Integrating UTAUT and TAM Models for Adoption of Blockchain Technology: A Review of Literature

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Abstract

Blockchain Technology is a ground breaking transformation securing its existence in every dominant field like healthcare, supply chain, financial market etc. it is decentralized distributed ledger which provides transparency, security and build trust due to its immutable nature. Blockchain provides numerous benefits to all industries but still its adoption is exceptionally challenging due to regulatory concern, technical challenges & user acceptance. This review paper reviewed 30 pertinent research studies to examine what factors of Model (UTAUT) Unified Theory of Acceptance and Use of Technology & (TAM) Technology Acceptance Model effects on the behavioral intention in adoption of Blockchain technology. In this paper the previous work done on both models for Blockchain adoption is analyzed and the effect of both models on Blockchain adoption is discussed. As the number of studies are there on the potential of Blockchain but not enough attention is given on the factors that impacts the behavioral intention to adopt blockchain technology. This study aims to create review of literature to identify factors that influence the adoption of Blockchain technology.

Keyword- Blockchain technology, decentralized, transparency, UTAUT, TAM, regulatory concern.

Introduction

Blockchain was initially popularized by Satoshi Nakamoto in year 2008 but it was developed in year 1991 by Stuart haber & Stornetta who offered to solve the the issue of data tempering by creating blocks to collect the information (Stuart Haber 1991). Since then many developments were occurred until the Blockchain technology turned into decentralized, immutable, transparent & secured ledger. It is a distributed ledger that records the transaction that occurred over a computer network and decentralized in nature that creates transparency and sharing of information in tracking of assets. Blockchain collect and store the data in a block and then all blocks are attached chronologically to make a chain. In blockchain every block is secured by cryptographic hash of the former block with the time stamp and information of transaction. Loukil. F (2021) stated benefits of blockchain but still the

popularity of this technology took almost one decade and the adoption is still under the question mark. Casino (2019) has focused on the need of multiple intermediaries to function any transaction and creates a decentralized system with transparency and security.

With its decentralized and unchangeable nature, blockchain technology has several benefits for various industries like healthcare, government, supply chain and finance.. Blockchain adoption confronts obstacles like user acceptability, regulatory issues, and technical difficulty despite its potential. "as Internet made revolution in communication in the same way Blockchain will create a revolution for trusted transactions," according to industry experts like Ginni Rometty, CEO of IBM (September 2017). Many experts & scholars have identified Blockchain as a disruptive technology that have multiple uses and can create wonders. However, Iansiti and Karim (2017) stated that blockchain is a foundational breakthrough that is awaiting widespread acceptance rather than a disruptive technology. In addition to it many scholars argued that this technology can transact financial transactions with removal of all the frauds and misuses According to Risius and Spohrer (2017) it could serve as the basis for completely new commercial and organizational paradigms. Yli-Huumo et al. (2016) also marked that Bitcoin remains the most popular and somewhat most publicize use of this blockchain technology, despite the increased attention and awareness surrounding this innovative technology. Now the environment is quickly shifting from the sole use of Blockchain in bitcoin to other varied uses through smart contracts. Smart contracts are the computerized contract that remove the need of intermediary and execute the transaction automatically. Sarra (2022) also stated that the smart contracts are automated and self executed and remove the need of intermediary and provides overall transparency and efficiency. Zabo (1997) also discussed in his literature about the use of smart contract in derivatives, bond and loans.

Some esteemed researches have been done in recent years on the acceptance models like TAM, UTAUT, theory of diffusion, theory of planned behavior etc. Tarhini (2016) concluded that each theory have certain challenges and advantages. Using only a single model may not reap much benefits so the combination of the technologies will work.

