Review Article

Driving Factors for the Adoption of Blockchain: A Focus on Startup Entrepreneurs

Joshua Ebere Chukwuere[1]

1. Department of Information Systems, North-West University, Potchefstroom, South Africa

Blockchain technology (BT) is trusted for its secure features. This paper investigates the factors that enhance startup entrepreneurs' adoption of blockchain technology. The study proposed an integrated and advanced conceptual framework based on the TAM, RTAM, UTAUT, and TRI frameworks through a comprehensive analysis of existing literature via narrative literature review (NLR) to unearth enabling factors that facilitate BT adoption by entrepreneurs. The proposed framework shows that BT adoption is enabled by initial, perception, intention, and actual usage. The hindering factors such as skill shortage, security (trust issues), limited capital, policy gap, and many more remain challenging. The research provides insightful findings that will provide an enabling ecosystem that allows startup entrepreneurs to adopt blockchain technology.

Corresponding author: Joshua Ebere Chukwuere, joshchukwuere@gmail.com

Introduction

Technology is becoming more disruptive with the advent of artificial intelligence (AI) which is fuelling disruptors like blockchain technology (BT). BT was first coined by Satoshi Nakamoto in 2008 to facilitate peer-to-peer electronic transactions without intermediary parties in financial institutions[1][2][3]. Blockchain as a disruptor was formally rooted in cryptocurrency but gradually became a foundation for business innovation across other industries Rahman et al.[4]. According to Orji et al.[5], blockchain is regarded as a shared "digital ledger" that is operated by a number of independent nodes. BT is built on cryptographic algorithms to provide data integrity and standardization. It can also be seen as a secure historical record segmented into blocks, chronologically chained, and distributed in

different servers to promote reliability[6][5]. For example, according to Mishra et al.[7], BT brings financial resilience and makes transactions sustainable and secure.

BT offers value features on data decentralization, immutability, trustability, and transparency in transforming data management and transaction processes by removing any form of intermediaries[4][3]. The elimination of intermediaries promotes new processes and practices. BT is further regarded as a transformative solution in managing payment, risk analysis, financial assets clearing and settlement, smart contracts, and many more[1]. The growth prospects in business are increasing but there are limited academic studies on how it can create and sustain business functions and values[4]. This limitation indicates a significant gap in practice and theory in the business sector, especially for startups.

Although, the application BT offers many benefits across different sectors. The benefits include its ability to enhance the traceability process, innovate risk management, operational transparency, data security, smart contracts, and sustainable business process model[8][9][10][11][12][3]. While the negative perception and some user experiences are challenging the adoption by start-up entrepreneurs. The negatives include but are not limited to lack of awareness, high implementation cost, literacy, technical skills, and many more. Nonetheless, BT will change how individuals and corporate organization conduct their businesses[13]. According to Lanzini et al.[2], scholarly attention is increasing towards investigating the effect of BT in different sectors.

This seeks to conduct NLR studies to fill the existing research gap on the adoption of BT by startup entrepreneurs by constructing a comprehensive framework to guide how to maximize BT potential in startup enterprises and business projects. By combining the features of technology acceptance model (TAM), revised technology acceptance model (RTAM), unified theory of acceptance and use of technology (UTAUT), and technology readiness index (TRI) framework, the study presents a comprehensive framework to guide the adoption of BT by startup entrepreneurs. This study is novel and innovative in setting the guide for future studies and theoretical advancement of BT adoption by startup entrepreneurs and adding knowledge and literature to emerging research in blockchain.

Literature review

BT for startup entrepreneurs

As a decentralized, immutable, and distributed network system, BT provides secured transactions and events using cryptographic methods across distributed nodes (participants) based on peer-to-peer operation[4]. Every block contains a cryptographic hash in the chain with the subsequent block, which assures secure network activities. The security of BT is characterized by its features like decentralization, verification, and immutability[6][4]. Nonetheless, researchers are suggesting additional features and attributes such as open source, anonymity, transparency, autonomy, and others to strengthen its security[4].

Different sectors have the option to choose among different types of blockchains.

1. **Public blockchain technology:** It provides every node or participant with an equal or permissionless opportunity to access, create, update, and validate data blocks, which are commonly applied in cryptocurrency exchanges and mining, such as Bitcoin, Litecoin, and many others[4]. It eliminates data centralization, security, and transparency issues and enables data authenticity[14].
2. **Private blockchain technology:** It restricts and authorizes access to the network, which is commonly done by single entities or organizations, such as Ripple[14][4].
3. **Consortium blockchains** are more decentralized, secure, and complicated to implement than private blockchains and operate by corporations or groups of entities or organizations. It can be called a federated blockchain[14].
4. **Hybrid blockchains** combine centralized operation with public transparency[4]. According to Parizo[14], this type of BT allows an organization to implement a private, permission-oriented system having a permissionless system with the ability for the organization to control data access.

