

Organizations' approaches to blockchain: A critical realist perspective

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ABSTRACT

Organizations face manifold implementation barriers in blockchain adoption. Of particular interest is the pre-adoption phase, where knowledge and attitudes guide organizations' approaches toward a new technology. This paper examines organizations' approaches to blockchain through a sensemaking lens to identify how blockchain prototype development is guided by perceived business value of and sentiments toward the technology. Taking a critical realist perspective, we examine divergences between organizations' approaches toward blockchain adoption, i.e., *what* they do, and *why* and *how* they approach blockchain. We differentiate between four types of approaches and provide recommendations how the pre-adoption phase can be considered in academic analyses.

1. Introduction

Blockchain is a distributed ledger technology based on a distributed transactional database, secured by cryptography, and governed by a consensus mechanism [5]. It offers new, open source-based opportunities for developing novel types of digital platforms and services. For instance, in the financial services industry it could support and enable a range of improved or novel financial instruments, such as micro-payments, peer-to-peer lending, and non-regulated money, potentially providing access to many banking services for about 2.5 billion people worldwide who currently lack such access [32]. The versatility of possible uses of blockchain is supported by its technical components, e.g., smart contracts combining computer protocols with user interfaces to automatically execute the terms of a contract [40, 53].

Using smart contracts, blockchain is not only able to improve financial services but can also be applied to track and transfer the ownership of a variety of tangible or intangible assets [17, 40]. This use of blockchain technology expands its applicability from the financial services industry to a multitude of other industries, including health-care, logistics, and manufacturing [19, 26, 60, 62]. IS scholars anticipate that blockchain adoption will have broad repercussions and create new decentralized interaction patterns on blockchain-enabled business platforms characterized by, among others, automatically enforced governance rules (e.g., Steemit, OpenBazaar) [42]. In particular, decentralized interaction patterns are expected to pave the way for decentralized electronic marketplaces and automated

machine-to-machine coordination, convergent with other emerging technologies such as the Internet of Things [6, 23].

To date, decentralized interaction patterns are more of an ideal, far from being implemented in reality. Although large organizations including Mastercard, Visa, Walmart, and JPMorgan Chase invested an estimated USD 1.2 billion in developing blockchain applications between 2012 and 2017 alone, and despite normative pressure characterized by the appearance that "everyone is doing it" [28, 51] driving blockchain adoption, most existing blockchain applications are proof-of-concepts or prototypes used solely in test environments [30]. Accordingly, the gap between the potential and actual business value of blockchain is large, causing uncertainty and disillusionment in organizations [24, 30]. Thus, organizations' efforts to apply blockchain are not only based on the future business value but also fueled by the high expectations among the market players.

IS scholars generally encourage organizations to do the work that "needs to be done" [30] to adopt blockchain technology. For instance, Lacity [30] advises organizations to cooperate by building consortia to develop applications jointly, define technical standards, and impel regulators to clarify compliance requirements to encourage scaled blockchain solutions. Although we applaud such efforts to support organizations in adopting blockchain, we see a danger of prioritizing speed over careful consideration. Wang et al. [57] observe that most technology adoption scholarship focuses on the implementation phase (e.g., systems integration, political processes), largely neglecting pre-adoption, which is the process of creating awareness, assessing the

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disruptive effect of a new technology, conducting initial exploration, and developing prototypes of a new technology. We assert that this applies to blockchain technology adoption as well. Jumping directly to the implementation phase blinds us to the cognitive processes underlying the pre-adoption phase, including identifying the strategic options of technology use and their implications for future measures [39].

Grasping the pre-adoption of blockchain as an inherently cognitive process is important as it reminds us of equivocality, a central feature of technologies and blockchain technology in particular, given its wide range of use cases. In the blockchain context, equivocality means that blockchain technology can be interpreted and applied by organizations in multiple and possibly conflicting ways [58]. Bearing this in mind, IS researchers should consider that organizations not only apply the technology in different ways but also because of various reasons. Thus, scholars should not treat organizations as a homogeneous group of “adopters”, i.e., companies developing knowledge about blockchain technology in order to leverage it to create value [29]. This study extends the current discussion on blockchain adoption to pre-adoption by going beyond understanding the technical specifications, the hurdles to implementation, and the potential business value of blockchain applications. In doing so, our study considers different organizational approaches to making sense of [58] blockchain, reflecting expected value, sentiment, and anticipated innovation.

In IS research, sensemaking refers to the ongoing interplay of action and interpretation, where actors develop attitudes and expectations that shape their approach toward a technology [58]. In terms of blockchain, the outcome of sensemaking reflects blockchain’s equivocality, resulting in multiple, well-justified reasons for organizations to restrain from scaling existing blockchain applications. We argue recommendations on adoption and implementation measures must consider how organizations’ sensemaking influences their approach to the technology, their behavior in testing the technology, and their use of the technology. Understanding sensemaking enables IS researchers to build on these insights to make informed scholarly recommendations about adoption.

This paper examines the attitudes and expectations that shape the sensemaking, approaches and actions that influence organizations’ decision on non-adoption, adoption, and expansion of blockchain applications. We take a critical realist stance and rather than focusing solely on *what* organizations currently do, do not do, or should do to adopt blockchain, we focus on understanding *why* and *how* organizations approach blockchain adoption. In other words, to account for the equivocality of blockchain, we analyze why and how organizations make sense of blockchain and take certain approaches to the adoption. Thus, our overall research questions are:

- (i.) How do organizations make sense of the potential business value of blockchain?
- (ii.) How are actions of organizations taken toward blockchain guided by sensemaking?

To answer these questions, we interviewed 24 blockchain experts from 16 organizations that publicly announced that they are seriously testing or using blockchain. We focus on financial organizations because the financial services industry is a pioneer in testing and applying blockchain [22]. In addition, we collected secondary data from official reports, organizations’ homepages, and press releases, leaving us, in total, with over 400 pages of qualitative data. We analyzed this data following a two-step approach: first we conducted a sensemaking analysis to answer our first research question, and then we performed a content analysis to characterize organizations’ approaches to blockchain and how they are influenced by their sensemaking.

Our results point to divergences between organizations’ actions taken toward exploring the decentralized technology, i.e., *what* they do, and *why* and *how* organizations act this way. In particular, we find that (i) actions organizations take to adopt blockchain are sometimes inconsistent with their sensemaking, which is because (ii) other

mechanisms, such as sentiment toward the technology, strongly influence the actions of organizations, leading to (iii) highly contradictory interpretations and intentions of organizations to test and apply blockchain. Based on these findings, we recommend that IS research adopts a more differentiated approach in making blockchain adoption recommendations that reflects how organizations make sense of the technology. Specifically, such recommendations should account for the wide range of interpretations of and motivations for adopting blockchain by considering core elements of blockchain pre-adoption (i.e., the phase of exploring and deciding for or against the adoption of the technology). Such scholarship should avoid the pitfall of considering all organizations as a homogeneous group of future adopters, including potentially adverse effects such as slower overall blockchain diffusion and less willingness to apply blockchain for decentralized interaction patterns [37]. Thus, our article encourages IS researchers to look beneath the surface and give more differentiated recommendations that correspond to the various results of organizations’ sensemaking about blockchain.

The remainder of this paper is structured as follows. First, we review related literature about blockchain technology and sensemaking and describe our theoretical perspective, critical realism, and its impact on data collection and analysis. We then present the results of the sensemaking analysis and emerging value categories associated with blockchain to answer our research questions. Next, we derive and discuss various types of organizational approaches, i.e., actions taken toward exploring blockchain. Finally, we discuss the of blockchain adoption and present specific scholarly recommendations for future research based on the different organizations’ approaches to blockchain.

2. Literature review: blockchain technology and organizational adoption

As the cryptocurrency Bitcoin was introduced in 2008, organizations and IS scholars have been intrigued by the burgeoning phenomenon of blockchain, which is a decentralized infrastructure facilitating validated and tamper-resistant transactions across a large number of network participants [5, 6]. The feature of blockchain that interests organizations and scholars particularly is its ability to provide a “single truth” among agents without requiring them to know or trust each other: a fundamental shift from trusting people to trusting algorithms [1, 40].

