The Role of Actors in Blockchain Adoption Decisions – An Innovation Translation Perspective

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Abstract

An overview of challenges around blockchain adoption has revealed that there is little understanding of the process of blockchain adoption decisions, including who needs to be involved and consulted at various stages. When systems are designed to intentionally protect privacy or to obscure actors, such as blockchain platforms, it can be challenging to identify them and to understand their roles. To do this we used an Innovation Translation approach from Actor-Network Theory (Latour, 2007) which looks at the roles of both human and non-human actors. To understand the interactions among the actors involved, multiple rounds of interviews were conducted with Blockchain experts, utilising the qualitative Delphi method. The findings of this study propose a framework that provides insight into the decision-process by exploring the actors involved and their roles as they implement strategies to adopt blockchain and to convince other actors. The outcomes will assist blockchain practitioners and researchers to have an understanding of pre-adoption decisions and stakeholder involvement. Organisations considering implementing blockchain will benefit from this research as they will know where to start, who to engage, and which stakeholders are needed during the decision-making process.

Keywords: Actors, Blockchain Adoption, Innovation Translation, Actor-Network Theory (ANT), Adoption Decision.

1 Introduction

Blockchain technology was introduced in 2008 by an unidentified person known by the pseudonym Satoshi Nakamoto, as the underlying technology behind bitcoin (Nakamoto, 2008). Since then, this technology has gained widespread popularity because of the secure and trusted platform it provides to store and process transactions. Later this technology was also used, not just as an underlying technology behind cryptocurrencies, but also as it attracted many industry participants as a use case for their industries like supply chain, tourism, healthcare, education, or finance (Bhaskaret al., 2020; Dujak & Sajter, 2019; Treiblmaier, 2020; Varma, 2019). There is hardly any industrial sector that does not see a potential application with blockchain technology. Blockchain adoption is a most reviewed aspect of literature in recent years as it is one of the most promising emerging technologies. Several blockchain

adoption models have been proposed, especially from behavioural, attitude and diffusion perspectives to streamline its adoption.

Despite these promising opportunities and exhaustive research in this technological domain, the practical implementation of blockchain use cases is very limited, indicating that there are still many gaps from a practical perspective to be explored. A brief overview of the challenges around blockchain adoption revealed that regardless of popularity and opportunities, the trust and respect for blockchain is not diffused with the actors involved in its adoption (Galati, 2021). Actors are the basic human or non-human elements involved in the adoption process of technology (Tatnall, 2005). Choosing blockchain as a platform also affects decision-making among the network of actors and overall organisational governance (Tan et al., 2022). Each of these actors involved in the decision may exert a positive or negative influence depending on their opinion about the technology (Barnes III & Xiao, 2019). The identification of actors is often challenging, especially when systems are designed to protect privacy or purposefully obscure them, such as in blockchain platforms (Tanniru et al., 2021). As the security and increasing value of data demands actions from all involved actors in blockchain (Caldarelli et al., 2020), it has become imperative to understand their role in blockchain adoption.

Our preliminary study (Chhina et al., 2021) suggested that there is a need to understand the role of the actors involved in blockchain adoption decisions but did not cover the Actor-Network (ANT) aspect to understand the role of these actors and their interactions. This study extends this work by the utilisation of the Innovation Translation approach from ANT by identifying the actors and changes in the role of key actors with the change in the stages of (the process of) Translation. The use of the Innovation Translation approach was needed to understand the change of roles in the blockchain adoption decision process.

This study is motivated to fill this gap in the literature and practical aspects by identifying and understanding the role of actors in blockchain adoption. To achieve this objective, we aim to answer the following research question:

How does the role of actors evolve in the process of a blockchain adoption decision?

The term 'evolve' here implies the "progressive change" (Bowler, 1975) in the adoption decision process as it moves towards a decision. Achieving this aim is not only important from a theoretical and a practical perspective but also crucial from a technological perspective, as blockchain platforms are based on mechanisms involving several actors. The benefits of a blockchain-based supply chain can only be achieved if multiple actors adopt the technology (Sternberg et al., 2021). Findings from Saurabh and Dey (2021) revealed that the degree of utilisation of blockchain attributes such as disintermediation (reducing the chain of interaction by diminishing intermediaries (Nasarre-Aznar, 2018)), traceability, price, and trust also influence the actors' adoption intention decisions. Furthermore, the list of actors grows as the blockchain system becomes integrated into socioeconomic infrastructures, including end users (external actors), policy makers, and the broader ecosystem engaged with or building on the blockchain (Hofman et al., 2021). Hence the need of identifying the actors and understanding the change and evolvement in their role in the blockchain adoption decision process from a technology perspective.

The above discussion made us realise the emerging need to develop a framework that explains each actor's role in the adoption decision process of blockchain adoption. Thus, this study

presents a framework for blockchain adoption decisions using the Innovation Translation approach informed by Actor-Network Theory (Latour, 2007).

It is important to consider the socio-economic and cultural context of the adoption situation (Kautz, 2021). The innovation translation approach attempts to meet this expectation by revealing the social-technological interactions among the actors involved in a process that cannot be understood by other theories that focus on one type of influence alone (Boerboom & Ferretti, 2014). The innovative translation approach is based on ANT's translation stage and process, which helps to understand the interactions that led to adoption decisions when many actors are trying to influence the outcome based on their own interests (Sarker et al., 2006). To have a greater understanding of the role of actors and how these roles gradually change, and to uncover every niche aspect of the interactions among the actors, we have recruited the key actors to gather data for this study. We selected the key actors because they are those who succeed to become indispensable, and they are the people in the process who are seen as having the solution (Tatnall, 2009).

This paper is organised as follows – the next section provides a brief review of the literature covering blockchain technology and its adoption, the importance of actors in technology adoption and justification for the use of the Innovation Translation approach for this study. Then we provide a detailed overview of the research method used for this study, followed by a findings and discussion section. Contributions from this study are then discussed along with suggested future research directions.

