UNDERSTANDING MANAGER RESISTANCE TO BLOCK-CHAIN SYSTEMS

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Abstract

Blockchain technology has received much attention in the media and there is an increasing interest amongst organizations within financial services due to the potential benefits. As blockchain-based systems are a nascent technology, the requirements of the technology need to be understood, to allow blockchain systems to be successfully integrated within financial service organizations. There are gaps in academic research in understanding how managers evaluate the value of a blockchain-based system. This study develops a model to explain manager resistance to implementing blockchain-based systems in financial services organizations. This research advances the theoretical understanding of managers' perspectives on blockchain-based systems and models their resistance to blockchain technology.

Keywords: Blockchain, Blockchain Adoption, Manager Resistance to Blockchain-based systems

1. Introduction

Blockchain has traditionally been associated with Bitcoin; the reason being its initial conceptualisation by Satoshi Nakamoto in 2008 as the core technology behind the bitcoin cryptocurrency (Mai et al., 2018; Zhao et al., 2016). Over time, blockchain has slowly moved away from its origins as being based in cryptocurrency, to one where it is used in a variety of technologies and applications (Beck et al., 2018; Kewell and Ward, 2017). As its potential uses have increased, this has created some ambiguity in academia as to the exact definition of the concept and its applications, and questions are raised as to whether it is more financially viable than current solutions (Rimba etc al., 2018). Similarly, in industries such as financial services, there is a lack of an industry wide definition and usage, with many organisations implementing their own proprietary solutions (de Kruijff and Weigand, 2017; Holotiuk et al., 2018, b).

At a simple level, the blockchain is a new means of storing data. As its name suggests, the blockchain is a chain of blocks with each block containing transaction data (Zheng et al., 2017). The core element of the block is that the block also contains a reference to the block that precedes it; this effectively means that it is possible to trace back though all the blocks (and the transactions stored) all the way back to the first block in the chain (Beck et al., 2018). To ensure that no blocks are tampered with, thus preserving the integrity of all transactions, hashing algorithms are used to ensure that the blocks are kept secure from alterations. If the block, or any preceding block, is altered then the hash no longer represents the block and it is obvious that tampering has occurred (Swan, 2015). To ensure that the blockchain is virtually unbreakable, the blockchain is not provided and maintained by a single server. It is maintained in a large network of computers as a distributed ledger. All of these computers work together to maintain and expand the blockchain; these participating computers are often called miners and work through consensus (Xu et al., 2017).

As the technology behind blockchain has found applications outside of cryptocurrencies, it is predicted to evolve from Blockchain 1.0 for digital currency, Blockchain 2.0 for digital finance, to Blockchain 3.0 for digital society (Zhao et al., 2016). Friedlmaier et al. (2016) note that while Blockchain is being investigated across many industries, financial services is one where it's very prominently represented. Indeed, Blockchain has generated significant enthusiasm and interest in financial services (Shrier et al., 2016; Zachariadas et al., 2019). Many financial service organizations are interested in blockchain technology as they assume it may be the next big thing to revolutionize the financial services sector (Beck & Müller-Bloch, 2017; Cong and He, 2019). These organizations believe there are a multitude of benefits on offer from using a blockchain system, including more efficient processes, increases in security, privacy, reliability and speed, to name a few (Planksy et al. 2016; Beck & Müller-Bloch, 2017). As blockchain systems are gaining traction in the market as an exciting technological development, financial services companies are beginning to recognise the potential blockchain could bring about (Brenig, Schwarz & Rückeshäuser, 2016). Blockchain is viewed not as just another technology, but as the next Internet revolution (Tapscott & Tapscott, 2016). Many have begun investing in blockchain technologies, both in-house as proof-of-concepts and also indirectly through start-up investment (Walsh et al., 2016).

Despite blockchain systems disruptive potential, little is known about how blockchain systems will be diffused successfully within financial organizations (Lindman et al., 2017; Harris and Wonglimpiyarat, 2019), their impact upon people and tasks and what reasons might motivate managers in organizations to oppose adopting a blockchain technology. This study investigates what those reasons may be. New technology brings many challenges to organisations as it changes how people work and the tasks they must perform. Even before the impact of technology, change was recognised as problematic for people, as change hurts (Robbins & Finley, 1998). Resistance to change impacts on many projects and organisations, to the extent that "probably one of the key skills required of managers in today's organizations is the ability to manage change" (Cushway & Lodge, 1999, p.180). Lacity (2018) describes how beyond the technical challenges, there are "daunting management challenges" that must be overcome before blockchain's potential can be fully realised; a concern arises though when managers themselves resist change. Managers in organisations are critical to change, but their resistance to change is overlooked as a research topic (Giangreco, 2005). A. Tapscott (2016) asks who in the financial services industry will lead paradigm shift to blockchain? Leaders have traditionally been slow to embrace changes to the status quo, and reserachers (Clohessy, Acton, Godfrey, and Houston (2018); and Tveita and Borander (2018) identify how management support is crucial to the successful adoption of blockchain.

The next section reviews blockchain-based systems within the financial services sector, blockchain adoption hurdles and resistance to change literature. Specifically, the section focuses on status quo bias theory towards developing a theoretical insight on the key motivations for managers resisting change from the status quo to a blockchain-based system. This enabled the creation of a manager's resistance to blockchain model and underpinning hypotheses for testing.

2. Blockchain and resistance

In the financial services sector, large organizations are forging partnerships with blockchain consortia. Financial institutions in these consortia perceive that blockchain technologies have the potential to significantly reduce the complexity of back-office procedures, replacing legacy systems and expensive databases. Blockchain systems support quick transaction settlement and clearing, while enhancing fraud protection and anti-money laundering protection. These benefits have been the key motivators behind financial institutions investigating blockchain systems to increase efficiency and reduce costs (Baker and Werbach, 2019; Glaser, 2017; Tsai et al., 2016; Tapscott & Tapscott, 2016).

However, before blockchain systems can be incorporated within financial organizations IT infrastructure, there will need to be an integration process to ensure that blockchain-based systems can be successfully integrated within the mainstream ecosystem and enables adherence to regulatory and data protection requirements. Issues such as integration, data standardization, regulation and scalability of blockchain systems will need to be addressed before blockchain systems will have wide spread adoption within financial services (Hughes et al, 2019; Beck & Müller-Bloch, 2017; Betzwieser et al., 2019). A concern arises though where, without addressing resistance to the adoption of blockchain, integration will not succeed. Discussions on blockchain transforming the payments industry talk about blockchain's possibilities in the 'near future', yet there has not been a wide adoption of the technology (Neyer & Geva, 2017). Despite the hype around blockchain, major barriers stand in the way of its adoption (Iansiti & Lakhani, 2017).

2.1 Blockchain Adoption Hurdles

Research conducted by Kot (2019) found that there remained major roadblocks to Blockchain adoption in financial services, including scalability issues, governance, and policy shortcomings. The factors which influence the adoption of Blockchain by organisations can be broken into five dimensions – technology (e.g. Prototyping problems, efficiency, implementation, the role of IT and interplay with business), organization (e.g. integration, formal and informal exchange, cross-functional teams, and attitude), people (e.g. partnerships, distributed knowledge, mindset, need for developers), project management (e.g. Bottom-up and Top-down approaches, motivation, and responsibility) and environmental (e.g. standardization, availability of use-cases, and uncertainty) Friedrich Holotiuk and Jürgen Moormann (2018).