The most popular model Technology Acceptance Mode is developed by Davis in year 1989. Davis propounds that there are two main constructs of this model that is perceived usefulness & perceived ease of use. These are principal determinants that show the adoption interest of individuals. According to PU . S. Alzahrani(2019) There are number of studies that have applied TAM model to discover the behavioral intention of users to adopt the blockchain technology.H. Albayati(2020) focuses on wide acceptance of this model builds trust in the constructs of this model. In this study the constructs of TAM have been concluded and also it is extended by various external variables that can effect behvaioral intention to adopt this technology. (Upayana Wiguna Eka Saputra (2022)

Constructs of TAM -

Perceived Usefulness (PU) Definition: an individual perceives or expect that this technology will enhance the job performance.

Transparency and Security: users assume that by using Blockchain technology their transactions will get secured and transparent as Blockchain is distributed ledger and immutable in nature so no one can alter or delete the data. Blockchain definitely improves transparency & security in all sectors including healthcare and finance Catalini and Gans (2016).

Blockchain provides data integrity as it is immutable in nature which is very essential in the sectors like finance and medical, as alteration of data in these fields can be highly detrimental Peters & Panayi(2016).

Efficiency and Speed: speed can be improved by the elimination of middleman that means automation in certain way, smart contract is the tool to eliminate the role of multiple middleman and provide self executing contracts Kshetri, (2018). Smart contracts cuts down the administration cost by removing the involvement of human factor from contract Nofer et al., (2017).

Cost Savings: removal of middle parties increases the speed and hence reduces the cost of transaction Peters & Panayi(2016). For example, in the financial sector,

blockchain can lower transaction fees and do away with the need for verification by external party, which can result in significant cost savings Guo & Liang (2016).

Perceived Ease of Use (PEOU)

Definition: It means the level of easiness, an user feels while using the technology.

Technical Complexity It is assumed that using Blockchain technology is very complex and it create hurdles in adoption of Blockchain technology Lin and Liao (2017).

As the deep knowledge of cryptography and distributed computing is required the adoption gets more difficult Zheng et al., (2017).

User Interface and Experience: It is greatly impacted by user-friendly interfaces and smooth interaction with current systems. if Blockchain have supportive environment system and easy user interface then it becomes easy to adopt this technology Swan (2015). According to Beck et al. (2018), if user interface is developed by pointing the ease of use for users then it becomes quite easy for users to use the technology.

Integration with Current Systems: it should match and gets easily integrated with the current running system without the creation of major changes.

"The ease of integrating blockchain with existing systems significantly affects its adoption" Beck and colleagues (2018). When not major changes occurs in integrating Blockchain in system then it is easily accepted Peters & Panayi (2016).

Unified Theory of acceptance and use of technology (UTAUT)

Overview of UTAUT

It is originated by Venkatesh et al. 2003 included constructs from various models including TAM. It identifies 4 major constructs performance expectancy, effort expectancy, social influence and facilitating conditions . Venkatesh et al. (2003) discussed that this model explained almost 70% variance than any of the other model which is greatest and impactful. It is concluded from the model that it have three direct determinants performance expectancy, effort expectancy and social influence, two direct determinants of intentions & facilitating behaviorLewis et al (2017). Dai & Vasarhelyi (2017) suggested that ease of use can be the prominent factor in adopting the technology. As we can see when transactions gets speedy and smoothly, ease of use exist. It is found in the study of Davis et al (1989) that perceived ease of use, trust & facilitating condition creates a relationship that is positive in nature with regards to individual's intention to use the technology where in contrast to cost establish a negative relationship with intention.C. Christopher lee (2019) constructed some measures to identify the perceived ease of use like : Q1.i find out easy to use this technology. Q.2 it is effortless etc.