According to Rahman et al.[4], BT is changing digital transactions and infrastructure by enhancing security, transparency, and decentralized transactions and governance. However, BT has the potential to make startups more sustainable and secure[15]. It promotes financial inclusion, especially for startups[16].

Adoption models

The information systems (IS) discipline has shown growth in recent years in the use of different frameworks or models to study and understand technology adoption across sectors. There are different frameworks or models to use, such as the unified theory of acceptance and use of technology (UTAUT), the technology acceptance model (TAM), the revised technology acceptance model (RTAM), and many more. The field of information systems is dominated by individual or organizational use and adoption of technology[17]. Development and deployment of new technology are just enough, rather, it is important to assess the acceptance rate to gain more insight into its usage and problems encountered[3].

TAM is a combination of the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) and is widely used to investigate technology acceptance and intention to use by individuals or organizations[18][19]. The components are perceived usefulness (a belief that new technology will improve efficiency, productivity, effectiveness, and performance and be beneficial), perceived ease of use (PEOU) (a belief or trust that new technology will facilitate work done effortlessly), behavioral intention to use (it shows realistic usage of technology which drives actual usage)[18][19]. Additionally, TAM is explored in different criteria, for example, Kelly and Palaniappan[19] the study provides additional factors like perceived cost (the cost of the device influences adoption and usage), perceived risk (the risk level associated with the technology defines adoption or rejection), perceived trust (it influences human behavior and attitude that drives intention), and social influence (it involves influence from friends and family drives adoption which increases trust).

UTAUT was previously coined as the combination of different models like TAM, Theory of Planned Behavior (TPB), TRA, extended TAM, Diffusion of Innovation (DOI), social cognitive theory, motivational model, and model of PC utilization. The combination yielded four factors social influences, facilitating conditions, efforts, and performance expectations, and efforts, also, gender, age, experience, and voluntariness of use were added as moderating variables[3]. Social influence was adopted in this study as a contributing factor in startup entrepreneurs adopting BT.

RTAM is based on TAM and the addition of components. It is divided into five layers. The layers present different components or factors that define the adoption of any technology[20]. For instance, RTAM provides components that can guide an individual or organization from start to finish to adopt technology, especially in developing countries. However, the framework didn't address some

components that can motivate a startup entrepreneur to adopt BT in performing its business functions.

The technology readiness index (TRI) looks at one's "propensity" to accept and use new technology to perform personal or work-related tasks[21]. This propensity is a combination of beliefs (positive and negative) which is different from one person to another. These beliefs are grouped into four concepts: optimism, innovativeness, discomfort, and insecurity, which influence one's understanding, perception, behavior and attitude, intention, and actual usage of a given technology. In this study, perceived innovativeness (innovativeness) was considered as a perception that defines the behavior and attitude of startup entrepreneurs to adopt BT.

Startup entrepreneur's adoption of BT challenges

Digitalization is an enabler for startup entrepreneurs to overcome a number of its challenges. According to Naik et al.[22], digitalization is a major driver for startup entrepreneurs' success and growth, although the adoption is challenging. As startup entrepreneurs rely on digitalization like blockchain to excel, the adoption of BT may not be easy. For instance, the adoption of BT can be challenged by limited knowledge (lack of public knowledge and awareness), initial cost (high cost of implementation), wrong perception (mistaken identity and some criminal elements using it), security issues (there are many security flaws and loopholes been exploited by hackers in the network), scalability (the usage expansion can be slow in performing transactions), and privacy concerns (transactions on the network is visible to others). Kumar et al.[1] suggest that BT implementation is challenged by elements like security, latency, energy wastage, and usability. BT is also challenged by a lack of regulations, skills, and experts.

According to Larios-Hernández[16], Bitcoin is the largest BT with many challenges like scalability, inflexibility, exchange infrastructure, lack of acceptance, unsustainability, and long latency. However, researchers continue to find different challenges confronting BT adoption across sectors, although, limited studies exist within startup entrepreneurs.

Problem statement

BT is transforming different sectors and business is not exceptional. Its application ensures data transparency, efficiency, and effective application toward business sustainability[7]. It is used for public, private, individual, and corporate purposes to advance data integrity and secure transactions.

