



The Literature Review of Blockchain Adoption

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Authors' contributions

This work was carried out in collaboration between both authors. Author SA designed the study, performed the analysis, wrote the protocol and wrote the first draft of the manuscript. Author NAS managed the analyses of the study and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Blockchain is an emerging technology that depends on distribution, decentralization, and encryption. Recently, it has gained wide interest in various fields of studies. Several considerable research on blockchain adoption has appeared in international journals across different disciplines, however, a review of literature on the adoption of blockchain remains rare. This study aimed to provide a comprehensive literature review of the current blockchain adoption studies that use individual adoption models or theories. This paper included the papers that are published in the 7 Scopus database from 2017-2021. Studies were analyzed to determine the adoption models or theories that are used, industry, country, methodology, and identify the most important influencing factors that drive the user to accept the adoption of blockchain technology. The results showed that there are still limitations in adoption studies in various fields such as health and education however, the field of supply chain management is one of the areas that received the most attention in the studies. Common studies relied on the Technology Acceptance Model (TAM) model as well as the Unified Theory of Acceptance and Use of Technology (UTAUT). Moreover, perceived ease of use (PEOU), perceived usefulness (PU) are considered the most important factors affecting the

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intention of users in adopting blockchain technology in different fields. The research findings have implications on blockchain adoption research. In terms of theory, the findings provide a guideline for the other researchers to put their own research in a better context and thus contribute to understanding the relevant blockchain adoption issues that require further investigation.

Keywords: Literature review; blockchain; distributed ledger; adoption model; technology accept model; UTAUT.

1. INTRODUCTION

Blockchain technology is based on storing data cryptographically in secured chains of blocks, it is also known as distributed ledger and it uses a peer-to-peer network. Since a blockchain is using cryptographic techniques, it is immune to tampering or modified the transactions which already store in blocks [1]. Stuart Haber and W. Scott Stornetta introduced the first idea of blockchain in a paper entitled "How to time stamp a Digital Document" in 1991 [2], their intention was to develop a system based on documented timestamps that could not be altered or tampered with. Being the Internet was immature, Heber and Store's idea did not reach the public about cryptographic trust between parties [3]. Blockchain appeared back in 2008 as an incredibly promising technology after Satoshi Nakamoto introduced Bitcoin as a cryptocurrency in a paper titled "A peer-to-peer electronic cash system"[4].

Blockchain is not limited to cryptocurrencies and the financial area. Blockchain has been widely used in many different fields areas, which range from finance [5], supply chains [6], advertising [7], healthcare [8], education [9], energy [10], IoT [11], etc. However the general structure of blockchain technology is relatively similar, blockchain-based applications and tools may differ across domains [12].

A number of adoption models, theories, and frameworks introduce factors, that have been developed to explain user behavior to adoption and acceptance of new technologies, such as the Technology Acceptance Model (TAM) [13-15], Theory of Planned Behavior (TPB) [16], Diffusion of Innovation theory (DOI) [17], Theory of Reasoned Action (TR) [18], Motivational Model [19], Unified Theory of Acceptance and Use of Technology (UTAUT) [20] and Social Cognitive Theory [21]. Many studies have used one of these models to conduct their researches in other hands some of them combined more than one model to carry out their study [22].

Surveys on blockchain technology in different fields and domains have already been published [23]. [24] Provide a review of the architecture, application, and the various mechanisms involved in blockchain technology. Additionally, [12] provides a review on blockchain for information systems management and security. Several studies analyze blockchain and associated factors that influence users and organizations to adopt blockchain technology, using both qualitative and quantitative methods. Despite considerable research on blockchain adoption that has appeared in international journals across different disciplines, a review of literature on blockchain adoption remains missing. There are rare reviews that address the adoption of blockchain. [25] identifies specific technological, organizational, and environmental (TOE) blockchain adoption factors, and examines how TOE factors impact organization's decisions to adopt blockchain however, It doesn't address the studies that used models or theories of adoption at the individual level.

This study accordingly aims to provide a comprehensive literature review of the blockchain adoption studies to extend the understanding of blockchain technologies.

Finally, this study summarizes the major adoption models and theories that have been used, and analysis the findings to identify the most important factors that affect (influenced) the intention to adoption of blockchain technology. It also summarized the hypotheses used by the studies, the country, the field, and the methodologies are followed by the studies.

2. RESEARCH BACKGROUNDS

2.1 Blockchain

As defined by [26], "A blockchain is a distributed database, which is shared among and agreed upon a peer-to-peer network. It consists of a linked sequence of blocks, holding timestamped transactions that are secured by public-key

cryptography and verified by the network community". Once data is added to the blockchain, it cannot be altered, and a blockchain is turning into a permanent record [27].

The essential features of blockchain technology are distributed computation using a peer to peer network, decentralized consensus algorithms (i.e., proof of stake, proof of work, and practical byzantine fault tolerance), immutability, and cryptographic (i.e., hashing, private-public key infrastructure). These features have made blockchain a unique technology and have drawn significant attention from several industries [28].

2.1.1 Characteristics of blockchain

Blockchains are effectively a digital storage network that is totally independent of the data contained within each block and identifies the key characteristics as decentralization, anonymity, immutability, and transparency [28, 29].

2.1.1.1 Decentralization

The decentralization in blockchain technology means that it has no central or authority to manage the network among the contributors. Blockchain network comprises of a distributed computer network and the blockchain itself is organized in a decentralized peer-to-peer network [30]. The participant in the decentralization network interact with the system and verify the transactions without the need for a third party. These ensure to reduce the risk of failure and improve the trust of service with guaranteed availability [31].