This aligns with earlier research done in Asia-Pacific organizations by State Street and Oxford Economics who found that there is a lack of readiness for blockchain systems (State Street, 2016)..This illustrates that there is a lack of knowledge and experience in relation to blockchain systems, particularity around the transition to blockchain systems in a financial services setting (State Street, 2016).

One of the issues preventing blockchain systems from becoming widely adopted within mainstream financial services is that the technology is deemed immature (Radanović, I., Likić, 2018) and there are certain risks that come from adopting an innovative radical technology like blockchain (Beck & Müller-Bloch, 2017). Process change will always require a new culture (Bossavit, 2002), and blockchain changes existing culture and processes as customers are going to be placing trust in the Blockchain ecosystem to secure their data and verify their electronic transactions (Crosby et al., 2016; Beck et al., 2016; Lindman, et al., 2017). Until it is widely used, there will be resistance to, even rejection of, the use of blockchain as it is such an extreme change (Mougayar, 2016). For example, Benbunan-Fich and Castellanos (2018) describe how blockchain disrupts the status quo in public services and that mechanisms to overcome resistance are needed. In addition, managers work in, or create, organisation that are hierarchical, insular, and vertically integrated; blockchain will challenge this status quo and even eliminate some managerial functions (D. Tapscott & Tapscott, 2017).

Chatfield and Reddick (2019) posit that incumbent organisations, experience a Status Quo Bias when it come to the adoption of Blockchain solutions. This is the result of technological uncertainty and issues with security and privacy. Their study focused on adoption of distributed ledger technology in central banks and determined that there is no imminent future full deployment of DLT-based platforms for the central banking core functions in high-volume and high-value payments, clearing, and settlement (Chatfield & Reddick, 2019).

The market structure in which an organization operates, as well as the nature of the firm itself may also influence the adoption of Blockchain (Zhang, 2018). Blockchain adoption has been considered more in industries with low adoption costs, such as cryptocurrencies and digital contents, as well as those with high costs of uncertainty, for example food, pharmaceutical and luxury goods. In these industries, new entrants and incumbents are more likely to develop their own Blockchain solutions. Conversely, industries such as high-tech, logistics, banking and insurance, which have high adoption costs and high product differentiation are likely to develop Blockchain as a Service platforms to serve others (Zhang, 2018).

Blockchain-based systems need to be proven as a resilient decentralized system with little to no chance of down time to increase wide scale adoption within financial organizations (Holotiuk et al, 2018). Indeed, for blockchain systems to reach widespread adoption within Financial Services, the necessary industry standards need to be developed (Holotiuk, F., F. Pisani, and J. Moormann, 2018, b; Wyman, 2016; Glaser & Bezzenberger, 2015). On one hand, government agencies potentially slow down the dissemination of blockchain systems by introducing new laws and regulation that tightly monitor the industry for compliance. On the other, increased regulation would result in a positive effect on the adoption of blockchain systems (Baker and Werbach, 2019; Peters, Panayi, & Chapelle, 2015; Crosby et al., 2016). Adoption decisions are further complicated with organisations needing to make a decision regarding which Blockchain platform to choose, with Ethereum, Hyperledger Hyperchain being just a few of the options available (Pongnumkul et al., 2017).

Scaling blockchain systems also presents a challenge for financial service players as it is very important that blockchain systems can scale efficiently as the number of transactions increase (Holotiuk et al., 2018 ; Crosby et al., 2016; Croman et al., 2016). As a blockchain system increases in size this may lead to the number of users on the network being able to verify new transactions to decrease, as they are unable to match the growth of the blockchain with the necessary resources required (Walsh et al., 2016). This may result in the system becoming more centralized and more at risk to a central point of failure or malicious attacks (Guo, 2020; Croman et al., 2016; Walsh et al., 2016).

As Blockchain technology has developed, smart contracts have become much more relevant – but also a potential inhibitor to their adoption. Smarts contracts are similar to normal contracts with the exception that they are digital; they are code stored inside the blockchain which execute when specific conditions arise (Macrinici, Cartofeanu, & Gao, 2018). The immutable nature of Smart Contract's is a barrier to their adoption in uncertain and multi-contextual environments as they do not have a mechanism to handle the varying requirements of different stakeholders (Gonzalez Rivas, Tsyganova, & Mik, 2018). Smart contracts offer many different benefits by offering customisation to applications using blockchain. There are a wide variety of uses for these smart contracts including:

- Security within 5G mobile networks (Nguyen, Pathirana, Ding, & Seneviratne, 2020)
- Managing access to IOT devices (Khan & Salah, 2018)
- Monetising the vale of IOT data (Suliman, Husain, Anououf, Alblooshi, & Salah, 2019)
- Supply chain in agriculture (Mirabelli & Solina, 2020)

These benefits should assist in their adoption, but smart contracts are not without problems (Macrinici et al., 2018). The relative infancy of the use of smart contracts, and the wide variety of programming languages (Singh, Parizi, Qi, Raymond, & Dehghantanhad, 2020), can lead to vulnerabilities which have the potential to lead to financial loss (Singh et al., 2020).

When smart contracts rely on external information then they use trusted Oracles, which provide data to the smart contracts. Example of this are seen in:

- the delivery of parcels with sensors attached to ensure that the parcel is delivered correctly and to the correct standard (Muller & Garzon, 2019)
- a decentralised access control system for data from IOT devices (Albreiki, Alqassem, Salah, Rehman, & Svetinovic, 2019)
- increasing the trustworthiness of decision making in Artificial Intelligence (Salah, Habib Ur Rehman, Nizamuddin, & Al-Fuqaha, 2019)

There are concerns though that these Oracles can become a single point-of-failures for the systems that rely on them, with the possibility of the Oracle being manipulated by a third party (Adler, Berryhill, Poulos, Veira, & Kastania, 2018), attacks which impact on their security (Albreiki et al., 2019; Dong & Boutaba, 2020), or just provide incorrect information (Murray, Kuban, Josefy, & Anderson, 2019). This is known as the "Oracle Problem" and, although researchers have suggested solutions (Singh et al., 2020), any doubts raised could impact on the potential adoption of blockchain.

The adoption of smart contracts by an organisation has also been shown to be influenced by their relational nature, a firm adopting smart contracts will bear up-front costs. These costs will only be justified if their partners are also willing to adopt, otherwise the benefits will be too small to justify the cost (Halaburda, Levina, & Semi, 2019). Additionally, unless the long-term existence of smart contracts is assured, the appeal of smart contracts will only apply to short term contracts, limiting the potential of long term adoption (Halaburda et al., 2019).

While these technical challenges exist for blockchain, there is an argument that there is too much of a focus on the technology behind the adoption of blockchain and not enough on the managers and people involved (F Holotiuk & J Moormann, 2018).

