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► **To cite this version:**

Sujeet Kumar Sharma. Theoretical Framework for Blockchain Technology Adoption in Public Sector Organizations: A Transaction Cost Theory Perspective. International Working Conference on Transfer and Diffusion of IT (TDIT), Jun 2022, Maynooth, Ireland. pp.323-330, 10.1007/978-3-031-17968-6_26 . hal-04666780

HAL Id: hal-04666780

<https://inria.hal.science/hal-04666780v1>

Submitted on 2 Aug 2024

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Theoretical Framework for Blockchain Technology Adoption in Public Sector Organizations: A Transaction Cost Theory Perspective

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Abstract. The Indian economy, driven by multiple digital initiatives in the past couple of years, is considered as a fast-growing economy among developing countries. In digital initiatives, Blockchain is one of the promising technologies with potential to transform organizations in particular public sector organizations. There are concerns related to the nature of Blockchain technology and benefits offered by the same in organizational settings. This study attempts to identify critical factors influencing Blockchain technology adoption in public sector organizations. This research attempts to develop a theoretical framework for value based Blockchain technology adoption by integrating task-technology-fit theory, transaction cost theory, and the unified theory of acceptance and use of technology (UTAUT) in Indian public sector organizations. The proposed research framework may provide insights to public sector organizations, technology service providers, academicians and researchers. Researchers may collect data from public sector organizations to test the proposed research framework using structural equation modeling or other statistical models. This is a working paper and intends to further test the proposed theoretical model as the ongoing work.

Keywords: Blockchain technology, Task-technology-fit theory, UTAUT, Transactions cost theory, India

1 Introduction

Blockchain technology, which supported the bitcoin revolution, has the potential to change the way organizations store, retrieve and share information. In 2021, the blockchain market worldwide was valued at \$4.67 billion and is expected to grow from \$ 7.18 to \$163.83 billion, showing a CAGR of 56.3% during 2022 to 2029 (<https://www.fortunebusinessinsights.com/>). Blockchain is a secure and append only ledger for peer to peer transactions without any third party. The main advantage blockchain technology offers are transparency and traceability of the transactions. It reduces dependency on third parties and also mitigates risk of manipulation or even risk of system failure as all nodes of the network keep the same information (Olnes et al. 2017).

In general, blockchain technology (BCT) stores transactional data such as educational certificates, land records, birth and marriage certificates, social benefits, votes among others. BCT may offer several benefits to public sector organizations such as reduction in the transaction cost and complexities in the procedures involved in public service deliveries and also may help in ensuring trust in government records. It is reported in the literature that BCT offers several benefits, however, there is uncertainty in the business value offered by this promising technology which has slowed down the adoption of blockchain technology (Liang et al, 2021). It is also reported in the extant literature that the public sector are laggards in adopting new technologies and hence adoption of blockchain technology among executives in public sector organizations is an important concern that requires comprehensive investigation.

The extant literature in the information systems domain has significant research in terms of theoretical models and empirical evidence to understand the phenomenon of intention to adopt an emerging technology. The prominent theoretical frameworks in the literature includes technology adoption model (TAM: Davis 1989), task-technology-fit (TTF), unified theory of acceptance and use of technology (UTAUT: Venkatesh et al., 2003), among others. These theoretical frameworks help in understanding factors that influence adoption of a new technology. It is important for middle level executives to understand the interaction of technology, process and people in the context of a new technology and also how new technology will provide business value. Therefore, it is important to identify the critical factors that executives in public sector organizations keep in mind while adopting blockchain technology.

This study attempts to make three contributions to extend the extant literature of information systems in the Indian public sector context. First, this study develops a research model for understanding blockchain adoption by middle level executives in public sector organizations. Second, this study integrates task-technology-fit theory, transaction cost theory, value-based model, and the unified theory of acceptance and use of technology (UTAUT) to develop the research model. Finally, this study proposed the blockchain adoption framework in the Indian context, which is the one of fastest growing economies in the world.

2 Literature review and theoretical background

2.1 Blockchain in Government

Blockchain technology has huge potential to change the way the working of public sector organizations to deliver better and faster services. For example, Blockchain technology adoption in Government is needed for tamper proofing of digital assets, and protecting them against an ‘insider-job’. It is quite common in government services, almost all the documents and certificates issued by governments and government run institutions and universities are in digital format and there is always a lurking danger of tampering with these documents in the ‘back end’ at the database level. Across India, there have been hundreds of cases of fake degrees and fake mark sheets from colleges

and universities. Many of them were issued with connivance of staff with access to university's database and the staff had added an unauthorized entry into the database and as a result when verification is done the fake degree gets verified as genuine ("Pan-India links in fake degree scam" 2015). There have been cases of manipulating marks by university employees. Many of the aforementioned and similar case in public sector organizations can be addressed using blockchain technology capabilities such as traceability and transparency. In addition, the tamper proof quality of blockchain can significantly help cyber security digital resource protection for Governments as well. It is virtually impossible to monitor thousands of Government websites and their contents, especially if there are dormant script injections attacks. The dormant scripts remain undetected till they maliciously manifest themselves. These challenges can also be addressed with the effective use of Blockchain hashing would help detect any unauthorized change in any digital resource, in near real time.