Researchers are busy researching ways BT can benefit or be implemented in a business environment. In the field of information systems, technology adoption is growing in practice and research[17], and adoption in different sectors[5]. For example, Singh et al.[23] applied a systematic literature review (SLR) to discover six themes: resilience, adoption, intermediation, cybersecurity, benefits, and challenges affecting BT in the supply chain. Happy et al.[10] also conducted SLR focusing on supply chain management and unearthing factors like "technological, organizational, social, and environmental". In 2021, Vu et al.[24] conducted an SLR study within the food business and proposed a conceptual framework that facilitates BT implementations by identifying key enablers and challenges in the application.

According to Rahman et al.[4], many studies have been conducted using SLR. For example, the healthcare sector[25][3], accounting education[26], business films[27], real estate[28], agriculture[29], logistics[5], Sustainable Development Goals (SDGs)[30], land administration[31], governance and public sector[32], eGovernment[33], governmental blockchain[34], and banking[7]. From indications, existing studies have focused more on using SLR across sectors, while limited studies focus on other research methods like NLR and startup entrepreneurs. Importantly, the application of BT in startup firms is still new[15]. Then, this study focuses on investigating the factors that enhance startup entrepreneurs' adoption of blockchain technology based on features from the TAM, RTAM, UTAUT, and TRI frameworks.

Research methodology

Different research methodologies can be applied in studying IS research to understand its adoption in business and startup entrepreneurs in particular. This study employed a narrative literature review (NLR). NLR is a secondary research method without collecting primary data, rather it uses existing literature on the particular subject matter. Opinion is divided among scholars in using NLR in academic research. For example, Alkhudary et al.[13] have the opinion that NLR research findings and results can be biased because it is less rigorous and transparent. The data collection and sampling of the articles are not specified or disclosed, however, its findings and contributions can be applied in decision-making. According to Chukwuere[35], NLR comprehensively investigates existing literature within the research topic, identifies research gaps (inadequacies), expedites the research process, and saves costs.

Literature search

NLR was employed in a study to look at existing literature covering BT adoption by startup entrepreneurs, its benefits, challenges, and the overview of BT. The study searched online academic databases like Google Scholar, Scopus, Sage journals, and ScienceDirect. The study evaluated studies within a period of five years (2020 to 2024). Specific keywords were used such as "blockchain", "blockchain technology", "blockchain in startup entrepreneurs", and "adoption of blockchain by startup entrepreneurs". These keywords provided deeper insights into understanding the topic and discovered research gaps. For example, the adoption of BT in growing in different sectors and business sectors is not excluded. The literature shows that scholars are proposing frameworks and models to increase its adoption in these sectors. However, there are limited studies covering BT in startups, and its adoption by startup entrepreneurs.

Inclusion and exclusion

The literature search for the study was defined by inclusion and exclusion criteria.

Inclusion criterion – The literature used was only those published in the English language, within a period, studies covering the keywords, and only academic peer review studies.

Exclusion criterion – The studies opposite of the inclusions were ignored, including non-academic materials.

Startup entrepreneur blockchain adoption model

BT adoption and usability depend on a number of factors to be considered. This section of the study presents integrated and comprehensive factors with the combination of components from TAM, RTAM, TRAM, and UTAUT that influence whether a startup entrepreneur will adopt BT or not. Figure 1 showcased the integrated conceptual framework called the Startup Entrepreneur Blockchain Adoption Model (SEBAM). The framework is divided into four stages (categories); initial, perception, intention, and actual usage.

- **Initial:** It presents the first eight components that influence the adoption of BT by startup entrepreneurs. These eight components are to be considered by startup entrepreneurs before conceding perception. The initial stage is influential. It influences directly the perception of startup

entrepreneurs to adopt BT. Also, the dotted line indicates that initial components have an indirect influence, meaning it may indirectly influence startup entrepreneurs' intention to adopt.

Hypothesis 1: *Initial components directly influence the perception of startup entrepreneurs to adopt BT.*

Hypothesis 2: *Initial components may indirectly influence the perception of startup entrepreneurs to adopt BT.*

- **Perception:** This stage presents nine components that directly change intention. The components define and change the startup entrepreneurs' mindset in the adoption of BT. Then, a positive perception of the functions and roles of BT in business changes startup entrepreneurs' views and opinions on the adoption of BT.

Hypothesis: *Perception components directly change startup entrepreneurs' intention to adopt BT.*

- **Intention:** This stage provides the action to use. The intention of a startup entrepreneur leads to the adoption and the actual usage of BT in the business process. This stage has two components that directly lead to actual usage.