2.2 Resistance Literature

This paper contributes to understanding how managers within organizations assess change in relation to a new technology, in this case blockchain, and identifying the causes for resisting the technology. Resistance refers to forces that prevent new behaviours from taking hold in seemingly functional systems (Keen, 1981; Gibson, 2003; Jasperson, Carter, & Zmud, 2005). Understanding resistance is important for IS researchers looking to explain the non-adoption of new innovations (Jiang, Muhanna, & Klein, 2000). Blockchain technologies are nascent in large multi-national organizations. Hence, by understanding the factors influencing resistance towards it, this paper hopes to provide future research a foundation to more effectively introduce blockchain systems in years to come.

Resistance in block chain literature is usually mentioned with regard to blockchain technology's ability to resist tampering to the data in the block structure (cf. Conoscenti, Vetro, & De Martin, 2017; Muzammal & Qu, 2019) or how the blockchain's censorship-resistance ensures that information can't be altered or censored (cf. Biswas &

Muthukkumarasamy, 2016). Resistance, though, is more than a technical capability, it also refers to a refusal or unwillingness by individuals and organisations to use blockchain. Blockchain technology will force managers in the financial sector to reassess and change their management processes (Collomb & Sok, 2016). Beck and Muller-Bloch (2017) describe how resistance to blockchain in existing financial organisations needs to be overcome for the business benefits to be realised.

Studies show that resistance is a key challenge for the implementation of large technology projects (Kim & Kankanhalli, 2009). Resistance is particularly significant in such large technology implementations due to the diverse changes in social and technical systems (Gibson, 2003; Kim & Kankanhalli, 2009). While losses and threats have been noted as causes of user resistance, there are gaps in understanding the psychological and decision making mechanisms underlying resistance to a new technology system (Kim & Kankanhalli, 2009). Kim and Kankanhalli (2009) developed a model to explain resistance prior to a new system implementation by utilising the technology acceptance and resistance model literature.

The status quo bias theory (Samuelson & Zeckhauser, 1988) explains that individuals can become resistant to adopting a new technology because of their bias or preference to stay with their current technology. Status quo bias involves assessing the relative costs and benefits of switching to a new technology over their current situation and the cost incurred when adopting the new technology (Kim & Kankanhalli, 2009).

The model of resistance developed by Kim and Kankanhalli (2009) is selected to act as a theoretical foundation for this study for two reasons. Firstly, the individual-based view of resistance resonates with this study's focus on managers within Financial Services. Secondly, the rational view of resistance presented by Kim and Kankanhalli assumes that an individual's resistance is, at least partially, concerned with the accomplishment of specific goals (Gleasure, 2015).

3. Material and methods

In order to enhance our understanding of manager resistance to blockchain-based systems, a mixed-method approach is required (Creswell & Clark, 2007). This approach is sequential and quantitative-dominant (Johnson et al., 2007). Such an approach will (i) facilitate refinement of the conceptual model and the creation of additional hypotheses via interviews with Financial Services professionals (ii) test the hypotheses via a survey and (iii) establish a model of manager resistance to blockchain-based systems. The participants of both the qualitative and quantitative components of this research were asked questions in relation to the perceived benefits and costs of changing some of their current systems to blockchain-based systems.

3.1 Preliminary Qualitative Study

Preliminary qualitative analysis focused on the attitudes of senior managers in Financial Service towards migrating from existing systems to blockchain-based alternatives to understand the factors which impact upon the operational adoption of Blockchain-based systems within the Financial Services sector. The aim of the preliminary qualitative analysis was to identify additional constructs and relationships of organizational managers/influencers attitudes towards the adoption of blockchain. Semi-structured interviews were conducted with five senior Financial Services managers from three organisations in the financial services industry (table 1)for a total of seven hours to gauge their individual experience and perceptions of blockchain-based systems.These interviewees were selected as their organisations were heavily involved in exploring Blockchain technologies within the financial services industry and their seniority meant that they were pivotal to the conversations taking place within their respective organisations.

Position	Length
Chief Data Scientist	1.5 hrs
Chief Technology Architect	1.5 hrs
Managing Director	1 hr
Head of Consultancy Services Group	2 hrs
Senior Vice President	1 hr

Table 1: Interviewee Position

Thematic analysis (Braun & Clark, 2006) was used to analyze data. The goal of thematic analysis is to identify key themes i.e. emerging patterns that are important and interesting. Open, axial and selective coding (Strauss and Corbin, 1990) were the coding methods used to analyse the transcribed interview transcripts.

The first theme identified was that the perceived ability to simplify infrastructure impacts resistance to blockchain-based systems. This theme is multifaceted, as on one hand it is perceived that blockchain-based systems could simplify your current infrastructure, as the Chief Data Scientist mentioned “(blockchain) could be used as a single source of truth”. While a blockchain provides a mechanism for trusted immutable transactions, the Chief Technology Architect spoke of how it also provides organizations with a “better way to track and manage data … there is a data trail from inception and complete tracking” on a blockchain. As some blockchain-based systems offer smart contract capabilities, there is the potential to automate certain business processes. The Chief Data Scientist described this as an “opportunity for (organizations) to offer new services”. All of these factors were grouped together as simplicity of infrastructure, describing some of the benefits a blockchain can provide.

The second theme was the perceived requirement for additional infrastructure to support a blockchain-based system. There was a perception of a large knowledge gap between organizations and their understanding of blockchain technologies. Interviewees felt that right now there are far too few developers with the necessary blockchain education and experience. A significant point mentioned by the Senior Vice President was “not only is there an importance to educating the business but also to educate the public … by educating the right people at the right time, so not to scare or overwhelm employees and the public with a new technology”. The Head of the Consulting Services Group mentioned the importance of educating the regulator, “The issue with the regulators is that their primary objective is to regulate not innovate”. There also needs to be an increase in investment into the necessary hardware and software in order to create and support blockchain-based systems. It takes time and resources from organizations to provide the necessary infrastructure for blockchain-based systems, which is bound in this study as perceived need for new infrastructure.

The third emerging theme was the importance of the organizations environment as a whole. There is a need for a change in culture as Blockchain-based systems demand a change in thinking. The Chief Technology Architect said “moving from stable legacy systems to new blockchain-based systems would require a shift in understanding how you could do business”. Similar concerns were directed towards the mindset of regulators, who are perceived to be influential actors by organizations. Having the correct standards and regulations in place is therefore key to the adoption of Blockchain-based systems in financial organizations. Regulation and compliance is a big cost for financial organizations, the Head of the Consultancy Services Group felt “if this cost could be minimized by the use of a blockchain”, this would really drive down resistance to said systems. A point reiterated in the interviews is that banks are traditionally restricted when it comes to innovative technologies like blockchain, because of compliance and risk considerations. As a means to overcome this restriction, the Managing Director mentioned how their organization “are creating different partnerships with parties who have much more freedom to work with disruptive technology”. This is perceived to mean that traditional financial service organizations are evolving to be more open to new partnerships with emerging Fintechs. Traditionally a banking environment is a closed and protected environment, hence opting to join a consortium or working with different partnerships represents significant departure from traditional practices. These emerging factors were grouped into the environmental support construct.

