Blockchain Technology Adoption Through the UTAUT Model

Exploring the Mediating Role of Trust in Technology

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Abstract: This paper studies the adoption of blockchain technology under the scope of the Unified Theory of Acceptance and Use of Technology (UTAUT). Previous results on Management Information Systems (MIS) research are divergent about the significance of UTAUT variables in explaining the adoption behaviour of blockchain technology. The paper focuses on this specific concern and tries to contribute to existing studies by testing the model in a specific context (Tunisia) and by considering the individual variable "trust in technology" as a mediating one. For this aim, a structural equation approach is adopted among 95 Tunisian professional respondents operating in technology-based sectors. The findings stipulate the importance of facilitating conditions and performance expectancy as drivers of the adoption intention. Additionally, the study reveals that trust in technology is significant in its mediating role in influencing the intention of adoption with the facilitating conditions and the social influence constructs. Moreover, the paper uncovers a direct relationship with the same variable. These findings provide valuable insights for both researchers and practitioners in understanding the factors that influence blockchain technology adoption in the Tunisian context and stress the indirect role of trust in technology with which decision-makers should be concerned.

Keywords: Blockchain technology, UTAUT, behavioural intention, adoption factors, trust in technology

http://doi.org/10.18080/jtde.v12n1.873

Introduction

Blockchain technology has emerged as one of the most promising innovations of the 21st century (Alshamsi *et al.*, 2022). Fundamentally designed as a distributed, decentralised ledger, blockchain provides a secure and transparent way to store information without the intervention of a trusted third party (Alshamsi *et al.*, 2022; Ameyaw & deVries, 2023). With its decentralised and immutable architecture, blockchain has the potential to transform entire industries, ranging from finance and logistics to healthcare and governance (Azan *et al.*, 2021). By leveraging concepts such as cryptography and distributed consensus, blockchain is paving the way for new business models and unprecedented collaboration, while preserving data integrity and building trust within networks. As the technology continues to grow in popularity, its impact transcends the limitations of simple digitisation to shape the future of how data is stored, shared and secured globally.

As a consequence of the recognition of its benefits, research on the topic of blockchain adoption has been extensive in recent years (Abed, 2020; Bag *et al.*, 2022), but results are divergent, and there are no common conclusions about theories and applications. Hence, the present paper studies the adoption of blockchain technology under the scope of the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2003; Venkatesh & Davis, 2000). The authors adopted the UTAUT because it is the best-known model in the management information system (MIS) field (Willams *et al.*, 2015;Ennajeh & Amami, 2014, Sharma *et al.*, 2023).The paper holds a specific theoretical framework to discover the most relevant factors explaining blockchain technology adoption. The choice of the UTAUT aims to identify the individual factors, considered as an important perspective in this context (Alshamsi *et al.*, 2022). However, previous results on MIS research are divergent about the significance of UTAUT variables in explaining the adoption behaviour of blockchain technology in different contexts. The paper focuses on this specific concern and tries to contribute to existing studies by testing the model in a specific context (Tunisia) and by considering the individual variable "trust in technology" as a mediating one.

Consequently, the paper aims to contribute to existing studies by focusing on testing the UTAUT in the Tunisian context. Furthermore, and as suggested by Sharma *et al.* (2023),the UTAUT inspired researchers to make modifications to the original structure of the model. Subsequently, the authors of this paper considered another individual variable, trust in technology, which is regarded as relevant in the case of blockchain technology (Fleischmann & Ivens, 2019).

The choice of trust in the research model is explained by the attributes of blockchain and by the nature of transactions embedded in this peer-to-peer network. The generation of trust is

http://doi.org/10.18080/jtde.v12n1.873

seen as one of the greatest advantages associated with blockchain (Fleischmann & Ivens, 2019). Therefore, trust is a key factor that can influence individual behaviour toward the use of blockchain. This idea is also maintained by Batwa & Normann (2021) who assumed that there is a strong relationship between trust and blockchain technology. They added that trust is the main driver for applying blockchain technology.

Furthermore, trust plays a crucial role in accelerating blockchain adoption across diverse industries. Trust serves as a crucial mediator in the widespread adoption of blockchain technology across various industries (Truong *et al.*, 2021).

Consequently, the main objective of this paper is to explain the behavioural intention of using blockchain through the UTAUT. Moreover, it sheds light on the mediating role of trust in technology with the determinants of the UTAUT model. The research questions of the paper are mainly as follows:

- What are the determinants of blockchain technology adoption in the Tunisian context?
- How does trust in technology mediate the relationship between the UTAUT variables and the behavioural intention of using blockchain technology?

To answer research questions and validate theoretical constructs, partial least squares structural equation modelling (PLS-SEM) (Hair Jr *et al.*, 2017) was performed. Data was collected from 95 Tunisian professionals operating in technology-based sectors in Tunisia.

As an outline, the rest of the paper presents a literature review of blockchain technology and its adoption. The second section concerns the theoretical foundations (UTAUT model and trust in blockchain). The third section aims to build the theoretical model and the hypothesis. The fourth section is dedicated to the presentation of the methodology and the research design. The fifth section presents a discussion of the results. Finally, the conclusion summarises the paper's contributions.

Literature Review

Introducing blockchain technology

Blockchain, as an emerging innovation in the digital economy, is supposed to transform traditional business models and reshape socio-economic dynamics. Its growing adoption globally is fuelled by both the vertical expansion of its adoption rate and the horizontal increase in the number of available blockchain applications (Ennajeh, 2021). This revolutionary technology operates within a network that brings together actors who want to exchange assets directly, without third parties or central authorities. It makes it easier to keep information in public records, accessible to all members of the network, where data is

http://doi.org/10.18080/jtde.v12n1.873

immutably recorded. Blockchain has the potential to build trust, transparency, security and visibility between partners (Golosova & Romanovs, 2018).