2 Literature Review

2.1 Blockchain Technology and its Adoption

A blockchain platform is designed to establish trust between parties by eliminating intermediaries and enabling them to perform their tasks over a blockchain network, thereby enhancing transparency in the flow of information between parties (Viriyasitavat & Hoonsopon, 2019). A blockchain can be compared to a linked list, where nodes are linked in a network. Blockchain nodes can also be described as entities connected to the blockchain (Casino et al., 2019). As each node confirms a transaction entered into the blockchain, it is verified and validated (Koteska et al., 2017). The broadcasting of a transaction makes it impossible for it to be altered. Full nodes verify the blockchain rules for transactions and group transactions into blocks (Casino et al., 2019). In a nutshell, blockchain can be understood as *"A technology that enables immutability and integrity of data in which a record of transaction made in a system is maintained across several distributed nodes that are linked in a peer-to-peer network"* (Viriyasitavat & Hoonsopon, 2019). In comparison to applications that are centrally controlled, blockchain technology offers many benefits such as decentralisation, disintermediation, immutability, and scalability.

For this article, we reviewed the current literature around the *blockchain adoption decision process* especially focussing on studies which have considered the importance of actors in adoption decisions. Table 1 below summarises some of the key studies from this domain in literature.

Source	Findings
(Sternberg et al., 2021)	The study highlighted the importance of supply chain actors in adopting blockchain technology and developed a framework for inter-organisational supply chains.
(Saurabh & Dey, 2021)	The study identified the factors that influenced wine production supply chain actors to adopt blockchain technology and suggested that these features influenced the actors' decision to adopt.
(Rugeviciute & Mehrpouya, 2019)	The study looked at the role of blockchain technology in financial aid flows and suggested that insufficient engagement of actors is a big concern in blockchain adoption.
(Barnes III & Xiao, 2019)	The study used the Technological-Organizational-Environmental (TOE) framework. The study extended the framework by considering a network of actors as part of the environmental ecosystem and suggested that to determine the influencing factors in the adoption of blockchain technology by organisations, one should examine the network of actors that comprise the enterprise blockchain ecosystem.
(Hofman et al., 2021)	This study proposed a framework for opportunities for blockchain innovation in governance. It suggested that the identification of actors is often a practical challenge, especially when systems are designed to preserve their identities.
(Caldarelli et al., 2020)	The study used the UTAUT (Unified Theory of Acceptance and Use of Technology) model to understand the factors that push organisational actors to use blockchain. The findings suggest that changes in the perception of organisational actors change their influence on the adoption and use of blockchain technology.
(Islam et al. 2019)	This study attempts to understand the role of actor heterogeneity in blockchain split and focuses on actors in bitcoin split transactions. It also suggested that it is necessary to investigate the actors involved in blockchain ecosystems.

Table 1. Literature review of blockchain adoption studies considering the role of actors

The above literature review summarises that researchers have made attempts towards realising the importance of actors in blockchain adoption. It reveals however that only one study - Islam et al. (2019) - has made an attempt to understand the role of actors, but this study is too limited focussing on bitcoin split and it does not consider the actors involved in the organisational adoption decision process of blockchain. Yet, many studies have suggested that it is crucial to understand which actors are involved and their adoption decisions, but no study has been found that made an effort to identify and understand the actors' involvement in the adoption decision process. Somehow no study has seen the evolvement of roles, referring to the changes these roles encounter while deciding to adopt blockchain. This provides support and motivation for this study.

2.2 The Role of Actors in Technology Adoption Decision Processes

In the adoption process of an inter-organisational technology like blockchain, actors play diverse roles. The adoption of information technology has evolved from a simple adopters' participation process to one in which various actors constantly interact and influence the process (Eze & Duan, 2016). There has been extensive research on IT adoption, but most of it has focused on factors that affect IT adoption by treating it as a static decision-making process. Adopting new technology is more of a socioeconomic process involving human and non-human actors who influence adoption (Venkatesh et al., 2003). The human actors could be part of an organisation like the business team, the R&D (Research & Development) team, or the finance team or could be external to the organisation like external stakeholders, or consultants. The non-human actors can be the hardware and software like the blockchain technology itself.

However, a very limited number of researchers have examined the influence of various actors on adoption (Cavusoglu et al., 2010). The literature has been criticised for neglecting actors' roles in innovation diffusion (Latour, 1987). Rather than viewing innovation diffusion as a phenomenon emanating from a centre, it is argued that innovations are transferred and spread in networks of connected actors (Law et al., 1986). These actors influence technology adoption decisions through their interactions with other actors and the social and economic context in which they operate (Bhatt & Singh, 2020). The interactions and influences keep changing in the project life cycle with the change in the actors' power (Berardi, 2013). These interactions, influenced by actors' habits and routines, may hinder, or advance an organisation's adoption of new technology (Bhatt & Singh, 2020).

Limited studies have considered the role of actors and their interactions across the stages of the adoption decision process. Bhatt and Singh (2020) suggested that there is a need for exploratory studies to identify the key actors and their interest in adopting new technology. Mirriahi et al. (2012) also suggested that there is a need for future studies to identify and understand the diversity of these actors. Organisations adopt emerging technology more quickly if diverse actors convey the right information to key actors, allowing them to make informed decisions and streamline their business processes (Eze & Chinedu-Eze, 2018). Peng and Mu (2011) also suggested to explore the social network of actors in technology adoption and to identify the actors and their interactions. Analysts need to be aware of the diverse actors in the adoption process to cope with constantly emerging technology, and the roles of these individuals (Eze & Chinedu-Eze, 2018). Therefore, considering the above discussion and the identified gaps in the literature, this study is motivated to explore the actors and their role in the blockchain adoption decision process from an emerging technology perspective.

