CREATING VALUE THROUGH BLOCKCHAIN TECHNOLOGY: A DELPHI STUDY

Research paper

Schlecht, Laura, EBS Business School, Oestrich-Winkel, Germany, laura.schlecht@ebs.edu
Schneider, Sabrina, University of Kassel, Kassel, Germany, sabrina.schneider@uni-kassel.de
Buchwald, Arne, Vlerick Business School, Brussels, Belgium, arne.buchwald@vlerick.com

Abstract

The blockchain technology has gained increasing attention and awareness in both corporate practice and academia. Both sides expect the technology's impact on business and society to be fundamental. However, more in-depth insights into how blockchain will disrupt the way businesses create and capture value are limited. In response to the prevalent uncertainty about the future developments caused by blockchain, this study aims at identifying the prospective value creation potentials for organizations. This forecasting study builds on a Delphi approach to derive reliable predictions about blockchain's future developments by 2030 in the business model context. We specifically discuss how blockchain is likely to influence value creation in the business model context. Based on expert interviews, workshop insights, and prior literature, we developed a meaningful set of 36 projections on the implications of the blockchain's future developments. Our findings predict that blockchain will mainly create value by massively increasing efficiency gains, which forms the basis for making entirely new business models feasible. We complement this finding by revealing that blockchain technology will create the most value, not in isolation, but in combination with other technologies. Our research reduces some of the environmental uncertainty managers face and identify relevant avenues for future research.

Keywords: *Blockchain technology, Delphi, future developments, business models, value creation*

1 Introduction

The blockchain technology has recently gained much attention in industry and academia (e.g., Weking et al., 2019). However, the concrete business applications and the further development of the blockchain remain uncertain (Glaser, 2017). When comparing the Gartner Hype Cycle of 2019 to the one of 2018, one can note an incredibly fast development, so that expectations that the technology will soon reach its productivity level are high (Gartner, 2019a; 2019b).

The emergence of the blockchain is often compared to the emergence of the Internet (e.g., Swan, 2015; Underwood, 2016). From the business model literature, we know that with the upcoming of the Internet, firms were forced to reconsider their business models (Teece, 2010). The Internet paved the way to change the creation and capturing of value of businesses, even though it took more than 30 years to accomplish this transformation (Iansiti and Lakhani, 2017). In contrast to the Internet, the adoption and usage of the blockchain may take place faster, due to "network effects of current widespread global Internet and cellular connectivity" (Swan, 2015, p. 13). Expectations exist that the blockchain will have enormous effects on current business mechanisms, which might lead to entirely new business models. Also, longstanding business models are likely to face challenges (Iansiti and Lakhani, 2017). These circumstances make the impact of the blockchain technology an interesting research theme. The focus of most of the existing contributions lies primarily on technological aspects of the technology (Risius and Spohrer, 2017), and has so far received limited attention within information systems research (Rossi, Mueller-Bloch, Thatcher and Beck, 2019). Recently, we observe an emerging discussion on blockchain's impact on business models in the academic literature (e.g., Holotiuk, Pisani and Moormann, 2017; Nowiński and Kozma, 2017; Weking et al., 2019). However, only limited knowledge exists about the applicability of blockchain, its governance, and its creation of value (Risius and Spohrer, 2017). In particular, the prospective business value of the blockchain remains uncertain, and depends on the elimination of current technological weaknesses and the matureness of the technology (Lacity, 2018).

The business model context offers a promising lens to assess potential options of blockchain applications by focusing on new forms of value creation and value capture (Iansiti and Lakhani, 2017). One recent study has initiated a discussion on how blockchain technology changes value creation by building on Amit and Zott's (2001) business model design themes (Schneider, Leyer and Tate, forthcoming). Another study has focussed on how blockchain technology changes business models in the music and entertainment industry (Dutra, Tumasjan and Welpe, 2018). However, empirical studies of blockchain and its implications on business models are still rare (e.g., Weking et al., 2019). Further, we need theoretical development, including the development of frameworks, to "better understand key concerns of IS research on blockchain" (Rossi et al., 2019, p. 1394). In response to the limited empirical and conceptual insights about blockchain technology's impact on value creation, this research aims to answer the following research question: *How will blockchain create value for business models by 2030?*

Our study builds on a comprehensive Delphi approach, which leverages the technological and business expertise of well-respected professionals and academics. The Delphi method represents a powerful tool to explore the potential implications of uncertain developments in complex contexts (Linstone and Turoff, 2002; Loo, 2002). Conducting scenario analyses can help in predicting how market environments alter when blockchain spreads (Schneider et al., forthcoming). We thereby predict the future of blockchain technology by investigating its prospective macro environment through the lens of the PEST framework (Wilson and Gilligan, 2009).

By identifying blockchain's value creation potential for businesses by 2030, we contribute to the emerging stream of literature emphasizing blockchains' business value. By applying a business model design lens, we link the results of experts' evaluations about a blockchain-enabled future with well-established theoretical foundations of value creation. We complement existing knowledge about value creation by Amit and Zott (2001), who investigated value creation in the e-business context. By conducting an empirical study, we create a picture of blockchain's future development and support strategic planning in the long-run.

This paper proceeds as follows. First, we review the literature on blockchain technology and value creation in the business model context. Thereafter, we outline the Delphi method, followed by the representation of our results. Finally, we discuss our findings and conclude by rounding off the paper with our conclusion.

2 Applications of the Blockchain Technology

The blockchain technology, through its unique components, can lay the foundation for business value for every kind of enterprise (Lacity, 2018). A "blockchain can be defined in brief as a distributed ledger or list of data records of transactions that may involve any kind of value, money, goods, property, or votes" (Beck and Müller-Bloch, 2017, p. 5390). Previous studies already investigated applications of blockchain (Rossi et al., 2019). In principle, through applying blockchain the creation of business value becomes promising (Lacity, 2018). It has a transformative potential for creating new, or challenging established business models (Iansiti & Lakhani, 2017), mainly through omitting intermediaries, through transaction cost reduction and the authentication of goods in trade (Nowiński and Kozma, 2017). Trusted intermediaries become redundant through blockchain, as it allows two parties to engage with each other directly (Ying, Jia and Du, 2018). Thus, an acceleration of reconciliation takes place because of a missing intermediary (Christidis and Devetsikiotis, 2016). Blockchain can, therefore, reduce inefficiencies concerning intermediation, for example, in complex industries or the involvement of a large number of suppliers (Nowiński and Kozma, 2017). Hence, the technology is beneficial for reducing times to execute transactions (Nowiński and Kozma, 2017), where additionally decreasing costs and risks take place without an intermediary. Thus, there is also a positive impact on efficiency (Ying et al., 2018). Through the blockchain, a trustless network develops, in which participants do not have to trust each other, but the chain. First, cryptography ensures the transaction's authorization, and second, smart contracts ensure the automatic execution of workflows (Christidis and Devetsikiotis, 2016), and the carrying out of transactions automatically based on the programming in the respective protocol (Beck, Czepluch, Lollike and Malone, 2016). Likewise, "malicious behaviour and misunderstandings are ruled out by the system" (Beck et al., 2016, p. 10), which again makes the problem of trusting redundant (Beck et al., 2016). Decreasing information asymmetry through blockchain due to reducing entry barriers is another impact. Decisive are smart contracts and that the technology ensures the authenticity of every participant who enters the network (Cong and He, 2019). Cryptographic proof ensures the verification of updates, which makes them traceable, forming an "auditable trail of information" (Christidis and Devetsikiotis, 2016, p. 2299). Likewise, the blockchain becomes "the system of record for all transactions" (Iansiti and Lakhani, 2017, p. 5). Thus, the blockchain allows to trace, certify, track and verify objects, which in turn can guarantee an object's "origin, authenticity, custody, and integrity" (Montecchi, Plangger and Etter, 2019, p. 288). The blockchain is advantageous for providing a solution concerning participating parties with misaligned interests due to addressing accountability and transparency issues (Casey and Wong, 2017). Furthermore, real-time updating of data becomes possible through blockchain, too (Casey and Wong, 2017), making, e.g., the updating of each stakeholder's database along the supply chain superfluous (Christidis and Devetsikiotis, 2016). To conclude, through blockchain there is a shift from an Internet of information to an Internet of value (Tapscott and Euchner, 2019) because the blockchain makes it possible to transfer different kinds of assets (Weking et al., 2019).