2.1.1.2 Immutability

Immutability means something that can't be altered or changed, it is a distinguishing characteristic of blockchain. Once a record of transactions is added to a block on the ledger, it cannot be altered or modified. Since each block contains a cryptographic hash of the original data, this hash is unique and each block contains the hash the previous block, and transactions are stored in different nodes in the distributed network, any attempt to change the block content is not allowed [27]. One of the disadvantages of the immutability feature is that it is also impossible to modify data that might be erroneous before entering the blockchain [32]. However, it facilitates the tracking of data sequences [25].

2.1.1.3 Anonymity

Anonymity is a key characteristic of the public blockchain, which allows users to interact with each other in a public blockchain network. Each user owns a pair of the private key and public key that allows the users in the network doesn't disclose each other's identity. The user only is identified in the network by public keys [31]. There is no need for any central entity or authority to manage and maintain private information. As a result, according to the transaction information, the real-world identity cannot be obtained, this greatly supports and maintains privacy. On the other hand, in the systems that are operated and governed by known entities in the settings like private and permissioned Blockchains identity is usually required [33].

2.1.1.4 Transparency

Blockchain facilitated read-only access to transactions and inspect contents of smart contracts for anyone in the blockchain network. This supports efficient and accurate record keeping, but it may interfere with privacy to some extent [34]. Blockchain has the potential to add transparency not only to financial transactions but also to business processes [27].

2.1.2 Types of blockchain

Blockchain types can be categorized into three types depending on how is the network operated and who can join: public blockchain, private blockchain, and consortium blockchain [35].

2.1.2.1 Public blockchains

A public blockchain can also be called permissionless [36]. It is a blockchain that the participation in a public network is entirely free and open without any approval [35]. Anyone with a computer with specialized software of a particular blockchain can act as users, developers, miners, or community members [23]. Public blockchains are designed to be fully decentralized and all transactions on public blockchains are fully transparent [37]. Bitcoin is the first example of public blockchain [35], generally, A public blockchain is mainly used for cryptocurrencies [28].

2.1.2.2 Private blockchains

A Private Blockchain is also called a permissioned blockchain (e.g., Hyperledger) [28]. It allows to select which nodes to be operated and view the transactions on the ledger, as well as who may transact with it since the privacy is improved [27]. That's mean the Participants require permission to join the networks [37]. Against the public network, it is managed by a centralized entity .Private blockchains consider by blockchain communities as the distributed databases with the full history that cannot be deleted or changed. Private blockchain mainly used in private enterprises that have sensitive information and they don't want to be known by the public [35].

2.1.2.3 Consortium blockchain

Consortium blockchain is like a hybrid of the private and the public blockchain .It enables only a selected group of nodes to participate in the consensus process. It is partially centralized and open for limited public use. It can be used in scenarios where there are various organizations involved in business activity e.g., (insurance companies, financial institutions, governmental institutions) [23,28].

2.1.3 Blockchain generation

According to the literature, there are four generations of blockchain [36,38]:

2.1.3.1 The first generation (BLOCKCHAIN 1.0)

The cryptocurrency, Bitcoin, represents the first generation of blockchain technology, which is also called blockchain 1.0. Other examples of this generation are Dash, Monero, and Litecoin.

2.1.3.2 The second generation (BLOCKCHAIN 2.0)

The second generation appeared with the start of the Ethereum network, where smart contracts are introduced. Smart contracts are the software programs that encode the rules of how the smart properties are managed and controlled. Examples of blockchain 2.0 include Ethereum Classic, Ethereum, QTUM, and NEO.

2.1.3.3 The third generation (BLOCKCHAIN 3.0)

With the development of blockchain technology, it has become more widespread and widespread as in this generation it has exceeded the application of blockchain in the financial fields to various fields and industries such as contract management, Internet of Things (IoT), supply chain management, identity management, healthcare, and insurance. Currently, blockchain technology is considered a general-purpose technology.

2.1.3.4 The fourth generation (BLOCKCHAIN 4.0)

This generation is still in development. In Blockchain 4.0 artificial intelligence (AI) will be an essential part of the platform, this will reduce the need for human management, the work and decision making will depend on systems.

We can summarize the differences between the four generations and explain the advantage of each generation as in the following Table 1.

3. TECHNOLOGY ADOPTION MODELS AND THEORIES

Theory of Reasoned Action TRA, Theory of Planned Behavior (TPB), Task Technology Fit Model (TTF), technology acceptance model (TAM), Extend TAM (ETAM), diffusion of innovation DOI, and UTAUT are more popular technology acceptance theories/ models that are being used worldwide in different settings more especially in IS literature [39].

3.1 Theory of Reasoned Action (TRA)

However, Reasoned Action (TRA) Theory firstly developed by (Fishbein and Ajzen) in 1975 for social psychology studies [18], becomes the foundation to examine the behavior of individuals for new technology. The theory proposes three factors that explain and predict the individual behavior, namely attitude (A), subjective norm (NS) (social influence), and behavioral intention (BI). The behavioral intention of an individual is depending on the attitude and subjective norms [24,40] as shown in Fig. 1.

3.2 Theory of Planned Behavior (TPB)

In 1991 Ajzen extend TRA to develop TPB theory [16]. A new factor has been added which

Table 1. Blockchain generation [38]

Generation	Example	Advantage
Blockchain 1.0	Bitcoin	<ol style="list-style-type: none"> 1. Lower transactional cost in comparison to other electronic payment channels. 2. Secure and Transparent transactions with tracking cash, so counterfeiting is not possible. 1. There is a finite supply of Bitcoins, just like gold markets. 2. Relative anonymity in transactions.
Blockchain 2.0	Smart contracts and ethereum	<ol style="list-style-type: none"> 1. Smart contracts are accurate and records all terms and condition to minutest explicit detail. 2. Terms and conditions of the contract are fully visible to all transactional involved peers. 3. Smart contracts are interpreted, thus the scripts are executed live on the server, thus transaction executes fast. 4. Businesses are now paper-free, thus smart contracts allow go-green initiative. 5. It eliminates a vast chain of intermediaries as only transaction parties are involved in the contract.
Blockchain 3.0	Convergence towards decentralized Apps	<ol style="list-style-type: none"> 1. No single point of failure as there is no single node controlling the transaction. 2. No central authority owing the DApps Network, even if any intruder tries to manipulate data, it is not possible as the app does not lie on any particular Internet Protocol(IP) address, hence trust on the system is enhanced. 3. The transactional speed is increased about 100 times in distributed environment system.
Blockchain 4.0	Seamless integration with industry 4.0and Artificial intelligence	<ol style="list-style-type: none"> 1. Artificial intelligence (AI) will be an essential part of the platform. 2. Provide automation and integration of different execution platforms as a single coherent unit.