2.3 Theoretical Foundation – Actor-Network Theory

To understand the interaction between human actors and human and non-human actors involved in blockchain adoption, we employed an innovation translation approach based on Actor-Network Theory (ANT). According to ANT, a translation process occurs when different actors in a network align their interests and beliefs about technology with each other (Callon & Latour, 1981) where innovation translation is "*the processes through which an innovation process, by necessity, transforms the social space of the actors in the innovation network*" (Lyytinen et al., 2016). Considering the distributed and decentralised nature of a blockchain, the translation process appears to be quite relevant to its adoption. In the translation process, adoption only occurs when the actors convince others to adopt new technologies, whether directly or indirectly (Callon, 1984). ANT assesses the role and influence of various actors in adopting emerging technologies like blockchain (Allen et al., 2018; Eze & Duan, 2016).

Actor-Network Theory emphasizes the importance of understanding the social and material factors that shape technological adoption. ANT suggests that technologies do not exist in isolation but are shaped by the network of actors involved in their development, implementation, and use (Esmaili et al., 2022). Innovation translation in ANT consists of a four stages process to understand the adoption process of an innovation, these are the problematisation, interessement, enrolment, and mobilisation stages. In the context of blockchain, these stages help to gain a deeper understanding of the intricate social and technical aspects involved in the adoption process of blockchain technology. Problematisation involves recognizing the issues that can be resolved by adopting blockchain technology. Interessement is about convincing stakeholders of the potential value of blockchain

technology. Enrolment entails motivating users to adopt a particular blockchain protocol or consensus mechanism. Mobilisation is the process of developing agreements among stakeholders and working collaboratively to overcome challenges affecting the network.

Therefore, ANT helps to identify the various actors involved and to show how their interactions with each other influence the adoption process. We discover new human and non-human actors through the analysis of associations, creations, and changes in heterogeneous actor-networks (Cecez-Kecmanovic et al., 2006). It also helps to understand the role of material factors, such as the technical design of blockchain technology and social factors, such as the regulatory environment in which it is being implemented (Allen et al., 2018). Thus, applying ANT to the study of blockchain technology adoption can provide a nuanced understanding of the complex social and material factors that shape technological adoption.

To summarize, despite many theories such Diffusion of Innovation and technology acceptance models like TAM and UTAUT, available to examine technology adoption, ANT has a number of advantages (Sarosa, 2012). While most theories consider the role of only the human element in the adoption process, ANT r also considers the role of non-human actors in shaping social phenomena. These include the complex technological systems and networks involved in blockchain adoption (Chhina, et al., 2021). ANT emphasizes the importance of understanding the relationships and interactions between all actors in a network. As stated above this is also relevant for blockchain adoption as it involves a wide range of actors with varying interests, incentives, and power dynamics (Islam et al., 2019). We thus argue that ANT is most relevant and appropriate to achieve the aim of our study. Islam et al. (2019) used ANT to understand the role of actor heterogeneity in blockchain splits, and Esmaili et al. (2022) conducted a strategic analysis of blockchain technology for security organisations. Several studies used ANT to investigate the adoption of different technologies, including mobile communication (McBride, 2003), autonomous vehicles (Seuwou et al., 2016), solar machines (Penteado et al., 2019), and business-to-business portals (Tatnall & Burgess, 2002). All these studies support the applicability and validity of ANT as the theoretical foundation for this study.

3 Research Methodology

Considering the exploratory and contextual nature of the study and the newness of blockchain technology, a qualitative research methodology was chosen. This approach is appropriate for studying blockchain adoption as it can provide an in-depth and contextual understanding of social factors and non-humans that influence its adoption (Chhina et al., 2021). Blockchain adoption involves a wide range of stakeholders with diverse interests, motivations, and perspectives, which are impossible to capture with any other approach. This research approach has the potential and capability to explore and understand those subjective viewpoints and provide insights into experiences of those involved in the technology adoption process (Myers, 2019). This research approach is thus best suited for this study.

3.1 Data Collection - A Delphi Study

The study uses the Delphi method to collect qualitative data. The method requires multiple iterations of data collection and analysis to arrive at a consensus, unlike other methods like survey and focus group (Hsu & Sandford, 2007). Since the Delphi method is an iterative process that allows experts to revise and refine their opinions based on feedback from other participants, this can lead to more accurate and reliable results (Levis et al., 2021). Most other data collection methods cannot capture the social, economic, and political contexts to examine

the adoption of an innovation (Levis et al., 2021). The Delphi method, however, enables subjective consideration of changes in interconnected contexts. Several research studies have used this method for data collection to understand adoption of different technologies including the blockchain (Dadkhahet al., 2022; Hanafin, 2004; Sangal et al., 2022). This implies the appropriateness of the Delphi method for this study.

There are different variants of the Delphi methods that researchers have used according to the needs and goals of their research. For this research, we used a three-round procedure.

The first round (Round 1), known as the "exploration phase", is where the topic is fully explored with mostly open-ended questions. This is a kind of pilot study to capture the initial themes and to determine whether the right questions were asked of the right people. A total of eight experts were recruited for Round 1, of which five were adopters, and three were consultants. Round 1 identified the main actors in the adoption decision process and the initial interactions among them. Having analysed Round 1, Round 2 questions were formulated. Round 2 was intended to expand on these findings by exploring more themes, identifying more actors at each stage of translation, and on understanding their interaction on how the roles evolved. As a result of an expert review from other researchers, it was decided to also include the views of experts who had once considered adopting the concept and technology of blockchain but dropped it later. Thus, a panel of ten members was recruited for rounds two and three, including five adopters, three consultants, and two non-adopters. This was also identified as one of the key limitations of the earlier study. Round 2 was followed by the last phase, known as the "evaluation phase" in which the results of the first rounds are generally verified to reach a group consensus (Fletcher & Marchildon, 2014). Round 2 data analysis had led to the development of a preliminary framework, and in Round 3 further questions were developed to evaluate the conclusions and justifications made by the experts. In creating the final framework, the experts kept the elements on which they agreed or were relatively close to an agreement.