3.2 Developing a conceptual model

The preliminary qualitative study established the importance of having the correct blockchain infrastructure and environment in place. Towards developing an understanding of potential resistance to blockchain adoption, the researchers leverage these emerging themes from the qualitative data alongside Kim and Kankanhallis’ established theoretical model towards developing a Blockchain Resistance model and associated hypotheses for testing (Figure 1). Table 2 defines the Blockchain Resistance Models constructs.

Construct	Definition
Individual resistance	The extent to which an individual is resistant to a blockchain implementation
Perceived value	The perceived benefits an individual will enjoy relative to the cost of implementing a new blockchain system
Perceived switching costs	The adverse effects an individual would experience when switching from the status quo to a blockchain technology

Perceived need for new infrastructure	Additional infrastructure required to support blockchain technologies in an organization in terms of hardware, software, new applications and personnel with blockchain knowledge and experience
Perceived switching benefits	The strategic benefits perceived by an individual in relation to blockchain technologies
Simplicity of infrastructureure	The benefits following switching from the status quo to a blockchain, including a reduction of infrastructure in terms of automated business process via smart contracts and a simplified ecosystem using a single distributed ledger
Self-efficacy for change	The confidence an individual has in their ability to adapt to a new way of working with a blockchain
Organizational support	The level of support within an organization in relation to blockchain technologies
Environmental support	The level of support shown by both regulatory bodies an organisation which can be a deciding factor when changing from the status quo to a blockchain-based system

Table 2. Model Constructs

Kim and Kankanhalli (2009) describe perceived value as the benefits relative to cost that a user may attain from switching from the status quo to a new blockchain system. Gleasure (2015) described perceived value as an individual's perception of the total benefits of adopting a new technology which is influenced by the switching benefits and switching costs of the new technology. If a manager's perceived value of blockchain technology is low, they are likely to have a greater resistance to change, whereas if the perceived value is high, managers will have a lower resistance to a blockchain implementation.

H1. *Perceived value of blockchain has a negative effect on manager resistance to blockchain*

Two constructs emerge which influence the perceived value of blockchain technologies. The first construct is *perceived switching costs of blockchain,* which indicates the adverse effects associated with switching from the status quo to a new blockchain system (Chen & Hitt, 2002). This includes the unexpected hassle and complex procedures of moving to a new implementation and the difficulty for employees to understand the new system

(Jones, Mothersbaugh, & Beatty, 2000). The factors mentioned above are perhaps important determinants of a manager increasing their resistance to using a blockchain system.

H2. *Perceived switching costs of blockchain has a positive effect on manager resistance*

Perceived switching costs not only has a direct effect on user resistance but also could have an indirect effect on resistance through perceived value. Higher switching costs would result in a decrease of benefits perceived by a manager; they may think it is not worthwhile changing from the status quo to a new blockchain-based system (Kim & Kankanhalli, 2009).

H3. *Perceived switching costs have a negative effect on perceived value*

Perceived need for new infrastructure appeared as an additional construct, which has an effect on the perceived switching cost and perceived value of a blockchain. This relates to the additional infrastructure required to implement and maintain a blockchain, including necessary hardware and software, development and maintenance of new blockchain specific applications and the necessary personnel with blockchain experience and knowledge (Back et al., 2014; Brenig, Schwarz & Rückeshäuser, 2016; Holotiuk, Pisani & Moormann, 2017). As the need for additional infrastructure rises, this will have a positive effect on perceived switching costs and perceived value as managers will conclude a new blockchain system will be more expensive than the status quo.

H4. *Perceived need for new infrastructure will have a positive effect on perceived switching costs of blockchain*

H5. *Perceived need for new infrastructure will have a positive effect on perceived value of blockchain*

The perceived switching benefits of blockchain refers to the value created if an organization switches from the status quo to a new blockchain technology (Chen & Hitt, 2002; Kim & Kankanhalli, 2009). Perceived benefits reflect an individual's belief that the use of a blockchain-based system, will result in both direct and indirect positive outcomes. Several blockchain benefits on offer for an organization include increased transparency, lower transaction costs, immutable and amend only records and disintermediation (Peters & Panayi, 2015; Abramova & Böhme, 2016). Higher perceived switching benefits would increase the perceived value of changing to a blockchain.

H6. *Perceived switching benefits of blockchain will have a positive effect on perceived value.*

Simplicity of infrastructure was identified as a contributor to the perceived value and perceived switching benefits of a blockchain-based system. This relates to the advantages a blockchain can provide to organizations. Once a blockchain system has been deployed, some of the resulting benefits include less time to complete transactions and reduced transaction fees (Wörner et al., 2016; Abramova & Böhme, 2016; Fabian & Sander, 2016). By the use of smart contracts, a blockchain can help automate certain business processes, which could make certain tasks much easier for users (Peters & Panayi, 2015; Beck et al., 2016). A blockchain can also provide increased transparency and immutability of data, allowing for new lenses for audits and regulatory requirements (Walsh et al., 2016; Wörner et al., 2016). As the number of blockchain advantages increases, this will have a positive effect on perceived switching benefits and perceived value as users will know what results can be achieved from a blockchain.

H7. *Simplicity of infrastructure will have a positive effect on perceived switching benefits*

H8. *Simplicity of infrastructure will have a positive effect on perceived value*

Self-efficacy for change described by Bandura (1997), as a user's confidence in their ability to adapt to a new way of working with a new system. Individuals who have a high level of self-efficacy will face new challenges with confidence, whereas those with low levels of self-efficacy will feel discouraged and more likely to resist the change to a new blockchain, therefore resulting in resisting the change to a blockchain.

H9. *Self-efficacy for change has a negative effect on manager resistance to blockchain*

Self-efficacy for change can also affect perceived switching costs of blockchain. If individuals have high levels of self-efficacy, they will experience less uncertainty regarding the change to a new blockchain. They may feel confident in learning new skills and feel prepared to use the new technology (Bandura, 1997). This will result in individuals having a lower perception of switching costs as they have self-belief that they will be capable of working with a blockchain.

H10. *Self-efficacy for change has a negative effect on perceived switching costs*

Organizational support for change to a new blockchain system is defined as the backing provided by an organization to make adapting to a blockchain technology easier. Changing from the status quo requires guidance and direction from management to make facilitating the change easier for employees (Kim & Kankanhalli, 2009). In the context of this study, organizations need to understand the strategic importance of implementing a blockchain but also that senior management is supportive of the development of new systems by providing learning resources for employees (Plansky et al., 2016). As the level of organization's support for blockchain technologies increases, this will result in employees feeling supported and if clear leadership is shown by senior management, managers will be less resistant to the implementation of a blockchain. An additional hypothesis to Kim and Kankanhalli's original model is that organizational support may also indirectly, through self-efficacy, have an effect on manager resistance. This is understood as the more support an organization shows, the more managers will feel capable of switching to a Blockchain-based system.