As per Gartner (2019), by 2025, the business value added by Blockchain is expected to grow to slightly more than \$176 billion – then move past \$3.1 trillion by 2030. However, surprisingly, Gartner (2019) further predicts that in 90% of the overall enterprises, blockchain projects will become obsolete by 2021. Realizing such massive growth of the Blockchain technology in the next one decade and the expected decline for a high percentage of the Blockchain projects in enterprises in the near future, it would be very much timely and imperative to understand and analyze the challenges of Blockchain implementation for the massive projects, which are being rolled out in the Government settings such as the Government of Tamil Nadu in India.

2.2 Task-Technology Fit (TTF)

The TTF is an important model in the extant literature of information systems that plays a critical role in new technology adoption within an organizational setting. This model helps in understanding the impact of technology in organizations with the help of performing tasks faster and with greater efficiency. There are two components in the TTF model namely task and technology characteristics. Task characteristics means some challenging activities an individual may face while using an IT artifact. Next, technology characteristics related to the IT artifact designed to complete a set of tasks (Aljukhadar et al. 2014).

2.3 Value-Based Model

The value-based model helps in the evaluation of importance, usefulness and worth of a new technology (Kim et al., 2007). The overall value of a new technology can be categorized in two components namely perceived benefits and perceived sacrifices (Zeithaml et al., 1988). Perceived benefits mean how much an individual save in terms of cost and time. Furthermore, perceived benefits play an important role in the adoption of a new technology.

2.4 Functional Benefits

Business value of IT of an artifact means the benefits received from the use of a new IT with existing resources to gain and sustain competitive advantage for a firm (Chau et al. 2007). In general, business value obtained from the effective use of IT can be categorized into functional value and symbolic value. In the context of blockchain adoption in public sector organizations, functional value is of greater importance than symbolic value so functional value is included in the proposed research model in this study. Functional value in the context of public sector organizations means alignment between new technology and tasks in the organizations and also how blockchain technology capabilities are aligned with the objectives of the public sector organizations.

2.5 Transaction Cost Theory

TCT, Transaction Cost Theory, primarily developed by Williamson aimed to understand the organization and governance structures of its economic activities (Devaraj et al., 2002). Consumers while proceeding with transactions must conduct activities such as searching for information, negotiating terms, and monitoring the on-going process to ensure a favorable deal (Liang & Huang, 1998). The costs involved with such transaction-related activities are called transaction costs. TCT, in the past two decades, has undergone a tremendous amount of change, especially with the advent of technological improvements and digital initiatives. With the rapid growth of the ICT and Internet-enabled service delivery platforms, citizens are participating in various types of online transactions like never before. The extant technological advancements and innovation in the IT sector of the Government of India have persuaded it to proactively apply its features to the rural areas with an aim to bridge the urban and rural divide. The emergence of the ICT enabled governance system as a force in developing India has helped it in discovering numerous innovative ways to deliver public services to citizens and businesses with the prime focus on the rural sector (Dwivedi et al., 2016).

2.6 Unified Theory of Acceptance and Use of Technology (UTAUT)

Technology Acceptance Model (Davis, 1989) is the leading theory of IS acceptance and use in the extant literature. Scholars (Irani et al., 2009; Chong 2013; Sharma 2019) have adopted TAM and explained the IS use phenomenon in the extant literature. Next, UTAUT (Venkatesh et al., 2003) is the extension of the TAM to further explain and understand IS acceptance and use in organizational context. The UTAUT includes four main independent variables namely performance expectancy, effort expectancy, social influence and facilitating conditions and four moderating variables namely gender, age, experience and voluntariness of use to explain intention and usage relationship in the context of an adoption of a new technology. The UTAUT model has been used to understand the user behavior in various information technology domains such as mobile banking (Alalwan et al. 2017), mobile health (Dwivedi et al. 2016),

mobile government Apps (Sharma et al., 2018), mobile payments (Slade et al. 2015; Sharma & Sharma, 2019), online information services (Oh & Yoon, 2014). Dwivedi et al. (2017) re-examined the UTAUT model and provided some useful insights to researchers and practitioners. In case of the applications of the UTAUT model, the aforementioned researchers have adapted hypotheses from the original UTAUT model developed by Venkatesh et al. (2003).

3 Hypothesis Development

The task technology fit is a conceptual framework that helps in matching the requirements of a task with the capabilities of a new technology so that it can be completed in a faster and efficient way and also can reduce the cost also (McGill & Klobas, 2009). The extant literature reports that TTF helps in improving performance of a task in an organizational context and relates with the benefits offered by the technology (Liang et al. 2021). In this study, it is hypothesized that blockchain technology and organizational capabilities will positively influence the perceived benefits offered by the blockchain technology.

H1: Task-technology-fit (TTF) positively influences the perceived benefits offered by blockchain technology.

Keller (1993) defined benefits offered by a product or services that meet the need after consuming the same. Blockchain as a new technology brings a set of benefits including transparency and traceability that will motivate organizations to adopt the technology. In the public sector organization context, blockchain may help in building trust between government and citizens. Therefore, it is hypothesized that perceived benefits offered by blockchain technology will have a positive influence on the intention to adopt the technology.