3 Creating Value through Business Models

Together, the upcoming of information and communication technologies, as well as companies based on the Internet, jointly caused the concept of business models to gain attention (DaSilva and Trkman, 2014). The Internet influenced business models by questioning existing business value creation and capture mechanisms (Teece, 2010), and caused novel possibilities of creating value (Amit and Zott, 2001). The role that technologies play within the business model context has already been investigated in academic literature (e.g., Baden-Fuller and Haefliger, 2013). However, academic literature taught us that technology creates only then economic value if "it is commercialized in some way via a business model" (Chesbrough, 2010, p. 354). By studying e-commerce firms, Amit and Zott (2001) found that business models provide a focal firm with four sources of value creation: efficiency, complementarities, lock-in, and novelty. Zott and Amit (2010) refer to these value sources as a business model's "design themes." Efficiency builds on Williamsons'(1975) transaction cost theory, which argues that reduced transaction costs contribute to value creation by increasing efficiencies. Complementarities as a design theme builds on previous findings that have shown how the combination of different products and services may allow for higher value creation than the separate, individual offering of the same components (Brandenburger and Stuart, 1999; Gulati, 1999). The idea of lock-in builds on the avoidance of switching costs (Williamson, 1975) and the creation of network externalities (Katz and Shapiro, 1985; Shapiro and Varian, 1999). Novelty fosters value creation through innovative products and services or the inclusion of new actors and novel connections among actors (Schumpeter, 1934). We will later relate our empirical results to the four sources of value creation. Each of these value creation sources builds on five well-established theoretical foundations with each taking a different view on value creation: The value chain analysis focuses on the activities of the firm, the transaction cost theory emphasizes on transactions, the resource-based view focuses on the resources and capabilities of a firm, the Schumpeterian innovation concentrates on the firm itself, whereas the network theory focuses on the network of firms (Amit and Zott, 2001). Amit and Zott (2001) identified the business model itself as an appropriate unit of analysis to explain the value creation potential in e-commerce firms.

4 Method

We apply the Delphi method, which is a technology forecasting technique that has its origin back in the 1960ies (Linstone and Turoff, 2002). It facilitates the solidification of opinions that groups of experts bear. It follows an interactive, however anonymous, and multistage approach (Rauch, 1979). The Delphi approach is particularly applicable when one has to make use of the judgment of people, especially then when vital data about a particular topic is missing. Consequently, other statistical approaches do not work out (Rowe and Wright, 1999). Technological advancements can have huge impacts, which require to deal with and to manage those (Branson et al., 2002) by taking a look into their future (Saritas and Oner, 2004). However, it is difficult to foresee the future because of the existence of external influences (Saritas and Oner, 2004). Therefore it is essential to predict the environment through the lens of the PEST framework (Wilson and Gilligan, 2009). Especially business models can require adjustment with the upcoming of innovations like technologies so that the assurance of value creation is still possible (Chesbrough and Rosenbloom, 2002). Thus, we investigate blockchain's prospective macro environment from a political, economic, socio-cultural, and technological point of view to derive blockchain's implications on business models by 2030.

To develop projections, we investigated the PEST factors to examine blockchain's macro environment. We first conducted exploratory expert interviews. By choosing judgmental sampling, we selected appropriate interview partners (Saunders, Lewis and Thornhill, 2009). Following this approach, we scanned conference participants, relevant journals, and newspaper articles dealing with the blockchain to identify appropriate blockchain experts. We also searched on professional social networks like LinkedIn and drew on contacts from our networks. In total, we interviewed 31 experts on blockchain technology. Our interview guide also followed the PEST-framework to study "the external business environment" on a macro-level (Gupta, 2013, p. 35) and covered specific blockchain-related questions. We additionally investigated relevant blockchain as well as relevant business model literature. Our focus lay especially on Amit and Zott (2001) and Zott and Amit (2010) as these studies form the basis for ours by specifically investigating sources of value creation in the business model context. We complemented and triangulated the insights from the expert interviews with findings from a series of blockchain workshops of a two-year working group with representatives from practice. It took place at one of the Universities of the authors. Based on the preparatory work done, we developed projections.

To capture the full spectrum of possibilities at hand, we included extreme projections (Gausemeier, Fink and Schlake, 1998). In line with previous literature (von der Gracht and Darkow, 2010; Jiang, Kleer and Piller, 2017), we revised our initial set of projections to avoid redundancy. To ensure validity, we reviewed the projections again and checked for completeness and credibility of the content (von der Gracht and Darkow, 2010). This procedure led to a final set of 36 projections (see Table 1). For the purpose of this study, we have further distinguished between socio-cultural projections with an organizational and an individual customer focus.

