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**DETERMINING BLOCKCHAIN BEHAVIORAL ADOPTION THROUGH THEORY OF PLANNED BEHAVIOR PERSPECTIVE**

**Kiran Patil**

University of North Texas

Denton, Texas 76205

**ABSTRACT**

Blockchain technology is a peer-to-peer distributed asset database that is capable of being shared across various sites, countries, or institutions. The technology is being used by organizations for a variety of reasons, including increased visibility and traceability, supply chain digitization and disintermediation, enhanced data security, and smart contracts. Previous research has not yet established a valid scale for assessing the behavioral adoption of blockchain technology. By creating a survey instrument through the lens of the Theory of Planned Behavior, we extend this avenue of research. This study will benefit practitioners in the information technology field in two ways. First, it will direct Blockchain technology adoption processes by highlighting the critical role of human behavioral variables at the organizational level. Second, it will serve as a retrospective metric for evaluating the hype around Blockchain technology and assisting in making educated judgments on Blockchain adoption.

**Keywords**: Blockchain, adoption behavior, Theory of Planned Behavior

**INTRODUCTION**

Blockchain is anticipated to revolutionize the way organizations conduct business (Kamble et al., 2019). In recent years, organizations have realized the importance of blockchain, an open standard technology, as an alternative to closed standard systems (Shetty & Nainan, 2019). Blockchain technology is a peer-to-peer distributed asset database that can be shared across a network of multiple sites, geographies, or institutions (Kshetri, 2018). Organizational motivations to employ Blockchain technology include extended visibility and traceability, supply chain digitalization and disintermediation, improved data security, and smart contracts (Kamble et al., 2019).

Past research has investigated blockchain from standpoints of its capabilities, influence on supply chain resilience and use cases in sectors such as finance, applying theoretical lenses, such as transaction cost economics, contingency theory, resource-based view, resource dependency theory, and relational governance theories (Risius & Spohrer, 2017; Kembro, Selviaridis, & Näslund, 2014). However, even though few studies (Kamble et al., 2019) have attempted to develop empirical models that postulate and test organizational behavior regarding blockchain, past research has yet to establish a reliable scale to gauge behavioral adoption of blockchain. We advance this research stream by developing a survey instrument through the lenses of Theory of Planned Behavior stemming from psychometric factors that channel human behavior of the people with crucial roles in influencing Blockchain initiatives at an organizational level. Blockchain behavioral adoption will amalgamate various behavioral factors, such as awareness, culture, training, and commitment, but bounded by limited resources.

This study will contribute in two ways, useful for the practitioners in the information technology sector. First, it will channel implementation processes of Blockchain technology by emphasizing the crucial importance of human behavioral factors extended to an organizational level. Second, it will provide a retrospective measure that helps to evaluate the hype surrounding Blockchain technology and makes informed decisions in adopting Blockchains. This paper starts with a brief overview of the blockchain, followed by the gap in the past research, theoretical reasoning behind the proposed Blockchain behavioral adoption measurement scale, survey instrument, and concludes with challenges and recent advances.

**OVERVIEW – BLOCKCHAIN**

Blockchain creates a single shared system of records, which are inter-organizational transactions expressed in financial terms. This system of records adheres to the principles of cryptography or encrypted transmission of transaction data, leading to secure transmission of data and protection of ownership rights (Min, 2019). The sense of security amongst the organizations builds trust, leading to business value creation through the comprehensive linkage of high-volume transactions (Wang et al., 2019). Blockchain connects multiple organizations in a single thread through functional and transactional linkages. These businesses or organizations arrive at a consensus, as facilitated by the functioning of the blockchain (Risius & Spohrer, 2017). The consensus further facilitates the creation of smart contracts, leading to the building of trust between the organizations and, ultimately, creating business value through linkages in transactions (Wang et al., 2019). A smart contract is an agreement with prescribed roles to govern business transactions. It is stored on the blockchain and automatically executed as part of the transaction (Wang et al., 2019). It contains contractual conditions to transfer resources between organizations. For example, when a flight is delayed by an agreed-upon duration, the smart contract, which contains travel insurance terms, is automatically triggered for execution. A smart contract is better than a traditional contract as it eliminates the hassles and delays in reaching a formal agreement by building the contract into inter-organizational transactions (Saberi et al., 2018). It establishes clear demarcated conditions under which transfer of assets or resources occurs, eliminating the need to transfer documents for multiple approvals (Min, 2019).