More technically, blockchain is defined as distributed ledger technology (DLT), which is a protocol allowing data exchange between network partners without intermediaries, such as third-party logistics (Jraisat *et al.*, 2021; Mohammed *et al.*, 2021).

Tapscott & Tapscott (2017) conceived the well-known definition of blockchain: *"An incorruptible digital ledger of economic transaction that can be programmed to record not just financial transactions but virtually everything of value*."

Originally, blockchain technology was created as the technology that supports Bitcoin (Nakamoto, 2008). Later, blockchain surpassed cryptocurrencies and financial services; it was expected to revolutionise many other sectors (Woodside *et al*, 2017). In fact, blockchain technology evolution has undergone three stages: first, Blockchain 1.0 where the deployment of cryptocurrencies as a peer-to-peer cash payment system emerged. Second, Blockchain 2.0, the more extensive blockchain application, includes bonds, loans, smart property and smart contacts. Third, Blockchain 3.0, which is characterised by the development of blockchain applications in the areas of government, health, science, literacy, culture and art (Alshamsi *et al.*, 2022).

Blockchain applications are explored and adopted in many economic sectors with different adoption rates, including healthcare, finance and banking, education, governance, supply chain, energy and agriculture (Ennajeh, 2023).

Blockchain technology adoption

Demand for blockchain applications is growing rapidly in various industries. Statistics published by Ruby (2023) demonstrate an annual growth of the blockchain industry of about 56.3%. The evolution of blockchain technology in terms of adoption rate and application development inspired questions to understand its actual and future use.

In the MIS field, studies about technology or innovation adoption comprise some of the most robust areas, and their major preoccupation is to explain the adoption behaviour predicted by individuals' or organisations' intentions to adopt innovation. Generally, the adoption is influenced by several factors related to the individual perception of the usefulness of new technology in the organisational context.

The exponential growth of blockchain technology applications calls for studies to understand its adoption. Literature on blockchain technology adoption has also grown in recent years and demonstrates that the blockchain system has not yet reached the maturity stage and that extensive studies should be conducted before implementation (Wang *et al*., 2016; Janssena *et al*., 2020).

According to Alshamsi *et al*. (2022), the technology acceptance model (TAM), technology organisation and environment (TOE), UTAUT and Innovation Diffusion Theory (IDT) are the models most widely used to understand blockchain technology adoption.

The study of Queiroz *et al*. (2021), for example, investigated blockchain technology adoption behaviour by drawing a model of UTAUT. The proposed model was validated in Brazilian operations and supply chain professionals. Results demonstrated that facilitating conditions, trust, social influence, and effort expectancy are the most critical constructs that directly affect blockchain adoption. However, performance expectancy was not decisive.

Khazaei (2020) also tested an extended version of UTAUT in a Malaysian context. The author added personal innovativeness, security, technology awareness and trust to the original constructs of the underlined model. Findings show that only technology awareness was not significant in its impact on adoption intention.

Furthermore, Kabir *et al*. (2021) investigated determinants of blockchain acceptance in the context of the Bangladeshi financing supply chain by testing the UTAUT model with direct and indirect relation. The results supported the original model relationships except for social influence. The mediating role of behavioural intention to use blockchain between facilitating conditions and the actual use of blockchain is also supported.

As a conclusion to the literature review, research on blockchain adoption has increased in recent years but results are not always the same given the difference in studied context, the nature of blockchain applications and the economic activity of adopters. Thus, previous findings call for substantially more investigations on determinants of blockchain adoption.

Theoretical Foundations

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

The UTAUT is a unified theory that gathers all theories advanced previously to the study of Venkatesh *et al*. (2003). The founders of UTAUT examined constructs of the theory of reasoned action (TRA) (Azjen & Fishbein, 1980), the social cognitive theory (SCT) (Bandura, 1986), the theory of planned behaviour (TPB) (Azjen, 1991), the model of personal computer use (MPCU) (Thompson *et al*., 1991), the model of technology acceptance(TAM and TAM2) (Davis *et al*., 1989;Venkatesh & Davis, 2000), the motivational model (MM) (Davis *et al*., 1992), the combined TAM-TPB theory (Taylor & Todd, 1995), and the diffusion of innovation theory (DOI) (Rogers, 1995). UTAUT authors have an objective to test all constructs proposed and tested in those theories to formulate a unique view that can explain adoption behaviour through the influence of individual intention to adopt any technology or innovation. Constructs deduced to build the original UTAUT model are *performance expectancy, effort expectancy, social influence, and facilitating conditions*. Moderator variables were also added and tested (age, gender, experience and voluntary use) (Venkatesh *et al*, 2003).

The UTAUT is one of the most frequently used models for researching technology acceptance (Wong *et al*., 2020). According to Google Scholar citations, the paper of Venkatesh *et al.* (2003) was cited 47,957 times until 2023.As a result, the purpose of this work is to add to the current literature by evaluating the UTAUT model in the context of blockchain technology and providing data that may be useful for future research.

Trust and blockchain technology

Trust as a construct in management science was first introduced and defined by Rousseau *et al.* (1998, p. 395) as a "*psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another*".

The specific construct of trust in technology was created and defined by Mcknight *et al.* (2011). In their study, the authors argued that "*trust in a specific technology refers to a person's relationship with a particular technology*" (Mcknight *et al.*, 2011, p. 6). They added that trust in technology is more palatable to apply than the interpersonal trust constructs used in previous studies.

In the context of blockchain technology, trust in general and trust in technology in particular were studied by many researchers(Fleischmann & Ivens, 2019; Chawla, 2020; Jardim *et al.* 2021). This is explained by the attributes of the technology itself and by the nature of transactions embedded in this peer-to-peer network. Fleischmann & Ivens (2019) argued that the generation of trust is regarded as one of the greatest advantages associated with nascent blockchain applications.