H2: Perceived benefits positively influence the intention to adopt blockchain technology in public sector organizations.

Facilitating conditions is one the critical factors motivating users to adopt a new technology is reported in the extant literature and defined by Venkatesh et al. (2003) in the seminal work as “the degree to which the individual perceives the existence of resources and support to use certain technology whenever necessary”. For example, Zuiderwijk et al. (2015) observed that facilitating conditions plays a critical role in determining an intention to use a new information technology. Many scholars in the extant literature (Crabbe et al., 2009; Venkatesh et al., 2012; Chong, 2013; Hew et al., 2015) have proved that facilitating conditions are a very strong predictor to determine the intention to adopt (m-commerce and mobile apps). It is expected that blockchain technology adoption will also get influenced by the facilitating conditions available in the public sector organizations. In this study, the following hypothesis is proposed on the basis of aforementioned arguments.

H3: Facilitating conditions in public sector organizations positively influences intention to adopt blockchain technology.

Devaraj et al., (2002) contextualized Transaction Cost Theory (TCT) to understand economic activities in the organizational context. The costs involved in transaction-related activities searching for information, passing information from one organization to another, negotiating terms, and monitoring are known as transaction costs. In the context of public sector organizations, transaction costs are huge. Blockchain technology has the potential to reduce the transaction cost significantly in public sector organizations. Therefore, it is hypothesized that

H4: Transactions costs in public sector organizations positively influences intention to adopt blockchain technology.

4 Proposed research model

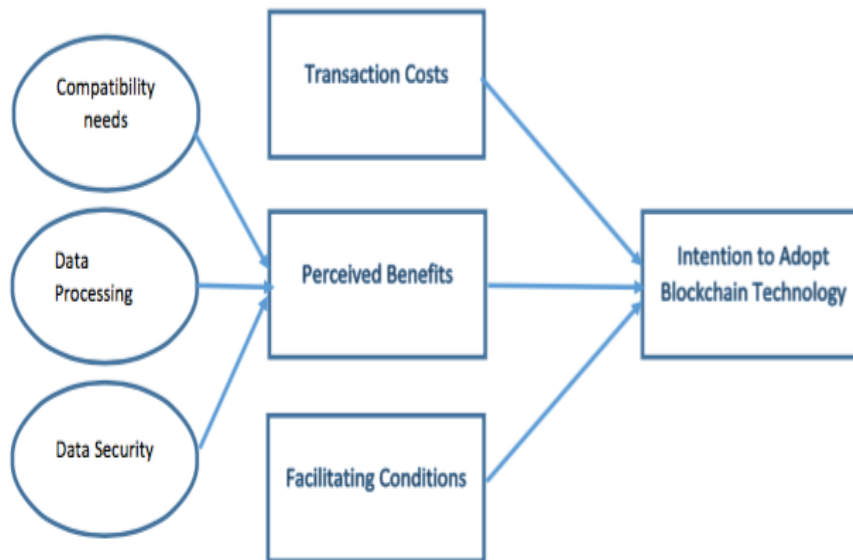


Fig. 1. Research Model (Adapted from Liang et al. 2021)

5 Concluding Remarks

Public sector organizations are also attempting to use emerging technologies to connect citizens better and deliver more value in public services. Blockchain being an innovative and general-purpose technology, is one of the prominent emerging technologies provides opportunities to organizations to deliver services to citizens in efficient and transparent manner. In particular, blockchain provides new ways to public sector organizations to record transactions, certificates, and ownership in multiple domains. To achieve this, it is essential to middle level executives in public sector organizations to adopt blockchain technologies to deliver public services. Consequently, this study attempts to develop a research framework to understand critical factors influencing adoption of blockchain technology in public sector organizations. The research framework to understand adoption of value based blockchain technology is developed by integrating task-technology-fit theory, transaction cost theory, and the unified theory of acceptance and use of technology (UTAUT) in Indian public sector organizations. The objective of this study is to develop a theoretical framework that can help decision makers to promote blockchain technology adoption in public sector organizations. The proposed research framework may provide some initial insights to senior executives working in public sector organizations and also for senior executive who develops blockchain based solutions. In addition, researchers are encouraged to collect data from public sector organizations to empirically test the proposed research framework. Furthermore, it is also recommended to conduct a rigorous qualitative research study (interviews of middle level and senior level executive working in public sector organizations) using proposed research framework. This approach may provide deeper insights about blockchain adoption in public sector organizations. Researchers may also explore longitudinal quantitative study using the proposed research framework to provide consistent and generalizable insights for decision makers to take strategic and informed decisions. Finally, researchers from two or more cultural settings may test the proposed research framework and recommend more generalizable and deeper insights about blockchain technology adoption in public sector organizations. This is a working paper and author is planning to collect primary data in a structured survey questionnaire from middle-level executives who are involved in the decision to adopt blockchain technology in Indian public sector organizations to test the proposed research model to provide deeper and generalizable insights for multiple stakeholders.

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