All models have some challenges and benefits but this model is extremely effective and can measure the construct of technology acceptance in a clear way.Chao (2019).In the opinion of Jevsikova et al. (2021) UTAUT is the extension of TAM model and identify technological constructs also. Venkatesh et al.(2003) also added that UTAUT model outperforms TAM model by adding constructs like facilitating conditions and social influence where as Wijaya et al. (2022) further added that this model provides overall organizational view by adding constructs like performance expectance and efforts expectancy. as it becomes mandatory to accept and update every other new technology in order to be update with new reality. The UTAUT model is one of the pertinent model that describes the usage and adoption of any technology in organizational and individual criteria Neriotti et al. (2018). In addition Tamilmani et al(2019) also provided the significance of UTAUT model in organizational setting. In year 2021 author also added new study in which he added the extension of UTAUT models & explained the base of theory.

Application of UTAUT to Blockchain Adoption

Application of this model creates a forecasting of acceptance and adoption of this technology with the regards of added constructs. It is found to be greatly methodical to use this model and create an understanding Chao (2019).

Performance Expectancy – The level at which user sense that adopting this particular technology will gain this much benefit in my job performance basically it is the expectations from the technology. Venkatesh et al. (2003)

identifies performance expectancy as a direct determinant of user acceptance and behavior. It creates a direct impact on user acceptance Zhou et al. (2020): also agreed and contributed that positive result of performance expectancy leads to greater user expectance.

Effort Expectancy-The level to which using technology feel effortless it is similar to perceived ease of use from TAM model .Davis (1989) Originated the concept in the Technology Acceptance Model (TAM), noting that perceived ease of use is crucial for technology adoption.Al-Jabri and Roztocki (2015): Found that more the users find the technology effort free more they will be attracted towards the technology.

Social Influence-The extent to which society or peer group feels the technology is relevant.Venkatesh and Davis (2000): Highlights the importance of social influence in adoption of technology at initial levels.Jiang et al. (2021): also added in his research that in supply chain management also the peer group and societal pressure were the factors that influenced the adoption of Blockchain.

Facilitating Conditions- the level of facilities that have been granted by organization to adopt blockchain technology. Venkatesh et al. (2003) Identified the role of facilitating conditions as a determinant of technology use, encompassing technical support and organizational infrastructure.Chang et al. (2020) also added the importance of facilitating condition to get regulatory support and technological infrastructure in adoption of the technology.

Trust and Security-As the name itself trust means how much you feel that this technology is secures or error free.Mayer et al. (1995)Discussed trust as a critical component in organizational contexts. Yli-Huumo et al. (2016)Highlighted that the more the security is provided the more trust is build for the technology.

Table 01. Review of Literature on TAM and UTAUT Models in adoption of Blockchain Technology-

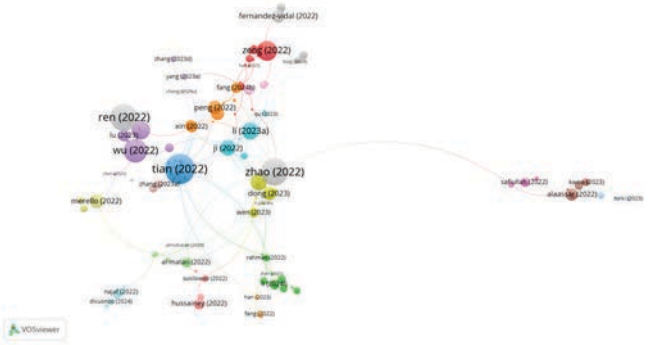
Author(s) & Year	Objective	Model/Framework	Key Findings	Relevance
Kamble et al. (2019)	Factors that effect the adoption of blockchain technology in mangement of supply chain.	TAM, TRI TPB	PE, PEOU and trust are the prominent factors that directs the acceptability of this technology.	TAM model is used to identify the impact of constructs.
Queiroz & Wamba (2019)	Reviewing the components of blockchain that impacts in operationmanagement & supply chain.	Extended UTAUT	Performance & effort expectancy , facilitating condition all three compete a significant role in acceptability of technology.	Extended UTAUT model is used to identify the impact on advocacy of technology.
Shrestha & Vassileva (2019)	Explore the level of acceptance users have on research data sharing system that is based on blockchain technology.	Extended TAM	System quality and perceived enjoyment significantly influence perceived usefulness; perceived ease of use does not significantly affect perceived usefulness.	Offers insights into factors affecting user acceptance of blockchain-based systems in research contexts.
Salem & Ali (2019)	Examine factors influencing blockchain adoption using UTAUT and TOE frameworks	UTAUT, TOE	Proposes a model integrating UTAUT and TOE frameworks to understand blockchain adoption, emphasizing the role of technological, organizational, and environmental factors.	Provides a comprehensive framework for studying blockchain adoption.