According to Chawla (2020), the nature of trust in blockchain differs from its traditional view in organisations. In fact, he indicated that trust in blockchain embodies algorithmic and organisational trust.

Following this idea, Fleischmann & Ivens (2019) underlined the crucial role of trust due to technical design features of blockchain technology and applications. Further, blockchain technology can create a level of trust in the digital world that even reputable market players are not able to do.

Theoretical Constructs and Model Building

As mentioned earlier, this paper intends to test the relevance of the UTAUT (Venkatesh *et al*, 2003) when explaining the intention to adopt blockchain technology. Given the novelty of this technology and its limited use in the Tunisian context, the analysis will be limited to studying the intention behaviour. The basic idea of the model is that an individual's intention to adopt blockchain technology is influenced by personal judgement about some determinants of innovation. According to the UTAUT model, those factors are as follows.

Performance expectancy

In their study, Venkatesh *et al.* (2003) defined performance expectancy as a measure of a person's belief in improving their job performance using a new system. Therefore, using a new system or technology to perform tasks can be perceived as offering many benefits (Khazaei, 2020). Performance expectancy can thus be seen as an important indicator of intention to adopt blockchain technology; a finding in line with previous research on the adoption of blockchain technology in various contexts (Khazaei, 2020; Queiroz *et al.*, 2021; Wong *et al.*, 2020; Alazab *et al.*, 2021;Kabir *et al.*, 2021).

Consequently, an individual's intention to adopt blockchain technology is related to the perceived advantages of a particular job. Subsequently, the following hypothesis is advanced:

> *H1: Performance expectancy has a positive impact on behavioural intention to use blockchain technology.*

Effort expectancy

Corresponding to research by Venkatesh *et al.* (2003), effort expectancy describes the perceived complexity or difficulty associated with using a new system. This expectancy of effort is critically important when an individual perceives the ease of learning and using technology. More recently, definitions have expanded on the original definition by emphasising that this variable measures the ease of use of a new technology. In the specific context of blockchain technology, many previous studies agree that effort expectation is a strong predictor of its adoption (Kabir *et al.*, 2021; Wong *et al.*, 2020; Khazaei, 2020; Queiroz *et al.*, 2021). In other words, if future users perceive blockchain technology as simple to use, it will entice them to adopt it (Kabir *et al.*, 2021).

As a result, we hypothesise as follows:

> *H2: Effort expectancy has a positive impact on behavioural intention to use blockchain technology.*

http://doi.org/10.18080/jtde.v12n1.873

Social influence

Social influence encompasses the assessment of the degree of influence exerted by various actors, such as colleagues, family, friends, partners, and peers, on individual intention to adopt a technology. In the specific context of blockchain technology, Khazaei (2020) argued that social influence is of crucial importance due to the community-based nature of this technology. In addition, a lot of previous research has corroborated the findings regarding the impact of social influence on behavioural intention to adopt blockchain (Kabir *et al.*, 2021; Alazab *et al.*, 2021; Wamba & Queiroz, 2019; Khazaei, 2020).

As a result, at this stage of the analysis we make the following assumption:

> *H3: Social influence has a positive impact on behavioural intention to use blockchain technology.*

Facilitating conditions

The construct of facilitating conditions, as introduced by Venkatesh *et al.* (2003), refers to the organisational and technical infrastructure put in place by an organisation to encourage the adoption of a new system. According to Wong *et al.* (2020), these enabling conditions refer to the user's perception of resources and support that facilitate the adoption of new technologies. In the specific context of blockchain technology, the company must offer technical support, software and hardware equipment, as well as in-depth knowledge of the system, as highlighted by Queiroz & Fosso Wamba (2019). The successful integration of blockchain technology into existing infrastructure is essential, as mentioned by Wong *et al.* (2020). Therefore, facilitating conditions exerts a significant influence on blockchain adoption. As a result, the following hypothesis is formulated:

> *H4: Facilitating conditions has a positive impact on behavioural intention to use blockchain technology.*

The original UTAUT model considers age, gender, voluntariness and experience as moderators of the relationship between adoption factors and behavioural intention to use a technology. In the present study, those moderators were not integrated like recent applications of the UTAUT such as in the studies of Wong *et al.* (2020) and Queiroz *et al.* (2021).

The mediation role of trust in technology

In the field of information systems, trust plays a crucial role as a key predictor of technology adoption and is a key determinant of how users perceive technology (Li *et al.*, 2008; McKnight *et al.*, 2011). One of the key factors influencing the adoption of any technology is the level of trust that users have in its capabilities. Trust is a vital aspect in technology adoption as it influences users' attitudes, perceptions and intentions towards using new technology (Momani, 2020). Perceived trust is a complex and multifaceted phenomenon that significantly impacts corporate relationships. In addition to people, technology is also trusted, which can alter people's behaviour and decision-making about its use (Chawla *et al.*, 2023).

In the case of blockchain technology, trust is guaranteed by the technology itself, given the level of security associated with transactions and exchanges in this chain (Queiroz *et al.*, 2021). Jardim *et al.* (2021) have claimed that the acceptance of technology such as blockchain depends on trust levels.

The suggested model is an extension of UTAUT by adding the mediating role of trust in technology. As discussed above, trust in technology has the potential to influence the individual's perceptions and then the acceptance of blockchain. Subsequently, the following main hypotheses can be introduced:

> *H5: Trust in technology mediates the relationship between UTAUT constructs and behavioural intention to adopt blockchain.*
>
> *H5a: Trust in technology mediates the relationship between facilitating conditions and behavioural intention to use blockchain technology.*
>
> *H5b: Trust in technology mediates the relationship between social influence and behavioural intention to use blockchain technology.*
>
> *H5c: Trust in technology mediates the relationship between effort expectancy and behavioural intention to use blockchain technology.*
>
> *H5d: Trust in technology mediates the relationship between performance expectancy and behavioural intention to use blockchain technology.*

In addition to its mediation role, the paper intends to test the direct relation between trust in technology and behavioural intention to adopt blockchain technology. For this reason, the following hypothesis is introduced:

> *H6: Trust in technology has a positive impact on behavioural intention to use blockchain.*

The final structure of the conceptual model is presented in Figure 1.