H11. *Organizational support for change has a negative effect on manager resistance*

H12. *Organizational support for change has a positive effect on self-efficacy*

Environmental support is an additional construct identified from the qualitative analysis. Systems can be well established in organizations and deciding to move to a new implementation can require a fundamentally different way of thinking. The key themes that appeared in relation to this construct is that a huge paradigm shift is required to implement a blockchain, as this is a new way of doing business. Regulatory support and governmental opinion is considered high when deciding to implement a new technology (Glaser & Bezzenberger, 2015; Abramova & Böhme, 2016). If the appropriate regulations and standards are in place and the regulator shows support towards blockchain technology, this would directly drive down manager resistance and also indirectly through perceived value.

H13. *Environmental support has a negative effect on manager resistance of blockchain*

H14. *Environmental support has a negative effect on perceived value of blockchain*

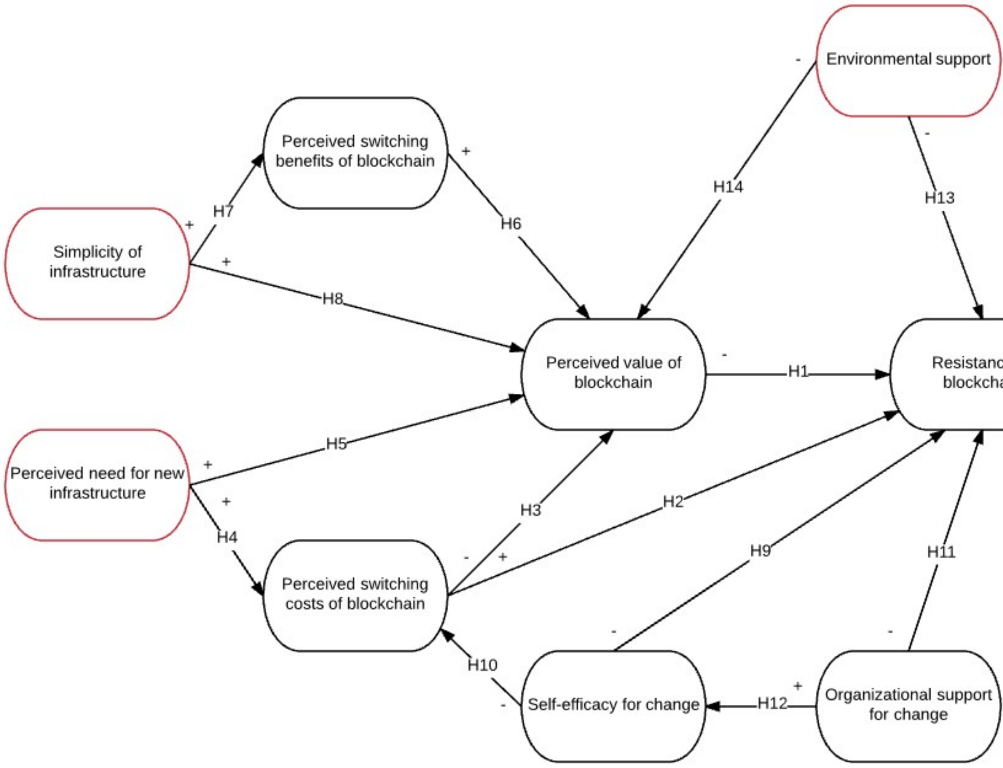


Figure 1. *Blockchain Resistance Model*

3.3 Quantitatively Testing the Model

Towards operationalizing the model in Figure 1 and testing the hypotheses, an online survey instrument was developed. The survey questionnaire was constructed using the indicators adopted from the literature to develop survey questions for the quantitative data-collection phase. The construct indicators along with their associated survey statements are depicted in Table 3. Following the generation of an initial iteration of the instrument as per Hair et al. (2006), the authors pre-tested the instrument with academic and industry "experts" in order to assess the semantic content of each construct. The authors retained those items that best fitted and reflected the definitions of the constructs, a process that facilitated the refinement and streamlining of the items included in this survey.

Data was gathered over a four-month period from November 2016 to February 2017 from Financial Services organizations. The survey was distributed via email (an anonymous URL link) to Financial Services managers. The survey was distributed to three different Financial Services organizations, specifically State Street, Fexco and Dell Financial Services. These three organizations were purposely selected as they met the criteria of having implemented, or being at an advanced stage of implementing, a Blockchain based system. Invitations were sent to 400 managers in these three organizations. This facilitated testing the legitimacy, explanatory power, and statistical generalizability of the proposed model (Marshall & Rossman, 1989; Yin, 1994, Venkatesh et al., 2013) and collecting data from managers in three organisations helped ensure representativeness.

Due to the sample size the author employed the Partial Least Square [PLS] (Structural Equation Modelling [SEM]) approach for data analysis purposes, which uses component-based estimations and allows simultaneous examination of two models, the measurement (outer) model and structural (inner) model. The outer model portrays the relationship between a construct and its associated indicators whereas the inner model identifies relationships between constructs (Tenenhaus et al., 2005; Diamantopoulos & Siguaw, 2006). SmartPLS (version 3.2.6) was utilized to generate the statistical outputs associated with the survey data.

Construct		Indicators	Survey Statements	Reference
Individual resistance	UR	ur1	I would oppose changing some of the systems I currently use for blockchain-based systems	Kim & Kankanhalli (2009)
		ur2	I do not agree with changing some of the systems I currently use for blockchain-based systems	
		ur3	I would not cooperate with changing some of the systems I currently use for blockchain-based systems	

		ur4	I would not comply with changing some of the systems I currently use for blockchain-based systems	
Perceived value	PV	pv1	Considering the time and effort that I have to spend executing tasks using current practices, changing some of the systems I currently use for blockchain-based systems is worthwhile	Kim & Kankanhalli (2009)
		removed	Considering the loss that I will incur, changing some of the systems I currently use for blockchain-based systems is good value	
		pv3	Considering the hassle that I will have to experience, changing some of the systems I currently use for blockchain-based systems will be beneficial to me	
Perceived switching benefits of blockchain	PB	pb1	Changing some of the systems I currently use for blockchain-based systems would enhance my effectiveness on the job in comparison to working in the current way	Kim & Kankanhalli (2009)
		pb2	Changing some of the systems I currently use for blockchain-based systems would enable me to accomplish relevant tasks more quickly than working in the current way	
		removed	Changing some of the systems I currently use for blockchain-based systems would increase my productivity in comparison to working in the current way	
		removed	Changing some of the systems I currently use for blockchain-based systems would improve the quality of the work I do compared to working in the current way	

Simplicity of in-frastructure	SI	si1	Using a blockchain system would result in reduced running costs	
		removed	Using a blockchain system would allow me to auto-mate business processes	
		si3	Using a blockchain system would make the infrastruc-ture simpler for me to use	
		si4	Using a blockchain system would provide me with better ability to track and manage data	
Perceived switch-ing costs of blockchain	PC	pc1	It would take a lot of time and effort to switch the sys-tems I currently use for blockchain-based systems	Kim & Kankanhalli (2009)
		pc2	Switching the systems I currently use for blockchain-based systems could result in unexpected hassles	
		pc3	I have already put a lot of time and effort into master-ing the systems I use today	
		removed	I would lose a lot of my work if I were to switch the systems I currently use for blockchain-based systems	
Perceived need for new infra-structure	PI	removed	An increase in the amount of hardware and software would be required to support new blockchain-based systems	
		removed	An increased number of blockchain specific applica-tions needs to be created	
		pi3	There would be a demand for an increased number of personnel required to manage new blockchain applica-tions	
		pi4	My organization would need to increase the number of personnel with blockchain knowledge and experience	