#	By 2030, ….
	Technological Projections
#01	… only public and hybrid blockchain-based solutions will have prevailed, building on a series of substituting generations of blockchain technologies.
#02	… blockchain-based solutions will be in use in combination with other technologies, enabling an interconnected machine economy through automation and intelligent decision-making systems.
#03	… blockchain-based solutions will easily connect with other (traditional) IT systems through a standard interface.
#04	… new algorithm mechanisms will have ensured that blockchain-based value transactions have become highly time-efficient enabling real-time and cost-efficient transactions, thus ensuring blockchain's scalability.
#05	… blockchain will act as a single source of truth in a collaborative setting through automatization and reconciliation avoidance, leading to reduced information asymmetries and thus to the replacement of centralized databases.
#06	… blockchain-based off-chain storage solutions will have become the standard, so that data availability can be specifically restricted without hindering data exchange and evaluation.
	Socio-cultural projections
#07	… the majority of consumers will prefer blockchain-based solutions to traditional intermediaries (such as banks) for transactions due to higher trust.
#08	… the majority of consumers will have become familiar with and thus willing to use blockchain-based solutions, triggering its mass adoption.
#09	… the majority of consumers will have become more empowered as blockchain-based peer-to-peer systems allow them to participate in sharing-economy solutions while simultaneously maintaining control over their personal information.
#10	…, blockchain will have led to sustainable stabilization of developing countries as it serves as the standard to eliminate tax evasion and money laundering.
#11	… blockchain will have become the standard for identifying misconduct by enforcing honesty and thus acting as a trust machine between unknown parties.
#12	… blockchain will have developed as the foundation for payment infrastructures for regions without a stable local currency, making full-backed currency systems redundant and emphasizing microcredits.
	Socio-cultural projections with focus on organizations
#13	… blockchain-based solutions will have created new inter-organizational structures with flat hierarchies and made traditional leadership roles superfluous through autonomous power assurance, transparency and trust.
#14	… smart contracts will have become the standard for automated processes, leading to improved process efficiency and hence to drastic layoffs of employees.
#15	… blockchain-based solutions will have become standard in small and medium-sized enterprises, ensuring a mass adoption of blockchain-based solutions in this organizational context.
#16	… blockchain-based solutions will have become standard in large enterprises, ensuring a mass adoption of blockchain-based solutions in this organizational context.
#17	… blockchain-based solutions will have become standard for authorization and verification in cross-organizational supply chains, thereby enhancing transaction transparency and making trust intermediaries redundant.
	Political & Regulatory projections
#18	… blockchain-based digital currency will have become a vehicle for automated transactions, however FIAT currencies will remain the dominant means of payment.
#19	… blockchain will have become embedded in an international legal and regulatory framework, which forms the foundation for blockchain-based international trade activities.
#20	… cryptocurrencies will have been declared as proper currency from a legal point of view and a change into FIAT currencies will also be possible.
#21	… a unified cross-country legal framework will have clarified how Initial Coin Offerings (ICOs) can be launched.
#22	… a legal framework for all different kinds of blockchain-based tokens (e.g. security or utility token) will have been launched, creating the conditions for treating different tokens in a regulated manner.
#23	… the legal obligations and regulations of smart contracts will have been clarified through the development of a corresponding legal framework.
#24	… blockchain-based solutions will have prevailed as the backbone of property rights by having established themselves as a common mode in the public sector (e.g. public authorities).
#25	… blockchain-based solutions will have prevailed as the backbone of property rights by having established themselves as a common mode in the private sector (e.g. companies).
#26	… regulations of data protection will have been created, allowing blockchain-based off-chain data storage possibilities to guarantee data protection.
	Economic Projections
#27	… bottleneck actors will have become transparent through blockchain and they will have gained more power.
#28	… enforced honesty will have reduced risk premiums in transactions due to lower transaction costs.
#29	… blockchain-based solutions will have emerged as the new standard for value transactions across industries.
#30	… pay-per-use business models enabled through blockchain will have become standard.
#31	… blockchain-based "to-go-services" will have replaced traditional payment mechanisms for services (e.g. insurance services), as payments will be immediately and automatically made upon demand on pre-defined claims.
#32	… blockchain-based sharing business models will have dominated the market and have made previously involved intermediaries redundant for transactions due to increased trust.
#33	… blockchain-based solutions will have facilitated standard-based machine-to-machine communication, ensuring that devices are able to transact with each other.
#34	… blockchain-based solutions will have contributed to the facilitation of automatic cross-border transaction execution, which has enabled new activities and economic growth.
#35	… blockchain-based micro transactions (=>either in the form of money, data or information) will have become standard through reduced transaction costs and efficient transaction processing, enabling entirely new business models.
#36	… one dominant blockchain will have developed in most industries, forcing organizations to participate.

Table 1. Blockchain projections for the year 2030

An essential part of a Delphi study is the choice of experts (Gordon and Pease, 2006) to participate. After we identified blockchain experts, we evaluated them for plausibility and finally recruited them (von der Gracht and Darkow, 2010). For conducting a Delphi study, "there is no one sample size advocated" (Loo, 2002, p. 765). Our expert identification followed several approaches: through personal contacts from the researchers, newspaper articles, conference participants, or searches in social networks, like LinkedIn and Slack. Successful searches through social networks enabled the personal recommendation of potential experts to further helpful contacts. We selected and evaluated the potential experts based on their profound understanding of blockchain. Precise criteria included the expert's know-how of the technology, their overall work experience with blockchain or applications, their occupation, function within the company, and the field of work. We further included those experts who participated in a two-year workshop series on blockchain. We initially identified 363 potential experts to participate in our Delphi study. In the end, our selected panel consisted of 74 experts who participated in our first round. In the second round, 51 experts participated, and in the final round, still, 46 experts participated, marking a final dropout rate of 37,8%.

We applied the conventional Delphi method and asked the experts to assess the projections according to the likelihood of occurrence until the year 2030 in percentages. In total, we sent two reminders to the experts in each of the three rounds. After that, we calculated the individual results of our experts as well as the aggregated results of all participants for providing them with feedback (Rauch, 1979). We then sent each participant the respective average results of them and all experts (Nowack, Endrikat and Guenther, 2011). Based on this feedback, we invited the experts to reconsider their initial replies (Jiang et al., 2017). In total, we conducted three Delphi rounds, which is the usual number of Delphi rounds (Loo, 2002), each following the same procedure. After completion of the third and final round, we calculated the final descriptive statistics. We calculated the mean, the interquartile range as well as the standard deviation (Ecken, Gnatzy and von der Gracht, 2011). The interquartile range (IQR) determined consensus achievement among the expert panel, and the standard deviation (SD) predicates the dispersion of our results. We did not include projections that received consensus among experts in the next round (von der Gracht, 2012). Afterward, we derived future developments based on experts' assessment of our a priori developed projections. We first determined the likeliness of occurrence and second the consensus rate or certainty level among the experts concerning our projections. This approach is in line with previous Delphi studies (e.g., Keller and von der Gracht, 2014; Jiang et al., 2017). Thus, we grouped our projections according to their likeliness of occurring, by following the grouping scheme developed by Keller and von der Gracht (2014): Projections that mark an expected probability (EP) > 70% are expected to occur unambiguously, whereas those with an EP > 60% are expected to highly enter. Projections that marked a low degree of occurring made up an EP > 50%, whereas those that marked an EP < 50% have shown a low degree of non-occurrence. All projections showing an EP between 30% and 40% have shown a high degree of that they are not occurring (Keller and von der Gracht, 2014). The experts reached consensus, meaning they were highly certain when a projection achieved "an IQR of ≤ 25%" (Keller and von der Gracht, 2014, p. 86). Based on Jiang et al. (2017), projections showing an IQR between 25% and 31,25% mark in our case a higher degree of uncertainty. We defined projections showing an IQR above 31,25% as highly uncertain.

5 Results

Our investigations show that seven (# 02, 03, 04, 06, 18, 26, 34) of our 36 projections are unambiguously expected to occur as their expected probability of occurrence (EP) exceeds 70%. Nine projections (# 09, 17, 22, 23, 28, 29, 30, 33, 35) reveal a strong expectation of occurrence as their EP exceeds 60%. A rather low likelihood that the projections will occur show eleven projections (# 01, 08, 12, 16, 19, 20, 21, 25, 31, 32, 36) with an EP above 50%, whereas seven of our projections (# 05, 07, 11, 14, 15, 24, 27) show an EP below 50%, indicating their low probability of not occurring. Two projections (# 10, 13) are highly probable of not occurring as their EP is above 30% and below 40%. Overall, twenty-seven of our 36 projections (75%) show an expected probability of occurrence of over 50%. The first round achieved no consensus for the projections among the experts. The experts consented for eight of the 36 projections (22,2%) after round two and eleven of the 36 projections (30,6%) after the third round. The following projections achieved consensus among the expert panel after the second round: projection 02, 04, 08, 17, 27, 30, 31, and 34. Projections 06, 07, and 13 achieved consensus after the third round. In line with previous literature (Jiang et al., 2017), we look at two kinds of developments: one is most likely to occur, whereas the other one is still likely but less certain to occur. We define our future development that is most likely to occur as the one that includes first those projections showing an EP ≥ 60% and second those with high certainty among experts (IQR ≤ 25). Likewise, we included those projections with the highest consensus reached among the expert panel (Jiang et al., 2017). Thus, we include projection 02, 04, 06, 17, 30, and 34. Additionally, the development that is most likely to occur also includes those projections that have the lowest probability of occurrence (EP between 30% and 40%), but still high confidence (IQR ≤ 25) among experts. We identify projection 13 as the one meeting these requirements. For our discussion in section 6, we neglected projection 13, as the experts were highly certain that it will not occur by 2030 and thus will not achieve any business value. The development that is still likely to occur (EP ≥ 60%), but which involves a higher degree of uncertainty, includes those projections within an IQR between over 25% and 31,25%. These are projections 03, 18, 22, 26, 28, 33, 35. Our final result shows that the projection that is most likely to occur concentrates on the combination of blockchain technology solutions with other technologies, which drives the interconnected machine economy (# 02). Those developments that are unlikely to occur include all those projections with an EP between 30% and ≥ 50%. The fact that these developments are rather unlikely to enter, we neglected them in our further analysis. We further did not include projection 07 and projection 27, even though both showed an IQR below 15%, but their expected probabilities already exceeded 40%. Figure 1 provides a detailed overview of all projections according to their likelihood of occurrence and their certainty among experts.