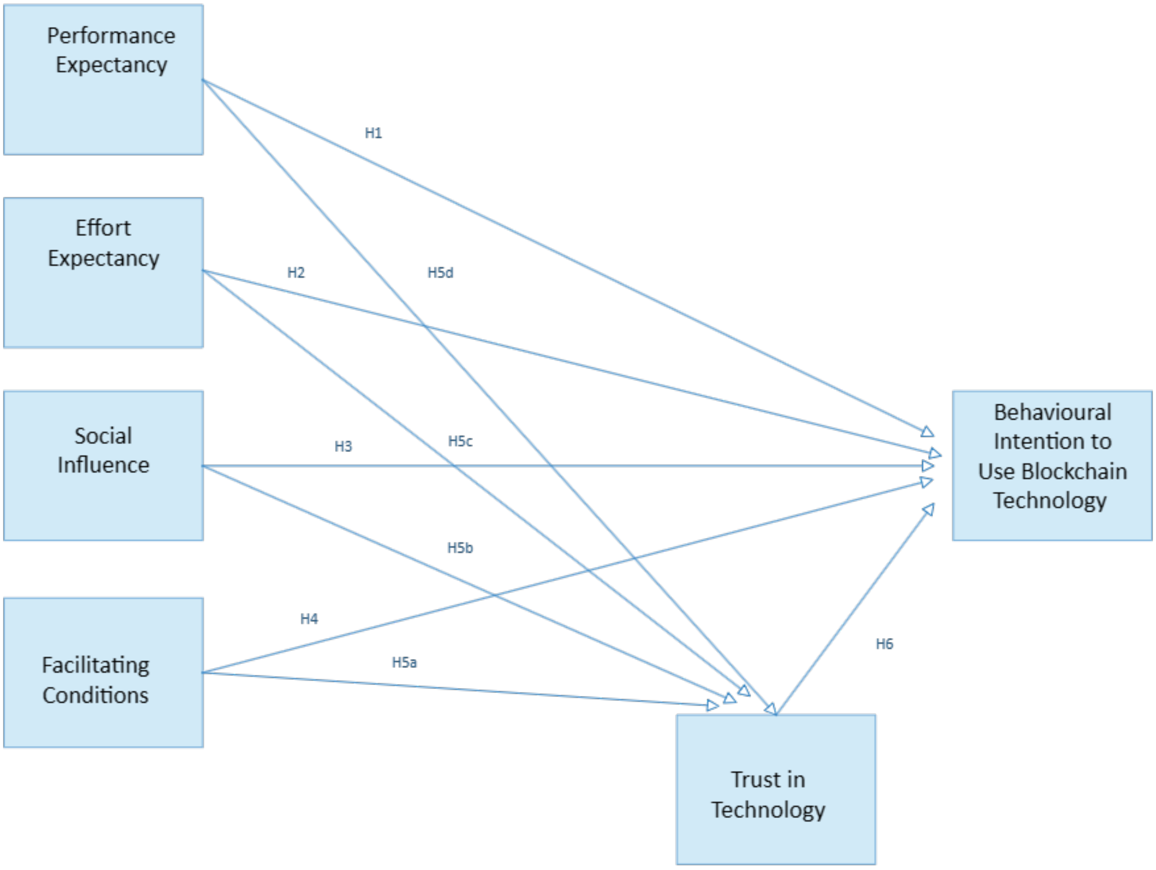

Figure 1. Extended UTAUT model explaining behavioural intention to adopt blockchain technology

Research Methodology Design

PLS (partial least squares) is a statistical method commonly used in social sciences and business research to analyse relationships between variables. Additionally, PLS is advantageous because it can cope with small sample sizes and does not rely on the assumption of normally distributed data.

The design of the research respects a set of stages. As a first step, authors pre-selected the respondents, intending to validate the selection criteria. Professionals chosen are in technology-based sectors and who deal with acceptable levels of technical tasks in their positions. The confirmatory phase of the model is assisted by the IBM-SPSS statistics. The principal analysis and the reliability of the items are well performed by the same program.

Additionally, the researchers conducted a pilot study to ensure the validity and reliability of the survey instrument. This helped identify any potential issues or areas for improvement before administering the survey to a larger sample. The data collected from the survey was then analysed using various statistical techniques to evaluate the hypotheses and draw meaningful conclusions.

We sought respondents who regularly accomplish their tasks through technology and who have a high level of technical knowledge. The distribution of the questionnaire is presumed as being the last step before the analysis and the verification of the hypothesis. The collected questionnaires reached 95 respondents from Tunisia.

Sample and participants

The 95 respondents consist of 39 women (41.1%) and 56 men (58.9%). The sample presents 59 technical respondents. Most respondents are between 26 and 45 years old (77.9%). Moreover, based on the selection criteria of the respondents, the implication of the technology used was relevant to choosing them. Hence, the sample presents 85.3% of people who are implicated in the technology acquisition process (recommendation and decision-making). In the same fashion, 63.2% of them are conscious of the incidence and the impact of blockchain technology on the functions of their companies.

Measures

A four-item measure created by Venkatesh & Zhang (2010) and Venkatesh *et al.* (2003) was used to evaluate respondents' behavioural intentions. The four items used in this article to evaluate performance expectation are Pexp1 and Pexp2 from Venkatesh *et al.* (2003), Pexp3 from Wong *et al.* (2020), and Pexp4 from Mearian (2018). We employed the Venkatesh *et al.* (2003) four-scale items for effort expectations. Based on the scale from Queiroz *et al.* (2021), social influence was evaluated.