3.1.1 Selection and composition of the panel

It is important to select appropriate Delphi participants since this directly impacts the quality of the results produced by the Delphi process (Hsu & Sandford, 2007). Although there are no formal criteria for determining a Delphi expert's qualifications (Hsu & Sandford, 2007), participants must meet certain criteria – having a high level of expertise in the research subject, committing to a number of testing rounds, and communicating with the researcher. Participants for this study were selected only if they satisfied the selection criteria by answering the following introductory questions and providing the requested description via email before the interview:

1. What is your total experience, and what is your designation and experience with blockchain technology in your current organisation?
2. Describe the role and responsibilities you handle in this position.
3. Is your organisation an adopter, consultancy, or a non-adopter (has not adopted after consideration) of blockchain technology?

Instead of aiming at generalising results, the Delphi method provides in-depth insight into a complex issue (Powell, 2003). It is thus neither necessary nor possible to calculate sample size according to a standard method within the Delphi approach (Avella, 2016). Rather than offering precise recommendations, Delphi seeks to explore minds (Jenkins & Smith, 1994). Our

study sampled decision makers (managers and above level) within organisations, and blockchain experts as its target population. It employed selective purposive sampling to achieve its objectives and meet Delphi technique requirements. Since Delphi invites input from a purposefully selected sample of experts, this approach was considered appropriate (Brady, 2015).

Study participants were interviewed using semi-structured interviews lasting approximately 30-40 minutes, with various key questions to identify the areas to be explored (Britten, 2006). In addition, experts were asked as per above to categorise their organisations as either adopters, consultants, or non-adopters. To avoid biases in the responses, experts who volunteered as consultants and adopters were considered consultants.

3.1.1 Reaching consensus among experts

Consensus between experts is one of the crucial requirements of the Delphi method. It is typical for Delphi studies to end when there is a minimal difference between experts' opinions between rounds, even if there has not yet been a strong consensus (Okoli & Pawlowski, 2004; Skulmoski et al., 2007). In most studies, this is achieved in two or three Delphi rounds (Ågerfalk et al., 2009). Delphi studies typically reveal saturation at approximately ten to twelve participants (Guest et al., 2006). For this study, the saturation was observed with eight experts in Round 1 and ten experts in Rounds 2 and 3. To reach saturation among the expert's responses, three rounds of interviews were conducted (Schmidt, 2004). Table 2 below provides a detailed overview of the participant profile recruited for our study.

Pseudonym	Designation	Category	Experience in years	Round 1	Round 2	Round 3
Interviewee 1 (I1)	Executive vice president	Adopter	21	✓	✓	✓
Interviewee 2 (I2)	Founder	Consultant	20	✓	✓	✓
Interviewee 3 (I3)	Co-founder and Chief Technology Officer (CTO)	Adopter	18	✓	✓	✓
Interviewee 4 (I4)	Chief Innovation Officer	Adopter	12	✓	✓	✓
Interviewee 5 (I5)	Co-Founder and CTO	Adopter	9	✓	✓	✓
Interviewee 6 (I6)	Enterprise Architect and Blockchain Advisor	Consultant	30	✓	✓	✓
Interviewee 7 (I7)	Senior Software Engineer and CTO	Consultant	10	✓	✓	✓
Interviewee 8 (I8)	Lead Engineer	Adopter	8	✓	✓	✓
Interviewee 9 (I9)	Senior Consultant	Non-Adopter	6		✓	✓
Interviewee 10 (I10)	Co-Founder	Non-Adopter	7		✓	✓

Table 2. Participant profiles

3.2 Data Analysis

To analyse the data, a thematic analysis approach was used. Considering the phenomenon under study, thematic analysis is often the most appropriate method for searching, identifying,

and reporting emerging themes (Braun & Clarke, 2006). Thematic analysis is suggested as a flexible and useful research tool that helps to provide a rich yet complex interpretation of the data (Vaismoradi et al., 2013). Thematic analysis is a distinguished qualitative approach that is most useful for identifying common threads that extend across interviews. Exploring common themes across heterogeneous participant interviews over multiple rounds was very important. As all interviews contained descriptive text, all were recorded and transcribed into Word documents. We used QSR NVivo software for our thematic analysis where as a first step the Word files were imported into the software. At the next stage, initial open coding was performed, and then codes were grouped using the emerging themes. Before beginning the next round of interviews, each round was analysed and coded. The initial themes identified the key actors, and then further themes evolved around other actors involved in the process. Identifying the themes guided the next round of questions and analysis where important themes were confirmed, and new themes that could inform the next round were identified in parallel. In the Round 2 interviews, there was also a change identified in the role of key actors. In Round 3 of the interviews, each participant had the opportunity to identify areas for additions and most of the participants reached a consensus in their responses, indicating saturation had been reached and no further data collection and analysis were needed.

4 Findings and Discussion

The source data from the interviews underpin the findings and provide a discussion on the evolvement of roles of actors involved in the process as we move from Problematisation to Mobilisation while translating the adoption decision process of a technology. Figure 1 summarizes our findings in a framework describing the actors and their changing roles involved in the blockchain adoption decision process.

4.1 Problematisation Actors

In the proposed framework in the problematisation phase, the key actors are the people who initiate the idea of an innovation (Tatnall, 2009). This phase involves the key actors and how they define the problem and how further, different actors are identified (Birke & Knierim, 2020). Here the key actor defines the issues and problems that blockchain technology proposes to solve or realises the problems that can be negotiated with the technological solution (Unnithan & Tatnall, 2014). It is a process in which one or more key actors as initiators (attempt to) define the nature of the problem and the roles of other actors who appear to be able to contribute to the solution of the problem (Tatnall, 2009).

In our study, problematisation is understood as the stage where (a) key actor(s) will realise the need for a blockchain solution in their organisation and justify the need for the proposed technology for the business. Thus, they initiate the process and identify blockchain technology as a need and/or a solution to their problem and formulate the strategic necessity for a blockchain solution for business.

In our study, these key actors identified themselves as such or as a primary actor in the group of key actors. When the participants were asked about the starting point or the origins of identifying the need for blockchain in their organisation, most of them mentioned that someone (usually themselves or the head of the group they were part of) from their organisation formed a group that looked for the emerging technologies and their usage.