The consensus reached amongst the organizations connected in the blockchain also validates the permanent transactions, leading to the creation of smart contracts (Saberi et al., 2018). This results in creating business value for every organization in the blockchain. Consensus is built through algorithms that validate and authorize inter-organizational transactions (Kamble et al., 2019). These validated and authorized transactions are termed permanent transactions. They cannot be deleted or modified and exist for the life of blockchain unless all the organizations involved in the blockchain enter into another consensus mechanism to terminate the permanent transactions (Treiblmaier, 2018). This allows the organizations participating in the blockchain to work at a speed synchronized with their business decision-making process (Felin & Wilson, 2018). The mechanism to reach consensus quickly is automated and varies across blockchains (Saberi et al., 2018). The mechanism of proof of stake is hinged on the notion that validation of transactions requires that the validating entity must own a certain percentage of the inter-organizational network's complete validation (Risius & Spohrer, 2017). This makes it very expensive to assume the role of a validator and prevents unauthorized ownership. The multi-signature mechanism entails consensus through transactional validation from multiple stakeholders (Queiroz & Fosso Wamba, 2019).

Organizations seek to leverage access, through partnerships and collaborations, in accomplishing their objectives. Blockchain provides access to privileges, which may not have been otherwise available for organizations within its boundaries (Felin & Wilson, 2018). This access regulates the audit of the transactions conducted historically between organizations linked in the blockchain (Kshetri, 2018). The periodic audits optimize the ecosystem of the inter-organizational network, as organizations chart their further courses of action based on the audit results (Kshetri, 2018). The optimized ecosystem shares risks across multiple organizations and creates business value for the organizations in the blockchain (Felin & Wilson, 2018).

As created by the blockchain, the single shared system of records traces all the permanent transactions, leading to the creation of smart contracts (Wang et al., 2019). As discussed earlier, smart contracts build trust between the organizations, resulting in the creation of business value. Traditional accounting ledgers, based on bookkeeping principles, have been in practice since medieval history. A shared and distributed ledger is advantageous over the traditional one because it is an immutable record of all the transactions on the blockchain network and is accessible to all the organizations in the blockchain (Risius & Spohrer, 2017). This prevents duplication of transactional records and enables constituent organizations to get a copy for their record (Risius & Spohrer, 2017). The distributed ledger is regulated by levels of permissions, allowing only authorized access to view and share the transactional information contracts (Wang et al., 2019).

Furthermore, the single shared system of records or a distributed ledger provides rightful ownership of assets, building inter-organizational trust and, ultimately, creating business value for the organizations in the blockchain (Felin & Wilson, 2018). The blockchain enables the transfer of ownership of assets between any two participating organizations in the blockchain network. This transfer is automatically recorded to the single shared system of records (Wang et al., 2019).

Lastly, the single shared system of records reconciles ledgers, or account-keeping documents, in a distributed ledger accessible to all the organizations connected in the blockchain. This reconciled ledger facilitates seamless, automated, and validated audits of the transactions, building trust amongst the organizations and creating business value (Wang et al., 2019). It also enables the blockchain to shift the paradigm from single owner to shared ownership of an asset or transaction (Felin & Wilson, 2018). Third-party intermediaries are eliminated, as participating organizations can validate the transactions and verify identities based on roles and access privileges, which are pre-agreed at this stage (Kamble et al., 2019).

**DETERMINING BLOCKCHAIN BEHAVIORAL ADOPTION**

The Theory of Planned Behavior has been instrumental in the past in judging information technology products, focusing on information technology acceptance and the degree of its use (Pattansheti et al. 2016; Issa & Hamm 2017; Xie et al. 2017; Ma et al. 2018). According to TPB, an individual's motivations are driven by the underlying attitudes, social norms, and perceived control over behavior. These motivations strengthen the intentions of the individual, which further result in action. The norms are subjective since an individual will be influenced by external influence in the form of perceptions of peers during the course of action. For a revolutionary technology, such as blockchain, which is hyped to change the ways organizations conduct business, TPB is instrumental in explaining the global frenzy to adopt blockchain and modify current processes. Just as tenants of TPB dwell on striking a balance in self-efficacy and exercising external control, the functioning of the Blockchain technology aligns in the same way at a fundamental level. Stronger attitudes, in the form of over-optimism, stringent norms that compel establishing a sense of belonging, and a high degree of perceived control over behavior are all the factors that lead to unshakeable motivation. Individuals are bound to behave predictably under such conditions (Ajzen, 1991; Kamble et al., 2019).

Applying the metaphor of TPB to organizations that intend to adopt blockchain, organizations are driven by the vital few people or top management, who are strongly motivated, are constantly focused on gaining acceptance in their social capital, and are confident of exercising a high degree of control over their subordinates and peers. Until the organization implements blockchain, in reality, there are various factors at play. First, awareness of the organization, which permeates the cascading organizational hierarchy, is a result of the persistent efforts of the strongly motivated individuals. Second, an organizational culture that channels organizations to constantly innovate and not just follow, but chart new paths to enhance business value, leads to intent to adopt a novel technology, such as blockchain. Third, training the workforce that comprises the organization is crucial in understanding the nuances of an underexplored technology. Fourth, management commitment through active supporting channels positively influences the intention to adopt blockchain. Last, organizational resources bind the degrees of freedom of the people in the organization who research, design, and implement futuristic technology, such as blockchain. Thus, we envision the Blockchain behavioral adoption stemming from a multitude of factors – awareness, organizational culture, training, management commitment, resource constraints, and intention to adopt.