This shift in trust is possible because information stored in the blockchain cannot be altered [6, 40]. As a result, time-consuming and costly intermediation in transaction processing and ownership checking is potentially eliminated. The shift in trust is enabled by blockchain’s unique combination of technological key components: distributed ledgers (a database maintained at different nodes instead of a central location), consensus and encryption mechanisms to secure and encrypt the storage and updating of information, a potentially immutable audit trail, and smart contracts that automatically enforce and verify the terms of agreement between users of blockchain applications [15]. Blockchain offers a degree of flexibility in terms of the appropriate consensus mechanism (including computer power-based and stakeholder-based approaches), the encryption technique, integrated smart contracts, and the conditions of participation among users, including fully open, public blockchains, private blockchains, and permissioned blockchains [11, 27]. Public blockchains allow all nodes in a peer-to-peer network to read blockchain data and propose new data entries, whereas private blockchains allow only nodes that are preregistered by a central authority to read blockchain data, submit and validate new information to be registered on the blockchain [6]. Permissioned blockchains are more suitable for closed or semi-closed systems (e.g., consortia consisting of just a few enterprises), where the majority of nodes are trusted [56].

Several scholars have identified barriers to implementing permissioned blockchain technology and the lack of real-world applications that go beyond prototypes. For example, van Hoek [25] and Saberi et al. [44] identify dependency on intra- and inter-organizational connections as a major barrier to a successful implementation of permissioned

blockchain, including financial constraints, lack of managerial commitment, and opaque information disclosure policies. Other scholars point to system-related barriers such as security concerns, system reliability issues, and the integration of blockchain within existing IT architectures [6, 57]. Lacity [30, 31] proposes guidelines on how to design concrete governance models, how to deal with intellectual property concerns, and how to handle regulatory uncertainty like industrial espionage risk in order to support organizations in adopting blockchain.

We note that such recommendations assume that companies know whether and how they can and will deploy blockchain within their organization. Based on the observation that many blockchain prototypes are not scaled by companies and are solely applied in test environments, we assert that such recommendations are premature. We posit that not all organizations experimenting with prototypes plan to engage in using the technology on a larger scale [57, 59] and that blockchain prototyping does not need to be part of the implementation, but rather can be part of the pre-adoption phase, where initial exploration and testing of blockchain supports a decision whether to embrace or reject blockchain technology [57]. Although pre-adoption plays an important role in influencing strategic options, *sensemaking*, i.e., building expectations toward a technology through a continuous cycle of action and interpretation of information, influences the adoption or non-adoption of a technology [39]. The sensemaking phase, however, has been largely overlooked in extant IS research. With a few exceptions, especially in the field of supply chain research (i.e., the use of permissioned blockchains in semi-closed systems [57]), our review of relevant literature reveals a gap in research on sensemaking about enterprise blockchains (i.e., fully private corporate blockchains). We assert that in order to support organizations in adopting blockchain in the future, scholars need to be clear that there is a necessity to better understanding of how organizations make sense of the technology, i.e., why and how they might apply it, rather than jumping directly to the implementation phase and making recommendations on what organizations should do to cope with challenges associated with the use of blockchain.

3. Research lens and method

To investigate why organizations approach blockchain and how they make sense of blockchain, this paper adopts a critical realist perspective, which is applicable when explaining *what causes observed events to happen* [16]. This section introduces critical realism and describes our data collection process as well as our two-step data analysis approach (sensemaking analysis and content analysis of data). This approach enables us to identify connections between how organizations make sense of and why and how they approach blockchain, including what generative mechanisms and organizational structures they implement to explore and test blockchain technology.

3.1. Critical realism

Critical realism is a meta-theoretical position or philosophical stance based on three key principles: realist ontology, epistemic but not judgmental relativity, and methodological pluralism [38]. Critical realism allows objectivism-relativism chasm between classical positivism and liberal interpretivism to be bridged by focusing on the search for generative mechanisms [9, 49], which are causal structures that trigger events in the material world [3]. Although this definition suggests some linearity, critical realists emphasize that the outcomes of mechanisms are contextual [9] and thus strive to identify generative mechanisms that triggered the phenomena of interest and could do so again [10].

Identifying generative mechanisms helps us better understand why and how organizations approach blockchain in two ways: First, it provides a research perspective which allows us to identify regularities without being deterministic. Second, it helps us understand organizations' approaches without interpreting observed approaches or referring

to statistical relationships by identifying mechanisms and the role of technology as a component thereof [10]. However, as mechanisms are only indirectly observable through their outcomes, researchers need to retroductively hypothesize mechanisms that might explain empirical observations and particular outcomes [14, 47].

As there does not exist a shared body of knowledge on the application of retroduction as a research method, our approach to identify explanatory mechanisms is based on the concept of sensemaking. Following this approach, we uncover common mechanisms organizations use to interpret uncertain situations [7, 13, 58]. This aligns with the definition of sensemaking as a social process in which individuals and groups seek to understand new phenomena through iterative testing of plausible explanations [7, 59]. We are building upon six key characteristics of sensemaking, including the retrospective consideration of experiences, the recognition of a discrepant set of cues in the ongoing flow of events, and the generation of plausible explanatory speculation, sensemaking fits the retroductive approach and the critical realist stance [7].

The process of sensemaking features twice in our research. First, as described above, we focus on how organizations make sense of and assess the business value of blockchain in general, using sensemaking specifically to create a set of complementary cognitive schemes as articulated representations of the perspective on a technology that guides their actions [2, 51]. Second, sensemaking informs the iterative process guiding our own data collection and two-step analysis, including interviews and higher-order coding to identify mechanisms, which we describe below [10, 61].

3.2. Data collection

To answer our research questions, we interviewed 24 executives and business professionals (hereinafter referred to as *key informants*) exploring blockchain implementation in their organization. Specifically, we chose key informants who work for a financial organization that has publicly announced on a homepage, in a press release, etc., that it is already using or testing blockchain technology for application. We screened potential interviewees to ensure they are familiar with the company's vision and strategy and with the implications of blockchain applications for their organization.

To recruit suitable informants, we followed a respondent-driven sampling method. Accordingly, we did not select informants from a sampling frame, but rather from among the professional network of existing members of the sample [21, 45]. To start the sample collection process, each author of this paper selected one seed from their professional network as a key informant, who recommended further potential key informants from their professional network.

We recorded, transcribed, and analyzed each interview taking an iterative approach alternating between data collection and analysis, until theoretical saturation was reached [45]. The primary indicator of theoretical saturation were mounting instances of similar codes in existing categories, leading us to conclude that further discourse analysis would not reveal further significant patterns of sensemaking [46]. Thus, we interpreted saturation as a matter of degree rather than as an event or a predetermined process [12]. This stance acknowledges that although there is always the potential for "new to emerge", saturation is reached when the "new" no longer contributes significantly to the overall story or theory [36, 46]. Each author ascertained this degree of saturation individually and independently.

This data collection approach generated a diverse pool of key informants with diverse professional backgrounds and at various stages of their career. Descriptive characteristics of the key informants as well as the identification of key informants (abbreviated with the letter "I" for informant and numbered consecutively) are summarized in Table 1. Each of the target organizations tasked a relatively small team of people with blockchain knowledge to (potentially) develop and test a prototype and, thus, interviewed key informants are assumed to be representative

Table 1
Descriptive characteristics of key informants and interviews.

Professional background	No. of informants	Code	Description	No. of informants
Business administration	6	Executive	C-level, President, VP, Director	6
Finance	5	Manager	Middle managers	8
Information technology	5	Professional	Non-managerial professionals	10
General management	2			
Economics	2			
Product management	2			
Human resources	1			
Physical science	1			

Year	Key informant	Total no. of interviews
2017	I01, I02, I03, I04, I05, I06, I07, I08, I09, I10, I11	11
2018	I12, I13, I14, I15, I16, I17, I18, I19, I20, I21, I23, I24	13

of their organization given the very small team size. In almost all cases, the person in the company who directs the team, whom we will call the blockchain team leader, was a key informant. In some cases, a second person from the blockchain team was selected in addition. The key informants confirmed that the blockchain teams they represent are the only units in the organizations that generate knowledge about blockchain and its application in the organization, which reinforces the assumption that key informants can make statements that are representative for their organization. See Appendix A for basic information about the interview partners, including their positions, the size of the organization, and the size of the blockchain teams.

Starting with the seeds, the second author of this paper conducted face-to-face interviews lasting on average 60.3 min, ranging from 44.1 to 70.3 min. The interviews were conducted and transcribed over roughly 2 years between April 2017 and November 2018. On average, the key informants had 10.3 years of total work experience and, on average, 3.3 years of work experience with blockchain. During the interviews, we asked the informants about the relevance of blockchain for their organization, the possibility to apply inside and outside the organization for various use cases as well as opportunities and challenges that blockchain poses to the organization. In addition, we asked whether and how the adoption of blockchain is fostered within the organization and, in cases where blockchain technology has been applied, what barriers typically arose during adoption.

In our interviews, we followed Tilley and Pawson’s [54] recommendations for conducting interviews for critical realist research. In particular, the critical realist interview approach puts the interviewer more firmly in the driving seat, but without suppressing the active role of informants [48]. Hence, while guiding the interviews actively, we stressed that there were no right or wrong answers to our questions and encouraged honest reflection on the organization’s views and approaches.