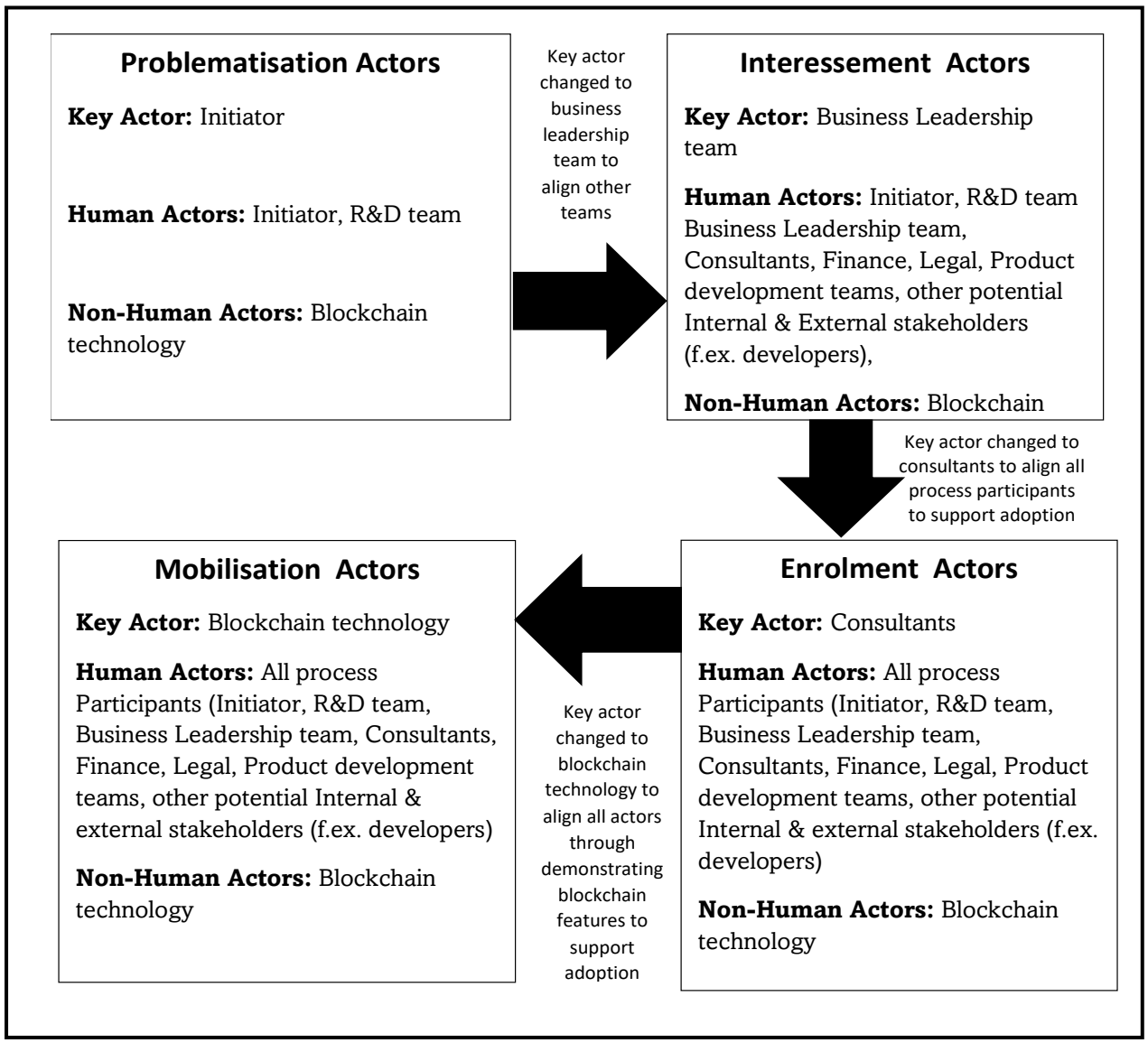

Figure 1. Proposed framework of Blockchain Adoption Decision Actors

Some also mentioned that they had a dedicated research and development group led by some blockchain expert (usually themselves) to see how this technology could be utilised. For instance, one of the participants, a consultant, from the Round 1 interviews stated that they had a group that constantly explored new technologies in the market, and that he was leading that group when they discovered blockchain.

> *"Yeah, so we have a group which constantly explores new things - new technologies and I lead that group in our organization." (I2, R1) - Consultant*

We further found that many organisations have a set Research and Development (R&D) Team to research new technologies, how these technologies are utilised in other organisations, and what their benefits are. We also found that usually the initiator, whom we call a key actor, is an individual who started the formation of the R&D group or was a part of this team.

We also found support for Forrest (1991) who argued that the interaction between the R&D team and other teams and individuals leads to the initial knowledge in the innovation-decision

process. For instance, one of the participants from Round 2 mentioned that they had formal and informal channels of research to look at blockchain technology and its uses.

> *"We did have formal research and as well as informal research, do I need a centre of excellence and that was essentially set up in 2016 to look at this technology, understand this technology." (I1, R2) - Adopter*

Bandura (2001) put forward that individuals who observe others who have adopted a particular innovation are favourably inclined to adopt the innovation themselves. In our study's context, when the key actors or the R&D team tried to look into the work and utilisation of blockchain technology, and its benefits, they were likely to discover the idea of blockchain adoption. In line with Straub's (2009) finding that individuals are capable of learning from other's experiences more than from their own, one of our participants who was a key initiator in his organisation, stated that it was a combination of their research and discussion with others that enabled them to start the blockchain adoption decision process.

> *"It is a combination of what you learned, and you researched, and the technology being adopted and so we did lot of discussions on some of the leading voices in the industry around this technology" (I1, R1) - Adopter*

From the collective responses from all participants, we gathered that at the problematisation phase the idea of adopting blockchain technology is initiated by someone who has basic knowledge or a background about the usage of the technology.

In this phase, as organisations encounter blockchain technology as an opportunity for technological advancement, it is the non-human actor – the block chain technology - that also influences other actors to move towards an adoption decision. Accordingly, one of the participants confirmed that one of the key motivations for considering blockchain adoption came from the expected advantages of blockchain technology for their organisation.