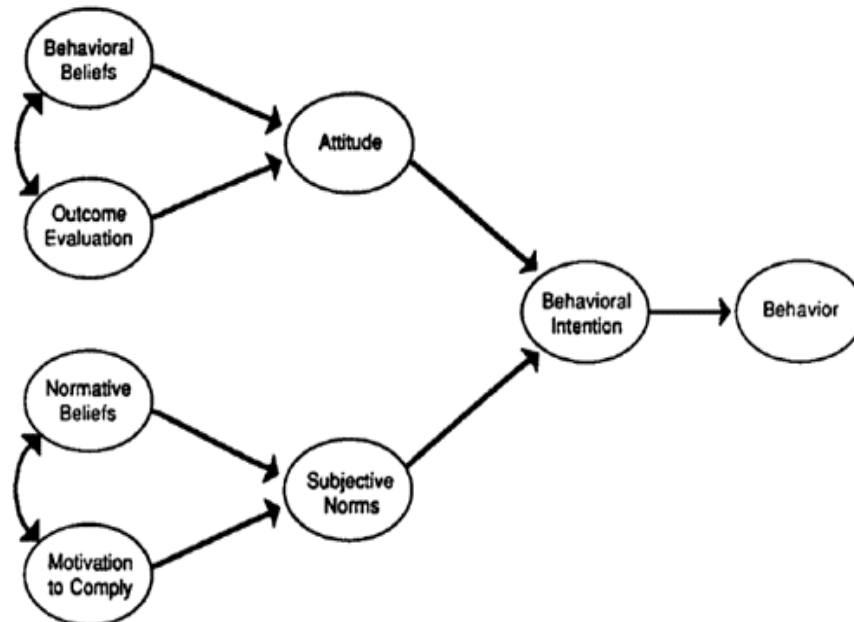


Fig. 1. Theory of reasoned action (TRA) [18]

is perceived behavioral control(PBC) in addition to the original factors of the TRA theory as shown in Fig. 2. Mainly, to obtain outcomes perceived behavioral control (PBC) is determined by the perceived significance of the skills, resources, and opportunities and the availability of skills, resources, and opportunities [22,41].

3.3 Task Technology Fit Model (TTF)

Task-Technology Fit model [42] considers that if the capabilities of technology meet the tasks that must be performed, IT is more probably to have a strong effectiveness on the performance of the individual and can be used. There are eight essential factors of Task Technology Fit Model (TTF) as shown in Fig. 3: systems reliability, quality, compatibility, authorization, locatability, authorization, production timeliness, ease of use/training, and relationship with users. The TTF model has been used in a variety of contexts in information systems studies [40].

3.4 Technology Acceptance Model (TAM)

TAM was proposed by Davis [13-15,43]. It is developed from TRA theory, however, subjective norm in TRA theory hadn't been used in TAM .TAM is considered as the first model use psychological factors that affect acceptance of new technology. Two factors are adding to

attitude (A) namely, perceived usefulness (PU) and perceived ease of use (PEOU). TAM suppose that perceived ease of use (PEOU) impact affect the perceived usefulness (PU) directly, the perceived usefulness (PU) and perceived ease of use (PEOU) impact attitude directly and impact behavior intention (BI) indirectly. Additionally, TAM take into consideration external variables such as (system characteristics, user training....etc.) as shown in Fig. 4. Technology accept model is the most popular model is used in technology adoption studies [40,43].

3.5 Extension of TAM (ETAM)

Due to the limitation of the original TAM, ETAM is developed by adding more factors to the original TAM thus enhancing TAM and increase its capabilities to determine the factors that affect the user to accept new technology. ETAM includes additional groups of factors to improve the predictive power of perceived usefulness which are cognitive (output quality, job relevance, and result demonstrability) and social influence (subject norms, and voluntariness, and image [44].

3.6 Diffusion of Innovation (DOI)

The theory of diffusion of innovation was suggested by Rogers (1995) in [17] to establish

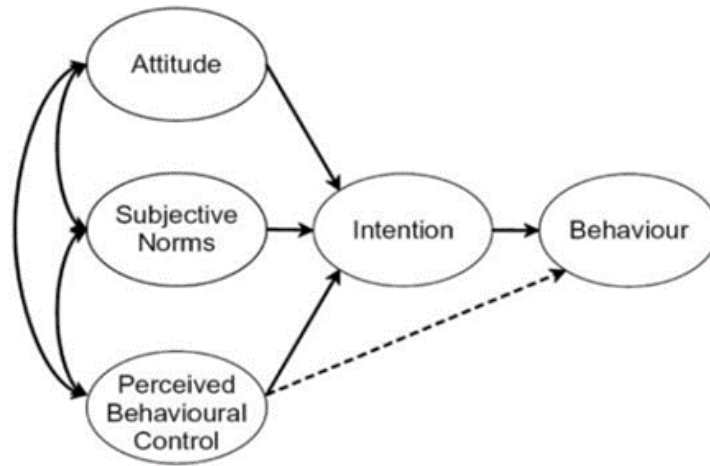


Fig. 2. Theory of Planned Behavior (TPB) [16]