Hypothesis: *Intention directly leads to startup entrepreneurs actual usage of BT.*

- **Actual usage:** This stage is the final component in the adoption of BT. It shows the actual usage of BT startup entrepreneurs.

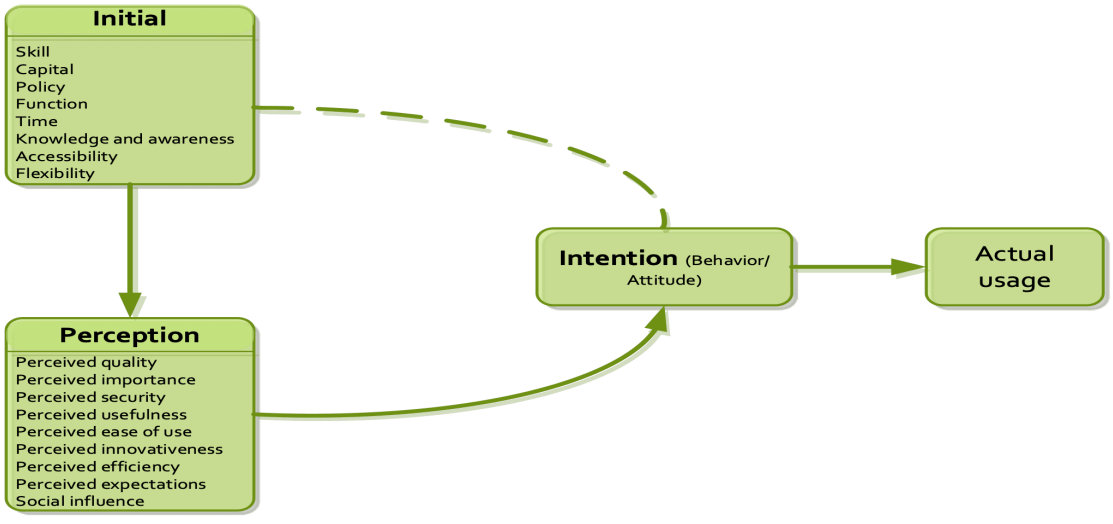

Figure 1. Startup Entrepreneur Blockchain Adoption Model (SEBAM)

Initial

Skill: It presents an ability and capability to perform a given task. The skill level is necessary for consideration to adopt technology. For BT to be adopted, startup entrepreneurs consider if skill is available in the business environment. Lack of skills and resources is resistance to digital technology adoption[36].

Capital: It has different meanings in economic, and business environments. Nonetheless, capital can be regarded as money or assets available to run or grow a business enterprise. This important asset will be considered while attempting to adopt BT. For example, startup entrepreneurs consider the available capital (money) to the business to execute the adoption of BT. According to Jiménez and Ziesemer[37], economic growth drives technology adoption.

Policy: It provides a set of standards or principles for an action. The political and business policy should be considered in attempting to adopt technology, especially in BT. Startup entrepreneurs look within the business and nationally (government) on available policies to facilitate their attempt to adopt BT. For example, a lack of political policy reduces or affects the diffusion of technology (ICT)[38] [39].

Function: It shows the capabilities of the new technology. In this study, it indicates the capabilities of BT in assisting startup entrepreneurs to operate their businesses. Startup entrepreneurs consider the function of the BT before adoption. It influences their perception to adopt or not.

Time: This factor looks into time saving and trends. If a startup entrepreneur believes that trending BT will save time to perform business functions, it influences the perception to adopt.

Knowledge and awareness: It focuses on concrete knowledge and level of awareness about the study. Sufficient knowledge influences one's ability to develop positive perceptions. This factor seeks to promote sound knowledge and public awareness about BT. So, for BT to be adopted, sound knowledge and wider awareness are important. The level of knowledge and available awareness influence whether a startup entrepreneur will adopt BT or not.

Accessibility: This is a fundamental factor that influences technology adoption as it focuses on system reachability for adoption and use by everyone including those with disability. The accessibility of BT can influence the perception of startup entrepreneurs in the adoption of BT.

Flexibility: BT is among the trending technological innovations in this time and age. Flexibility means its ability to adapt to continuous business and technological changes. At the initial stage, startup entrepreneurs will want to know if BT is adaptable for the current and future. This clarity will influence their perception of the technology towards adoption.

Perception

Perceived quality: This factor looks at the belief that a new technology is worth it or excellent. It covers the standard (degree of reliability and responsive), of the new technology[20]. If a startup entrepreneur perceives that BT is of a good standard, and worth it, their behavior and attitude towards it changes.

Perceived importance: This factor covers the perception of an individual that new technology will improve tasks and operations[20]. This factor changes personal behavior and attitude about technology, in this case, the BT in operating startups.