> *"One is the opportunities that blockchain technology provides us, for us to bring industry changes where we can use it like a utility on some of the key things where the technology could benefit the organisation." (I2, R2) - Adopter*

Therefore, considering the motivations and identifying the technology as a solution to the problems, the study identified blockchain technology itself as an important non-human actor influencing other actors involved in the adoption decision.

In summary, we found the following roles of problematisation actors. The initiator is usually a part of the R&D team or the one to start a group to research the innovation. They are either a part of the R&D team or others who initiated research on blockchain adoption. The key actors at this stage are usually technology-savvy people and/or group who has formed their understanding through some formal or informal research. The participants stated that it is clearly the technical benefits that are understood and taken into account by the actors and the technology is seen as a solution to an existing problem or is identified as a benefit to the organisation, but primarily from a technological perspective. It is also evident that at this stage the key actors' beliefs are based on their understanding of the technology and its use (Eze & Chinedu-Eze, 2018). Thus, at this stage, the key actors, initiators, and/or R&D team look at and explore the adoption of blockchain technology by others, the benefits and success stories, and how they can utilise this technology to solve their problems.

As Kyratsis et al. (2012) argues it requires an organisation's members to acquire and process new knowledge about an innovation in order to reduce uncertainty around its adoption. In our study this knowledge helped the initiators to map the opportunities associated with blockchain technology for their organisation and for existing problems in the business. Considering the important role of blockchain technology itself, the study identifies blockchain technology itself as one crucial non-human actors involved in the translation process that might help other actors towards an adoption decision.

Thus, thus in the problematisation phase, the human actors are the initiator and mostly an R&D team and the non-human actor is the blockchain technology. The key actor is the human actor who is the initiator usually as part of an R&D team.

4.2 Interessement Actors

This phase focuses on bringing all the actors together to convince and interest them in the proposed blockchain solution. It helps to understand the strategies used by the key actors and the actions performed to gather the interest of other actors in the organisation so that they willingly adopt the roles defined for them (Birke & Knierim, 2020). It identifies how the key actors establish an interest in the technology (Unnithan & Tatnall, 2014). According to Callon (1984), interessement consist of a series of processes that identity the role bearers that are defined in the problematisation phase and the roles that can be imposed on further actors (Tatnall, 2009). In our study, interessement is understood as a stage where the key actor/s try to justify the need for blockchain technology in their (business) organisation and attempt to convince people - to make them 'interested' - in the proposed blockchain solution.

As described in the proposed framework (see figure 1), at this stage the identified actors consist primarily of the members the business team, but are not restricted to them, as anyone in the organisation who is involved in the adoption decision processes can act in this stage. When the participants were asked who were those involved in the interactions after the conclusion of problematisation phase, in what we consider the interessement phase, most of them highlighted the business team or the business members responsible for making strategic decisions. We found that the key actors from the problematisation phase in the interessement phase look for other actors who adhere to and support their beliefs and values (Eze & Chinedu-Eze, 2018). For example, one of the participants stated that their business team and the product team evaluated the idea of blockchain along with the blockchain experts and then tried to develop the best possible use case to start the adoption decision process with.

> *"[We gather members of the] Product and business teams' domain, knowledge experts and technologists to figure out like what are the ideas that make the most sense for us using this technology and then they can perhaps have a scorecard in order to justify which is the best-suited idea to start with" (I3, R3) - Adopter*

Top management's role is crucial in the adoption decision process as they are responsible for all strategic, operational, and tactical decisions (Khayer et al., 2020). Its tight alignment with an interest in the technology is crucial to ensure a company's long-term viability and profitability when adopting a technology (Sarker et al., 2006). Bhatti et al. (2021) also emphasise the role of top management support in embracing new technologies to ensure an organisation's success. The business leadership team in an organisation should act as change enabler by leading other employees to adopt new technologies (Garrett Jr & Neubaum, 2013).

Actors who adopt leadership roles are usually also leaders in adoption decision making processes (Seyfried, et al, 2019). However, while top management's general support in technology adoption has been discussed widely, the specific actors from top management and their role in the adoption decision process has not. Our study emphasises members of the business leadership team as key actors to identify the business needs of the technology. We found that as soon as the business team realises the need for the technology, they take over the role of key actors and try to create an alignment of interests with and between other actors. An explicit focus on the interessement phase accentuates the involvement of the business leadership team as the key actors. We also identified that the ownership of the idea of adopting blockchain technology changes with degree of the interest and power that actors hold in convincing other to adopt and further may lead to a successful adoption process.

Another important group of actors that we found in the interessement phase were consultants. As one of the participants stated consultants make the adopters go through a process of approval on requirements concerning possible blockchain solutions.

> *"Consultants have to sort of explain things and document things for them and go through like approval process" (I6, R1) - Consultant*

The role of consultants appears to be crucial in management and leader's choice of block chain technology as it is the consultants who create an alignment between management, leaders and a firm's interest when recommending an appropriate course of action (Leiby, 2018). Consultants fill a managerial gap by providing advice regarding the adoption process through transfer of their expert knowledge, sharing implicit and explicit experience and cross-pollinating between firms (Bessant & Rush, 1995). Consultants may also challenge and tailor the key actors' beliefs and understanding of the technology (Eze & Chinedu-Eze, 2018). However, as stated before recent studies on blockchain adoption and the adoption decision processes did not uncover the importance of consultants and their role in adoption decision process. Our frameworks highlight their importance as our analysis identified consultants as crucial actors and their significant role in this phase when helping organisations to explore the practical aspects that are involved in implementing a blockchain project. The data also showed, that given their own limited technological knowledge, the key actors tend to agree with the propositions initiated by the consultants. In summary, consultants as actors are crucial in the process of the adoption decision as they support organisational members in this process through real case experience of other organisations.

We also identified internal stakeholders who represent the internal departments such as members of finance, legal, or product development teams who may become involved in the adoption decision process. One of the participants described how they implemented a communication strategy to clarify understanding and expectations of the blockchain technology to get positive responses from involved departments.