To minimize cognitive bias, we further collected secondary data such as press releases, organizational statements, reports, and information available on the organizations’ homepages to verify and enrich our understanding of organizations’ sensemaking. The secondary data was combined with the insights on how sensemaking patterns influence actions taken toward adopting blockchain identified through the interviews with key informants. This helped us ensure substantive coherence between key informants’ statements and the organizations’ official statements regarding the usefulness and applicability of blockchain. In particular, we analyzed combined primary and secondary data to answer our second research question. In total, we analyzed 298 pages

of interview transcripts and 156 pages of secondary data using MAXQDA. Table 2 below provides an overview of our primary and secondary data.

3.3. Data analysis

We performed a two-step data investigation consisting of a sense-making analysis to capture how organizations assess the business value of blockchain (research question 1), and a content analysis to assess how sensemaking guides organizations’ approach to the technology (research question 2).

Regarding the first research question, we analyzed primary data, assuming that organizations, confronted with blockchain, make sense of the technology by considering a range of perspectives on its value in order to find a shared understanding that guides their actions toward the technology [33, 58]. We analyzed interviews at the level of arguments, which represent a mode of communication in which individuals actively support their claims, which requires reflection, anticipation, and interest in critical sensemaking [7].

To deconstruct and analyze the arguments of our key informants, we applied Toulmin’s [55] structure of argumentation, which is a methodological tool used to analyze patterns of sensemaking in practical discourses [7]. Toulmin [55] defines three components of arguments: claims, grounds, and warrants. Claims are defined as the central assertion of an argument, i.e., the conclusion whose merits we seek to establish [7, 55]. Grounds, which are also known as data or evidence, are statements offered to support the claims. Warrants reflect the principles and rules of inference, which suggest that the movement from grounds to the claim is appropriate [7]. Whereas claims and grounds are explicit, warrants are often implicit assumptions, reflected in a line of argumentation [7]. To analyze the implicit assumptions, we refer to Brockriede and Ehninger [8], who identified different types of warrants, summarized in Table 3. We used these types to code and classify our key informants’ arguments.

Table 2
Primary and secondary data.

Type of data	Number of pages
Interviews (audio-recorded, transcribed, single-spaced)	298
Secondary data (homepage information, reports, press releases, organizational statements, single-spaced)	156
Total	454

Table 3
Types of warrants following Brockriede and Ehninger [8].

Warrant Type	Actions of Warrants
Cause	Attributes a generative power to the grounds (i.e., the grounds cause the claim)
Sign	Interprets the meaning or significance of the facts provided in the grounds; inference based on symptomatic indications
Generalization	Assumes that what is true of the items in the sample will be valid for related phenomena; the inference from a sample to a population
Analogy	Grounds assert a relationship between two familiar items or events and this relationship is assumed by the warrant to hold for the distinct items or events in the claim
Parallel Case	Assumes an essential similarity between an event or condition in the grounds and that of the claim
Authority	Asserts the reliability or validity of a presumed expert source and expert statement (i.e., grounds) expressed. Classification warrants are implicitly rooted in authority.
Principle	Inference-based on values, ideals, or an assumed moral common ground

In the later course, we use this classification to determine not only the organizations’ perceived value of blockchain but also to put this classification in relation to the actual organizations’ approaches to understand or adopt the technology. In particular, the warrants that support organizations’ argumentation of the value of blockchain are compared with the actual practices of accessing the technology (e.g., congruence or non-congruence of the perceived value of the technology and practices to approach it), which eventually results in four types of blockchain approaches as described below.

With regard to our second research question, we analyzed primary and secondary data by using theory-driven content analysis [20]. To this end, we developed a coding framework which aimed to capture the approaches taken by organizations toward blockchain. At the same time, we take into account the innovation progress of organizations, for which we used the strategy implementation framework developed by Okumus [41], arguing that strategy is implemented in the internal context, i.e., through organizational structure and culture, which in turn, influences operational processes, such as communication, resources, control, and organizational planning [41]. We use this framework to elicit strategic actions that are classified according to three overarching factors: organizations’ strategy, structure, and culture. In particular, this enables us to link perceived business value with approaches taken toward understanding and potentially adopting the technology. In recoding the transcripts and the secondary data using the coding framework, the sensemaking patterns identified were associated with the innovation process and internal actions to explore and potentially adopt the technology. Appendix C shows the coding framework and provides exemplary quotes from the transcripts.

To assess the progress of actions taken to discover blockchain, we used the innovation phases defined by Swanson [50], who distinguishes the sub-phases comprehension, implementation, adoption, and assimilation. Comprehension is defined as organizations making a new technology part of their routine by deciding whether or not a technology should be considered. Implementation is the process where organizations undertake a planned and staffed project with the goal of identifying and deploying the new technology. Adoption reflects resource commitment and initial use of a new technology. Assimilation is the process whereby the new technology is appropriated by its users [50]. Together with the factors strategy, structure, and culture, the innovation phases provide us with initial codes to analyze the interviews and secondary data, thereby forging connections between arguments, i.e., sensemaking, and organizations’ approaches toward blockchain.

Both analyses were conducted by each author individually, and the results were discussed until the authors reached consensus on open, axial, and selective codes. For instance, for the sensemaking analysis, each author identified passages and sentences containing arguments (open coding), which were discussed until consensus was reached on a

final set of arguments. We proceeded with axial coding using Toulmin’s [55] notions of claims, grounds, and warrants to deconstruct arguments and continued in classifying warrants by categorizing them by applying warrant types proposed by Brockriede and Ehninger [8]. Again, each author performed this step individually, and the results were discussed until consistency was established.

Similarly, each author performed the content analysis individually, starting with extracting sentences and passages from the interviews and secondary data, using the initial codes delivered by the framework (open coding). Once consensus was reached on open codes and associated passages, we used axial and selective coding to identify themes and connections between them, i.e., we forged connections between sense-making and organizations’ approaches to blockchain. We thereby followed the recommendations of Syed and Nelson [52] on establishing reliability when coding narrative data. In the next section, we present the findings of each of these analyses, starting with the results of the sensemaking analysis.

4. Understanding sensemaking: assessing blockchain’s business value

Analyzing the interviews, we identified four categories of potential business value of blockchain. In particular, we find that organizations’ sensemaking is clustered around four value categories: future, current, contingent, and limited value, each accompanied by the use of specific warrant types.

4.1. Future value of blockchain

Organizations that argue for a future value of blockchain claim that there is potential business value in applying blockchain but that this value is not yet sizeable. We identified 23 claims associated with the future value of blockchain across the interviews. This assessment is typically supported by the warrants *principle, sign, and causal*.

Warrant “Principle” – competitive advantages through innovation: Organizations’ assessments of the future business value of blockchain are often accompanied by a strong belief in the technology’s capabilities to create opportunities for new business models, products, and, consequently, value creation. In particular, one key informant [14] argues that “while there are new press releases every day about banks building new applications on blockchain automating existing processes, we think that this is a huge mistake. Instead of bringing existing processes on the blockchain, we need to think about new products, and we should ask ourselves: what are the benefits for our customers?”. This assumption builds on principles, i.e., the belief that blockchain will be important, even “if we cannot see it today” [14]. Given the faith in technology, the future business value of blockchain evolves along with the expectation to one day be a technology leader by developing the technological standards of the future. Consequently, claims were future-directed, i.e., based on assumptions about a hoped-for future adoption of blockchain.

Warrant “Sign” – increasing competition: Some arguments focused on increasing competition and the opportunity to apply blockchain to improve the organization’s market positioning. For example, I18 argues that “blockchain is not the reason why the financial services industry has to change. It is the other way around: banks have to change anyway because of increasing competition, for example, through fin-techs and other players like Amazon or Google who are putting pressure on the market. Blockchain can help us keep up with the competition.” Thus, these claims are advocative, i.e., suggesting what should be done, encouraging other organizations to pursue the technology.

Warrant “Causal” – expectations on blockchain’s value in the short vs. long term: Arguments associated with the future business value of blockchain also extrapolate on the success of existing use cases. For example, I22 refers to the effectiveness of blockchain-based innovations and expects similar effects to be realized by follow-up

innovations. I04 expects that cost reductions and efficiency gains provided by blockchain prototypes will remain, but innovations based on blockchain will open up even more opportunities for organizations, including new business models. Thus, he expects that “blockchain will uncover new sources of business, new business models and value creation for finance that builds upon previous success”. Notably, the informant bases his claim on observations projected into the future, i.e., “Blockchain, in the short term, leads to cost reduction and it has been shown that it creates a lot of efficiencies. Based on these initial accomplishments, more value will emerge from follow-up innovation that creates new platforms and business opportunities, e.g., in trade finance, in the long term”.