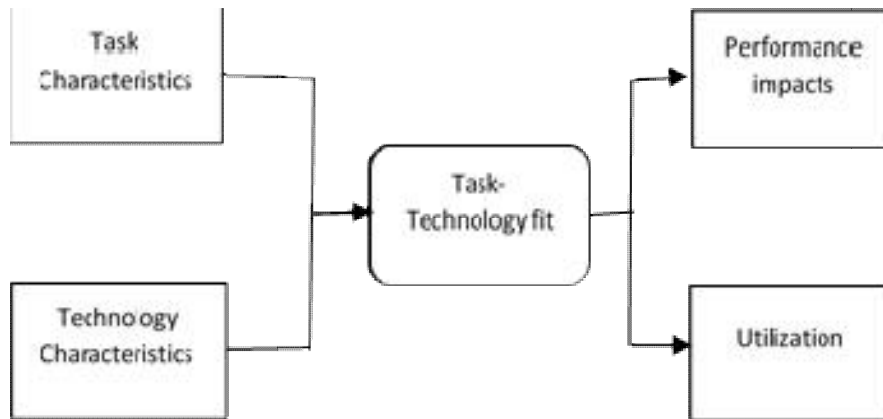


Fig. 3. Task-technology fit [42]

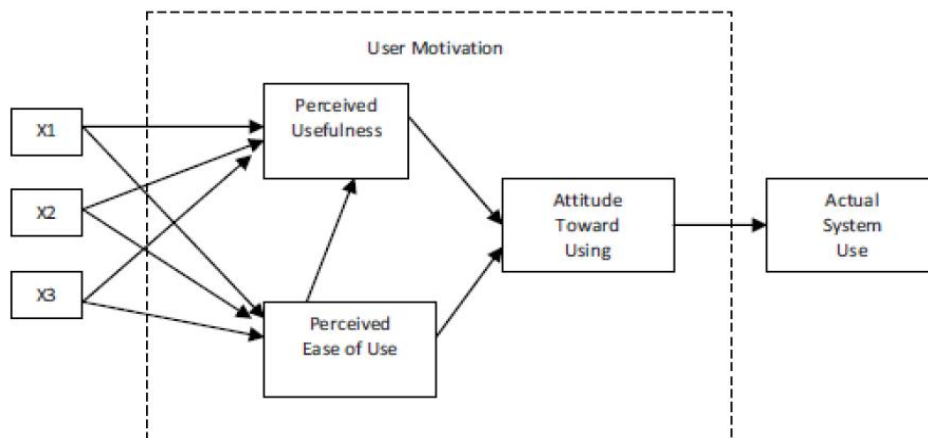


Fig. 4. Original technology acceptance model [13]

the foundation for conducting research on innovation acceptance and adoption. Rogers collected research from over 508 diffusion studies and came out with the theory of diffusion of innovation for the adoption of innovations in organizational and individual levels, also offers a theoretical basis to discuss adoption at a global level. The theory describes “the process by which an innovation is communicated through certain channels over time among the members of a social system” [24]. DOI model explores a diversity of innovations by presenting four factors (the time, channels’ communication, innovation, or social system) that affect the spread of a new idea. Innovation decision process characteristics of an innovation, and adopter characteristics are the major components of DOI model. Innovation decisions have five steps which are confirmation, knowledge, implementation, decision, and persuasion have taken place over a period of time through a series of communication channels among the members of a similar social system. Five main constructs in characteristics of innovation have been proposed as effective factors on any innovation acceptance which are relative advantage, complexity, compatibility, observability, and trialability. In adopter characteristics step have five categories namely early adopters, innovators, laggards, early majority, and late majority. In conclusion, DOI focuses more on the Technology characteristics, organizational attributes, and environmental aspects. However, comparing to other adoption models, it has less power in explanatory and less practical for the prediction of outcomes [22].

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

It was developed by Venkatesh, Morris [20], as illustrated in Fig. 5 UTAUT is based on eight previous models which are Theory of Reasoned Action, and Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), combined TAM, Model of PC Utilization, Diffusion of Innovation (DOI), Motivational Model, and Social Cognitive Theory. Compared them to identify similarities and differences. Based on the result, four significant constructs for accepting a new technology, which are performance expectancy, effort expectancy, facilitating conditions, social influence. In addition, four moderating variables were identified; experience, gender, age, and voluntariness of use [22].

4. RESEARCH METHODOLOGY

This research used a structured research approach, according to [45], to understand the literature of blockchain adoption. The review obtains the articles that have been published and indexed in the Scopus database. It included the following seven electronic databases (Science Direct, Springer, IEEE, Emerald, Taylor & Francis, MDPI, and Wiley) to identify published articles related to blockchain adoption. The search for relevant blockchain adoption articles was performed using the query string(s) defined below. We have used the following search terms:

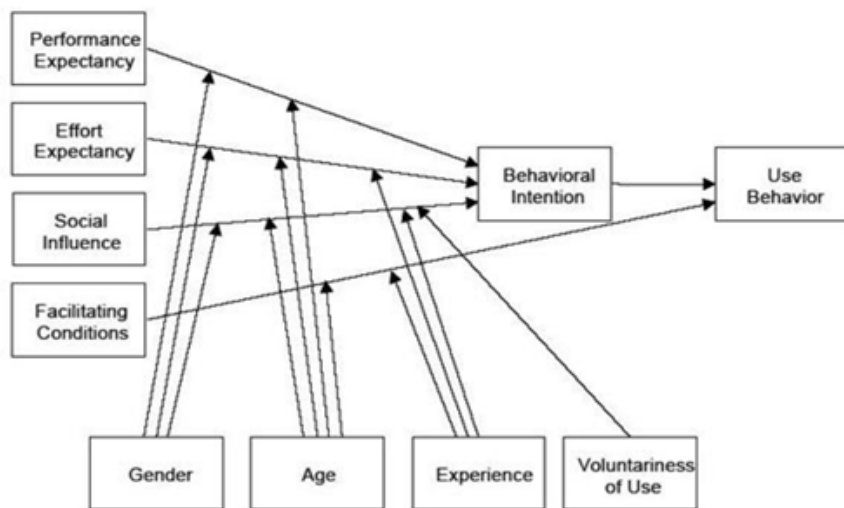


Fig. 5. Unified theory of acceptance and use of technology (UTAUT) [20]

(blockchain OR “blockchain” OR distributed ledger) AND (adoption OR acceptance OR TAM OR UTAUT OR DOI OR TR or TBP).