Furthermore, Blockchain technology behavioral adoption should be gauged in terms of indicators that reflect measurements of these factors. Table 1 contains the survey instrument, developed on scrutiny of past research in behavioral technology adoption from the ages of the advent of the internet. The items or questions to measure each factor were adapted from the previously established scales to suit the present context of Blockchain behavioral adoption through the lenses of TPB (Ajzen, 1991; Aboelmaged & Gebba, 2013; Issa & Hamm, 2017).

**Table 1**

**Survey items to gauge Blockchain behavioral adoption**

|  |  |  |
| --- | --- | --- |
| Construct | Measurement Items | Source |
| Organizational Culture | Employees participate or are willing to participate in blockchain-related activities. | (Taylor & Todd, 1995), (Wu & Chen, 2005) |
| Participation in blockchain-related activities is linked with the performance evaluation of the employee. |
| A method is available for measuring the effectiveness of blockchain-related activities. |
| Employees strive to improve continuously because of blockchain-related activities |
| Blockchain-related activities are changing the perception of employees towards business value. |
| Management Commitment | Management encourages employees to participate in blockchain-related activities. | (Ho & Ko, 2008), (Hsu,  Chiu, & Ju, 2004),  (Venkatesh et al., 2003),  (Venkatesh & Zhang, 2010). |
| Leadership is committed to blockchain-related activities. |
| Management is accountable for blockchain-related activities. |
| Management provides requisite support to tackle hurdles in blockchain-related activities. |
| Resource Constraints | My organization has sufficient resources (human, time, financial) available for blockchain-related activities. | (Parasuraman, 1999), (Parasuraman, 2000), (Godoe & Johansen, 2012) |
| My organization uses advanced information technology tools to drive blockchain-related activities. |
| There is a reward and recognition system for participants of blockchain-related activities. |
| There is a process for prioritization of blockchain-related activities to optimize resource utilization. |
| Awareness | Management is aware of blockchain-related activities. | (Davis, 1989), (Taylor & Todd, 1995), (Aboelmaged & Gebba, 2013) |
| Employees are aware of blockchain-related activities. |
| Awareness training of blockchain technology is conducted. |
| Training | There is a structured process in the organization to learn blockchain-related activities. | (Ho & Ko, 2008), (Wu & Chen, 2005), (Aboelmaged & Gebba, 2013) |
| Training resources (internal or external trainers, training material) are available for blockchain-related training activities. |
| A budget is allocated for training about blockchain-related activities. |
| My organization uses database management tools and techniques in blockchain-related activities. |
| Intention to Adopt | I will incorporate blockchain in my present information management system. | (Davis, 1989), (Godoe & Johansen, 2012) |
| I will influence my partners to collaborate using blockchain. |
| I have already invested my time and money to get acquainted with blockchain. |

**CONCLUSION – CHALLENGES AND RECENT ADVANCES**

Behavioral adoption of blockchain is hindered because of a few challenges. First, blockchain-based solutions are perceived to be bulky, consuming significant resources in data storage and processing (Bruce, 2014). Second, blockchain promises to protect the privacy of its users, and it is yet to establish a guarantee of transactional privacy as all the transactions, even though immutable, are susceptible to revealing real user identity, which can be potentially misused (Barcelo, 2014). Third, the growing value of the blockchain-based currencies has resulted in increased selfish and stubborn mining, as pessimistic miners intentionally slow down the functioning of the Blockchain (Nayak et al., 2016). However, the recent advances promise a brighter future for blockchain. Zeroblock forces each new block to be generated and accepted by the Blockchain network within a fixed maximum time interval (Solat et al., 2016). Zerocoin uses a proof of zero-knowledge algorithm to validate a transaction (Miers et al., 2013). Coinjoin leverages a central mixing server to mingle the user internet protocol addresses to prevent theft (Maxwell, 2013). Bitcoin Next Generation (Eyal et al., 2016) decouples the conventional block into a prime block to elect the leader and a micro block to store transactions (Zheng et al., 2017).

Undoubtedly, blockchain's promise of business transformation is of substance due to its key attributes of decentralization, auditability, immutability, etc. This study presents a comprehensive overview of blockchain, develops a scale to measure Blockchain behavioral adoption through the lenses of the Theory of Planned Behavior, and mentions the present challenges related to blockchain, with recent advances. Future studies will include empirical validation of the scale developed through Structural Equation Modeling.

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**ABOUT THE AUTHOR**

**Kiran S. Patil**, is a doctoral graduate student at the University of North Texas, He focused on the transformative role of blockchain in supply chain management for his dissertation. Dr. Patil now serves as an assistant professor of practice in the Area of Marketing and Supply Chain Management at Texas Tech University's Rawls College of Business. His research interests span blockchain, supply chain collaboration and performance, data mining, and behavioral experiments.