Overall, organizations that argue for the future value of blockchain see the technology as a solution for inevitable problems, including increased competition and changing market conditions, and, thus, as necessary for the survival of the company. Even if this motive is rather negatively connoted, the assessment of blockchain is thoroughly positive. In particular, key informants express a strong belief that blockchain will remain relevant, even though it is not yet foreseeable what exactly this future will look like. Whereas these claims emphasize the future value of blockchain, this group of experts does not necessarily see the current value of blockchain.

4.2. Current value of blockchain

Organizations arguing for the current value of blockchain view the application of the technology as leading to immediate value. In particular, we found 16 claims by interviewees emphasizing the current value of blockchain. These claims were supported and leveraged by several grounds and warrants, including *parallel case* and *sign*.

Warrant “Parallel case” – expectation of comparable developments: Organizations arguing for the current value of blockchain often compare the technology to the business value associated with the emergence of the Internet. For example, I11 states that “a comparison with the Internet is quite appropriate. It was always said that the Internet would change the world, and then there was this hype, the dot-com boom, which collapsed. This was the time when critics said the Internet might fade. However, it did not fade, but rather changed our world lastingly”. The informant notes that the Internet already had value before it spread worldwide, but was applied as a specific application by small pioneer companies. Pointing out the parallels, the expert sees the same happening now with blockchain, emphasizing the already existing business value of blockchain, even if not yet scaled. I11 refers to other organizations and use cases, where the mere fact that they apply blockchain is sufficiently convincing evidence that blockchain delivers current business value.

Warrant “Sign” – blockchain as complementary technology: Some arguments focus on automation and the need to track advancements in other industries by implementing blockchain-based applications that support innovative business models. I19 states that the future of mobility builds upon autonomous vehicles that use connected and autonomous services as well as electricity as the main source of propulsion. This development could be a cornerstone for the use of blockchain as this technology might offer the fundamental infrastructure for combining the various building blocks necessary to achieve true innovation in mobility. Rather than being another „stand-alone” technological innovation, blockchain could therefore contribute as a basic infrastructure to the interconnection and use of numerous innovations of the last few years and support their realization. The current value of blockchain in this case is seen in the interconnected nature of the technology, i.e., that blockchain as a fundamental technology and infrastructure only acquires its value in combination with other technological innovations and vice versa.

Overall, experts arguing for the current value of blockchain are less driven by the belief in blockchain or the vision to become a technology leader than experts who primarily anticipate the future value of

technology. Experts who associate current business value with the application of blockchain often refer to concrete examples of value delivered by the technology, which might be apparent in specific applications or analogies to other technologies with which the value creation can be compared and justified.

4.3. Contingent value of blockchain

Contingent value reflects organizations’ belief that the realization of blockchain’s business value is contingent on certain factors. 31 claims were assigned to this value category, making contingent value of blockchain the most common category in the interviews. Claims associated with a contingent value of blockchain are associated with the warrants *authority* and *sign*.

Warrant “Authority” – external pressure and implementation barriers: Key informant I20 attributes contingent value to blockchain, based on media reports and experts reporting on business value delivered by new and innovative applications of blockchain. In addition, I9 argued that “these reports create external pressure on companies in the financial services sector, which are now afraid of missing something”. Accordingly, the informant’s organization expects the technology to generate value but doubts that the implementation in the financial services industry is as easy as in other industries. In particular, strict regulation is cited as a factor that makes it challenging to exploit blockchain’s potential and, thus, to capture the promised value of blockchain.

Warrant “Sign” – lack of clarity in the value added of future applications: The second pattern associated with the contingent value of blockchain builds on the ground and warrant of market observation, i.e., organizations observe other companies deploying the technology and anticipate a specific business value. For example, I21 argues that “the development of applications in the payment sector is simple, but currently there is no clear application in the core business, as there are currently too many questions regarding the technology that need to be answered. However, an application in the future cannot be ruled out.”

Overall, experts arguing for a contingent value of the technology claim that there is a specific business value in applying the technology in various industries. This conviction, however, is largely based on the observations of other companies applying the technology as well as on reports rather than on internal efforts to define and test applications in depth. Overall, key informants who underscore the contingent value of blockchain assess the technology as relatively neutral. Their sentiments toward the technology tend to be neither overwhelmingly positive nor overwhelmingly negative, leading key informants to report a wait-and-see attitude in their organization.

4.4. Limited value of blockchain

Some organizations report that blockchain offers only limited value, either due to its nature or because the value would never be monetarized due to prohibiting factors within or outside the organization [7]. In the interviews, we identified 22 claims associated with a limited value of blockchain. This value category evolved around the warrants *sign* and *generalization*.

Warrant “Sign” – unnecessary application because of external pressure: Key informants claiming that blockchain has only limited business value base their opinion on observed events. For instance, I07 notices that following an internal call for ideas “there was no idea that really necessitated blockchain”. Notably, the informant interprets this fact as an indication that the technology has no business value at all. I07 argues that “we are still very far away from using blockchain in our day-to-day business”, concluding that this is not going to change any time soon.

Warrant “Generalization” – blockchain as marketing tool and unfulfilled expectations: Key informant I23 observes that other organizations that have developed and applied blockchain-based

applications have not seen the desired results. Similarly, I24 argues that “there are already many use cases in which old processes are simply moved onto blockchain. However, this is just marketing or showing off competence in a relatively new field. Overall, there is no real business value through improvement or optimization by blockchain, but they make money with it.” This informant concludes that blockchain has little if any value resulting from its technological features; instead, it is marketing that delivers increased attention and, thus, value. Key informants who do not see value in blockchain tend to have a very negative attitude toward and assessment of the technology.

Overall, the arguments pointing to organizations’ view that blockchain has limited business value are quite surprising, given the fact that we interviewed key informants working in organizations that have publicly announced that they are exploring, testing, and/or developing blockchain solutions. This is even more surprising as we encouraged the key informants to reflect on the general opinion represented by their company, and not to express their own, possibly very individual view of the business value of the technology.

5. Understanding organizations’ approaches to blockchain: four types of blockchain approaches

Looking at the results of the sensemaking analysis, it is obvious that organizations’ assessment of the potential business value of blockchain differ greatly, ranging from a future business value associated with blockchain that is primarily based on faith in the technology to limited value with few potential applications of the technology. As this assessment of blockchain’s business value reflects how organizations make sense of the technology by discursively arguing on a range of perspective on the potential value of blockchain, sensemaking is theorized to guide an organization’s strategic actions, ultimately influencing the experimentation and possible subsequent adoption or non-adoption of blockchain [7, 35]. Following this assumption, we expect to observe differences in how organizations approach blockchain, depending on the business value ascribed to the technology.

Based on the content analysis, we identified four types of blockchain approaches. In the following, we describe them in terms of the organizations’ strategy, structure, and culture (openness to experimentation, attitude toward technology, and existing innovation processes). We combine the results with key informants’ assessments of the potential business value of blockchain, i.e., how organizations make sense of

blockchain (the warrants). The coding transcript helped to identify sensemaking patterns and combining the patterns with secondary data the relationship between sensemaking patterns and organizations’ approaches could quickly be uncovered. Fig. 1 provides an overview of the four types of approaches, the sensemaking value ascribed to the technology, and the associated innovation phase reflecting actions (i.e., whether actions are already taken toward adoption or not). The lightning bolts indicate discrepancies between sensemaking results and blockchain adoption activities. For the sake of simplicity, we will speak of types of blockchain approaches in the following and explain them without explicitly mentioning warrants again. The warrants are already textually merged with the description of four types and the concrete approaches of the organizations in the pre-adoption phase.

5.1. Type 1: the strategist

The *strategist* emerges from a unique combination of characteristics associated with the aspects of strategy, organizational structure, and culture fostered within the organization. These combinations of characteristics were identified in three organizations in interviews with key informants I04, I08, I14, I18, and I22. The strategists’ actions taken toward blockchain are mostly consistent with the results of sensemaking associated with the assessment of the future business value of the technology.

The strategist is characterized by a strong belief in decentralized technology, leading to a vision that incorporates being a technology leader through developing technological standards and providing a platform for other organizations that are not familiar with blockchain. The strategist views blockchain as a tool to reinvent the organizations’ current business model to remain competitive in an increasingly challenging market. Consequently, the strategist approach toward blockchain focuses on a “complete repositioning of the bank through the technology” [I08], which is why organizations attach “great importance on understanding the technological implications and the full range of consequences of applying blockchain” [I08].