We included the papers that are published from the years 2008 to 2021. Due to the fact that blockchain technology was first presented in 2008 [4]. Therefore, there is no blockchain adoption related studies before 2008.

Accordingly, there is a total of 95 research articles that are relevant to blockchain adoption. The articles were refined to find those that focus on the used individual adoption and acceptance models or theories for the adoption of blockchain technology. The study also included the studies that focused on adopting cryptocurrencies as blockchain is the main technology for cryptocurrencies. This study excludes irrelevant articles. Finally, twenty one relevant publications have resulted for literature analysis, of which three (14%) were conference publications and eighteen (86%) were published in scientific journals. These various studies applied different research methods using various adoption models and theories.

Classification focused on the adoption (model, theory) is used, industry, country and identify the most important influencing factors that drive the user to accept the adoption of blockchain technology.

5. FINDINGS AND DISCUSSION

The studies that are included in this review investigated features that may influence the behavioral intention toward the adoption of blockchain. For most studies, the main objective was to explore the critical factors that affect users' acceptance and usage intention toward blockchain adoption. Table 2 summarize blockchain studies, which outline adoption models or theories that used, significant factors that influence blockchain, adoption, hypotheses, country, industry field, and the significant result of the researches. Table 2 was created based on a comprehensive literature review.

This review includes 21 studies, all studies are conducted between 2016- 2021; studies of adopting blockchain technology are still recent, so it is noticeable that most of the studies were in 2020, as it represented 61%, followed by 28% in 2019. Most of the studies which represented

(90%) used quantitative research and relied on a survey instrument to collect the data. In addition, just one study used both survey and interview, and one used a case study.

As shown in Table 2 the studies have been conducted in the following country (Brazil, Italy, Pakistan, Spain, Taiwan, India, United Arab Emirates, Malaysia, and Australia) most of the studies are conducted in the devolved country.

The hypotheses were summarized as it contributed to displaying the models or frameworks used by the studies. This is because some studies merged more than one model or used an extended model from the original model to develop their research model.

In total, seven technological adoption models and theories are used for investigations of blockchain adoption which are (TAM, TRI, TPB, TTF, UTAUT, ISS, and DOI). Table 2 reveals, some studies used one specific adoption model as [46] or an extension of the original model as Extended TAM [43,47]. In addition, some of the studies combined more than one model or theory as in [48].

It is noted that the TAM model and the UTAUT model are the most popular models are used. TAM model and extended TAM were used in (71%) of the studies. TAM model asserts that ease of use and perceived usefulness are fundamental determinants of system adoption and usage; TAM seemingly has limited use for explaining users' attitudes and behavioral intentions toward blockchain adoption, because the TAM excludes economic and demographic factors and external variables [65]. Many blockchain adoption studies extend the original TAM by adding factors, such as job relevance [64], awareness [50] etc. UTAUT was used in (28%), this theory focuses on the motivations for user behavior, such as perceived usefulness or relative advantage. As an extension of the TAM model, it is based on four factors: performance expectancy, facilitating conditions effort expectancy, and social influence. Does not including cultural factors considers the greatest limitation of UTAUT. The rest of the models mostly combined with TAM or UTAUT, except in [63] which used only DOI, [56] used TPB and in [57] combined TAM with UTAUT.

Table 2. Summary of articles

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
[49] 2016	TAM	Bitcoin	1. Perceived risk (PR). 2. Perceived usefulness (PU). 3. perceived ease of use (PEU)	--	--	Type of research → Qualitative Interview && case study	- Positive factors are PEU and PU.
[48] 2018	(TAM) (TRI) (TPB)	Supply chain	1. Discomfort(DISC) 2. Insecurity (INSC) 3. Perceived Usefulness(PU) 4. Perceived ease(PEOU) 5. of use 6. Attitude (ATTI) 7. Subjective norms (SN) 8. Perceived behavioral control(PC) 9. Behavioral intention(BI)	H1: PEOU → PU H2: PEOU→ ATTI H3: PU → ATTI H4: ATTI → BI H5: PU → BI H6:DISC(-) →PEOU H7:DISC (-) → PU H8:INSC(-)→ PEOU H9:INSC (-) → PU H10: SN →PU H11:SN →BI H12:PC →BI	India	Type of research→ Quantitative Instrument →questioner Sample : Primary =450 Response 181	- Usefulness. Perceived usefulness, attitude, and perceived behavioural control had a positive and significant impact behavioural intention. - Subjective norm has a negligible impact on behavioural intention. - However, discomfort and Insecurity shows insignificant impact on the perceived ease of use
[50] 2019	TAM	Digital currency	1. Awareness (AW) 2. Perceived ease of use (PEOU) 3. perceived usefulness (PU) 4. social influence (SI) 5. Perceived trust (PT)	H1: AW → PEOU H2: AW →ITU H3: AW→ PU H4:PEOU→ ITU H5:PU → ITU H6:SI → ITU H7:PT → ITU	the United Arab Emirates (UAE)	Type of research→ Quantitative Instrument →questioner *final sample= 181	- perceived usefulness, perceived trust, social influence, and perceived ease of use are significant had a positive and significant impact on intention

