optimistic, there are also voices suggesting that this technology has limited business potential; that currently it has shortcomings (such as, for example, low transaction speed); that its application is still in a form of experimental ventures; and that companies that use it do not still achieve the expected value from its use (Weking et al. 2020).

As for the nature of the technology, blockchain is like a ledger in accounting. It chronically records transaction, but unlike the traditional database, it has one centralized authority managing the data, but it is a rather a distributed database (Zhao et al., 2016). Blockchain ledger is decentralized as all transaction data are stored by all the blockchain network nodes. Blockchain is a network of nodes, and each node validates and records transactions and then shares it with other nodes (Kimani et al., 2020). Based on the consensus protocol, the transaction records are synchronized to obtain a unique transaction trace in the whole blockchain.

Although there are various blockchain technologies, all of them share some common characteristics (Table 1).

Table 1. Mutual elements of various blockchain technologies

Elements	Description
Distributed ledger	Decentralized database, identical blocks of transactions' information stored in every node of the network.
Consensus mechanism	An algorithm which allows the ledger's update. The majority of nodes should agree on the update.
Encryption mechanism	The public key of the encryption mechanism is used for the encryption of the data, while the authentication of the participant is done with the private key.
Peer-to-peer exchange	Data are exchanged between peers, unlike with the classic databases where the user/client communicates with the server.
Immutable audit trial	The ledger cannot be modified or deleted, which makes the audit trial immutable.

Source: Kimani et al. (2020, p. 2); Weking et al. (2020, p. 287)

Blockchain functions as a distributed ledger in which transaction data is stored in digital blocks (Kimani et al., 2020, pp. 3-6). The blocks are arranged one after the other following a mathematical logic called hashing, which forms a chain of blocks, hence the name blockchain. In classical databases, there is a central authority that processes all data taking into account their chronology. On the other hand, there is no such central authority in a blockchain, but different nodes process transactions and record it. Therefore, the order of transactions being processed may be different between

different nodes. In order to reduce this inconsistency, blocks (groups) of transactions are formed, which slows down the entry of data into the database and thus gives nodes the time to reach an agreement on recording transactions. The elements of a block are: the header and the body of the block. The header contains: hash value of the previous block, protocol version, timestamp, difficulty target, Merkle tree root hash value and nonce.
The hash value of the previous block is used to connect the focal block to the one which precedes it (thus creating a chain). Thanks to this connection, blockchain is resistant to changes, since a change of one block causes the change of the next one (which contains the hash value of that previous block that has been changed), and so on. If someone wants to change a value in the database, he/she must change the contents of the block in which that value is located, as well as all subsequent blocks, and at the same time to keep up with a speed of creation of new blocks. For that, a minimum of 51% of the computer power of the network should be controlled.
The protocol contains rules on block validation, while the timestamp refers to the time of the block's formation. Merkle tree root is a hierarchical structure that starts from the bottom, from the level of an individual transaction and moves to the top, using a hash value at each level. The block header contains the root hash value (the hash value at the highest level), which, in fact, summarizes all the transactions that the block contains. Nonce (short for *number only used once*) is a random number used to generate a hash value that is less than the difficulty target value. The correct hash value is formed in a trial-and-error procedure, in each attempt the node that forms the block changes the nonce value until the correct hash value is found. A hash function is a mathematical function that transforms any amount of data into fixed-size data. The hash function allows data validation, without the need to know the data being validated. This is possible thanks to certain characteristics of the hash function. This is a deterministic function, which means that the same input data always generates the same value of the hash function. At the same time, it is not possible for different input data to generate the same hash value. Then, this is a one-way encryption function. This means that it is not possible to detect input data based on hash values (the encryption direction is up to the input data towards the hash value). A small change in the input data causes significant changes in the hash value, which makes it difficult to predict the value of the hash function before it is actually calculated. Identical hash values are only possible if the input data is identical. The hash value of a block summarizes the contents of the block and represents its identifier.
In the body of the block there is a transaction counter (number of transactions that are in the block) and a transaction list (this is the data stored in the ledger). For some blocks, the body of the block may also contain a list of smart contracts. A smart contract is a digital contract that automatically executes the transaction, if pre-defined conditions are met. For example, when imported goods arrive, the exporter is automatically paid. These are digital contracts that are written in programming languages.
When a block is created, it is broadcast to other nodes. Each node then validates the block before adding it to its copy of a blockchain. If a block is invalid (for example, it contains an invalid transaction, or has a hash value greater than the difficulty target), then other nodes will ignore it. Even if some node accepts it, most will ignore it and will not tie it to their chain and use it to make the next blocks, and vice versa. In another words, nodes that have accepted an invalid block and nodes that have not accepted a valid block will have an outdated chain version and will not be able to create valid blocks. This discourages that kind of a behavior. It is also possible to receive multiple valid blocks at the same time (when different nodes create valid, but different blocks at the same time). For example, some nodes receive block A, while others receive block B as a valid block at the same time. This is called a fork and it represents the existence of multiple chains in a blockchain. The existence of fork in a blockchain is only a temporary situation, because the protocol will determine which chain is the main/active one. Nodes that have accepted the second branch of the chain are then reorganized to match the active chain. Transactions that were included in the block that started the branch that was declared inactive are returned to be included in one of the next blocks. Transactions that are part of blocks that are validated and included in the chain become confirmed. The confirmed block gets a value of 1. Each time a new block is added, the number of confirmations for the block increases. The higher the confirmation number is, the greater is the number of blocks that follow the observed block so it becomes more difficult to change the data that the focal block contains.