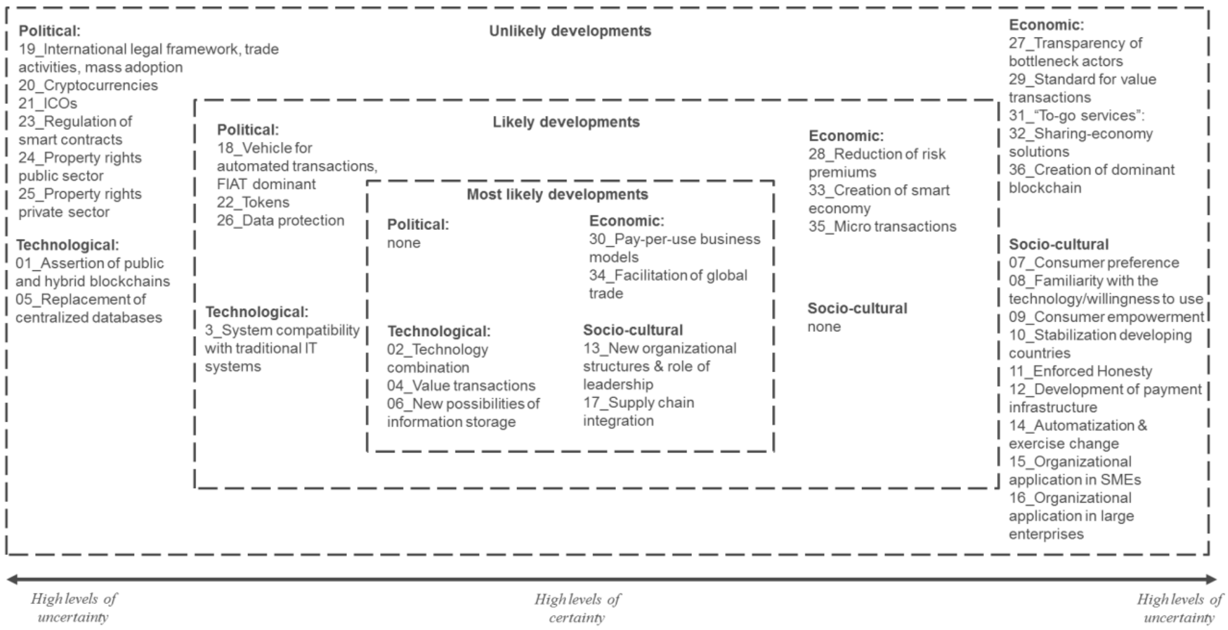

Figure 1. Future Developments of Blockchain Technology based on expert's certainty levels

The first category of developments includes those developments that the experts identified as the most likely ones to occur by 2030. The experts are highly confident that until 2030, blockchain-based solutions coexist and interact with other digital technologies. This combination, in turn, enables an interconnected machine economy, powered by automation and intelligent, potentially autonomously acting decision-making systems. The experts are further confident that until 2030, new algorithmic mechanisms ensure that blockchain-based value transactions are highly time-efficient, thereby enabling real-time, cost-efficient transactions. These ameliorations for transactions, in turn, ensure that blockchain becomes scalable. The experts are also sure that by 2030, blockchain-based off-chain storage solutions have become standard. While this restricts the possible availability of data, it does not hinder the exchange and evaluation of data. Further, there is high certainty among experts' opinions that blockchain-based solutions contribute to the facilitation of cross-border transaction's automatic execution by 2030. The development provides opportunities for new activities and economic growth. Along with this, the experts are also highly confident that blockchain-based solutions will form the standard for authorization and verification in cross-organizational supply chains. Thus, it is possible to improve transparency among transactions and thereby to make trust intermediaries redundant. Further, through blockchain, pay-per-use business models become the standard by 2030. In contrast to this, it is interesting to outline that the experts are also highly confident and agree that blockchain-based solutions do not create new inter-organizational structures. Hence, the blockchain does not create flatter hierarchies and does not make traditional leadership roles superfluous through autonomous power assurance, transparency, and trust.

Our second category includes those expectations that are still likely to occur, however, with higher uncertainty identified among the expert panel. Within this category, the experts agree that by 2030, blockchain-based solutions easily connect with other (traditional) IT systems through a standard interface. They also believe that it is likely that by 2030, blockchain-based digital currencies have emerged as a vehicle for automated transactions. However, the experts also believe that FIAT currencies (legal currencies like the Euro, where the government is responsible for backing and issuing it) remain the dominant means of payment. With an even lower degree of uncertainty, experts agree that by 2030, efficient regulations for data protection will be in place. Such regulations would allow blockchain-based off-chain data storage, which in turn could offer solutions for data protection guarantees. Furthermore, the experts are confident that blockchain-based microtransactions will have become standard by 2030. This assumption builds on expectations of reduced transaction costs and efficient transaction processing, which would enable entirely new business models. With a lower expected probability of occurrence and a higher uncertainty among expert's agreement, the experts believe that by 2030, the launch of a legal framework for all different kinds of blockchain-based tokens (like security or utility tokens) has taken place. The legal framework would allow treating all types of tokens in a regulated manner. The experts highly agree that blockchain-based solutions will facilitate standards-based machine-to-machine communication, but its likelihood to occur is somewhat lower. The experts believe that devices will be capable of transacting with each other, even though they think that the probability of occurrence is lower. Furthermore, the experts are rather sure about the fact that enforced honesty, ensured through blockchain technology, reduces risk premiums in transactions because transaction costs decrease, is the least likely projection to occur.

6 Discussion

We focus the discussion of our findings on the most likely developments of blockchain by 2030. Using insights from expert judgments, we discuss blockchain's expected impact on a focal firm's value creation. We thereby build on the four value drivers identified by Amit and Zott (2001) in the e-commerce setting and compare them to the blockchain context. Table 2 provides an overview of the value creation effects.

Value Sources		***Projections***					
		02 technology combination	04 value transactions	06 off-chain storage	17 supply chain integration	30 pay-per-use business models	34 facilitation of global trade
Efficiency	Information made available as a basis for decision-making	↑	↑	0	↑	↑	↑
	Transaction transparency	↑	↑	↓	↑	↑	↑
	Reduction of information asymmetries	↑	↑	0	↑	↑	↑
	Transaction simplicity	↑	↑	↓	↑	↑	↑
	Transaction speed	↑	↑	0	↑	↑	↑
	Scalability of transaction volume	↑	↑	0	↑	↑	↑
	Bargaining cost	↑	↑	↓	↑	↑	↑

