

Blockchain Technology Adoption in Saudi Hospitals: IT Professionals' Perspectives

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Abstract

While blockchain is an emerging technology that has exponential interest, the literature shows limited real-world examples of blockchain applications that have been applied in developed countries and there is no evidence of its adoption in Middle Eastern hospitals, especially in Saudi Arabia. Before adopting any new technology, it is necessary to know the extent of user acceptance of the technology. This study will investigate the factors that influence the adoption of blockchain technology in Saudi hospitals. The aim of this study is to develop a framework for blockchain decision-making in hospitals to provide a systematic approach to blockchain adoption that takes different perspectives into consideration. The framework developed is based on Technology-Organisation-Environment (TOE) framework and seeks to help healthcare decision-makers by covering three categories of blockchain adoption: technological, organisational and environmental. The implications of this study will contribute to both theory and practice.

Keywords: Blockchain, Adoption, Acceptance, TOE framework.

Introduction

Blockchain is simply a time-stamped group of immutable data records that is handled through a group of computers that are not owned by a central authority (Sharples and Domingue 2016). Cryptographic principles are used to provide security to these blocks of data (i.e. block) and to keep them bound to one another (i.e. chain) (Swan 2015). Healthcare is one industry that can gain significant benefits from blockchain technology. There are several areas of the healthcare system where blockchain technology can be used as it offers accessibility and security. In a study carried out on patient privacy and data security, it was found that there was at least a single security violation in the last two years in 94% of the hospitals (Patil and Seshadri 2014). Using blockchain in pharmaceutical industries helps in the fight against counterfeit medicines (Mettler 2016). It will improve medical record management and insurance claim procedures while increasing the pace of clinical/biomedical research (Kuo et al. 2017).

Before a new technology is adopted, it is critical to determine if users will accept the new systems/applications/services, and if the new system is compatible with the existing systems. To comprehend if an organisation will adopt a technology, the factors that will have an influence on the adoption process need to be identified. This study proposes a conceptual framework to enhance blockchain adoption in healthcare, which could be utilized by governmental hospitals in Saudi Arabia as well as in private hospitals. This study will investigate IT professionals' points of view on the following three dimensions: technological, organisational and environmental to find which factors will impact blockchain adoption in healthcare. This study explicitly aims to explore the main factors affecting the adoption of blockchain technology in Saudi hospitals. The research question for this study is formulated as follows in order to fulfil this objective: "What are the main factors affecting blockchain adoption in Saudi hospitals?". Understanding these factors in a better way may help in making sure

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that blockchain technology, which is still in its initial stages, is implemented in a way that is acceptable to healthcare organisations, so as to promote the meaningful use of the technology.

Research Framework

There are several factors in developing countries that can have an influence on the effective adoption of blockchain technology. Determining the theoretical perspective that was used to formulate the research hypothesis and model is critical. Different theories were taken into account when choosing the most appropriate theory as the basis of the study. Very limited research has been conducted that examines the adoption of blockchain technology. The TOE framework was used in some of these studies as the most relevant and widely used theory as presented in Table 1.

Table 1 Theories and models used in previous studies.

Theories/Models	Studies	No. of Theory/Model used
TPB	(Schaupp and Festa 2018); (Kamble et al. 2019)	2
TRI	(Kamble et al. 2019)	1
TAM	(Folkinshteyn and Lennon 2016); (Kamble et al. 2019); (Queiroz and Wamba 2019); (Lou and Li 2017); (Grover et al. 2019)	5
TAM2	(Morita et al. 2018)	1
UTAUT	(Arias-Oliva et al. 2019); (Queiroz and Wamba 2019); (Francisco and Swanson 2018)	3
IDT	(Dobrovnik et al. 2018); (Lou and Li 2017); (Fairooz and Wickramasinghe 2019)	3
TOE	(Clohessy et al. 2019); (Batubara et al. 2018); (Fairooz and Wickramasinghe 2019); (Baharmand and Comes 2019); (Holotiuik and Moormann 2018); (Dai and Vasarhelyi 2017); (Kulkarni and Patil 2020); (Orji et al. 2020); (Wong et al. 2020)	9

Technology–Organisation–Environment framework (TOE)

Tornatzky et al. (1990) formulated the TOE framework to analyse organisational level adoption of different information system/information technology services and products. The theoretical foundation of the model is solid, and it is capable of being used in IT adoption (Oliveira and Martins 2011). Its key objective is to determine technological, organisational and environmental perspectives that have an effect on the adoption of the latest IT systems in organisations (Tornatzky et al. 1990). The TOE framework will be used in this study by applying it to the context of Saudi Arabia to comprehend blockchain technology adoption in Saudi hospitals.