The table in Appendix A provides the operationalisation of several ideas associated with our study, assessed using a five-point Likert scale. The Venkatesh *et al.* (2003) scale was used to quantify the facilitating conditions, while trust was assessed using the scale from Ooi & Tan (2016) and Slade *et al.* (2015). All variables demonstrated high internal consistency, with alpha values greater than 0.8. The operationalisation of the items associated with our study is shown in the Appendix.

Research Results

Test of the measurement model

As shown in Figure 1, reflective structures make up the research model. We tested the reflective constructs' validity and reliability, which are divided into three stages (Chin, 1998): discriminant validity, convergent validity, and reliability.

These stages of testing ensure that the reflective constructs used in the research model are reliable and valid. As shown in Table 1, the results indicate that the composite reliability and Cronbach's alpha values meet the established thresholds for dependability.

Additionally, the average variance extracted (AVE) for each latent variable was found to be above 0.5, as recommended by Fornell & Larcker (1981) (Table 1).

Table 1. Reliability and validity of the constructs

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	AVE
Behavioural intention to use blockchain technology	0.874	0.876	0.914	0.728
Effort expectancy	0.916	0.930	0.941	0.799
Facilitating conditions	0.913	0.923	0.939	0.796
Performance expectancy	0.915	0.916	0.940	0.797
Social influence	0.888	0.894	0.930	0.817
Trust in technology	0.905	0.918	0.933	0.739

In this study, the outer loadings of the measurement items for all latent variables exceeded the threshold of 0.7, indicating good convergent validity (see Appendix C). It is important to mention that the item TRS5 has the value of 0.595 in the outer loading with its construct. We decided to preserve it, since the elimination of items is considered to be a crucial decision in keeping the acceptable level of prediction.

Table 2. Fornell–Larcker criteria for discriminant validity of the constructs

	Behavioural intention to use blockchain technology	Effort expectancy	Facilitating conditions	Performance expectancy	Social influence	Trust in technology
Behavioural intention to use blockchain technology	0.853					
Effort expectancy	0.524	0.894				
Facilitating conditions	0.777	0.594	0.892			
Performance expectancy	0.617	0.579	0.532	0.893		
Social influence	0.720	0.687	0.892	0.568	0.904	
Trust in technology	0.785	0.618	0.852	0.488	0.840	0.860

The Fornell–Larcker criteria are used to assess discriminant validity, which requires that the square root of each construct's AVE should be higher than its correlations with other

http://doi.org/10.18080/jtde.v12n1.873

constructs. By applying this test, the study confirms that the latent variables in Table 3exhibit discriminant validity.

Additionally, Hair *et al.* (2017) test discriminant validity in PLS-SEM using the heterotrait–monotrait ratio (HTMT) criteria. For any pattern of build, the HTMT statistics' confidence interval should not include the value 1 (Table 3).

This indicates that the constructs in the study have discriminant validity, meaning they measure distinct concepts and are not redundant or repetitive. The HTMT criteria provide a reliable method for assessing discriminant validity in PLS-SEM.

Table 3. Heterotrait–monotrait ratio (HTMT) discriminant validity of constructs

	Behavioural intention to use blockchain technology	**Effort expectancy**	**Facilitating conditions**	**Performance expectancy**	**Social influence**	**Trust in technology**
Behavioural intention to use blockchain technology						
Effort expectancy	0.581					
Facilitating conditions	0.864	0.653				
Performance expectancy	0.691	0.629	0.587			
Social influence	0.807	0.756	0.993	0.625		
Trust in technology	0.884	0.683	0.931	0.553	0.930	

Test of hypotheses of the structural model

The coefficient of determination (R2), which expresses the strength of the relationship between the independent and dependent variables, is used to evaluate the model's quality. The R2 values are 71.6% and 76.3% respectively for the intention behaviour of using blockchain technology and for trust in technology, which indicates a high-quality model.

To evaluate the impact's importance, the coefficient's value is insufficient. To determine if the route coefficients are relevant, the t-test is the suitable method (see Table 5).

The t-test allows us to assess the statistical significance of the coefficients in determining the impact's importance. By comparing the t-values to critical values, we can determine if the coefficients are statistically significant or not. This helps us determine if the route coefficients have a meaningful impact on the outcome variable.

Table 4. t-test of the path coefficients after bootstrapping (resampling: 5000)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics(|O/ STDEV|)	P values
Effort expectancy -> behavioural intention to use blockchain technology	-0.078	-0.066	0.093	0.834	0.405
Effort Expectancy -> Trust in technology	0.109	0.108	0.075	1.453	0.146
Facilitating conditions -> behavioural intention to use blockchain technology	0.371	0.390	0.167	2.219	0.027
Facilitating conditions -> Trust in technology	0.520	0.527	0.136	3.823	0.000
Performance expectancy -> behavioural intention to use blockchain technology	0.307	0.307	0.081	3.779	0.000
Performance expectancy -> Trust in technology	-0.033	-0.029	0.070	0.475	0.635
Social influence -> behavioural intention to use blockchain technology	-0.136	-0.142	0.166	0.820	0.412
Social influence -> Trust in technology	0.320	0.310	0.117	2.731	0.006
Trust in technology ->behavioural intention to use blockchain technology	0.481	0.459	0.139	3.466	0.001

We have evaluated the structural model's output after verifying the validity and reliability of our constructs (Table 1). This entails analysing the crucial parameters, including the path coefficient's magnitude, sign, and significance as well as the R2 value (Hair *et al.*, 2017).

As a first step, the test of the direct relations is performed (Table 5). Additionally, we will also examine the mediating effect of trust in technology on the relationship between behavioural intention to use blockchain technology and the four latent variables in our model (Table 6). This analysis allows us to gain a deeper understanding of the indirect impact of trust in technology on the adoption of blockchain technology. As an outline, based on the significance of the path coefficients, the paper confirms the validation of the following direct relations; H1, H4, and H6.