	Communication cost	↑	↑	↓	↑	↑	↑
	Cost for transaction processing	↑	↑	↓	↑	↑	↑
	Exchange mechanism	↑	↑	↑	↑	↑	↑
	Transaction cost	↑	↑	0	↑	↑	↑
Complementarities	Complementary products, services, and information	↑	↑	↓	↑	↑	↑
	Complementary activities	↑	↑	↓	↑	↑	↑
	Complementary virtual assets*	↑	↑	0	↑	↑	↑
	Combination of online and offline resources	↑	↑	↑	↑	↑	↑
	Complementory customers / machines*	↑	↑	0	↑	↑	↑
	Technology combination with participants	↑	(↑)	(↑)	↑	↑	↑
Lock-in	Promotion of trust through no third party*	↑↓	↑↓	↑	↑↓	↑↓	↑↓
	Entry Barriers*	PP ↓ / PR (↑)	PP ↓ / PR (↑)	PP ↓ / PR (↑)	PP ↓ / PR (↑)	PP ↓ / PR (↑)	PP ↓ / PR (↑)
	Customers control the use of personal information	PP ↑ / PR ↑	PP ↑ / PR ↑	PP ↑ / PR ↑	PP ↑ / PR ↑	PP ↑ / PR ↑	PP ↑ / PR ↑
	Switching costs	↑↓	↑↓	↑	↑↓	↑↓	↑↓
	Network Externalities	↑↓	↑	↑	↑	↑	↑
	Information flow security	↑	↑	↑	↑	↑	↑
	Transaction reliability	↑	↑	↑	↑	↑	↑
Novelty	New activities/ combinations of products, services, and information	↑	↑	(↑)	↑	↑	↑
	New governance (role and actors)	↑	↑	0	↑	↑	↑
	New structures (new linkages)	↑	↑	↑	↑	↑	↑
	New collaborations*	↑	↑	↑	↑	↑	↑
	New Business Model Opportunities*	↑	↑	0	0	↑	0
	New assets*	↑	↑	↑	↑	↑	↑

↑: positive impact; 0: no impact; ↓: negative impact; (↑) partially positive impact
PP= public blockchain; PR= private blockchain
*Additions to the Amit and Zott (2001) model, which blockchain creates

Table 2. Sources of Value Creation for Blockchain Technology

Efficiency. A focal firm's business model can increase the value it creates through efficiency gains, e.g., by decreasing the firm's costs of transactions (Williamson, 1979). Our findings reveal a range of opportunities for efficiency gains through blockchain. In contrast to network theory (Gulati, Nohria and Zaheer, 2000), it is the blockchain itself that creates the network and thus, makes information available by likewise influencing decision-making (Amit and Zott, 2001). When combining the blockchain with other technologies (# 02), like the Internet of Things (IoT), extensive amounts of information become available. Especially IoT creates so many information which the current, centralized systems cannot handle (Deloitte, 2020). These huge amounts of information may impact how people or even machines will make decisions (Amit and Zott, 2001). By reducing the necessity of trust intermediaries, more information becomes available, too (# 02, 04, 17, 34). In contrast, blockchain-based off-chain storage solutions (# 06) ensure the restriction of information or data availability, which can influence decision-making, without the impediment of data exchange and evaluation. Blockchain further increases transaction transparency and decision-making in a transparent way (Amit and Zott, 2001) as its ledger includes every transaction undertaken (Iansiti and Lakhani, 2017) by also accelerating reconciliation (Christidis and Devetsikiotis, 2016). In line with network theory (Gulati et al., 2000), blockchain enhances efficiency through reducing information asymmetries (Cong & He, 2019) and thus also costs of contracting (e.g., Williamson, 1979). Especially smart contracts provide the foundation to reduce information asymmetries (e.g., Cong and He, 2019) and therefore cause a more efficient organization of processes (# 02, 04, 17, 30, 34). However, off-chain solutions (# 06), show a neutral effect on efficiency, as information asymmetries may arise, even though data evaluation and exchange will continue to proceed. Blockchain provides efficiency gains (# 02, 04, 17, 30, 34) through simple transactions (Williamson, 1981), especially through reconciliation acceleration (Christidis and Devetsikiotis, 2016) and when crossing organizational boundaries (# 17 & 34). Blockchain off-chain storage solutions (# 06) negatively influence efficiency by increasing transaction complexity. Further, blockchain can increase transaction speed and thus, transaction volume (Garciano and Kaplan, 2001). Despite blockchain's specific attributes, the development of new algorithm mechanisms, which will also ensure blockchain's scalability (# 04), will supersede current energy-intensive ones (e.g., Swan, 2015), by likewise improving current transaction throughput issues (Li et al., 2016). Hence, blockchain positively impacts efficiency (# 02, 04, 17, 30, 34) and again when crossing of organizational boundaries (# 17 & 34) takes place. Likewise, we see positive impacts on transaction throughput (# 02, 04, 17, 30, 34). However, off-chain storage solutions (# 06) will rather harm efficiency concerning the speed and volume of transactions (Garciano and Kaplan, 2001). Blockchain will furthermore reduce bargaining costs (Williamson, 1975) and communication costs (Garciano and Kaplan, 2001). Overall, especially through automation (# 02) blockchain will positively influence efficiency (# 04, 17, 30, 34). Off-chain storage solutions (# 06) create a negative impact on efficiency. Furthermore, blockchain will enable a variety of new exchange mechanisms, corresponding to the findings of Amit and Zott (2001) in the e-commerce context, through its peer-to-peer principle and the secure transaction transfer (e.g., Franco, 2015). New algorithm mechanisms will change current blockchain-based exchange mechanisms by laying the foundation for enabling efficient and real-time value transactions (# 04). Hence, all prospective developments (# 06, 17, 30, 34) will experience an efficiency increase. Lastly, blockchain will reduce transaction costs (# 02, 04, 17, 30, 34) and thus increases efficiency, corresponding to the findings of Amit and Zott (2001). For off-chain storage solutions (# 06), we expect a neutral impact.

Complementarities. A focal firm's business model may benefit from complementary offerings that enhance the firm's value offering and thereby increase its strength and variety of revenue streams. Our findings reveal a range of opportunities for creating complementarities through blockchain. Like in the e-commerce context (Amit and Zott, 2001), blockchain allows the bundling for complementary products, services (Weking et al., 2019), and information (# 02, 04, 17, 30, 34). Thus, blockchain allows gaining access to relevant information (# 02) or reaching new customers (# 17, 34). Pay-per-use business models (# 30) are further beneficial for complementarities, as these allow the accession to complementary information from other organizations, consumers, or machines. In addition to Amit and Zott (2001), we found out that access to complementarities may also stem from machines (# 02). Hence, blockchain allows the engagement in complementary activities (# 02, 04, 17, 30, 34). However, off-chain storage solutions (# 06) may limit the availability of complementary information and thus hinder engagement in complementary activities. Since blockchain will become scalable by 2030 (# 04) makes us agree with the findings of Weking et al. (2019), where customers can become complementors through selling and offering of user-specific or virtual assets. Thus, we extend the finding of Amit and Zott (2001) by showing that the bundling of virtual assets and not only the bundling of products, services, and information is possible (# 02, 04, 17, 30, 34). As machines become able to transfer assets, they also might become complementors (# 02). However, we expect a neutral impact concerning off-chain storage solutions (# 06). Another value creation aspect is the combination of online and offline resources (Amit and Zott, 2001). The transfer from every resource from the analog world into a blockchain becomes feasible, which justifies our assumption (# 02, 04, 06, 17, 30, 34). Another aspect where firms can create value through complementarities is the combination of technologies (Amit and Zott, 2001), as companies can combine their blockchain-based technologies (# 17, 30, 34). Value transactions (#4) and off-chain storage solutions (#6) show a partially positive impact.