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
[47] 2019	TAM	Maritime shipping	<ol style="list-style-type: none"> 1. Customs clearance (CC) 2. Digitalizing and ease paperwork (DP) 3. Tracking and tracing (TT) 4. Standardization and platform (SP) 5. Business model and regulation (BR) 	<p>H1: DP → INU H2: TT → INU H3: CC → INU H4: SP → INU H5: BR → INU</p>	Taiwan	<p>Type of research→ Quantitative Instrument →questioner *Primary sample= 508 *Response= 121</p>	<p>- Customs clearance and management, digitalizing and easing paperwork, standardization and platform development dimensions had a positive and significant affected on intention to use.</p>
[51] 2019	TAM and task-technology fit (TTF)	Blockchain-based smart lockers	<ol style="list-style-type: none"> 1. Individual-technology fit(ITF) 2.task technology fit(TTF) 3.Perceived ease of use (PEOU) 4.perceived usefulness (PU) 5.Attitude (ATT) 6.Usage intention.(UI) 7.Network externality(NE) 8.Perceived safety(PS) 	<p>H1:ITF → PEOU H2: ITF → PU H3:TTF → PEOU H4:TTF → PU H5:PS → PEOU H6:NE→ PEOU H7:NE→ PU H8:PU → ATT H9:PU→ UI H10:PEOU→ PU H11:PU→ATT H12:ATT→UI</p>	Taiwan	<p>Type of research→ Quantitative Instrument →questioner Response= 262</p>	<p>- Perceived usefulness and perceived ease of use shows an insignificant impact - Safety is not the major concern when using a blockchain-based smart locker - The network externality of smart locker shows an insignificant impact</p>
[52] 2019	TAM	Corporate governance	<ol style="list-style-type: none"> 1. Attitude(ATT) 2. Perceived Ease of Use (PEOU) 3. Perceived Usefulness (PU) 4. Actual Behavior (AB) 5. Behavioral Intension to use(BIU) 	<p>H1: ATT → BIU H2: PEOU → BIU H3: PU → BIU H4: BIU → AB</p>	--	<p>Type of research→ Quantitative Instrument →questioner Primary sample = 250 Response=223</p>	<p>- The results of the manuscript shows the model fit indexes for various constructs are prove the model fit as per the theorized</p>

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
							model. The values of the various indexes are found to be under the permissible 2ange which explains the relationship of various constructs based on the theorized model
[53] 2019	UTAUT	Supply chain	<ol style="list-style-type: none"> 1. Performance Expectancy (PEXP) 2. Facilitating Conditions (FCON) 3. Effort Expectancy (EEXP) 4. Behavioural Intention (BI) 5. Social Influence (SINF) 	<p>H1: (SINF) → (FCON)</p> <p>H2:(SINF) → (PEXP)</p> <p>H3: (SINF) →(EEXP)</p> <p>H4:(FCON) → BI</p> <p>H5:PEXP → BI</p> <p>H6:EEXP → BI</p>	Brazil	<p>Type of research→ Quantitative Instrument →questioner</p> <p>Primary sample=500</p> <p>Response=138</p>	<ul style="list-style-type: none"> - Social influence had a positive and significant impact in predicting other UTAUT constructs. - Effort expectancy and the facilitating conditions moderates the effect in the relationship between social influence and the behavioral
[44] 2019	Extended TAM	Blockchain-Based Research Data Sharing System	<ol style="list-style-type: none"> 1. Perceived Ease of Use (PEOU) 2. Usefulness (PU) 3. Quality of System (QOS) 4. Perceived Enjoyment (PEnj) 5. Intention to use(ITU) 	<p>H1: (PEOU) → (PU)</p> <p>H2: (PEnj) → (PU)</p> <p>H3: (QOS) → (PU)</p> <p>H4: (PEOU) → (ITU)</p> <p>H5: (PU) → (ITU)</p> <p>H6: (QOS) → (ITU)</p> <p>H7: (PEnj) → (ITU)</p> <p>H8:(PEOU)+ (PEnj)</p>	online	<p>Type of research→ Quantitative Instrument →questioner</p> <p>*Primary sample22</p> <p>Response=20</p>	<ul style="list-style-type: none"> - Perceived enjoyment and the quality of the system have stronger influence on the perceived usefulness. - However, perceived ease of use shows insignificant impact on perceived usefulness.

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
				+(PU)+(QOS)→ (ITU)			
[54] 2020	TAM/ TRI/ TPB	Service and Manufacturing Industries	1. Attitude (ATT) 2. Behavior Intention (BI) 3. Innovativeness (INN) 4. Optimism (OPT) 5. Perceived Behavioral control (PBC) 6. Perceived Usefulness (PU) 7. Perceived ease of use (PEOU) 8. Subjective Norms (SN)	H1. (PEOU) → (PU) H2. (PEOU) → (ATT) H3. (PU) → (ATT) H4. (ATT) → (BI) H5. (PU) → (BI) H6. (OPT) → (PU) H7. (OPT) → (PEOU) H8. (INN) → (PU) H9.(INN) → (PEOU) H10. (SN) → (PU) H11. (SN) → (BI) H12. (PBC) → (BI)	Pakistan	Type of research→ Quantitative Instrument →questioner Primary sample=350 Response = 211	- Perceived ease of use (PEOU), attitude (ATT), Perceived behavioral control (PBC) and Perceived usefulness (PU) had a positive and significant impact on behavioral intention. - However, Subjective norms (SN) have negligible impact on behavioral intention - Innovativeness (INN) shows insignificant impact on perceived usefulness.
[55] 2020	TAM\TRI	Energy Management	1. Perceived Ease of use (PEOU) 2. Perceived Usefulness (PU) 3. Attitude (ATT) 4. Cost Saving (CS) 5. Innovativeness (INN) 6. behavioral intention (BI)	H1: (PEOU) → (PU) H2: (PEOU) → (ATT) H3: (PU) → (ATT) H4: (ATT) → (BI) H5: (PU) → (BI) H6: (CS) → (PU) H7: (CS) → (PEOU)	Developing country	Type of research→ Quantitative Instrument →questioner primary sample=178 Response= 165	- Perceived ease of use, attitude, perceived usefulness and cost saving had a positive and significant impact on behavioral intention. - Innovativeness showed a positive effect on the perceived ease of use.