Research Model and Hypothesis

Technological Context

The features of technology are explained by the technological dimension, comprising the functionalities, equipment, expenses and techniques for technology adoption (Tornatzky et al. 1990, Oliveira and Martins 2011). Because blockchain has only recently been introduced, the factors that have an impact on its adoption have not been well identified so far. Hence, it is important to assess a variety of factors. With respect to the technology context, a variety of perceived technological factors are considered to be pertinent to the adoption decision (Rogers 1995). There are various perceived technological factors that have either a positive or a negative impact within the TOE framework. These are complexity, relative advantage and compatibility.

Complexity

Complexity is the extent of the apparent intricacy and difficulty associated with the comprehension and utilization of a certain innovation (Tornatzky et al. 1990). It is imperative that new technologies are user-friendly in order to increase the adoption rate. Because of the perceived levels of complexity and the inadequate business use cases, many larger companies and SMEs have rejected the use of blockchain (Clohessy and Acton 2019). This suggests that complexity functions as a barrier in the adoption of blockchain. There is a negative relationship between an innovation's perceived complexity and its adoption (Holak and Lehmann 1990, Abbas et al. 2017). Thus, the proposed hypothesis is:

H1: Complexity has a negative influence on blockchain adoption in healthcare.

Relative Advantage

Relative advantage is defined as “*the degree to which an innovation is perceived as being better than its precursor*” (Rogers 1995). In this study context, relative advantage refers to the degree to which blockchain technology is believed to be better in comparison with its predecessor for healthcare organisations. The higher the perceived advantage of blockchain technology (such as security, fast transactions, immutability, etc.) to an organisation, the greater the possibility of the organisation adopting the innovation (Clohessy et al. 2019). To ensure that adoption is successful, key stakeholders should acknowledge the relative advantage of the technology. Thus, the proposed hypothesis is:

H2: Relative advantage has a positive influence on blockchain adoption in healthcare.

Compatibility

Compatibility is defined as “*the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters*” (Rogers 1995). The adoption decision of an organisation is affected by compatibility. The lack of compatibility between new technologies and the prevailing principles and practices being followed in the workplace will affect the adoption (Kwon and Zmud 1987). It was asserted by Tornatzky et al. (1990) that the perceived high compatibility of the innovation with the existing technologies of an organisation may have a positive impact on the adoption process. A significant factor pertaining to the adoption of health data standards in hospitals in Saudi Arabia was compatibility (Alkrajji et al. 2013, Alharbi et al. 2016) and this had a positive impact on adoption. Thus, the proposed hypothesis is:

H3: Compatibility has a positive influence on blockchain adoption in healthcare.

Organisational Context

Descriptive measures regarding the organisation, for example management structure, scope and size fall under the organisational context (Oliveira and Martins 2011). Organisations personally and independently regulate their internal factors known as organisational factors. These factors greatly affect the process of decision-making (Oliveira et al. 2014). It is expected in this study that top management support, hospital size and hospital readiness will be the key factors in the adoption of blockchain by Saudi hospitals.

Top Management Support

Top management support is described as the views of the management regarding technological initiatives, their involvement in those initiatives, as well as the degree to which technological growth is encouraged by top management (Kulkarni et al. 2017). A significant part is played by top management in the adoption of the innovative supply chain management of small and medium enterprises using blockchain technology (Nayak and Dhaigude 2019). Top management support plays a vital role in the adoption of blockchain as there may be a need to introduce new regulatory requirements (Castaldo and Cinque 2018). Thus, the proposed hypothesis is:

H4: Top management support has a positive influence on blockchain adoption in healthcare.

Hospital Readiness

Having particular organisational resources in hand to adopt blockchain technology is referred to as organisational readiness (Iacovou et al. 1995). When an organisation shows greater willingness to adopt a new technology, it is more likely that the management and staff will be supportive of change, and

display a cooperation and supportive attitude (Wang et al. 2010). In a study carried out by Clohessy and Acton (2019), it was shown that if IT infrastructure is easily accessible and there are adequate economic and human resources, then such conditions have a positive impact on the company's intention to adopt blockchain technology. Thus, the proposed hypothesis is:

H5: Hospital readiness has a positive influence on blockchain adoption in healthcare.

Hospital Size

Organisational size refers to the measure of various factors that bring about innovation, such as overall resources, slack resources, the technical capabilities of employees and organisational structure (Rogers 1995). A significant determinant of blockchain adoption is organisational size (Tapscott and Tapscott 2016). Therefore, hospital size has a significant effect on the decision to adopt innovative technology (Chang et al. 2007). It has been indicated in previous studies that organisational size has a positive impact on the willingness of an enterprise to adopt new innovative IT (Clohessy and Acton 2019, Damanpour 1992). Thus, the proposed hypothesis is:

H6: Organisational size has a positive influence on blockchain adoption in healthcare.