Lock-in. Amit and Zott (2001) identified numerous possibilities for firms to hinder their customers or partners from switching to competitors in the e-commerce context. Our findings reveal mixed opportunities on how a focal firm may leverage blockchain to create lock-in effects. We observed a reduction in lock-in effects through blockchain technology because trusted third parties become redundant, which corresponds to previous literature (Schneider et al., forthcoming). In contrast to the e-commerce setting, the promotion of trust (Amit and Zott, 2001) in the blockchain occurs without a third party (Christidis and Devetsikiotis, 2016; Ying et al., 2018) and is a blockchain-specific attribute. Thus there is a reduction of lock-in effects through each of our projections. However, through a blockchain, trust into conventional networks (Gulati, 1995) becomes obsolete. Instead, participants need to trust the blockchain, which in turn means a shift of trust from networks to blockchain. Schneider et al. (forthcoming) found out that low entry barriers to the public blockchain network exist without a present intermediary. Likewise, Cong and He (2019) referred to lower entry barriers due to the removal of information asymmetries. Concerning a private network, our findings correspond with the findings of Schneider et al. (forthcoming), where some lock-in effect exists because a verification and validation of nodes wishing to enter the network needs to takes place before-hand (Schneider et al., forthcoming). Thus, the creation of lock-in depends on the blockchain type and, therefore, also whether the customer or user has the chance to control their personal information (Amit and Zott, 2001). However, since off-chain storage solutions (# 06) become possible by 2030, we believe that the blockchain type might prospectively not matter anymore. Consequently, users can control the kind of information that they wish to control. On the one hand, switching costs (Williamson, 1975) decline because the participation in a blockchain network does not require trust between two parties anymore (Schneider et al., forthcoming). Further, the usage of blockchain opens up access to new actors (# 02, 04, 17, 30, 34). If there are more actors to choose from, switching costs decrease and thus create no lock-in effect (Shapiro and Varian, 1999). On the other hand, switching costs increase through blockchain: Blockchain requires the establishment of interfaces and, therefore, investments in IT systems and learning investments (Shapiro and Varian, 1999). Hence, the usage of multiple technologies (# 02) causes high switching costs and locks the customer in. We further detected high switching costs due to high learning efforts (Shapiro and Varian, 1999), especially in terms of programming, as well as investment costs (# 04, 06, 17, 30, 34). The development of new algorithm mechanisms that will ensure the scalability of blockchain (# 04) will lay the foundation for creating network externalities and thus for creating value (Shapiro and Varian, 1999), especially for blockchain-based pay-per-use business models (# 30). The participation of new actors in the blockchain network (# 02, 17, 34) will contribute to the creation of network externalities (Shapiro and Varian, 1999). The possibility of storing data off the blockchain by 2030 (# 06), might also cause more participants to participate in a blockchain network. Due to its unique properties, blockchain-based solutions create a secure flow of information (Shapiro and Varian, 1999) and reliable execute transactions (Amit and Zott, 2001). Even though blockchain possesses a more secure transmission path compared to e-commerce (Franco, 2015), it only partially creates lock-in effects. Both properties represent unique selling propositions of blockchain-based solutions in comparison to non-blockchain-based solutions. Thus, these properties do not create lock-in effects for other blockchain networks. This finding contradicts the fact that a network becomes more valuable through interlinks with others (Shapiro and Varian, 1999). In contrast, when linking several blockchain networks, where unique selling propositions in comparison to non-blockchain-based solutions exist, lock-in occurs. In turn, switching costs increase, and thus, the value potential (Shapiro and Varian, 1999). So, we argue that projection two experiences both – positive and negative – lock-in effects. The reliable execution of transactions (Amit and Zott, 2001), which stems in the e-commerce context from independence or highly credible third parties (Amit and Zott, 2001), becomes obsolete in the blockchain context. Hence, creating value through transaction reliability in the blockchain context will shift, but will still positively affect lock-in for all our projections.

Novelty. The business model of a focal firm may further increase its value by adopting novel activities (new business model content), novel linkages among activities (new business model structures), and/or novel roles and actors (new business model governance) (Zott and Amit, 2010). Our findings reveal several possibilities to create novelty through blockchain. It allows the novel combinations of products, services, and information, which has already been shown by Amit and Zott (2001) in the e-commerce context. Combining blockchain with other technologies allows for novel combinations of products, services, and information (# 02) and represents a novel feature of production (Schumpeter, 1939). Blockchain also combines information in novel manners to enable novel services (# 06, 17, 34), and combines new services and products (Amit and Zott, 2001) (# 30). In line with the findings of Amit and Zott (2001), several novel actors in the blockchain context arise. The blockchain ledger itself represents a novel participant per se (Schneider et al., forthcoming). As this is a blockchain-specific attribute, we can see an increase in novelty when the technology acts as an enabler (# 02, 04, 06, 17, 30, 34). Furthermore, machines (# 02) and smart contracts appear as novel actors, too (# 02, 04, 17, 30, 34). Novel actors show no impact on off-chain storage solutions (# 06). Moreover, the blockchain network is also new and "functions as a symbiosis of a technology with a community […] and that facilitates new forms of collaboration between human and non-human actors" (Schneider et al., forthcoming, pp. 17–18). Previous actors that usually have been relevant between transaction partners become redundant, which also represents a novelty and provides new opportunities for business models (Schneider et al., forthcoming). Along with that, blockchain's peer-to-peer network creates new connections among actors (Amit and Zott, 2001). For example, firms can start overtaking novel activities that, in former times, their partners have taken care of, so that the power balance shifts (Schneider et al., forthcoming). We can confirm this finding for all our projections. Overall, blockchain allows the creation of entirely new business models and not merely first-mover business models (Amit and Zott, 2001). The scalability of blockchain (# 04) may lay the foundation for entirely new business model opportunities, like blockchain-based pay-per-use business models (# 30), or machine-based business models (# 02). In line with previous literature (e.g., Weking et al., 2019), our findings reveal that through blockchain the transfer of different kinds of novel assets becomes feasible (especially projection 04). Those kinds of assets have not been present in the e-commerce context (e.g., Amit and Zott, 2001), which in turn lays the foundation for the internet of value (Tapscott and Euchner, 2019).

7 Conclusion

Intending to investigate how blockchain can create value by 2030, we brought clarity in blockchain's current unclear state-of-the-art. This study extends existing literature on value creation in the digital era, especially concerning blockchain-enabled business models. We compared the findings of Amit and Zott (2001), who elaborated on value creation in e-businesses, to the findings of our study by focusing on blockchain and its creation of value. The comparison shed light on how a focal firm can create value through blockchain in terms of a business model's design themes - efficiency, complementarities, lock-in, and novelty (Amit and Zott, 2001; Zott and Amit, 2010). Despite the supposedly transformative character of the blockchain, no new design theme emerges. However, in three of the four design themes, new elements arose that will prospectively influence value creation through blockchain. Through the application of blockchain, firms will create value by offering complementary virtual assets. Not only complementary products, services, or information (Amit and Zott, 2001) create value, but also complementory customers or machines, as their roles become stronger. The study has shown that shifts in trust in the design theme "lock-in" (Amit and Zott, 2001) occur. Through the application of blockchain the creation of trust does not occur with a third party (Amit and Zott, 2001), but rather without a third party. Thus, we saw a reduction of lock-in effects. However, we have shown that trust into the technology itself becomes essential so that merely a shift of trust into conventional networks (Gulati, 1995) to the blockchain occurs, which in turn creates a lock-in effect. Another impact influencing lock-in causes entry barriers (Schneider et al., forthcoming), where especially the type of blockchain plays an essential role. Whereas a public blockchain creates low entry barriers and thus reduces a lock-in effect, a private blockchain can set entry barriers higher, and thus create some lock-in effect (Schneider et al., forthcoming). Additionally, we identified new assets and new business models opportunities as additional drivers for value creation, which may lead to strong business and societal implications. The transfer of value in terms of different forms of assets instead of merely information will lay the foundation of a novel value creation possibility. Our research shows that through the application of blockchain, not only information transactions but also value creation transactions are taking place. Hence, the use of blockchain will change the components of the sources of value creation from a rather information-centric approach to a value-driven one.