> *"…I would say that we have had pretty positive response from most departments …. So, for example, when you're pitching to a department, you need to be very clear about. What is the problem you are solving and what is the end benefit you're getting rather than just putting dropped in for blockchains?" (I6, R2)- Adopter*

Similarly, another participant stated that as a blockchain consultant they need interaction with the internal and/or external technical development team and blockchain engineers (see also below) to design effective blockchain solutions.

> *"I mean especially the blockchain consultant and the blockchain engineers, because engineers do really tend to do the tech improvement and are highly, highly dependent on the input from the consulting teams." (I4, R3)- Consultant*

Among others Pólvora et al., (2020) have highlighted the importance of stakeholder engagement and prototyping technical solutions with stakeholders. In these participatory activities, stakeholders can explore current possibilities, as well express, and test visions about the future application opportunities for blockchain. Collaboration and coordination can be driven by internal relationships and act as a driver for blockchain adoption (Kouhizadeh et al., 2021). Our framework of actors involved in blockchain adoption highlights how this interaction among internal stakeholders, internal and external developers and consultants is crucial in making an adoption decision.

Exemplifying the above arguments one consultant stated that for blockchain technology adoption to be successful, the collaboration of multiple external stakeholders is needed confirming that external stakeholders are also involved in the interactions in the interessement phase.

> *"You need to be really collaborating and co-innovating with the potential competitors, your clients and the other industry partners" (I7, R1) - Consultant*

The importance of involving external stakeholders has been introduced in the literature where studies have identified the importance of external actors (Bhatti et al., 2021). Our study confirms and extends these findings by emphasising the role of consultants and/or external developers as external stakeholder in the blockchain adoption decision process when providing knowledge from an external stakeholder perspective for the process.

In summary we found the following roles of interessement actors. There is a change in the role of key actors at this stage from the initiator to the business leadership team. Considering the power in convincing other teams for adoption, it became clear that as soon as the business leadership team identifies the business need of the innovation suggested in the problematisation phase, they take on the role of key actors.

Further, the business leadership team involves other teams as part of the adoption decision process when developing and using prototype solution with the blockchain technology to gain their trust and understanding, and to mould their perspectives towards the technology. In this process the role of the initiator and R&D team changes from being key actors, to become as common human actors. Considering the influencing power of the business leadership team, they take over the role of key actors.

As soon as the business leadership team is convinced about the idea of blockchain adoption, they implement strategies to convince other actors by involving consultants to, beyond the actors from the problematisation phase, the initiator and/or R&D team, and bring in further internal and external stakeholders, such as the finance and product team and to develop appropriate use cases and cost benefit analysis, and possibly a development team to demonstrate the change in business process. Blockchain technology along with its properties remains as the standout non-human actor and there is no change in its role.

4.3 Enrolment Actors

This phase involves the active enrolment of actors after their successful interessement. Its analysis provides a deeper understanding of the interactions among the human and non-

human actors and the challenges involved (Birke & Knierim, 2020). In these interaction situations, there is not a straight-forward process of enrolment. Instead, coercion, seduction, or consent is executed and negotiated (Grint & Woolgar, 1997). Enrolment involves more than a one-way process with just one actor imposing their will on another, the other must yield as well (Tatnall, 2009). The aim is to achieve consensus among all process participants including external consultants and developers. In Round 1 and 2 of our interviews we identified as the actors in this phase all earlier categorised process participants, stakeholders and consultants (see figure 1).

To support active enrolment, one participant, a member of the business leadership team, stated that they with the help of consultants developed a score card for other stakeholders and involved departments to decide from a pool of use cases on which one to focus first to support an adoption decision.

> *"So we developed a score card like this with around 20 different factors and the process we followed was indifferently the technology team, the business team and the product team rated the idea and then we were able to evaluate a score on one is this problem is really worthy for [organisation] to solve?" (I1, R1) - Adopter*

Thus, in the enrolment phase consultants became key actors for adopter organisations. On participant, who was a consultant, described how they invited everyone to vote about the idea of introducing blockchain technology and then identified use cases which had revenue earning potential.

> *"We invited everyone who is a key stakeholder in this process to vote for that and then we decided and the client interest as well, in terms of whether these had revenue earning potential." (I3, R2) - Adopter*

The consultants provided practical views of the potential use cases and supported the projects that organisations intended to implement. Considering their knowledge and power to design and showcase the prototype, as well to convince other process participants, we thus qualify consultants as a key actor in the enrolment phase.

We summarise the roles of enrolment actors as follows. A change in role is observed among the human actors and the key actors. Consultants take over the role of key actors, considering the propositions they make at the interessement stage, and provide an advanced picture of technological, cost and complexity aspects involved in the practicalities of a blockchain adoption project. Involving consultants in the interessement phase as ordinary human actor providing explanations and documentation services changed to providing their understanding and practical knowledge of blockchain adoption process in support of building practical problem solutions using blockchain technology. In this context we confirm Awa et al. (2016) who stated that voting may occur before an application is accepted and is problem is resolved.

Alignment of interest of all the major stakeholders is important for establishing any IT infrastructure (McBride, 2003). This, and the multitude of actors, shape how the technology will be accepted and used in future (Palas & Bunduchi, 2020). Thus, in the enrolment phase the common human actors were all the beforementioned process participants such as stated above members of the finance, legal and product team, and other internal and external stakeholders such as members of development teams. This also included members of business leadership teams whose role changed from key actors to more common human actors and the

Initiator and R&D team members who remain human actors as process participants. The initiators became stakeholders to vote on the ideas of the consultants and contributed their consent towards the adoption decision. No change was observed in the role of blockchain technology, and it was still seen as a non-human element that is part of the actor-network. Considering the major change that the technology will bring, the blockchain technology (still) is a prominent non-human actor.