Self-efficacy for change	SE	se1	Based on my own knowledge, skills and abilities, changing the systems I currently use for blockchain-based systems would be easy for me	Kim & Kankanhalli (2009)
		se2	I would be able to change the system I currently use for blockchain-based systems without the help of others	
		se3	I would be able to change the systems I currently use for blockchain-based systems reasonably well on my own	
Organizational support	OS	os1	I feel my organization would provide me with guidance on how to change the systems I currently use for blockchain-based systems	Kim & Kankanhalli (2009)
		os2	I feel management would provide the necessary help and resources to enable me to change the systems I currently use for blockchain-based systems	
		os3	I feel I would be given the necessary support and assistance by the company to change the systems I currently use for blockchain-based systems	
Environmental Support	ES	removed	Using blockchain-based systems would involve a huge paradigm shift	
		es2	Were my organization to adopt and implement blockchain-based systems the influence from regulatory bodies would be significant factor	
		es3	Using blockchain-based systems would call for a fundamentally different way of thinking	

Table 3. Items and Survey Statements

4. Quantitative Results

This section describes the findings from the quantitative components of our mixed methods research.

4.1 Respondent profiles

As outlined earlier, the respondents were Financial Services professionals, holding a minimum rank of manager. The survey was completely anonymous and did not ask for any sensitive information. The respondents were asked to identify the department/discipline they belonged to (i.e. business or IT function) and their level of blockchain knowledge. The online survey had 123 responses, resulting in 90 complete and valid responses. 90 responses is sufficient to get reliable PLS results. It satisfies an accepted "10 times" rule of thumb, that states the minimum sample size as 10 times the most complex relationships within the research model (Chin, 1998).

4.2 Hypothesis and model testing

The reliability of items was evaluated by examining the Composite Reliability (CR), which is typically superior to Cronbach's Alpha for PLS modelling studies (Gefen & Straub, 2005). Table 4 shows that the CR of each construct is greater than 0.7, which is the accepted threshold for construct reliability (Bagozzi & Yi, 1988). Average Variance Extracted (AVE) was used to test convergent validity (Table 4), for which all constructs scored above the accepted threshold of 0.6 (Chin, 1998). Discriminant validity was assessed following the Fornell and Larcker (1981) approach whereby the square root of the AVE of each latent variable must be greater than correlations among the latent variables (see Table 5).

Construct	Composite Reliability (CR)	Average Variance Extracted (AVE)
Perceived need for new infrastructure (PI)	0.844	0.732
Environmental support (ES)	0.781	0.641
Organisational support for change (OS)	0.951	0.867
Perceived switching benefits (PB)	0.916	0.846
Perceived switching costs (PS)	0.769	0.525
Perceived value of blockchain (PV)	0.948	0.901
Self-efficacy for change (SE)	0.923	0.801
Simplicity of infrastructure (SI)	0.879	0.708
Individual resistance to blockchain (UR)	0.920	0.743

Table 4. Internal Consistency Reliability Test

	PI	ES	OS	PB	PC	PV	SE	SI	UR
PI	0.856								
ES	0.372	0.801							
OS	0.194	0.141	0.931						
PB	0.059	0.354	0.221	0.920					
PC	0.581	0.409	0.146	0.050	0.725				
PV	0.112	0.181	0.304	0.602	-0.002	0.949			
SE	0.023	0.016	0.308	0.353	0.046	0.358	0.895		
SI	0.111	0.414	0.293	0.707	-0.026	0.683	0.310	0.841	
UR	-0.278	-0.312	-0.384	-0.291	-0.208	-0.406	-0.135	-0.421	0.862

Table 5. Fornell-Larcker criterion analysis for checking discriminant validity

The authors also tested discriminant validity by examining the cross-loadings of items across constructs. Table 6 shows that each item loads at 0.707 or higher on the target construct, with no items coming within 0.2 of the items loading on separate constructs (Bagozzi & Yi, 1988; Gefen & Straub, 2005). These results suggest each of the indicators retained in the final theoretical model are reliable and valid.

	PI	ES	OS	PB	PC	PV	SE	SI	UR
pi3	0.774	0.226	0.147	0.062	0.353	0.034	0.067	0.068	-0.1
pi4	0.931	0.382	0.182	0.045	0.596	0.135	-0.007	0.114	-0.326
es2	0.144	0.798	0.223	0.359	0.239	0.185	0.061	0.439	-0.225
es3	0.45	0.803	0.004	0.209	0.416	0.105	-0.035	0.226	-0.275
os1	0.159	0.166	0.937	0.266	0.118	0.364	0.278	0.347	-0.407
os2	0.21	0.064	0.913	0.132	0.17	0.192	0.267	0.194	-0.325
os3	0.176	0.155	0.942	0.209	0.123	0.28	0.316	0.265	-0.335
pb3	0.01	0.273	0.167	0.910	-0.006	0.538	0.245	0.596	-0.22
pb4	0.093	0.373	0.236	0.929	0.093	0.568	0.395	0.7	-0.311
pc1	0.408	0.381	0.015	0.007	0.707	0.022	-0.157	0.042	-0.14
pc2	0.333	0.25	0.017	-0.173	0.733	-0.242	-0.195	-0.201	-0.038
pc3	0.49	0.256	0.241	0.2	0.734	0.143	0.179	0.144	-0.235
pv1	0.03	0.16	0.195	0.629	-0.072	0.952	0.355	0.688	-0.35
pv3	0.188	0.183	0.387	0.511	0.079	0.946	0.325	0.605	-0.422
se1	0.038	0.054	0.326	0.303	0.012	0.360	0.918	0.324	-0.087
se2	-0.086	0.046	0.115	0.324	-0.089	0.214	0.810	0.215	-0.118
se3	0.055	-0.036	0.315	0.336	-0.07	0.347	0.951	0.275	-0.158
si1	0.192	0.414	0.28	0.669	0.1	0.593	0.342	0.841	-0.444
si3	0.01	0.274	0.215	0.516	-0.106	0.527	0.208	0.823	-0.266

si4	0.062	0.345	0.239	0.587	0.052	0.597	0.222	0.859	-0.338
us1	-0.254	-0.282	-0.288	-0.189	-0.1	-0.329	-0.198	-0.356	0.878
us2	-0.188	-0.217	-0.298	-0.352	-0.062	-0.318	-0.261	-0.401	0.797
us3	-0.269	-0.324	-0.357	-0.246	-0.309	-0.358	0.056	-0.305	0.848
us4	-0.24	-0.241	-0.367	-0.234	-0.198	-0.385	-0.127	-0.407	0.921

Table 6. Cross Loadings

Following the validation of the outer model, the inner model was tested via bootstrapping (Davison & Hinkley, 1997; Hair et al., 2014). Significant relationships were observed between *simplicity of infrastructure* and *perceived value of blockchain*, *simplicity of infrastructure* and *perceived switching benefits of blockchain*, *perceived need for new infrastructure* and *perceived switching costs of blockchain* and *organisational support for change and self-efficacy for change (*see Figure 2 and Table 7).