Driven by the belief in blockchain as well as external pressure to apply the technology, e.g., the success of competitors and other market influences, the strategist achieves its blockchain goals by allowing a team of employees to “form an innovation or digital lab, in which they work exclusively on the adoption of blockchain” [I04]. The team is empowered to spend its time building up competencies within the

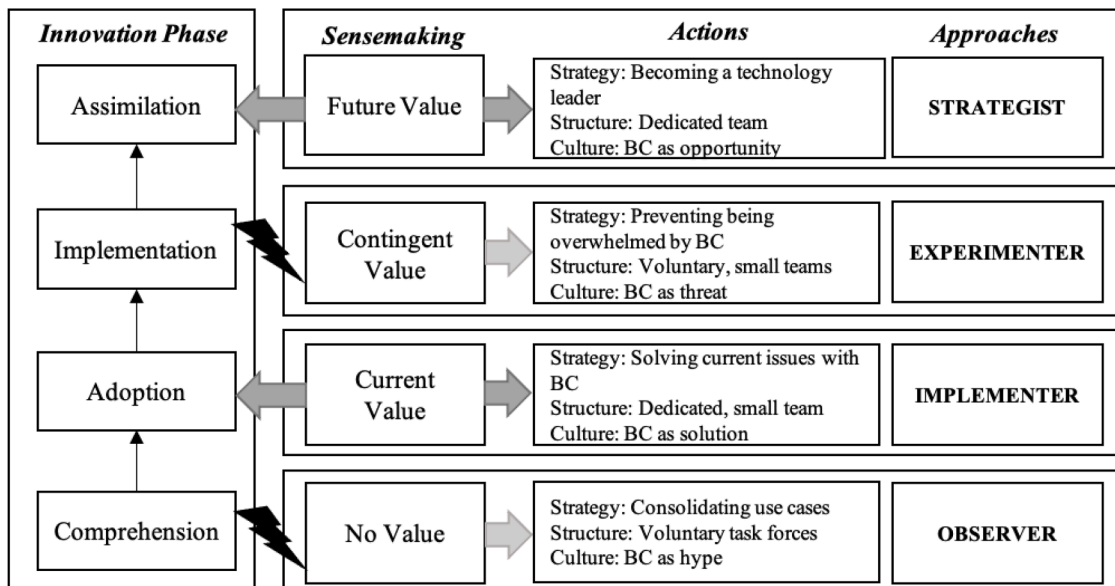


Fig. 1. Overview of the four types of blockchain (BC) approaches, their sensemaking, their actions, and associated phase of the blockchain innovation process.

blockchain domain and receives strong management support. The strategist prioritizes the development and application of the technology. Within the blockchain team, employees are encouraged to act as “entrepreneurs within a large corporation” [I04], and the mindset is closely linked to a “startup way of doing things as well as innovative problem solving” [I14]. Thus, the focus is on the rapid development and testing of prototypes that are not brought directly to the market. Instead, the strategist prefers to wait for the right moment to get the most out of its investments.

In terms of its organizational structure, the strategist is characterized by a rather formal and structured approach where the top management sets clear targets in a top-down process that the blockchain team follows. To this end, the strategist establishes a direct link between the blockchain team and the executive board, starting exploration and prototype development after a brief presentation. This direct link to the executive board prevents the blockchain team from being dependent on a decision or approval by a particular business line. From an organizational viewpoint, “the team is separated from the rest of the organization to remove the risk of being limited by data security aspects and to act freely outside the bank’s infrastructure” [I18]. Moreover, the strategist collaborates with other companies in consortia to bundle activities and to create an environment that enables all companies in the consortium to “be really at the forefront of the technology” [I18]. Participation in the consortium allows the strategist to be involved in the development of legal frameworks for different use cases and to “influence the development of the regulation in their favor” [I04].

The strategist can be classified in the assimilation phase of the blockchain innovation process, moving beyond exploration and understanding to adapt blockchain to its needs and the organization’s specific social and economic context. Notably, the strategist integrates the development of blockchain applications as an everyday task for its dedicated blockchain team, where new blockchain applications are deployed and appropriated by the organization or collaborating organizations. As learning continues, blockchain applications are continuously adapted by the strategist organization.

5.2. Type 2: the implementer

The second type of blockchain approaches identified through content analysis is the *implementer*. Characteristics of the implementer were evident in four organizations represented by key informants I02, I03, I05, I11, I13, I15, and I19. Actions taken toward blockchain are driven by the results of sensemaking activities and the conclusion that blockchain has current business value for the organization. The implementer interprets blockchain as an opportunity to solve current issues related to internal or external business processes. The implementer generally develops its own blockchain applications to solve existing, mainly internal issues by leveraging features of the technology. The implementer is less interested in collaborating with consortia or partner organizations, treating blockchain as a niche solution for specific problems rather than a long-term strategic component.

Driven by experiences suggesting efficiency gains of successful applications of the technology, the implementer’s strategy is focused on the development of a few applications that provide an immediate increase in value or quick problem-solving. The implementer is less influenced by external changes or the pressure to change. The implementer’s attitude toward blockchain is rather neutral, as blockchain is considered a component that can solve some of many current business problems.

The implementer delegates responsibility to develop blockchain-based solutions to a small, dedicated team of employees. This approach aims at fostering interdisciplinarity in teams “comprised of employees from the IT and business side that work collaboratively on the adoption of blockchain” [I15]. Rather than treating the blockchain team as external to the organization, the implementer relies on active integration and networking among employees from various departments to

identify use cases and areas of the greatest potential added value through the application of blockchain. Similar to the strategist, the implementer cultivates a startup-like atmosphere which triggers the engagement of the entire organization to evaluate whether blockchain can help to fix business-related issues and challenges and to enable the rapid development and assessment of blockchain-based solutions. As the implementer’s approach necessitates a certain amount of expertise on the functioning of blockchain, knowledge sharing is fostered through enabling informal communication and the organization of topic-specific events (e.g., thematic lunch breaks or the demonstration of showcases).

Although the implementer relies on a bottom-up approach in evaluating new ideas and developing prototypes, the management also drives the development and implementation of blockchain-based solutions. Typically, the team of employees working on blockchain reports directly to the top management and receives support and feedback. Organizations following this inclusive approach are at the implementation phase of the blockchain innovation process, where planned and staffed projects are undertaken, budgets and deliverables are allocated, and buy-or-make decisions are made. In line with the focus areas of this approach, the implementer intends to acquire, deploy, and leverage blockchain-based solutions to solve its problems and reach its goals.

5.3. Type 3: the experimenter

The third type of blockchain approaches identified through our data analysis is the *experimenter*. Characteristics of the experimenter were evident in five organizations represented by key informants I01, I06, I09, I12, I16, I20, and I21. Notably, the actions taken toward exploring blockchain and the results of the experimenter’s sensemaking are not always consistent.

Although the experimenter only sees contingent value in the application of blockchain, the experimenter is not far behind the strategist in terms of the innovation process. In the adoption phase of the blockchain innovation process, the experimenter aims at making blockchain tangible within the organization by defining and exploring blockchain-based applications with strong support from the top management. The focus of the experimenter is thereby on the “potential the technology has to offer” [I09], although at the same time, “only the most necessary human and pecuniary resources are allocated for the development and testing of blockchain applications” [I09]. The strategy of the experimenter relies heavily on the collaboration with consortia, which are seen as the main responsible for the technological development of blockchain-based applications. Thus, only technological advances and insights that are achieved and gained through collaboration are used by the experimenter to explore own use cases.

This somewhat ambiguous behavior with regard to the application of the technology is due to the fact that the experimenter has a cautious sentiment toward blockchain. In fact, one key informant expressed his perception that “blockchain is a threat to the whole organization” [I21]. Due to such negative feelings and fears about blockchain’s impact on the financial services industry, the experimenter adopts blockchain anyway, conceding only minimal business value stemming from the application of the technology. The experimenter thus approaches the adoption of blockchain as something “that needs to be done” [I16]. Technological advancements and new insights delivered through the consortium are implemented by a small team of employees who consider the examination of the technology necessary or have an intrinsic interest in blockchain. Members of these teams are motivated and recruited through the exchange of ideas, for example in use case presentations. However, the experimenter limits the focus on adoption phase of the blockchain innovation process by “restricting the time they are allowed to work on blockchain over and above their regular workload” [I12].

Overall, the experimenter is mostly driven by external expert opinions and market observations, which the experimenter perceives as pressure to “do something with the technology” [I06]. Notably, the

external pressure the experimenter perceives to adopt blockchain may help explain the divergence between its perception of contingent value and its negative attitude toward blockchain.