BLOCKCHAIN AND BUSINESS MODELS

Blockchain is a novel technology and its use outside the realm of cryptocurrencies is even newer (Nowinski&Kozma, 2017). The first source on the technology itself is the already mentioned work of Nakamoto (2008), while the business use of blockchain technology has been discussed and written about since 2016-2017, rarely before (Nowinski&Kozma, 2017). When identifying blockchain-inspired or blockchain-based business models, there are practically two possible variants; the business models of the firms which are users; and of those which are providers of blockchain solutions or blockchain-based services. Moreover, the potential impact of blockchain technology on business models can be twofold. Blockchain can be implemented to alter one or several elements of the existing business models, or it can be a foundation for developing entirely new business models. The Walmart which uses blockchain to track goods in its supply chain (Morkunas et al., 2019) is an example of the former, while the later usually refers to creation of new types of digital business models. Digital business models are business models of firms which provide digital offerings (products/services). Therefore, in the theoretical field, it seems that so far there are basically two branches of analysis of blockchain in the business contexts. One discussing how blockchain is affecting the existing business model elements, and the other trying to identify various types of digital business models inspired or based on a blockchain (Figure 1).

According to Morkunas et al. (2019), blockchain has the potential to affect all the elements of the existing business models. Thus, for example, within the customer-oriented elements of the business model, blockchain can facilitate a reach of entirely new market segments or/and it can introduce greater transparency and confidence in customer relationship. Blockchain can alter the value proposition by providing the possibility to offer new products/services or/and by enabling faster/cheaper transactions. Channels for delivering the value can be simplified or innovated by using blockchain technology. Blockchain allows resource provision to be flexible by allowing access to resources only when they are needed instead of traditional ownership, and so on[1].

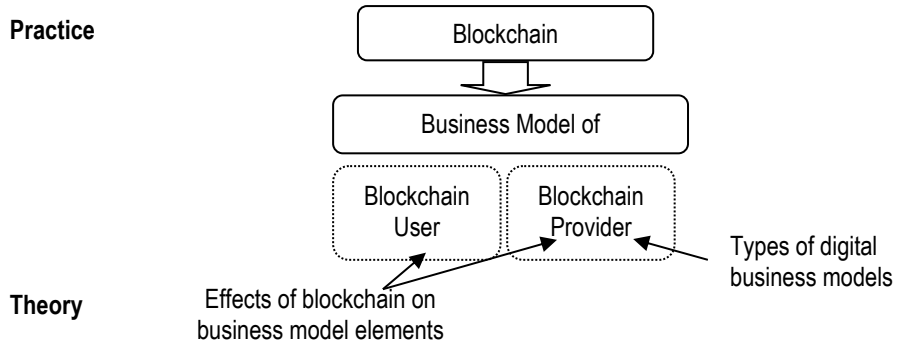

Figure 1: Business models and blockchain: practical relations and theoretical considerations

Source: Authors

In an attempt to classify various digital business models based on blockchain technologies, Weking et al. (2020) identify five business model patterns for businesses which use blockchain technology. While some of the proposed business model patterns change only the value proposition, the others are entirely new business models. Aiming the same, but using different terminology, Chong et al. (2019) define five distinct digital business models inspired by blockchain technology. A comparative analysis of these typologies leads to a conclusion that there is a certain level of similarity and complementarity between the presented types of digital business models (Table 2). For example, *blockchain for business integration* and *blockchain for security* are similar to the *disintermediator* and *mediator* in a way that they all are becoming a part of a supply-chain making it more efficient. *Blockchain technology as offering* and *platformer* are business models which value proposition includes a platform for development of specific blockchain-based business applications. Finally, digital business models which Weking et al. (2020) are naming *blockchain as multi-sided platform* and *blockchain for monetary value transfer* are both creating an alternative environment for performing business tasks, just as the *co-innovator* from the Chong et al. (2019) typology does. So, it seems like that up to now there are three main directions of development of digital business models inspired by blockchain technology. We are naming them: supply chain efficiency enhancer, platforms for new business applications; and new framework for old businesses.