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Perceived need for new infrastructure -> Perceived switching costs of blockchain ***	0.582	0.572	0.091	6.396	<.001
Perceived need for new infrastructure -> Perceived value of blockchain	0.112	0.11	0.075	1.493	0.136
Environmental support -> Perceived value of blockchain*	-0.178	-0.154	0.089	1.994	0.047
Environmental support -> Individual resistance to blockchain	-0.182	-0.179	0.117	1.557	0.121
Organisational support for change -> Self-efficacy for change ***	0.308	0.313	0.095	3.248	<.001
Organisational support for change -> Individual resistance to blockchain **	-0.268	-0.251	0.104	2.59	0.01

Perceived switching benefits of blockchain -> Perceived value of blockchain *	0.266	0.249	0.107	2.483	0.014
Perceived switching costs of blockchain -> Perceived value of blockchain	-0.019	-0.025	0.089	0.21	0.834
Perceived switching costs of blockchain -> Individual resistance to blockchain	-0.092	-0.106	0.107	0.857	0.392
Perceived value of blockchain -> Individual resistance to blockchain *	-0.312	-0.316	0.141	2.213	0.028
Self-efficacy for change -> Perceived switching costs of blockchain	-0.059	-0.06	0.13	0.458	0.647
Self-efficacy for change -> Individual resistance to blockchain	0.058	0.036	0.109	0.532	0.595
Simplicity of infrastructure -> Perceived switching benefits of blockchain ***	0.707	0.707	0.074	9.573	<.001
Simplicity of infrastructure -> Perceived value of blockchain ***	0.556	0.557	0.099	5.628	<.001

Table 7. Results of bootstrapping inner model

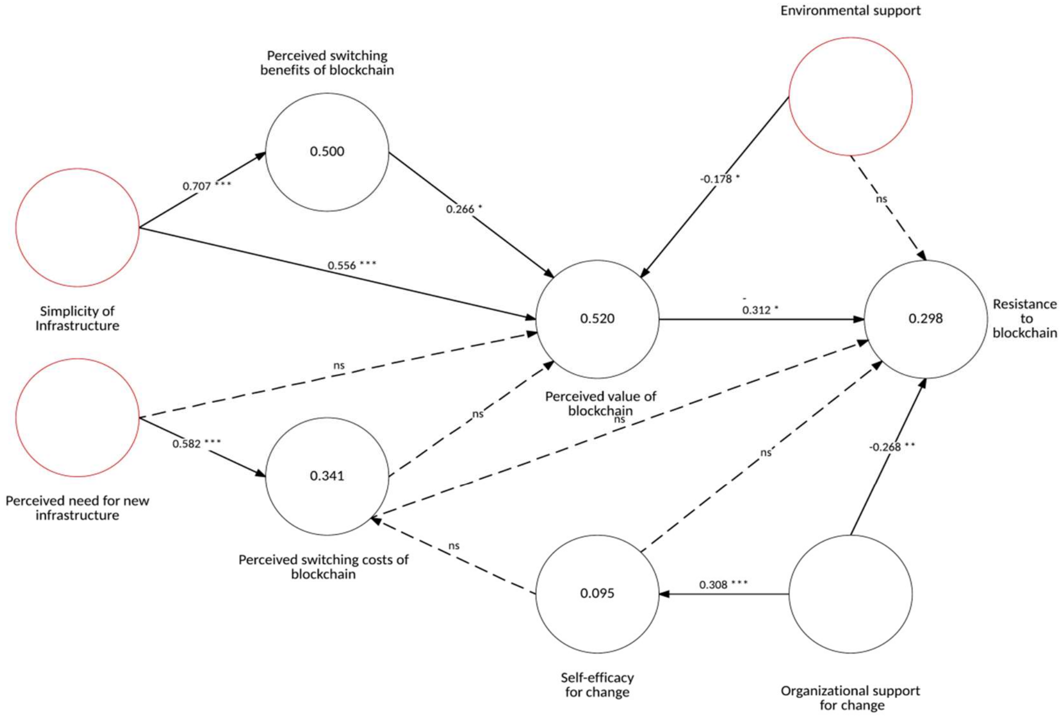
Table 8 demonstrates that 8 of the 14 research hypotheses were supported by the findings of our model estimation and data analysis in this study.

Hypotheses	Outcome	Values
H1. Perceived value of blockchain has a negative effect on individual resistance to blockchain	Supported	-0.312
H2. Perceived switching costs of blockchain has a positive effect on manager resistance	(ns)	-
H3. Perceived switching costs have a negative effect on perceived value	(ns)	-

H4. Perceived need for new infrastructure will have a positive effect on perceived switching costs of blockchain	Supported	0.582
H5. Perceived need for new infrastructure will have a positive effect on perceived value of blockchain	(ns)	-
H6. Perceived switching benefits of blockchain will have a positive effect on perceived value	Supported	0.266
H7. Simplicity of infrastructure will have a positive effect on perceived switching benefits	Supported	0.707
H8. Simplicity of infrastructure will have a positive effect on perceived value	Supported	0.556
H9. Self-efficacy for change has a negative effect on manager resistance to blockchain	(ns)	-
H10. Self-efficacy for change has a negative effect on perceived switching costs	(ns)	-
H11. Organizational support for change has a negative effect on manager resistance	Supported	-0.268
H12. Organizational support for change has a positive effect on self-efficacy	Supported	0.308
H13. Environmental support has a negative effect on manager resistance of blockchain	(ns)	-
H14. Environmental support has a negative effect on perceived value of blockchain	Supported	-0.178

Table 8. Hypothesis

PLS path modelling suggests the overall level of explained variance of the dependent construct *Resistance to Blockchain* is 29.8% (see Figure 2). Resistance was explained at the high end of the weak level consistent with Chin's (1998) criteria (i.e. 0.19 – 0.33). The results indicated that perceived value (H1), self-efficacy (H9) organisational support (H11) and environmental support (H13) had significant effects on resistance, explaining 29.8% of its variance. Switching costs (H3), perceived need for new infrastructure (H5), switching benefits (H6) and simplicity of infrastructure (H8) had a significant effect on perceived value, explaining 52% of its variance. However, switching benefits (H6) and simplicity of infrastructure (H8) have a much higher weighting on perceived value compared to switching costs (H3) and perceived need for new infrastructure (H5). Perceived need for new infrastructure had a significant impact (H4) on switching costs and simplicity of infrastructure (H7) affected switching benefits, respectively explaining 58.2% and 70.7% of its variance.