5.4. Type 4: the observer

The fourth type of blockchain approaches identified through the content analysis is found in four organizations and called the *observer*. Key informants I07, I10, I17, I23, and I24 provide evidence of this type. The observer’s strategy aims at tracking and analyzing the development of blockchain. Although it sees little potential business value in the technology and no advantages of using the technology, external pressure and the observed engagement with the technology by other organizations drives the observer to be ready to act quickly, should blockchain lead to more value than currently expected. In other words, the observer’s goal is to “be prepared and understand how use cases for blockchain are developed” [I24].

The observer gives low priority to blockchain, delegating responsibility for screening and understanding other organizations’ applications of blockchain to the IT department, reflecting its perception of blockchain as a purely technical-driven issue with relatively little potential to impact the overall organization. The observer does not build a formal team to assess blockchain adoption or to track and analyze use cases. Instead, “the blockchain topic is loosely assigned to the IT department, where employees deal with the technology individually and mostly based on their interests” [I24].

Without a designated team, the observer has trouble building up relevant knowledge and skills to be ready to adopt blockchain if necessary. Thus, “cooperation with startups is considered as a promising link to the fintech-ecosystem, which has not been established yet” [I23]. The observer is at the comprehension phase of the blockchain innovation process, to the degree that it desires to understand the plausibility of blockchain adoption, an organizational vision toward the technology, and future steps toward adoption. Notably, the observer’s sentiments toward blockchain are less negative than the experimenter’s, in that it is open to future potential business value of blockchain, even though no current business value is seen.

6. Discussion: toward more differentiated scholarly recommendations

Fig. 2 summarizes the results of our analyses. For the sake of clarity, the characteristics of approaches to blockchain are depicted as a spectrum, e.g., the assessment of blockchain’s future value ranges between “limited value” up to “future value” of the technology, assuming that

assessments of contingent and current value lie in between. Considering the differences between the four types of approaches in terms of how they evaluate the business value of blockchain and their sentiments and progress in the innovation process, more differentiated recommendations are needed that account for discrepancies between actions taken toward the technology and how organizations seek to make sense of blockchain.

In the following, we discuss how the four approaches intersect with extant blockchain adoption research and scholarly recommendations to illustrate the need for more differentiation. We are aware that the approaches are snapshots of how organizations make sense of blockchain and that these approaches may change and be adjusted as new insights into blockchain are gained through experimentation and application. For this reason, we refer to them as primary approaches at a given point in time with no firmly demarcated domains. For instance, although a company might follow the strategy to set technological standards for a certain application of blockchain at a certain point in time, it might simultaneously observe other use cases beyond the focus of their primary approach.

Driven by a strong belief in and positive attitude toward blockchain, the *strategist* strives to achieve technological leadership, which is consistent with the results of its sensemaking activities. Scholarly recommendations to participate in consortia, share knowledge, and leverage collective market power to compel regulators to clarify compliance requirements are perfectly suited for this type and will likely lead to the desired goal of developing joint applications of blockchain.

However, as the implementer, the experimenter, and the observer interpret the technology differently and often take actions that do not align with the above interpretations, scholars should avoid making undifferentiated recommendations to all organizational types to avoid unintended and potentially adverse effects [37, 59]. Several studies show that managers can anticipate undesired effects if they more profoundly understand how their organization makes sense of blockchain and its consequences [18, 37, 43]. The following outlines potentially unintended effects and discusses how to derive more differentiated recommendations.

The *implementer* is driven by the desire to find solutions to primarily internal business problems, viewing blockchain as a niche solution. Although the implementer is interested in clear regulations and the advancements made in the context of consortia, its approach focuses on the here and now. Thus, engaging in consortia aiming to develop blockchain applications over the long term does not match the goals of the implementer. Hence, scholarly recommendations should consider that implementers use the momentum around blockchain to solve primarily internal process-related issues, rather than building a future

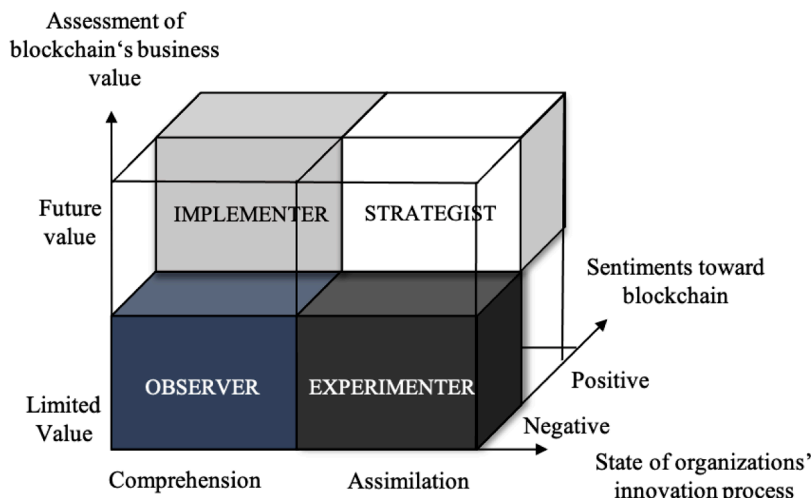


Fig. 2. Organizations’ approaches to blockchain.

blockchain strategy or positioning itself as a blockchain development leader. The implementer that creates real value by applying blockchain technology provides successful and proven use cases that other organizations can consider.

The *experimenter* is driven to adopt blockchain by perceived threats and negative sentiments which cause discrepancies between its actions and sensemaking. Experimenters and observers are unlikely to benefit from taking a leading role in consortia or actively promoting the development of blockchain among their peers. Hence, scholarly recommendations to engage in consortia and promote the development of blockchain is contrary to their assessment of the technology's actual business value. This might lead to what Maitlis and Ozcelik [35] call "toxic decision making", which reinforces negative sentiments within the organization and, potentially, create resistance. Instead, recommending that experimenters and observers reach beyond creating organizational readiness is a more appropriate goal given their negative assessment of the business value of blockchain. Thus, IS researchers must understand the experimenters' motivations to refrain pushing an experimenter into a direction that is not primarily in its intention.

These examples illustrate why IS scholars need to tailor their recommendations to specific approaches to blockchain, including perceived values, sentiments, and the phase of the innovation process within an organization, as shown in Fig. 2. Paying attention to the pre-adoption phase is especially important here, where it becomes clear that the development of a prototype is part of pre-adoption (assessment of economic value, feasibility, and understanding of the technology in general) and is not synonymous with adoption of the technology and thus the actual application of blockchain.

Practitioners can use this framework as a conceptual guide in designing and conducting workshops to explore the business opportunities provided by blockchain technology. Further, we see an opportunity for scholars that our analysis sheds light on the importance of sensemaking. Scholars can apply the sensemaking framework as part of the technology pre-adoption phase, which is as important as adoption and implementation. Our study illustrates that in order to help organizations overcome challenges in developing and implementing value-adding blockchain applications, scholars must examine "why" and "how" organizations make sense of and experiment with blockchain technology, reach decisions to adopt or not adopt the technology, and develop and implement appropriate measures. Researchers could therefore use this study as a blueprint or as a starting point for conducting similar studies about sensemaking on blockchain technology and corresponding actions of organizations. In the following, we propose specific recommendations for IS researchers who seek to assist organizations to approach (and potentially adopt) blockchain.

Recommendation 1: Consider how equivocal sentiments toward blockchain influence organizations' sensemaking, vision, strategy, goals, and application of the technology

The first step in helping organizations approach blockchain is to understand how they make sense of and view the potential business value of the technology. On this basis, tactical and functional recommendations for blockchain adoption and rational explanations that currently dominate much of the discussion about the progress in the development and application of blockchain are needed [7]. We argue that these recommendations must be tailored to the organizations' approaches to blockchain and recommend discourse analysis as an analytical tool because discursive practices significantly impact the sensemaking of information technologies, especially in the early phases of the adoption [51]. Suitable theoretical frameworks include cognitive frames and social representations, depending on the available data set.

Recommendation 2: Identify discrepancies between the "what" and "why" behind organizational activities and sensemaking

In a second step, we encourage researchers to assess whether the observable actions taken by organizations to approach blockchain match the results of their sensemaking activities and why there might be discrepancies. The classification of the organizations' approaches

proposed in this paper provides orientation.

Our study shows that although some organizations follow the logic of their causal arguments, i.e., acting in line with their assessment of the business value of blockchain, others deviate from the logic, perhaps due to cognitive limits, limited access to information, or divergent preferences. Our study finds that sentiment toward blockchain and its possible consequences for the organization are strong drivers of organizations' ambiguous behavior. As organizations differ in their interpretations and actions, we recommend further research into additional mechanisms that explain seemingly ambiguous behavior of organizations with regard to their approaches to blockchain.