Test of the mediation effect

Direct effects refer to the relationship between two constructs that are not influenced by any other variables. On the other hand, indirect effects occur when there is an intervening variable that mediates the relationship between the two constructs (Hair *et al.*, 2017). These indirect effects can involve a series of interactions with multiple intervening variables, further complicating the understanding of the underlying mechanism or process.

"*To test the mediation relations, researchers should bootstrap the sampling distribution of the indirect effect*" (Hair *et al.*, 2017). As a result, the mediating effect's choice considers the importance of both the direct and indirect effects.

The concept of partial mediation suggests that the mediator construct only partially explains the relationship between the two latent variables, leaving a place for other factors to influence the connection. On the other hand, complete mediation (full mediation) implies that the mediator construct fully accounts for the observed relationship between the variables, with no additional factors playing a role. The methodology used by Zhao *et al.* (2010) is valuable in understanding and identifying these diverse types of mediation effects.

The authors of this paper advise examining the bootstrapped distribution's confidence interval if there are discrepancies between the estimated indirect impact and the mean of the bootstrapped distribution. The bootstrap confidence interval, in fact, "*provides an estimated range of values that is likely to include an unknown population parameter*," according to Hair *et al.* (2017).Confidence intervals are commonly used in statistical analysis to provide a measure of uncertainty and to assess the precision of an estimated parameter.

Based on the work of Zhao *et al.* (2010), the study of the indirect relations of the model was assessed. The results are presented in the following table.

Table 5. Test of the indirect effect after bootstrapping (resampling: 5000)

	Original sample (O)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	2.5%	97.5%	Signific-ance (p<0.05)
Total effect							
Performance expectancy -> behavioural intention to use blockchain technology	0.291	0.294	3.361	0.001	0.123	0.462	YES
Effort expectancy -> behavioural intention to use blockchain technology	-0.025	-0.018	0.247	0.805	-0.206	0.194	NO
Social influence -> behavioural intention to use blockchain technology	0.018	0.006	0.099	0.921	-0.351	0.346	NO
Facilitating conditions -> behavioural intention to use blockchain technology	0.621	0.625	3.778	0.000	0.305	0.939	YES

http://doi.org/10.18080/jtde.v12n1.873

	Original sample (O)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	2.5%	97.5%	Signific-ance (p<0.05)
Direct effect							
Facilitating conditions -> behavioural intention to use blockchain technology	0.621	0.625	2.219	0.027	0.296	0.929	YES
Facilitating conditions -> trust in technology	0.520	0.527	3.823	0.000	0.236	0.773	YES
Social influence ->behavioural intention to use blockchain technology	0.018	0.006	0.820	0.412	-0.335	0.359	NO
Social influence -> trust in technology	0.320	0.310	2.731	0.006	0.095	0.558	YES
Effort expectancy -> behavioural intention to use blockchain technology	-0.025	-0.018	0.834	0.405	-0.209	0.187	NO
Effort expectancy -> trust in technology	0.109	0.108	1.453	0.146	-0.027	0.275	NO
Performance expectancy -> behavioural intention to use blockchain technology	0.291	0.294	3.779	0.000	0.109	0.450	YES
Performance expectancy -> trust in technology	-0.033	-0.029	0.475	0.635	-0.164	0.112	NO
Trust in technology ->behavioural intention to use blockchain technology	0.481	0.459	3.466	0.001	0.203	0.730	YES

	Original sample (O)	**Standard deviation (STDEV)**	**T statistics (|O/STDEV|)**	**P values**	**2.5%**	**97.5%**	**Signific-ance (p<0.05)**
Indirect effect							
Facilitating conditions -> trust in technology -> behavioural intention to use blockchain technology	0.250	β=0.236	2.974	0.003	0.114	0.458	YES
Social influence -> trust in technology -> behavioural intention to use blockchain technology	0.154	β=0.149	1.892	0.050	0.033	0.368	YES
Effort expectancy -> trust in technology -> behavioural intention to use blockchain technology	0.053	β=0.048	1.438	0.151	-0.002	0.146	NO
Performance expectancy -> trust in technology -> behavioural intention to use blockchain technology	-0.016	β=-0.013	0.469	0.639	-0.094	0.047	NO

Referring to Table 5, the findings on mediation and confidence intervals demonstrate the verification of certain hypotheses (see Table 6). Specifically, two indirect effects of the mediating variables were found to be significant (through social influence and facilitating conditions), while the other two were not (through performance expectancy and effort expectancy). Regarding the direct impact of UTAUT determinants on the intention to adopt blockchain technology, the results highlight the importance of performance expectancy and facilitating conditions.

Moreover, the direct relationship between trust in technology and the intention to use is presumed to be significant. The former citations disclose the full mediation and the complementary mediation of the social influence and facilitating conditions constructs (Zhao *et al.*, 2010). However, the two other constructs (performance expectancy and effort expectancy) did not show mediation relations with the trust in technology and the adoption of blockchain technology.

As a summary, Table5 demonstrates that the intention of using blockchain technology is positively influenced by the social influence through the construct of trust in technology:

$$\beta = 0.149, p = 0.050, CI [0.033; 0.368]$$

Concerning the facilitating conditions, the mediation is partial (complementary) with

$$\beta = 0.236, p = 0.003, CI [0.114; 0.458]$$

However, the construct performance expectancy has no mediation through trust in technology (only direct relation):

$$\beta = -0.013, p = 0.639, CI [-0.094; 0.047]$$

And the same result for the construct effort expectancy where no mediation is founded:

$$\beta = 0.048, p = 0.151, CI [-0.002; 0.146].$$

Table 6 displays the verification of the research hypotheses.