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
				H8: (INN) → (PU) H9: (INN)→ (PEOU)			- However, innovativeness shows an insignificant impact on the perceived usefulness
[47] 2020	Extend TAM	Cryptocurrency	1. Performance Expectancy 2. Web Quality(WQ) 3. Trust 4. electronic word of mouth (e-Wom) 5. Perceived Risk(PR) 6. Behavioral Intention(BI)	H1a:(e-Wom)→ Trust H1b:(e-Wom) → (BI) H2a: (WQ) → Trust H2b:(WQ) → (BI) H3a:(PR) → Trust H3b:(PR) → (BI) H4a:Trust → (BI) H5: (WQ) → Trust → (BI) H6:(e-Wom) → Trust→ (BI) H7:(PR) → Trust → (BI) H8:(PE) → (BI)	Spain	Type of research→ Quantitative Instrument →questioner Primary sample =411 Response=327	- All the factors proposed had a positive and significant effect, either directly or indirectly, on the intention behind (IB).
[56] 2020	TPB	Cryptocurrency	1. Attitude (A) 2. Perceived Behavioral Control(PBC) 3. Subjective Norm(SN) 4. Behavioral intention(BI)	H1: (A) → (BI) H2: (PBC)→ (BI) H3: (SN)→ (BI)	South Africa	Type of research→ Quantitative Instrument →questioner sample of 900 269 were usable	- Attitude and perceived behavioral control positively impact the intention to adopt cryptocurrency. Subjective norm showed a negative non-significant influence

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
[43] 2020	Extend TAM	Business in Tourism and Hospitality SMEs	1. Strategic Orientation (SO) 2. Social Influence(SI) 3. Innovativeness(INN) 4. Self-Efficacy(SE) 5. Perceived usefulness (PU) 6. Perceived Ease of use (PEOU) Behavioral intention(BI)	H1: PU → BI. H2: PEOU → BI. H3: PEOU → PU H4: SO → PU H5a:SI → BI H5b: SI → PU H6: INN → PEOU H7:SE → PEOU	Hualien area in Taiwan	Type of research→ Quantitative Instrument →questioner Response=101	- Strategic orientation, social influence, and SMEs' owner/manager's individual characteristics had a positive and significant effect on the behavioral intention. - However, the moderating effects of technology characteristics, gender and age on BI were not significant.
[46] 2020	TAM	Logistics industry	1. Perceived ease of use (PEOU) 2. perceived usefulness (PU) 3. Attitude (ATT) 4. Behavioral intention(BI) 5. Actual behavior(AB)	H1:ATT → BI H2: PEOU → BI H3: PU → BI H4:BI → AB	online	Type of research→ Quantitative Instrument →questioner Primary sample =250 Response=240	- PEOU, PU and attitude had a positive and significant impact on Behavioral intention(BI)
[57] 2020	TAM3 and UTAUT	Accounting and auditing profession	1. Computer self-efficacy(CSE) 2. Perception of external control(PEC) 3. Job relevance(JR) 4. Output quality(OQ) 5. Results demonstrability(RD) 6. Effort expectancy(EE) 7. Performance expectancy(PE) 8. Social influence(S I)	H1:PEC → INT H2: PEC → EE H3:CSE → EE H4:JR →PE H5:QQ →PE H6:RD →PE H7:EE →INT H8: PE→INT H9:SI → INT	Italy	Type of research→ Quantitative Instrument →questioner Primary sample= 1,354 Response= 279	- Performance expectancy ,social influence and effort expectancy had a positive impact on auditors' intention to use blockchain

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
[58] 2020	UTAUT	Supply chain	9. Intention(INT) 1. Performance Expectancy (PE), 2. Effort Expectancy (EE), 3. Facilitating Condition (FC), 4. Technology Readiness (TR), Technology Affinity (TA) 5. Trust (TT) 6. Behavioural Intention (BI) Regulatory Support (RS)	H1: PE→BI H2: EE→BI H3:FC →BI H4:TR→ BI H5: TT→BI H6:TA→BI H7A:FC→RS→BI H7B:TR→RS→BI	Malaysia	Type of research→ Quantitative Instrument →questioner Primary sample=200 Response= 157	- FC, TR and TA have a positive influence on intention to use BCSCM - Regulatory support moderates the effect of FC.
[59] 2020	UTAUT	Supply chain	1. Performance Expectancy (PE), 2. Effort Expectancy (EE), 3. Facilitating Condition (FC), 4. Social Influence 5. Trust (TT) 6. Behavioural Intention (BI)	H1: FC→ BI H2: PE→ BI H3 :TT→ BI H4 :SINF → BI H5 :EE → BI	Brazil	Type of research→ Quantitative Instrument →questioner Useful responses=184	- Facilitating conditions, trust, social influence, and effort expectancy had a positive and significant impact on affect BCT adoption directly. - However, performance expectancy shows an insignificant impact on predicting BCT adoption.
[60] 2020	(UTAUT) model with the task technology fit (TTF) and information system success (ISS) models	--	1.Performance expectancy(PE) 2.Efforts expectancy(EE) 3.Social influence(SI) 4.Facilitating conditions(FC) 5.Blockchain efficiency(BE) 6.Intention to adopt blockchain(BI) 7.System quality (SQ) 8.Information quality(IQ) 9.Service quality(SQ) 10.User satisfaction(US) 11.Technology trust(TT)	H1-1:PE →BI H1-2:PE→ US H1-3: US →BI H2:EE →BI H3:SI → BI H4:FC →BI H5-1:SQ →SI H5-2:SQ→PE H6-1:IQ→US H6-2:IQ→PE H7-1:SQ→US H7-2:SQ→PE H8-1:BE→PE	Australia	Type of research→ Quantitative Instrument →questioner Primary sample= 1457 Useful responses= 449	Inter-organizational trust had a positive and significant effect on the relationship between the UTAUT dimension and behavioral intention. Social influence factor shows an insignificant effect on the intention to adopt blockchain,