One of our main findings is that blockchain will create value through enormous efficiency gains, even though no new elements within the design theme arose. Through automation and the reduction of reconciliation, blockchain can enormously reduce transaction costs (Williamson, 1979). The massive efficiency gains will lay the foundation for entirely new business models, which have not been feasible up until then. Our findings let us agree with existing research that blockchain will restructure businesses or create entirely new ones (e.g., Swan, 2015; Fanning and Centers, 2016; Iansiti and Lakhani, 2017). Our analysis revealed that the most likely development that is going to occur by 2030 is a combination of blockchain solutions with other technologies, which in turn will drive the interconnected machine economy. This finding points out that a firm will especially then create value when it combines blockchain with other technologies. The resulting establishment of an interconnected machine economy will cause that firms will especially experience enormous efficiency gains. Hence, novel possibilities arise for firms to do things differently, hence laying the foundation for innovations (Schumpeter, 1939) or creating value through complementarities (Amit and Zott, 2001). In contrast, firms can only create lock-in if they combine other blockchain solutions. The creation of lock-in does not take place when combining blockchain with other non-blockchain-based solutions. Overall, our findings demonstrate that even though blockchain will change how firms create value, it will not occur in such a revolutionary way as predicted by previous literature (e.g., Zhao, Fan and Yan, 2016). We especially expect a change in business (Zhao et al., 2016), when a combination of blockchain with other technologies occurs. We also contribute to the emerging stream of literature that emphasizes blockchain technologies' business value (e.g., Schneider et al., forthcoming; Zavolokina, Ziolkowski and Bauer, 2020). Our research contributes to missing empirical investigations about blockchain technology. We likewise close existing gaps to theoretically missing contributions (Weking et al., 2019) by investigating blockchain's value creation potential based on well-established theoretical frameworks. By taking a look into the future, we show prospective development paths of blockchain, which creates certainty about blockchain's current uncertainty (e.g., Glaser, 2017). Our research sits at the interface with the business model and information systems (IS) research. Mainly, applying the Delphi method in IS research is currently sparse (e.g., Skinner, Nelson, Chin and Land, 2015), which also highlights the innovativeness of our paper.

Despite the growing academic awareness of blockchain, corporate practice will benefit from the findings of this study by understanding the prospective development of blockchain technology. Our research supports strategic planning in the long-run by paving the way that blockchain will create value in combination with other technologies, by likewise laying the foundation for an interconnected machine economy. Blockchain will mainly entail enormous efficiency gains for organizations, especially in terms of streamlining processes. The resulting scalability causes that blockchain will create new business model opportunities like pay-per-use business models and the interconnected machine economy.

Our study does not come without limitations. Despite the Delphi method's advantages, it remains to be a forecasting technique that suffers from the uncertainty of future developments and the subjective judgments of the experts involved in the data collection. Further statistical investigations about our results would help to foster our forecast. Following blockchain's diffusion into different industries and observing the business model transformations caused by blockchain technology especially in businesses in which trust and privacy are prevailing, provides interesting avenues for future research. This study specifically emphasized the implications of one digital technology in isolation without analyzing the potential interdependencies with other digital technologies. In particular, as of the most likely and most certain projections foresees blockchain technology to interact with other technologies, gaining more insights about the potential interdependencies emerges as a promising avenue for future research. Finally, our analysis reveals several areas in which experts have widely diverging expectations – in particular concerning legal and regulatory frameworks for the blockchain-enabled business context. Whereas this is not an unusual outcome in Delphi studies, it helps to shed light on relevant avenues for future research.

References

Amit, R. and C. Zott. (2001). "Value creation in E-business." *Strategic Management Journal*, *22*(6–7), 493–520.

Baden-Fuller, C. and S. Haefliger. (2013). "Business Models and Technological Innovation." *Long Range Planning*, *46*(6), 419–426.

Beck, R. and C. Müller-Bloch. (2017). "Blockchain as Radical Innovation: A Framework for Engaging with Distributed Ledgers." *Proceedings of the 50th Hawaii International Conference on System Sciences*, Hawaii, USA, 5390-5399.

Beck, R., J. S. Czepluch, N. Lollike and S. Malone. (2016). "Blockchain – The Gateway To Trust-Free Cryptographic Transactions." *Twenty-Fourth European Conference on Information Systems (ECIS)*, İstanbul, Turkey, 1–15.

Brandenburger, A. M. and H. W. Stuart. (1999). "Value-based Business Strategy." *Journal of Economics & Management Strategy*, *5*(1), 5–24.

Branson, W., J.-J. Laffont, R. Solow, D. Ulph, C. von Weizsäcker and D. Kyriakou. (2002). "Economic dimensions of prospective technological studies at the Joint Research Centre of the European Commission." *Technological Forecasting and Social Change*, *69*(9), 851–859.

Casey, M., J. and P. Wong. (2017). *Global Supply Chains Are About to Get Better, Thanks to Blockchain*. URL: https://hbr.org/2017/03/global-supply-chains-are-about-to-get-better-thanks-to-blockchain.

Chesbrough, H. and R. S. Rosenbloom. (2002). "The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies." *Industrial and Corporate Change*, *11*(3), 529–555.

Chesbrough, H. (2010). "Business Model Innovation: Opportunities and Barriers." *Long Range Planning*, *43*(2–3), 354–363.

Christidis, K. and M. Devetsikiotis. (2016). "Blockchains and Smart Contracts for the Internet of Things." *IEEE Access*, *4*, 2292–2303.

Cong, L. W. and Z. He. (2019). "Blockchain Disruption and Smart Contracts." *The Review of Financial Studies*, *32*(5), 1754–1797.

DaSilva, C. M. and P. Trkman. (2014). "Business Model: What It Is and What It Is Not." *Long Range Planning*, *47*(6), 379–389.

Deloitte. (2020). *Can blockchain accelerate Internet of Things (IoT) adoption?*. URL: https://www2.deloitte.com/ch/en/pages/innovation/articles/blockchain-accelerate-iot-adoption.html.

Dutra, A., A. Tumasjan and I. M. Welpe. (2018). "Blockchain is changing how media and entertainment companies compete." *MIT Sloan Management Review*, *60*(1), 39–45.

Gartner. (2019a). *5 Trends Emerge in the Gartner Hype Cycle for Emerging Technologies, 2018*. URL: https://www.gartner.com/smarterwithgartner/5-trends-emerge-in-gartner-hype-cycle-for-emerging-technologies-2018/.

Gartner. (2019b). *Newsroom.* URL: https://www.gartner.com/en/newsroom/press-releases/2019-10-08-gartner-2019-hype-cycle-shows-most-blockchain-technologies-are-still-five-to-10-years-away-from-transformational-impact.

Ecken, P., T. Gnatzy and H. A. von der Gracht. (2011). "Desirability bias in foresight: Consequences for decision quality based on Delphi results." *Technological Forecasting and Social Change*, *78*(9), 1654–1670.

Fanning, K. and D. P. Centers. (2016). "Blockchain and Its Coming Impact on Financial Services." *Journal of Corporate Accounting & Finance*, *27*(5), 53–57.

Franco, P. (2015). *Understanding Bitcoin*. United Kingdom: John Wiley & Sons Ltd.

Garciano, L. and S. N. Kaplan. (2001). "The Effects Of Business-To-Business E-Commerce On Transaction Costs." *The Journal of Industrial Economics*, *49*(4), 463–485.

Gausemeier, J., A. Fink and O. Schlake. (1998). "Scenario Management: An Approach to Develop Future Potentials." *Technological Forecasting and Social Change*, *59*, 111–130.