Table 6. Verification of the hypothesis

Hypothesis	Validation/rejection
H1: Performance expectancy has positive impact on behavioural intention to use blockchain technology.	Validated
H2: Effort expectancy has a positive impact on behavioural intention to use blockchain technology.	Rejected
H3: Social influence has a positive impact on behavioural intention to use blockchain technology.	Rejected
H4: Facilitating conditions have a positive impact on behavioural intention to use blockchain technology.	Validated
H5: Trust in technology mediates the relation between UTAUT constructs and behavioural intention to adopt blockchain technology.	Partially validated
H5a: Trust in technology mediates the relation between facilitating conditions and behavioural intention to use blockchain technology.	Validated. complementary (partial mediation)
H5b: Trust in technology mediates the relation between social influence and behavioural intention to use blockchain technology.	Validated complete mediation (full mediation)
H5c: Trust in technology mediates the relation between effort expectancy and behavioural intention to use blockchain technology.	Rejected (no mediation)
H5d: Trust in technology mediates the relation between performance expectancy and behavioural intention to use blockchain technology.	Rejected: only direct effect (no mediation)
H6: Trust in technology has a positive impact on behavioural intention to use blockchain technology.	Validated

Discussion of Results

Findings of the present study demonstrate the significance of performance expectancy (structural coefficient = 0.302) and facilitating conditions (structural coefficient = 0.371) on

http://doi.org/10.18080/jtde.v12n1.873

explaining the intention to adopt blockchain technology. In addition, trust in technology seems to have the greatest impact on behavioural intention (0.481). Subsequently, the recommended model explains 71% of the behavioural intention to use blockchain technology by individuals in an organisational context.

The results of trust and facilitating conditions are consistent with the study of Queiroz *et al.* (2021). However, the significance of effort expectancy and performance expectancy diverge from the results of Queiroz *et al.* (2021).

The systematic literature review of Alshamsi *et al.* (2022) found that social influence is one of the most determinant factors of blockchain technology adoption. The result of the present study about social influence is not in line with previous ones.

This finding is, then, appropriate to the Tunisian context and for Tunisian professionals. Highly skilled people (respondents) understand blockchain technology more than people around them. Consequently, they are not influenced by colleagues' or friends' opinions.

To summarise, the results of full UTAUT constructs were significant in the studies of Khazaei (2020) and Kabir *et al.* (2021), which is not consistent with the findings of the present study where only two constructs of the model are significant. Managers and practitioners involved in blockchain projects need to consider the particularities of the contexts, showing that there are meaningful differences between countries in blockchain adoption (Wamba & Queiroz, 2019).

Concerning the mediation relation of trust in technology, a full mediation and a partial one are verified with the facilitating conditions and the social influence. The main contribution of the present study is adding trust to the UTAUT original model. Results show the relevance of trust construct in the case of blockchain technology. The direct impact on behavioural intention is maintained by previous studies. For example, Fleischmann & Ivens (2019) discovered that trust has been identified as one of the key drivers of acceptance of technology in the digital context. They added that trust acts like an antecedent of usage behaviour "*by establishing confident expectations about the system, and as an antecedent of controllability, by reducing uncertainty*" (Fleischmann & Ivens, 2019).

Results of the present study are consistent with this idea because of the direct relationship found between trust and facilitating conditions on one hand, and trust and the social influence on the other hand.

As Chawla (2020) assumed: "*Blockchains are often assumed to be trust-free, or to distribute trust, since their design is unique from the perspective of traditional organisational theories*" (2020, p. 4).

Trust in technology, as advanced in this paper, reflects the trust that individuals have in blockchain technology. The mediating role of trust explains how individual perception of blockchain adoption factors (effort expectancy, performance expectancy, facilitating conditions and social influence) could impact trust in technology and then influence the intention to adopt it. Empirical results demonstrated that trust in blockchain is impacted only by facilitating conditions and social influence. These findings result in relevant practical insights because they identify determinants of trust toward the use of blockchain and, subsequently, its adoption in organisations. Thus, managers should provide the required infrastructure (resources, expertise and knowledge) to implement blockchain technology. By doing this, managers guarantee ideal technological and social climates that have a significant impact in influencing individual intention to use blockchain.

The construct of facilitating conditions seems the more critical one in the Tunisian context (the context of the study) because of its direct influence on the behavioural intention to use blockchain and its impact on trust in technology. The relevance of this construct was supported by previous studies (Queiroz *et al.*, 2021; Wong *et al.*, 2020; Queiroz & Wamba, 2019; Kabir *et al.*, 2021).

Understanding factors influencing blockchain adoption intention through MIS theories would help researchers and managers prepare procedures and strategies to encourage the adoption and integration of blockchain technologies across various economic sectors, especially in developing economies like Tunisia. The resulting model of this study can be used by governments, organisations and start-ups to better understand what encourages people to adopt blockchain technology.

Conclusion

The current study tried to uncover the elements that promote blockchain adoption, providing practitioners and decision-makers with relevant information. Organisations may make informed decisions about integrating blockchain technology and optimising their operations if they understand these drivers. Additionally, bridging research gaps in this area might lead to a better understanding of blockchain acceptability and its potential influence on organisational growth. The findings of the research demonstrated the direct effect of performance expectancy and the facilitating conditions. Also, the indirect effect of trust in technology is partially verified regarding the UTAUT determinants.

The research presents theoretical and contextual contributions. On the theoretical side, the research has drawn on the UTAUT model with a special focus on the variable trust in technology. In fact, the mediating role of the said variable is relevant to blockchain adoption.

This statement confirms the existing literature about the importance of trust in projects of blockchain implementation.