***p < 0.001, **p < 0.01, *p < 0.05 (Based on t(299[1]), two-tailed test).

Figure 2. PLS Algorithm of Measurement and Structural Models

5. Discussion

Blockchain-based systems provide a multitude of benefits with decentralization at the core. In a distributed decentralized system, the requirement for a central authority to control the system can become obsolete. This can result in benefits such as faster transaction speeds compared to other alternatives and transaction irreversibility (Zohar,

[1] The t-test for each path coefficient was conducted with 299 degrees of freedom, where is a number of subsample repetitions in bootstrapping procedure. 300 repetitions were chosen resulting 299 is degrees of freedom.

2015; Abramova & Böhme, 2016). Blockchain-based systems also have the potential to create a simpler infrastructure and bypass the role of traditional financial intermediaries (Gao, Clark & Lindqvist, 2015; Yee, 2014). This study highlights the importance of this potential for a simplification of infrastructure in determining manager resistance. This simplicity reduces manager resistance indirectly through both switching benefits and perceived value of blockchain.

A surprising finding from this study is that perceived switching costs didn't appear to impact manager resistance to blockchain-based systems (H2). This contradicts the general model proposed by Kim and Kankanhalli. More fundamentally, it appears to jar with the underlying theory of reasoned action and planned behaviour at the heart of that model, as it suggests that costs are not being factored into decision-making at an individual-level. The researchers interpret this as a reflection of the confidence many people have in Blockchain-based systems, i.e. they believe the benefits will outweigh the costs, hence are presently only interested in figuring out what those benefits may be. An alternative may be that managers are simply not aware of the costs, meaning they are omitting them unknowingly. However, this alternative explanation is challenged by the observation that the perceived need for new infrastructure had a significant effect on perceived switching costs (H4). This finding extends previous research suggesting there is a knowledge gap in relation to blockchain and a need for more blockchain education (Kursh & Gold, 2016; Holotiuk, Pisani & Moormann, 2017).

Analysis also showed that environmental support decreases manager resistance both directly and indirectly through its effect on perceived value. In particular, this study highlights the importance of the regulator - a finding consistent with prior literature (Bohr & Bashir, 2014; Grant & Hogan, 2015; Grinberg, 2011; Reid & Harrigan, 2011). There is no evidence of a universal standard or regulation in place regarding the storage and transmission of data in blockchain-based systems. This absence of said standards and regulatory backing creates a perceived risk associated with blockchain-based systems that undermines adoption (Abramova & Böhme, 2016). Numerous financial organizations and regulators are currently coming together to explore blockchain standards towards potentially improving adoption levels (Brenig, Schwarz & Rückeshäuser, 2016), e.g. the European Central Bank, New York State Department of Financial Services, and the Bank of England, to name a few . Yet, the outcome of such efforts remains uncertain.

Another surprising finding was that self-efficacy (H10) was not found to decrease resistance. Rather, it actually seemed to have a small positive effect, explaining 5.8% of its variance. The general model proposed by Kim and Kankanhalli's (2009) suggested the impact of self-efficacy on resistance may be trivial or non-existent. However, the idea that it could actually increase resistance is curious. The most compelling explanation is that the introduction of blockchain-based systems is not seen as something within the capabilities of most individuals. Hence, those individuals with low self-efficacy do not see themselves as having the expertise to resist a blockchain-based system, assuming instead they will adopt it by default. Alternatively, those with more specialised knowledge are more likely to be considered and reflective in their adoption of specific systems, thereby more likely to become resistant.

6. Conclusions

This paper presents one of the few published studies looking at individual's perceptions of blockchain-based systems and one of the first focusing on financial services professionals' perspectives on the adoption of Blockchain based systems in mainstream financial services. Most existing studies look specifically at the Bitcoin community (Bohr & Bashir, 2014), country specific adoption of Bitcoin (Kumpajaya & Dhewanto, 2015) and more recently the perceived benefit and risk of Bitcoin (Abramova & Böhme, 2016). This study took a deliberately abstract view of blockchain to represent the larger and more domain-spanning implications of this radically new technological paradigm. A study by Beck and Müller-Bloch (2017) established that radical innovations similar to Blockchain will only be adopted once resistance is overcome and once the organization sees value in adopting such a system.

Christensen (1997) noted that disruptive innovation consists of three principal components:

1. In many industries, the pace of technological progress outstrips customer's demands for high performing technologies. As a result, incumbents can over serve the market producing more advanced, feature-rich products than customers need.

2. New disruptive innovations, when initially introduced are inferior to incumbent products on accepted performance dimensions.

3. Existing customers and established profit models constrain established firm’s investments in new innovations.

Blockchain technology has long been described as a disruptive technology (Noker et al., 2017), since it’s beginning as an enabler for Bitcoin.

The focus of the paper is very much from the perspective of individual managers within organisations who would be using the Blockchain based systems for their daily roles. Christensen’s principal that disruptive technologies are inferior to incumbent products on accepted performance dimensions (e.g. security, scalability) holds through in the context of Blockchain and hence provides an additional perspective on organisation’s resistance to Blockchain. It also illustrates that for any emerging disruptive technology, it must perform on a par with existing technology to be broadly adopted by incumbents.

While Christensen (1997) states that established profit models constrain established firms investments in new innovations, our findings reveal that this does not appear to be an issue for Blockchain. One can surmise that the reason for this is the potential benefits, such as reduced costs and improved transparency that Blockchain can potentially enable. Hence, there is very significant demand for such benefits among stakeholders.

One can extend this principle to other disruptive technologies. In cases where the potential benefits clearly outweigh the adoption costs, financial considerations are not an impediment to adoption.

It’s clear that incumbents are motivated to adopt disruptive technologies in cases where they believe that failure to do so could significantly lead to significant market and business model disruption for them. Critically, it is clear that there needs to be significant trust, both in a human and technological context, in any emergent technology..

The findings of this study were similar to resistant to other technologies, e.g. the focus on value and support (Joshi, 1991; Keen 1981; Krovi 1993; Martinko, Zmud & Henry, 1996). However, our results suggest many of the issues impacting on resistance to blockchain-based systems remain elusive. Even with the addition of new blockchain-specific constructs, the explanatory power of the new model proposed in this study was modest. This is an important finding in and of itself, as it shows the uncertainty around blockchain amongst financial services professionals and how/why it may be introduced.

Despite this modest explanatory power, important insights emerged with implications for practice. First, the perceived benefits have a significant effect on reducing manager resistance. This suggests the lack of blockchain knowledge is currently an issue for organizations, who will be required to capture new talent and up-skill employees for them to understand the benefits. This is likely to take time and resources but appears nonetheless to be a vital step if blockchain-based systems are to take hold within organizations. Moreover, it is crucial for organizations to show support and commitment to blockchain-based systems by providing the necessary resources and training for employees to get up to speed and understand the technology. Finally, the perceived support of the surrounding environment plays an important role. This suggests suitable communication lines must be open between governing bodies and organizations to discuss the future of blockchain-based systems. A high level of support externally from regulatory bodies and internally within an organization, could potentially be a factor to drive down user resistance. Therefore, these findings offer organizations suggestions for managing resistance to blockchain-based systems, with the aim of increasing user adoption to blockchain-based systems.

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