Perceived security: Security is a major determinant of technology adoption. It is concerned with how secure technology is and how it changes behavior and attitude toward it[40]. The safety consideration changes the behavior and attitude of a startup entrepreneur in determining the acceptance level. According to Chukwuere et al.[20], security concerns affect users' perception of new technology and define adoption levels. Technology users who understand security measures and protocols will have increased confidence[41].

Perceived usefulness: The component deals with the belief and confidence level that the new technology will support and improve activities[42][43]. It also suggests that new technology will serve its use and purpose to improve performance. The perception of a startup entrepreneur will change and confidence increase if the BT is useful in the business process and operations. This perception changes personal behavior and attitude.

Perceived ease of use: It is concerned with personal judgment in believing the new system or technology will be used effortlessly in a given task[20][44]. This perception can improve the adoption of BT by startup entrepreneurs. It also defines personal behavior and attitude toward the new technology.

Perceived innovativeness: This concept is defined as one perception of being a technology pioneer[21]. Individuals who see themselves as technology pioneer or technology forefront leader have a positive

perception of it. This positive feeling increases the confidence to adopt technology. According to this study, a startup entrepreneur with a positive perception as a technology pioneer will increase BT adoption in business.

Perceived efficiency: It deals with personal perceptions that optimal results can be achieved with minimal time spent, resources, and effort [45]. This perception drives one's behavior and attitude toward adoption. According to this study, a positive perceived efficiency will encourage startup entrepreneurs to adopt BT in their business operations.

Perceived expectations: This factor focuses on expectations from the new technology (expected reward, service, or benefit to be derived from the system). A positive expectation from BT changes a startup entrepreneur's behavior and attitude toward the adoption. According to Ayaz and Yanartaş[46], expectancy changes behavioral intention.

Social influence: This factor is seen as the degree a person influences another to use new technology. It can be friends' opinions that influence a behavior or attitude[46]. The social influence provides a thought that changes or influences another's opinion to adopt BT.

Intention (Behavior/Attitude)

An intention can be behavioral or attitudinal. The two are the cardinal components and influence of an intention. A behavior is how one acts toward a situation (another). It is an action and reaction in a situation. According to Baggio[47], a behavior relates to human conduct. While an attitude deals with an opinion or a feeling about something. It is a function of personal behavior and attitude toward a given technology. The intention is regarded as the "subjective likelihood" to engage in a task[42]. For example, the intention of a startup entrepreneur is defined by his or her behavior and attitude. Before the final adoption, one's intention is improved as a result of positive behavior and attitude toward the technology (for example, BT).

Actual usage (Adoption)

Actual usage of a new technology is a process derived which is the final factor in technology adoption. Although some authors believe that perceived usefulness influences actual usage[21]. This is the behavioral and attitudinal intention to use technology for personal, academic, or work purposes. According to Marikyan and Papagiannidis[48], actual technology usage (use) is a direct function of

behavioral intention. As a final stage in the technology adoption process, the positive views and consideration of other concepts of the framework will influence the actual usage or adoption of BT by startup entrepreneurs.

Limitation and future study

This study was conducted using NLR methodology without collecting or analyzing primary data. The disadvantages of NLR can be applied to the findings, however, it provides space for the foundation for more studies in the future.

Implication of the study

This study provides implications for different stakeholders like:

Developers and practitioners: This study will assist BT developers, practitioners, and implementers in understanding the factors that influence startup entrepreneurs in idealizing, and defining perception, behavior, attitude, and final usage or adoption of BT. Understanding those factors makes it easy to read the views and expectations of startup entrepreneurs regarding BT adoption.

Policy-makers: This study provides a comprehensive framework component to guide policymakers to formulate tailored policies to facilitate startup entrepreneurs' adoption of BT.

Academics and students: This study exposes the literature gap in proposing a comprehensive conceptual framework for more empirical to test the framework component to concretize the factors that influence startup entrepreneurs' adoption of BT. It opened new research areas for more studies.

Conclusions

The wave of BT in business cannot be underestimated especially in startups. This narrative literature review (NLR) study has presented an integrated conceptual framework with the combination of concepts from TAM, RTAM, UTAUT, and TRI in unearthing different factors to consider as well as influenceers in the adoption of BT by startup entrepreneurs. Startup entrepreneurs play a significant role in role national economy, then, the adoption of BT will facilitate business toward business growth and sustainability. In the future, more studies are expected to test this conceptual framework using primary data for its effectiveness in influencing startup entrepreneurs' adoption of BT.

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Declarations

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.