Recommendation 3: Derive scholarly recommendations based on the "why" and not only the "what"

Having elicited the results of sensemaking and the mechanisms that trigger organizations' approaches to blockchain, researchers should derive recommendations based on the "why", i.e., how organizations seek plausibility in the application of blockchain, rather than focusing only on the "what", i.e., observable actions. By asking "why", scholars can understand the motivating factors influencing organizations' decisions to or not to adopt blockchain through the selected approach by the organization. Focusing solely on observable actions relies on researchers' interpretations, resulting in weak blanket assessments and recommendations. Instead, we recommend taking a critical realist approach, including in-depth discussion of the real, the current, and the empirical to understand the organizational mechanisms and motivations influencing decision-making about blockchain adoption and how these mechanisms interact with sensemaking. This approach reduces the ambiguity around blockchain and yields more differentiated recommendations.

7. Limitations and conclusion

This study has several limitations. First, we presume that experts in the blockchain teams represent the collective result of sensemaking in a company. As the blockchain teams responsible for investigating prototypes and the use cases included in the study are small and, for the most part, focused, our assumption may be justified. However, it is possible that we failed to include some key stakeholders of the companies with different perspectives in our sample. Second, we interviewed key informants representing relatively small blockchain teams. These teams are empowered for the organizations' sensemaking of blockchain, i.e., they concentrate the knowledge about the technology in the organization and decide on the right measures. Therefore, we argue that focusing on one or two key informants of the small blockchain team in our sample is representative for the particular organization. Although it is common to focus on small groups in investigating organizational sensemaking and organizational change [4, 34, 59], there is a risk that focusing on a small group overlooks interactions among heterogeneous stakeholders and other factors influencing attitudes and sensemaking [34]. To overcome this limitation, we call for future research to dive deep into representative case studies to validate our findings in-depth investigations. Third, although we compared secondary information and official statements with the statements of the key informants to minimize cognitive bias, future research might also include ethnographic techniques and/or focus group discussions. Fourth, although our interviews were held over 2 years to control for consistency over time, each interview captures a single point in time. Future research should analyze longitudinal data to understand how sensemaking and the perceived value of blockchain evolves over time and across the adoption, implementation, and assimilation phases.

This study contributes theoretically by shifting the focus from the implementation phase to the pre-adoption phase. This allows us to provide more differentiated support to companies in evaluating and potentially applying blockchain. Thus, we believe that our work will help better understand blockchain in practice and, equally, provide insights especially in the theoretical perspective taken.

Furthermore, this study takes a first step toward overcoming the tendency among scholars aiming to assist organizations in the adoption of blockchain to treat every organization (the “adopters of the technology”) and their actions equally. This tendency overlooks heterogeneous patterns of sensemaking across organizations, the wide range of stakeholders involved, and the spectrum of factors motivating the decision to adopt or not adopt the technology in the pre-adoption phase [34, 57].

Introducing sensemaking in the analysis of blockchain and building on the established relationship between sensemaking and the impulse to act or at least to decide how to act [34], moves the debate further. We uncover the connection between sensemaking and activities by emphasizing sensemaking patterns and associated business values on the one side, and action taken (i.e., organizations’ approaches) in response to perceived values and sentiments toward blockchain technology on the other side. This study shows that (i) actions taken toward the adoption of blockchain are sometimes inconsistent with the results of organizations’ sensemaking activities because (ii) other mechanisms, such as sentiment toward the technology, strongly influence their actions, leading to (iii) profoundly different interpretations and intentions to test and apply the technology. Therefore, we argue that IS scholars must derive recommendations that take into account these different interpretations and motivations to use blockchain by considering

different types of approaches, which we have presented in this article.

The study underscores the value of adopting a critical realist approach and considering sensemaking activities to derive more differentiated scholarly recommendations, accommodating the reasons “why” organizations adopt the technology rather than focusing on “what”, i.e., the observable actions the organizations can take or have taken to adopt the technology in the implementation phase. We propose a framework of blockchain approaches with four different types which scholars can rely on in considering the range of interpretations and motivations across organizations in the pre-adoption phase.

CRedit authorship contribution statement

Nadine Kathrin Ostern: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Visualization, Supervision. **Friedrich Holotiuik:** Validation, Formal analysis, Investigation, Data curation, Writing – review & editing. **Jürgen Moormann:** Validation, Writing – review & editing.

Declaration of Competing Interest

None

Appendix A. : Overview on organizations and key informants (FTE = full time equivalent; employees working full-time in the blockchain team)

Organization	Size of the organization	Name of blockchain team	Size of the blockchain team (FTE)	Number of interviews	Informant code (year)	Position of the key informant	Interview length (minutes)
A	1000–10,000	–	7 (2)	2	101 (2017)	Head of capital markets and blockchain	59
					112 (2018)	Member of the board – blockchain lead	43
B	>10,000	Blockchain Lab	16 (6)	3	102 (2017)	Head of operations	79
					103 (2017)	Head of blockchain lab	52
					113 (2018)	Project manager in blockchain lab	65
C	1000–10,000	Innovation Team	3 (1)	2	104 (2017)	Director innovation management	61
					114 (2018)	Director innovation management	51
D	1000 – 10,000	Sub-team of the Innovation Center	5 (1.5)	2	105 (2017)	Senior manager digitization and innovation	62
					115 (2018)	Manager digitization and innovation	61
E	>10,000	–	13 (3)	2	106 (2017)	Head of product management payments	60
					116 (2018)	Head of product management payments	59
F	>10,000	DLT Team	10 (5)	2	107 (2017)	Head of core banking	54
					117 (2018)	Stream lead in the DLT team	62
G	1000 – 10,000	–	2 (0.5)	2	108 (2017)	Head of business development and innovation management	55
					118 (2018)	Head of Financial Markets	70
H	1000 – 10,000	-	5 (1.5)	1	109 (2017)	Head of blockchain initiative	68
I	1000 – 10,000	–	2 (0.5)	1	110 (2017)	Head of innovation in financial technology	61
J	>10,000	Blockchain Team (as sub-team of the innovation center)	9 (4)	1	111 (2017)	COO and head of operations	58
K	>10,000	–	2 (0.25)	1	119 (2018)	Head of process and IT	56
L	1000 – 10,000	–	6 (1.5)	1	120 (2018)	Managing director of the digital unit	44
M	<1000	–	1 (0.25)	1	121 (2018)	Head of product management	67
N	<1000	Innovation Team	4 (2)	1	122 (2018)	Chief executive officer	55
O	>10,000	Technology Innovation Solutions	15 (4)	1	123 (2018)	Director technology and solutions	66
P	>10,000	–	15 (2)	1	124 (2018)	Managing director/ head of corporate finance	56

Appendix B. : Exemplary quotes and codes for identifying sensemaking pattern (RQ1)