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
			12. Inter-organizational trust(IOT)	H8-2BE→BI H9-1:TC→TTF H9-2:TCH →TTF H9-3:TTF→PE H9-4:TTF→BI H10-1:PE→TT→BI H10-2:EE→TT→BI H10-3:SF→TT→BI H10-4:FC→TT→BI H11-1:PE→IOT→BI H11-2:EE→IOT→BI H11-3:SF→IOT→BI H11-4:FC→IOT→BI			
[61] 2020	UTAUT	—	1. influence(SI) 2. Performance expectancy(PE) 3. Facilitating conditions(FCON) 4. Effort expectancy(EX) 5. Experience(Expr)	H1:PE → BI H2: SI → BI H3:FCON → BI H4:EX → BI H5: EPR → BI	Italy	Type of research→ Quantitative Instrument →questioner Primary sample =322 Useful responses==267	- Performance expectancy and social influence have a positive and significant effect on intention to adopt blockchain. - However, experience has a negative effect on blockchain use intention.
[62] 2020	TAM	Healthcare service	1. privacy concern (PCON) 2. perceived utility(PU) 3. perceived ease of use(PEOU) 4. behavioral intentions (BI)	H1A:PU → BI H1B:PEOU→ PU H1C:PEOU →BI H2A: T →BI H2B: T →PEOU H3A:PCON(-) →BI H3B:PCON(-)→PU H3C:PCON(-)→ PEOU	India	Type of research→ Quantitative Instrument →questioner Useful responses = 416	- perceived usefulness, perceived ease of use, trust and privacy concern are direct predictors of patients behavior to accept technology
[63] 2020	DOI	The Halal food and beverage manufacturers	1. Perceived desirability (PD)	H1: (PD) → (ITP) H2: (IP) → (ITP) H3(IP) →(PD)	Malaysia	Type of research→ Quantitative Instrument	- orientation strategy(OS) assist in

Reference	Model	Industry	Factors	Hypotheses	Country	Methodology	Result
			2. Institutional pressures (IP) 3. Orientation strategy (OS) 4. Intention to participate (ITP)	H4: OS → (IP) H5: OS → (PD)		→questioner Useful responses=143	appreciating the institutional pressures(IP) that motivate to participate in a blockchain-based Halal traceability system but insignificant in helping them to develop favourable perceived desirability (PD) for the Halal traceability system
[64] 2021	TAM	Supply chains	1. Subjective Norm (SN). 2. Image (IM) 3. Job Relevance (JR) 4. Output Quality (OQ) 5. Result Demonstrability (RD) 6. Perceived Usefulness (PU) 7. Perceived Ease of Use (PEOU) 8. Intention to Use(IU) 9. Usage Behavior (UB) 10. Experience Voluntariness (EV)	--		Type of research → Qualitative Case study	- Intention (IU), Job relevance (JR) and output quality (OQ) factors are the most importance factors.

H: Hypothesis; → Positively affects; (-) → Negative affects

The results of analysis studies reveal that blockchain adoption was not limited to a specific industry field, although the beginning of the blockchain was in cryptocurrencies, the studies were interested in the adoption of blockchain in other fields such as (supply chain, Service and Manufacturing Industries, Energy Management, Business in Tourism and Hospitality SMEs, Maritime shipping, logistics industry, auditing profession, and healthcare service). Supply chain management is one of the areas that has received the most attention in studies (33%); due to the nature of blockchain in support of supply chain management greatly. Perceived ease of use (PEOU), Perceived Usefulness (PU) Performance Expectancy (PE), Social Influence (SI), Attitude (ATT), Effort expectancy (EE), and Facilitating Conditions (FCON) most of the factors that were repeated; those factors mentioned in the original version of TAM, UTAUT. Analyzing the result of the studies, the significant effects of factors could be explained by the nature of the industry field of study and the culture of the country, which is dominant in shaping behavior.

6. CONCLUSION

This paper contributed to providing a review of previous studies, providing a general overview of what has been achieved in the field of blockchain adoption, and thus helps to define what should be done in blockchain adoption research. Studies were analyzed to determine the adoption (model, theory) is used, industry, country, methodology, and identify the most important influencing factors that drive the user to accept the adoption of blockchain technology. The results showed that there are still limitations in adoption studies in various fields such as health and education however, the field of supply chain management is one of the areas that received the most attention in the studies. Common studies relied on the TAM model as well as UTAUT. Moreover, perceived ease of use (PEOU), perceived usefulness (PU) are considered the most important factors affecting the intention of users in adopting blockchain technology in different fields. Although this research sheds light on blockchain adoption studies, there are limitations in the study as it relied on only 7 databases to collect studies, also this study focused on studies that depend on models and theories of adoption at the individual level only, as it did not include the factors affecting the adoption of blockchain technology at the organization level.

Future studies: Expand future research to discover blockchain adoption and study the challenges of adopting adoption at all levels, develop strategies for blockchain adoption based on the factors, and investigate post-adoption stages to monitor the development of blockchain adoption.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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