Author(s) & Year	Objective	Model/Framework	Key Findings	Relevance
Kamble et al. (2019)	Investigate blockchain adoption in supply chain management using a triple helix model	TAM, TOE	Perceived benefits, organizational readiness, and external pressure significantly influence blockchain adoption intention.	Highlights the role of organizational and external factors in blockchain adoption.
Wamba & Queiroz (2020)	Examine all the factors including challenges, benefits and uses of blockchain technology in supply chain management.	Review of literature	Identifies key benefits (e.g., transparency, traceability) and challenges (e.g., scalability, regulatory issues) of blockchain adoption in supply chain management.	Provides a overall overview of the present state of blockchain adoption in supply chain management.
(C. Christopher Lee 2019)	This study investigates the likelihood that consumers will embrace the new blockchain technology using the unified theory of acceptance and use of technology (UTAUT) model created by Venkatesh et al. (2003). .	UTAUT model	Both perceived operational usefulness and perceived simplicity of use positively impact blockchain adoption. Additionally, demographics suggest that blockchain usage may increase, with younger generations and IT professionals potentially serving as early adopters.	Evaluated five variables and the adoption of blockchain technology using multivariate statistical models.For example, perceived operational utility, cost, perceived simplicity of use, perceived trust, and perceived facilitating condition. Based on the aforementioned five UTAUT model components, a hypothesis and questionnaire were created.
(Upayana Wiguna Eka Saputra 2022)	This paper aims to analyze the level of intention on acceptability and usage of blockchain technology particularly in My T wallet.		-It was concluded that social influence,security & ease of use impacts positively on the intention to use any new technology.	To predict the intention to use Blockchain researcher applied extended TAM model and included trust,social influence,government rules and regulations and security along with perceived usefulness & ease of use. My T wallet from Tokoin was used as reference for Blockchain in Indonesia.
(Joseph M. Woodside 2017)	In this researcher tried to find out the category of Blockchain in the model of diffusion of innovation, to find out he conducted Text analysis, PEST analysis & financial analysis.	Diffusion of innovation. PEST analysis Text analysis Financial analysis	This paper is majorly all about the managerial problems faced by big companies and the reasons to adopt Blockchain to solve issues. And tried to understand on which stage of diffusion of innovation Blockchain technology exist. And tried to know which firms can apply Blockchain and what benefits they can get through Blockchain technology.	In political factor of PEST analysis Blockchain is transparent and does not require regulatory party,while in economic it lowers the cost of transaction and lowers completion time, in social it can easily monitor transaction in single location whereas in technical decentralized reliability, durability and security.