Organization	Informant number	Exemplary quote 1	Exemplary quote 2	Exemplary quote 3	Overall value perception
C	104	<u>I think several use cases are the next big thing. Blockchain as a technology will never go away again, but will it look the same as it does today in 10 years? I don't think so. The token [as an application of blockchain] also, but for which use cases will it [the token] be used? I don't know but based on what we see it will be huge [Warrant: principle (strong believe)].</u> Blockchain allows a completely different handling of ownership possesses, it has brought the digital securitization and digital deed of ownership. The rechargeable token is nothing more than a security with more information. (...) <u>I see an opportunity for this new [blockchain-based] infrastructure to give us new business possibilities [Warrant: sign (symptomatic indication)].</u>	And as far as blockchain part is concerned, I can say that we have joined the movement at a very early point, because the technology claims to make banks obsolete. The starting point [for this] is disintermediation. This is the word that causes the most headaches. That's why we said, let's put few resources in there and also look, <u>if there's a global blockchain standard emerging, that we're proactively getting involved in, because it's just better to get involved early on and together have a good standard in the end [Warrant: principle (strong believe)].</u>	<u>I think it [blockchain] can cover other business areas that are still unthinkable without it. I have the topic of pay per use, which I can keep better, more transparent and more comprehensible and thus I have the opportunity to develop new business models, on the bank side as well as on the customer side [Warrant: sign (extrapolation)].</u> That is the added value where I say, when we understand where our corporate clients see added value for themselves, due to the fact that they can offer completely different [payment] models.	Future value
	114	Building on smart contracts, the feeling has arisen that there is huge potential associated with it [blockchain]. There seemed to be a clear simplification. That is why the smart contracts were our step and our first engagement with blockchain, because logically many contracts have to be administered in the financial service industry. <u>Today, however, the world is different, we see the potential of actual blockchain uses not only in efficiency issues, but also in the redefinition of value chains enabled by the technology.[...]Leading to the fact that the role of market participants is changing [Warrant: sign (symptomatic indication)].</u>	Blockchain has been in our innovation radar for some time and in the summer of last year we set out to take action. Together with my boss, I presented this [blockchain] to the entire IT unit in a divisional meeting and then won 5 to 6 IT professionals, who then thought with great passion in an interdisciplinary team about which use cases we could implement. At our company there is a so-called 'IT advance time', similar to the 20% rule at Google, so our IT colleagues can invest 5 days in an independent topic [of their choice]. <u>We used this format to build a first prototype together with the IT colleagues. Now we have this prototype and the next step is to expand it further as we see great potential in it [Warrant: sign (extrapolation)].</u>	<u>We observed technology convergence by blockchain starting to connect with more thing that are technically necessary, like access to more data through the blockchain [Warrant: generalization (inference)].</u> Due to the technology convergence we took two approaches. We tried to get the blockchain solution that we have installed in even more pilot countries and institutions to see how it works. At the same time, we wanted to see how the blockchain solution develops itself. What is the core of the solution or as the innovators would say; we have to change our approach and focus on something else because the main demand is there. Similar to the lean startup theory.	Limited value
F	107	So far it [blockchain] is only a marginal issue, it is only strongly represented on the agenda. It used to be different, but at the moment <u>we don't foresee any useful applicability [Warrant: cause (observation)]</u>	There are always topics in the financial sector that are very prominent, where we can achieve real added value for the customer, we implement technologies which create a direct advantage for the customer. With blockchain, it's a bit <u>difficult because we have the whole universe that's necessary to be able to use the technology and which has to be transported to the customers. For example, the customer has an account, can pay mobile...but if you want to integrate blockchain, the customer would have to have wallets, the question arises where they are attached, how do you deal with the security aspects...At first, that is not promising for the bank [Warrant: sign (symptomatic indications)].</u>	[It started] with the first hype. I had spoken to the person who had been in charge of [blockchain] project at the time, <u>but the objective was only to create our own blockchain system and start thinking about how the whole thing works. But the applicability was not given [at the time] [Warrant: authority (purpose)].</u>	Limited value
	117	<u>I think the expectation [associated with blockchain] in general is too high. Especially in companies. It [blockchain] is often used as a marketing tool, which may be in line with the expectations, but I believe that the changes are so substantial that they simply cannot come so quickly [Warrant: sign (observation)].</u> We would have to completely realign your business model to the central features [of blockchain]. Therefore, as I said, this is not a one-time thing that you introduce and then immediately see the results.	<u>In fact, blockchain plays a minor role, because [most initiatives at the moment] appear to just accompany an industry trend [Warrant: generalization].</u> However, I believe that the issue will become more dominant for us in the future, because the world I am in today and which is <u>essentially defined by regulation does not allow the full exploitation of the blockchain at all [Warrant: cause (observation)].</u>	I believe that blockchain is special, the community aspiration is inherent. <u>By definition, it is a distributed system [in a technical and social sense], or at least the great advantage is played out by it [a distributed system]. [Contrary,] I can use AI without a network, so it has less to do with community for me. Thus, I think blockchain is just not (yet) suitable for being applied in an organization [Warrant: Parallel Case]</u>	Limited value
H	109	I wouldn't say that blockchain stands out now, with regard to that now there	Our company is not looking for blockchain use cases by all means. <u>Our company is</u>	Of, course, you also have to keep the business side in mind. <u>So blockchain is a</u>	Contingent value

(continued on next page)

(continued)

Organization	Informant number	Exemplary quote 1	Exemplary quote 2	Exemplary quote 3	Overall value perception
		are technology and business working together. <u>A big difference, in my opinion, is that, of course, the advantage of blockchain comes only from the fact that there are many others are on it [Warrant: sign (observation)].</u> The fact that we are thinking about developing a new market, we always have to think about what position we [our company] actually have on this market right now. (...) Usually, we are not [in this position]. Nowadays, hardly anyone financial industry can say that. Or do we create a consortium, which we can use to leverage a certain market power and to create a new joint market setting?	<u>looking for use cases that fit to us. If it is the case that blockchain is necessary, then we will not fight it. If it's not the case, then we still focus on the issue [but try to solve it without blockchain]. We are not in the position that we have to force blockchain. That is just simply not our company's aspiration. And I also don't think that this is our group's aspiration. Why should it? It doesn't make sense to just doing something with blockchain if it is not needed. Therefore, I do not set those targets to the team [Warrant: authority (purpose)].</u>	<u>topic that many people like to push forward because it's a new technology, but often the business-related justification isn't really given. [Often, we observe the] "technology searching for an application" phenomenon. This problem arises very quickly with blockchain, I have seen a lot of use cases, where blockchain is applied on a higher level, but on a deeper level the processes were not properly structured and the technology was not applied correctly [Warrant: sign (observation)].</u>	
J	111	That's why it was a compulsion to participate there at the time. This was not due to the fact that current clearing system is better, but it can lead to upheavals in business relatively quickly. This is one of the main reasons that we want to understand blockchain <u>in order to realize in time that 'the train' is about to leave, in which we should be sitting. But not from the motivation that this [blockchain] is what we have always needed for our business model. [Warrant: Sign (symptomatic indication)]</u>	The market, of course, affects us in many ways. If I now take the high-level approach, then it [blockchain] is of course already known by the management board and <u>they know that there are various blockchain activities around us which are partly equipped with much more energy, much more resources than we invest into it [blockchain] [Warrant: Sign (significance)].</u> Of course, they perceive this, and the effect it has on us - this is out of question. Then, of course, all the hype around cryptocurrencies affects us as a bank. [We are affected by blockchain] just by <u>having to make a statement as a bank and saying how we deal with such [Warrant: Principle (ideal)],</u> because we are simply asked about it.	<u>You have to ask yourself, where is a potential showcase behind it [blockchain] and where can you 'grab it'. But this is no different from other technologies, [Warrant: Parallel case (essential similarity)]</u> such as service integration or SOA or other topics. The ideas were certainly not all bad, but you have to see if it [blockchain] hits and thus solves our problems.	Current value

Appendix C. : Coding framework and exemplary quotes to assess approaches driven by sensemaking (RQ2)

Characterizing factors Organizations' progress in the innovation process	Strategy (i.e., the concrete plans and corporate goals aimed to be achieved by applying blockchain technology)	Structure (i.e., the shape, division of labor, job duties, division of power within the financial organization)	Culture (i.e., the shared understanding about why and how to apply blockchain technology)
Comprehension	"We consolidate use cases, because we think that there might be several useful applications. However, we are unsure where the concrete benefit is for us and will wait and see." [I23]	"We have a small task force looking at use cases, but that's more initiative than a formal structure. There is no given approach or way to communicate results, it is more informal exchange." [I23]	"We talk during our "stammtisch", which is more or less leisure. It is not like we're running to the board saying we have to use the technology, probably there would be no backing. Blockchain is not seen as that important." [I24]
Adoption	"In the past, there were always new technologies, but blockchain is different. With blockchain, we were afraid from the beginning thinking like "oh crap, this can be disruptive". That's why we care about blockchain and build own use cases." [I06]	"Individual employees have teamed up because we think we missed something. We have only limited freedom to deal with blockchain, thus we work basically extra hours, despite management actually encourages us to explore the technology." [I09]	"There is more the attitude that we cannot get around to deal with blockchain. Many don't want to be concerned with it but know that we have to. Trying to get people excited about blockchain is hard because there is not much backing from the top, in terms of the reallocation of working time or bonuses." [I16]
Implementation	"We need to counter potential revenue loss; this is the highest pressure and incentive to implement blockchain. We aim at making our internal processes more efficient with it, but do not strive for cooperation to develop standards or so." [I11]	"We have a dedicated, small team of IT employees, who find and develop suitable solutions for our problems. We have a high level of support from the top management and report our ideas directly to them. Employees work full time in these projects." [I03]	"Technology gave us the stimulus to think differently about how we can solve issues. Especially when it comes to data access, we now think about applications where it is beneficial for all parties to have equal access and rights." [I15]
Assimilation	"First of all, we have developed use cases ourselves. With our experiences, we now also want to go outside and profit from our knowledge." [I08]	"We have a small group that is dedicated to the topic of blockchain and aims to contribute to the development of standards for the entire industry. We report directly to the senior management and are encouraged to educate our colleagues." [I14]	"It's such an important issue that we can't just stand on the sidelines and wait. Our board defined that we have to shape the game and see where there is a niche that earns our money." [I22] "We have solid innovation capabilities, and it is our self-understanding to go ahead here." [I14]

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