[1] Due to the limitations in the length of the present paper, for practical examples of each of these blockchain effects on the busines model elements, please refer to Morkuna et al.(2019).

Table 2. Blockchain-inspired digital business models

Classifications of blockchain-inspired digital business models found in literature		**Systematized types of blockchain-inspired digital business models**	
Weking, Mandalenakis, Hein, Hermes, Bohm, &Kromar (2020)		**Type**	**Example**
Blockchain for business integration	A business model of blockchain intermediary that ensures that blockchain solutions are integrated into the existing value network.	Supply chain efficiency enhancer Changing the supply chain structure and improving its efficiency	A blockchain-based system for tracking goods in a supply chain.
Blockchain as multi-sided platform	Includes providers that use blockchain to run a multi-participant platform or market. Multiple entities offering complementary products or services are integrated on the platform.		
Blockchain for security	This business model enables the security of distributed data. Additional services, such as a cloud, are often provided.		
Blockchain technology as offering	A business model of firms which offer blockchain infrastructure or APIs (Application Programming Interfaces) for developers of modified blockchain solutions targeting more specific business needs.	Platform for new business applications Providing a platform for development of specific blockchain business applications	Offering of a blockchain infrastructure or APIs (Application Programming Interfaces) for developers of modified blockchain solutions targeting more specific business needs.
Blockchain for monetary value transfer	Is the first use of blockchain technology and it covers use of a blockchain for performing a transaction of values (cryptocurrencies) between peers.		
Chong, Lim, Hua, Zheng, &Tan (2019)			
Platformer	A firm that innovates the basic blockchain technology which then becomes an open platform for new business applications to be developed on.		
Disintermediator	A firm which becomes a part of the existing supply chain and then they change the way transactions between members take place. The disintermediator disrupts existing supply chain members by changing their role, position and importance.	New framework for old businesses Creating alternative (competing) frameworks for doing business	A novel framework for transfer of monetary values. Transaction-related costs are reduced by eliminating intermediaries in the transfer of monetary values.
Mediator	Like the disintermediator, the mediator becomes a part of the existing supply chain. But unlike the disintermediator, the mediator does not change the structure, but tries to solve inefficiencies in the supply chain.		
Transformer	A firm which develops blockchain solutions which complement the existing business practices.		
Co-innovator	A firm which undermines existing practices by defining parallel environments for doing business.		

Source: Authors, building on typologies offered by Weking et al. (2020) and Chong et al. (2019)

CONCLUSION

Although opinions on what business models represent are different, the fact is that business models are essential for market success, as they represent the company's various alternatives to implement its strategy. Market success is determined by various factors and therefore is exposed to the changes in the environment. Those changes often require modification in the existing business model or need for a new one, which consequently leads to a business model dynamic character. Having that in mind, once established business model cannot guarantee permanent success and thus is a subject of constant innovation. And these innovations can be triggered by both internal and external factors. One of the most significant factors that causes business models' dynamic is technology. Choosing the right technology is a matter of business model decision, as it can impact value creation, value delivery and cost structure. Moreover, technological progress may initiate the development of new business models in order to generate, deliver and appropriate the expected value.

Speaking of new technologies, it appears that blockchain technology is the one with great potential since it offers multiple opportunities to innovate current business models or create new ones. Created as infrastructural support for cryptocurrency transfer, blockchain can be seen as a distributed database, which consists of smaller blocks of chronically recorded transactions. Blockchain technology can be used almost everywhere where two or more parties interact and has a great impact on various fields, such as financial sector, health system, logistic, or even government. However, lack of research on the possibilities and limitations of the blockchain technology as well as practical difficulties in linking the blockchain technology to business models create a gap between possible and actual value delivered.

In this paper, we have tried to systematize the research work on this topic so far, as well as to aggregate the typologies of blockchain-based business models in order to determine what is the basic application of blockchain technology in business models. After reviewing the relevant literature, we have come to a conclusion that blockchain-based business models are analyzed either as busines models of the firms which are users, or of those which are providers of blockchain services. Blockchain technology can induce creation of entirely new business models which can reduce costs in the supply chain by eliminating intermediaries, level up supply chain management, or even create a platform for new business applications. Moreover, blockchain technology can facilitate a reach of entirely new market segments, increase transparency, improve security, alter the value proposition by providing the possibility to offer new products/services, or provide faster and cheaper transactions.

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