4.4 Mobilisation Actors

This is the final phase of the Innovation Translation approach of ANT. Its analysis provides insight into whether the roles taken by or assigned to the key actors in the enrolment phase were executed by the actors and how the actor-network of, in our case, blockchain decision making process was maintained (Birke & Knierim, 2020). Mobilisation is focused on finalising the working prototype of the proposed blockchain technology solution, new processes, and the new roles of stakeholders as a foundation for the ultimate blockchain technology adoption decision. Mobilisation requires the involvement of representatives of all impacted stakeholder groups as spokesperson to provide consent (or rejection) on the proposed solution and any proposed detours (Tatnall, 2009). At this stage the proposed solution locks in if it is accepted by those involved (McMaster et al., 1997) and might lead to some envisioned benefits.

One participant referred to the use cases and blockchain technology that they are utilising for proxy voting in the capital market and that all their products are now generating revenue for them.

> *"We have launched 3 solutions in the last 4 years which are actually actively in production. Which means that they are actually revenue generating solutions…" (I2, R1) - Adopter*

When explaining the outcome of a prototype that had built to showcase what blockchain is capable of doing, another participant added that their proof of concept has resulted in an increase of 30% in terms of operational efficiency introduced by blockchain technology.

> *"…once we did the experiment and we compared the timelines that it took for one against the other what we realised was there was a 30% efficiency gain in an industry that does 19 trillion dollars a year… …. 30% efficiency gain in a 19 trillion-dollar industry you have fundamentally altered the way this industry works…" (I7, R1) - Consultant*

A further participant stated that their expectations from blockchain technology have been met, and blockchain has helped to address the problem that existed before.

> *"I think that the problems that we thought blockchain would help address has been addressed. So obviously blockchain has helped address the problems that existed for those specific areas before blockchain extension." (I1, R2) - Adopter*

Thus, we concluded that at the mobilisation stage, blockchain technology acted as the as the key - non-human - actor with blockchain technology-based prototypes demonstrating the exceptional features required for decentralisation processes and immutability and transparency met as per expectations, while the technology improved the business processes in question in terms of efficiency, time, and effort. These features and expectations may vary with different organisations but are specific to what blockchain technology is capable of.

In summary the roles of mobilisation actors were as follows: the key actor in this phase was the blockchain technology as a non-human actor for mobilising this technology for future use in organisations. To successfully adopt technology within an actor-network, human and non-

human actors must align their interests and properties (McBride, 2003). Thus, the technology features and their use were showcased to the process participants and actors involved in the previous phases and aligned to support the blockchain adoption decision. The analysis of this phase uncovered that the successful application demonstrated by the technology itself as an actor led to positive adoption decisions by other actors involved in the adoption decision process.

There was another a major change concerning the role of key actor with the blockchain technology becoming the key actor. The technology in the form of prototypes (had the power to) convinced other actors to support adoption decisions. Compared to the enrolment phase the consultants changes as they became common process participants. We did not observe other changes in the roles of other remaining participants including the initiator and the R&D team, the members of the business leadership teal as well the members of the finance, product and legal team and other internal and external stakeholders such as members of the development team compared. All these actors became normal human actors who were mobilised by the non-human actor blockchain technology as the key actor to make the blockchain adoption decision.

5 Contribution and Future Research

The study makes several contributions from theoretical and practical perspectives. Its first, and its primary contribution, is the identification of a multitude of different actors who are involved in the various phases of the blockchain adoption decision process and their varying roles in the decision process. Utilising the Innovation Translation approach, the study provides an innovative approach and framework to understand the blockchain adoption process and offers an explorative view of the translation of actors' interactions and the evolvement of their roles, in particular the role of the technology itself as it actively supports the adoption decision.

Our analysis of the problematisation phase identified that a member/s of the R&D team initiate the process as the key actor while blockchain technology acts as the primary non-human actor. As the translation process progresses towards interessement, we found that the business leadership team took over as the key actor as its members held the power to align other actors to the adoption decision. Other process participants involved were internal and external stakeholders, members of the finance, product team, and legal team as well as developers and consultants. After the business teams aligned the process participants in the interessement phase, consultants took the role of the key actor in the enrolment phase based on the practical knowledge they have about use cases for organisations' possible adoption of blockchain. To provide the other process participants with some understanding of the technology, they explained its capabilities to them and involved them further by letting them vote on the practical adoption of the technology. In the final stage of mobilisation, when use case prototypes were presented to the process participants, the blockchain technology non-human actor took over the role of the key actor. Showcasing its features, the technology actively contributes to the other actors' adoption decision. The outcomes of the study provide an in-depth understanding of the interactions and change of roles among the actors throughout the process adoption decision.

From a practical perspective, the study will help potential adopters to identify the actors involved in adopting an emerging technology like blockchain in their organisations. It will

also help them to understand the importance of collaboration between internal and external stakeholders, aligning actors' perceptions of the technology and the degree of influence that each actor holds towards adoption decisions. The study underlines the overall importance of collaboration and interactions between those involved in the adoption decision process. It might thus also benefit current non adopter to revisit their decision potentially based on a lack of understanding of the technology to seek further information.

To extend the findings of this study beyond its current limitations, we suggest some future research directions. First, this study followed a qualitative approach. We suggest a future quantitative study to confirm the validity of our findings. Second, we suggest an in-depth study to explore the processes, factors and pressures that influence the actions of the actors in the several phases of the adoption decision process. Lastly, based on our framework and the innovation translation approach we suggest future research to explore the phases of the adoption decision process that tactors institute to convince and align other actors towards or against the adoption of blockchain technology in more depth and with multiple case studies.

6 Conclusion

This study set out to answer the research question: *How does the role of actors evolve in the process of a blockchain adoption decision?* As answer we propose a framework of the relevant actors for blockchain adoption decisions process by using the innovation translation approach from ANT.

The research investigates the evolvement process of actors roles through the adoption decision process. The framework identifies the actors who are involved in blockchain adoption decision, and determines their roles by exploring their interactions through the phases of translation. Our research contributes to the theoretical and practical domain of the blockchain adoption decision process and blockchain adoption and illustrates how the innovation translation approach is productive in examining the role of various actors and their strategies in adoption decisions. As such it provides a foundation for future research in the area of information technology adoption.

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