Glaser, F. (2017). "Pervasive Decentralisation of Digital Infrastructures: A Framework for Blockchain enabled System and Use Case Analysis." *Proceedings of the 50th Hawaii International Conference on System Sciences*, 1544–1552.

Gordon, T. and A. Pease. (2006). "RT Delphi: An efficient, "round-less" almost real time Delphi method." *Technological Forecasting and Social Change*, *73*(4), 321–333.

Gulati, R. (1995). "Does Familiarity Breed Trust? The Implications of Repeated Ties for Contractual Choice in Alliances." *Academy of Management Journal*, *38*(1), 85–112.

Gulati, R. (1999). "Network Location and Learning: The Influence of Network Resources and Firm Capabilities on Alliance Formation." *Strategic Management Journal*, *20*(5), 397–420.

Gulati, R., N. Nohria and A. Zaheer. (2000). "Strategic networks." *Strategic Management Journal*, 21, 203-215.

Gupta, A. (2013). "Environment & PEST Analysis: An Approach to External Business Environment." *International Journal of Modern Social Sciences*, *2*(1), 34–43.

Holotiuk, F., F. Pisani and J. Moormann. (2017). "The Impact of Blockchain Technology on Business Models in the Payments Industry." *13th International Conference on Wirtschaftsinformatik*, 912–926.

Iansiti, M. and K. R. Lakhani. (2017). "The Truth About Blockchain." *Harvard Business Review*, 1–11.

Jiang, R., R. Kleer and F. T. Piller. (2017). "Predicting the future of additive manufacturing: A Delphi study on economic and societal implications of 3D printing for 2030." *Technological Forecasting and Social Change*, *117*, 84–97.

Katz, M., L. and C. Shapiro. (1985). "Network Externalities, Competition, and Compatibility." *The American Economic Review*, *75*(3), 424–440.

Keller, J. and H. A. von der Gracht. (2014). "The influence of information and communication technology (ICT) on future foresight processes — Results from a Delphi survey." *Technological Forecasting and Social Change*, *85*, 81–92.

Lacity, M. C. (2018). "Addressing Key Challenges to Making Enterprise Blockchain Applications a Reality." *MIS Quarterly Executive*, *17*(3), 201–222.

Li, W., K. Liu, M. Belitski, A. Ghobadian and N. O'Regan. (2016). "E-Leadership through Strategic Alignment: An Empirical Study of Small- and Medium-sized Enterprises in the Digital Age." *Journal of Information Technology*, *31*(2), 185–206.

Linstone, H. A. and M. Turoff. (2002). *The Delphi Method: Techniques and Applications*. Reading, Mass.: Addison-Wesley.

Loo, R. (2002). "The Delphi method: a powerful tool for strategic management." *Policing: An International Journal of Police Strategies & Management*, *25*(4), 762–769.

Montecchi, M., K. Plangger and M. Etter. (2019). "It's real, trust me! Establishing supply chain provenance using blockchain." *Business Horizons*, *62*(3), 283–293.

Nowack, M., J. Endrikat and E. Guenther. (2011). "Review of Delphi-based scenario studies: Quality and design considerations." *Technological Forecasting and Social Change*, *78*(9), 1603–1615.

Nowiński, W. and M. Kozma. (2017). "How Can Blockchain Technology Disrupt the Existing Business Models?" *Entrepreneurial Business and Economics Review*, *5*(3), 173–188.

Rauch, W. (1979). "The decision Delphi." *Technological Forecasting and Social Change*, *15*(3), 159–169.

Risius, M. and K. Spohrer. (2017). "A Blockchain Research Framework: What We (don't) Know, Where We Go from Here, and How We Will Get There." *Business & Information Systems Engineering*, *59*(6), 385–409.

Rossi, M., C. Mueller-Bloch, J. B. Thatcher and R. Beck. (2019). "Blockchain Research in Information Systems: Current Trends and an Inclusive Future Research Agenda." *Journal of the Association for Information Systems*, *20*(9), 1388–1403.

Rowe, G. and G. Wright. (1999). "The Delphi technique as a forecasting tool: issues and analysis." *International Journal of Forecasting*, *15*(4), 353–375.

Saritas, O. and M. A. Oner. (2004). "Systemic analysis of UK foresight results." *Technological Forecasting and Social Change*, *71*(1–2), 27–65.

Saunders, M., P. Lewis and A. Thornhill. (2009). *Research methods for business students* (5. ed). Harlow: Pearson Education Limited.

Schneider, S., M. Leyer and M. Tate. (forthcoming). "The transformational impact of Blockchain technology on business models and ecosystems: A symbiosis of human and technology agents." *IEEE Transactions on Engineering Management*.

Schumpeter, J. A. (1934). *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Cambridge, MA: Harvard University Press.

Schumpeter, J. A. (1939). *Business Cycles - A Theoretical Historical, and Statistical Analysis of the Capitalist Process*. New York; London: McGraw-Hill Book Company, Inc.

Shapiro, C. and H. R. Varian. (1999). *Information rules: a strategic guide to the network economy*. Boston, Mass: Harvard Business School Press.

Skinner, R., R. R. Nelson, W. W. Chin and L. Land. (2015). "The Delphi Method Research Strategy in Studies of Information Systems." *Communications of the Association for Information Systems, 37*.

Swan, M. (2015). *Blockchain: blueprint for a new economy* (First edition). Beijing : Sebastopol, CA: O'Reilly.

Tapscott, D. and J. Euchner. (2019). "Blockchain and the Internet of Value: An Interview with Don Tapscott." *Research-Technology Management, 62*(1), 12–19.

Teece, D. J. (2010). "Business Models, Business Strategy and Innovation." *Long Range Planning, 43*(2–3), 172–194.

Underwood, S. (2016). "Blockchain beyond bitcoin." *Communications of the ACM*, *59*(11), 15–17.

von der Gracht, H. A. (2012). "Consensus measurement in Delphi studies." *Technological Forecasting and Social Change*, *79*(8), 1525–1536.

von der Gracht, H. A. and I.-L. Darkow. (2010). "Scenarios for the logistics services industry: A Delphi-based analysis for 2025." *International Journal of Production Economics*, *127*(1), 46–59.

Weking, J., M. Mandalenakis, A. Hein, S. Hermes, M. Böhm and H. Krcmar. (2019). "The impact of blockchain technology on business models – a taxonomy and archetypal patterns." *Electronic Markets*.

Williamson, O. E. (1975). *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization.* New York: Free Press.

Williamson, O. E. (1979). "Transaction-Cost Economics: The Governance of Contractual Relations." *The Journal of Law and Economics*, *22*(2), 233–261.

Williamson, O. E. (1981). "The Economics of Organization: The Transaction Cost Approach." *American Journal of Sociology*, *87*(3), 548–577.

Wilson, R. M. S. and C. Gilligan. (2009). *Strategic marketing management: planning, implementation and control* (3. ed., repr). Amsterdam: Elsevier/Butterworth-Heinemann.

Ying, W., S. Jia and W. Du. (2018). "Digital enablement of blockchain: Evidence from HNA group." *International Journal of Information Management, 39*, 1–4.

Zavolokina, L., R. Ziolkowski and I. Bauer. (2020). "Management, Governance, and Value Creation in a Blockchain Consortium." *MIS Quarterly Executive*, *19*(1), 1–17.

Zhao, J. L., S. Fan and J. Yan. (2016). "Overview of business innovations and research opportunities in blockchain and introduction to the special issue." *Financial Innovation*, *2*(1), 28.

Zott, C. and R. Amit. (2010). "Business Model Design: An Activity System Perspective." *Long Range Planning*, *43*(2–3), 216–226.