Environmental Context

The distinctive features of the external world where the organisation performs its business is known as the environmental context (Alharbi et al. 2016, Lian et al. 2014). Organisational environment can support or restrict an organisation in adopting innovation (Rogers 2003). External factors such as government or competitors will have an impact on the use of blockchain technology in the field of healthcare. There are two factors in this research framework that are related to blockchain adoption, government regulations and external pressure.

Government Regulations

Government regulations or particular applications that may be prevented can hamper the adoption of blockchain (Janssen et al. 2020). To supervise and regulate the industry for compliance, new rules and policies may need to be devised (Crosby et al. 2016). Technologies like blockchain should be regulated by governments, which should simultaneously work in cooperation with the community, instead of serving like a strict legally binding authority (Tapscott and Tapscott 2016). Healthcare providers' decisions to adopt new technologies can be influenced by government laws and policies (Yusof et al. 2008). Chang et al. (2007) indicated that government policy has a positive effect on hospitals seeking to adopt a new technology. Thus, the proposed hypotheses are:

H7: Government regulations have a positive influence on blockchain adoption in healthcare.

External Pressure

The pressure imposed by competitors, trading partners and the government on the organisation is known as external pressure (Duan et al. 2012, Chwelos et al. 2001). One of the external pressures is competition which plays a very important part in driving organisations to adopt IT innovations (Lumsden and Gutierrez 2013). Organisations usually try to adopt the most recent technologies so that they can increase their market share, decrease costs and ensure more effective service delivery (Low et al. 2011). A positive relationship between external pressure and cloud computing adoption in the healthcare sector in Saudi Arabia has been identified (Alharbi et al. 2016). A positive impact may be exerted by external pressure from IT vendors, or when governmental regulation is mandatory (Alharbi et al. 2016, Low et al. 2011). The Saudi government may also exert pressure on Saudi healthcare organisations, as it is seeking to generate a digital transformation in the country in accordance with the 2030 vision (Khan 2016). Thus, the proposed hypothesis is:

H8: External pressure has a positive influence on blockchain adoption in healthcare.

Based on proposed hypotheses, our conceptual research model is presented in Figure 1.

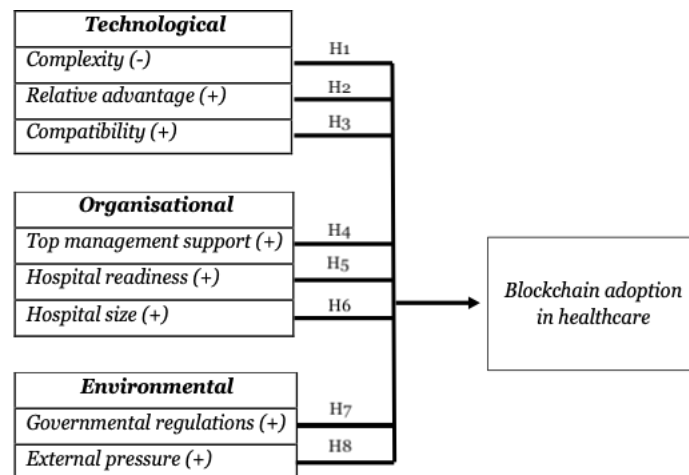


Figure 1 Conceptual research model.

Hypotheses will be tested to study the way the constructs in the framework are related to each other. Therefore, the primary method will be used to determine the effects of the constructs is the quantitative method.

Conclusion and Future Direction

Blockchain adoption in hospitals is still in the stage of rapid development and requires its own theoretical foundation for business value and risk identification (Woodside et al. 2017). The results of this study will play a part in filling the gap in knowledge and the unavailability of a predictive framework to identify the blockchain adoption intent of hospitals. To the best of our knowledge there is no research examining blockchain adoption in healthcare in developing countries such as the case in Saudi Arabia. This study conceptually identified the key factors as being the most influential in the previous studies are extracted and classified into the three contexts on the basis of the TOE framework, technological, organisational and environmental. The conceptual research model and the identified variables will be evaluated in Saudi Arabia to understand the adoption of blockchain technology by healthcare IT professionals. The Saudi government and/or decision makers will benefit from this study by obtaining an improved understanding of the advantages and challenges of blockchain adoption in healthcare. Healthcare organizations will also benefit from this research by acquiring a better comprehension of how the technology can be applied in the context of Saudi Arabia.

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