Author(s) & Year	Objective	Model/Framework	Key Findings	Relevance
(Vikram Sadhya 2018)	To identify 16 barriers of blockchain technology so that he can find out the gap that exist in adoption of technology. He reviewed 136 articles for the same and found out the most prominent barriers.	Inductive content analysis	The barriers identified in analysis is said to temporary in nature as it can be eradicated with the awareness of Blockchain in long run. Main issue of most of the barriers is the lack of awareness of Blockchain and Trust on this technology that can be eradicated by the more knowledge and by social influence.	Herd behavior,privacy & security, 51% attack,regulatory issue,energy consumption,ease of use,storage concern,technical maturity were the major factors that has been analysed through reviewing articles.
(Grover 2019)	Conduct survey through twitter to understand application,opportunities & drawbacks of Blockchain technology	(DOI) (TRAM) (TRI) (TPB) (TTF) (TAM) (UTAUT) (TOE)	Results indicated that there were more discussion of benefits rather than drawbacks of Blockchain. Perceived usefulness gained attention due to reduced transaction cost & increasing speed. TAM model was also used to conduct analysis of perceived usefulness,ease of use & external variables.	Blockchain use cases were studied- .initial coin offering .smart contract .distributed ledger In benefits- reduced transaction cost,speedy transaction & trust & security, whereas drawbacks were
(Ammar AL-Ashmori 2022)	Conduct survey on 5 best known theories for Blockchain adoption is TAM,UTAUT,TRA,TPB,TOE.	TAM,UTAUT,TRA,TPB,TOE	It is observed that first study was done on Blockchain in 2015 and only one study was published in 2016. In 2020 it was tremendous increase in numbers of publications. Keywords like smart contract, initial coin offerings, distributed ledger appeared. Country Malaysia and industry supply chain is the most attracted towards Blockchain adoption.	In this review paper Blockchain types,theories,genrations,models everything was discussed. In this researcher tried to find out the no. of publications on Blockchain each year,which country is mostly engaged with this buzz word Blockchain,most cited Blockchain articles,most serached keywords. In which years research on Blockchain was in boom. These all things were reviewed and presented in bibliometric format with the use of VOS viewer.
(Rabindra Kumar Jena 2022)	To analyze the adoption criteria of blockchain technology in banking industry with the use of extended UTAUT model	Extended UTAUT model	The most important factors that influence the adoption decisions are facilitating conditions , initial trust and performance expectancy	Here author tried to use extended UTAUT model to understand the Implication of Blockchain technology in banking system. But in the end government regulations,initial trust & perceived security was added in the proposed model.

Any major detailed investigation initiates with review of literature, a systematic review of literature is collecting , reviewing and analyzing all the relevant literature Bayram (2020) and when the review is done correctly it offers a replicable study that provides sufficient detail to other scholars. It provides in depth assessment of the literature. Through the use of bibliometric analysis SLR can be described in pictorial form. Below is the bibliographic map created by using VOS viewer in which 715 research paper have been exported out of which 175 research papers with maximum citations have been selected and formed in a map. Most cited authors are Ren(2022), Wu(2022), Tian(2022), Zhao(2022) and Zeng(2022).

Figure 1: Bibliometric map of citations



Conclusion

This review paper conducted a detailed analysis of 30 papers based on the technology acceptance model and unified theory of acceptance and use of technology in adoption of Blockchain technology. In this paper the constructs of both models are discussed and its impact is reviewed. It is found that UTAUT is somewhere the extended version of TAM model providing broader aspect. Many studies uses TAM and UTAUT combined and many studies uses extended TAM or UTAUT model, some of the studies uses single models but for better results the integration of two is recommended. Perceived usefulness or performance expectancy and ease of use and effort expectancy are two constructs that plays a pivotal role in determination of adoption of Blockchain technology. except these two constructs trust also plays a major role in adoption of technology but somewhere trust also depends on above mentioned two constructs. We have also conducted thematic analysis which shows that perceived usefulness & trust are the two constructs that have been used most. It could be concluded that perceived usefulness i.e PE, perceived ease of use i.e EE and trust are the main constructs that influence the adoption of technology. It is found out that there are very limited research on the models examining the adoption of specifically Blockchain technology. despite the potential of this research area there is very limited literature available. There should be some studies that validate the combination of both models in different areas like finance, supply chain and healthcare individually to find out the scope of adoption of Blockchain technology. lastly bibliometric analysis is also done to figure out the most cited authors on the "adoption of blockchain technology using TAM and UTAUT model between year 2021 to year 2025" .

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