On the contextual side, the research is an attempt to validate the UTAUT model of the intention of blockchain use in the Tunisian context. Tunisia has actively embraced the implementation of these technologies, recognising their ability to streamline processes and improve efficiency in various sectors. Even though the government has been supportive of initiatives that promote the adoption of blockchain technology, encouraging collaboration between public and private entities to explore its potential applications further, it has extensively invested in research and development to ensure the continuous advancement of blockchain technology and its effective application.

There are several limitations that should be specifically highlighted to establish the validity of the model's findings. First, the sample could limit the generalisation of the study results at two levels. Second the sample size influences the representativeness of the population. Second, respondents' profiles are also limited to highly skilled individuals, which can influence the significance of technology-related factors such as effort expectancy and performance expectancy.

The authors note that it is imperative to conduct an evaluation using a sizable and diverse sample including various profiles and contexts, such as in the French context.

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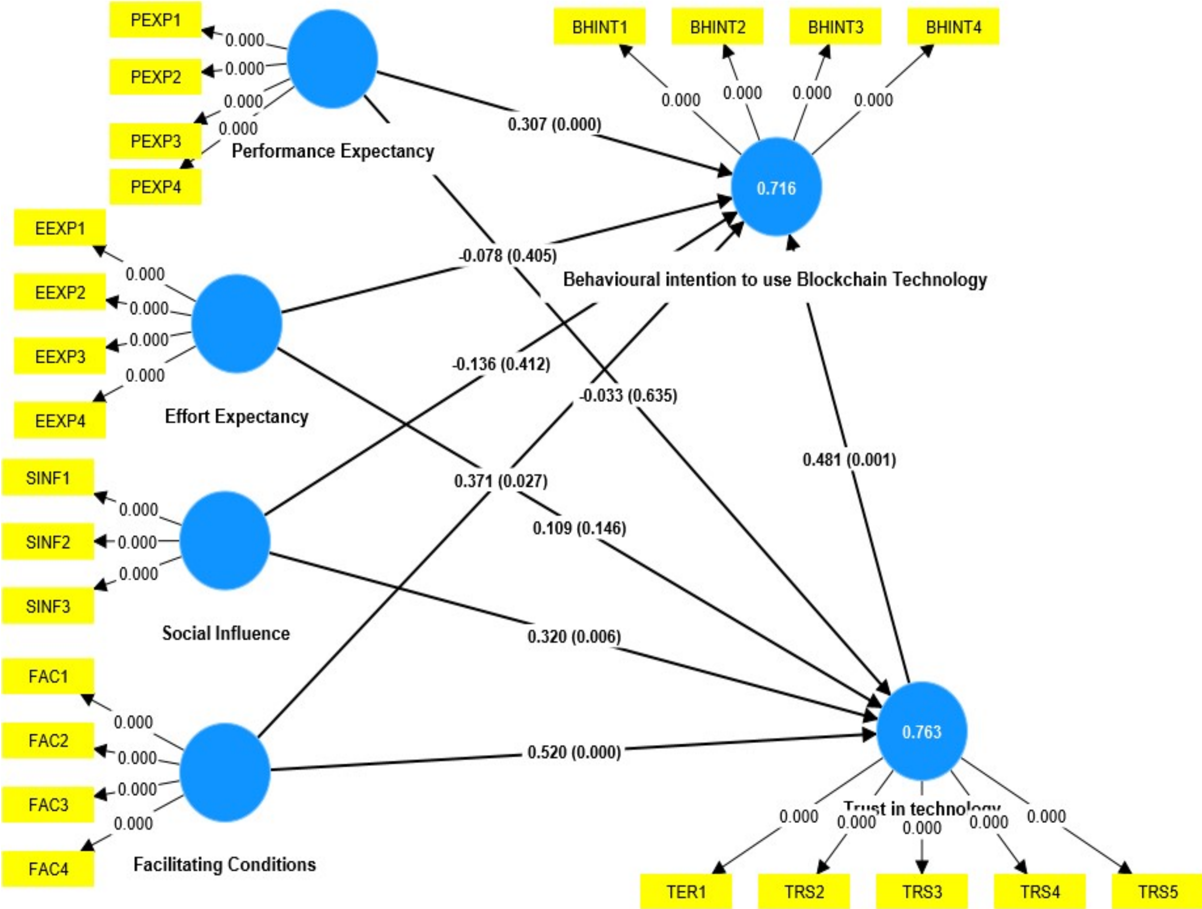
Appendix A: Construct Items

Concept	Items
Behavioural intention Adapted from Venkatesh *et al.* (2003); Venkatesh & Zhang (2010)	**BHINT1** I intend to adopt BC within 3 years **BHINT2** I predict my firm will move into BC within 3 years **BHINT3** My firm is amongst the pioneers to explore BC **BHINT4**My firm intends to digitally transform supply chain management
Performance expectancy Adapted from Venkatesh *et al.* (2003) (1.2); Wong *et al.* (2015) (3); Mearian (2018)	**PEXP1**Using BC enables me to accomplish my tracking tasks more efficiently and effectively **PEXP2**Using BC saves my time and eliminates processing costs by offering all parties a single source view of master ledger **PEXP3**Using BC increases the quality of my work through the use of smart contracts **PEXP4**Using BC can improve financial liquidity because once all parties agree on the delivery of goods, payments can be issued since everyone sees the same record updated in real-time
Effort expectancy Venkatesh *et al.* (2003), Venkatesh, Thong & Xu (2012)	**EEXP1** Learning how to use blockchain is easy for me **EEXP2** My interaction with blockchain is clear and understandable **EEXP3** I find blockchain easy to use **EEXP4** It is easy for me to become skilful in using blockchain
Social influence Queiroz *et al.* (2021)	**SINF1** People who are important to me think that I should use blockchain **SINF2** People who influence my behaviour think that I should use blockchain **SINF3** People whose opinions I value prefer that I use blockchain
Facilitating conditions Adapted from Venkatesh *et al.* (2003)	**FAC1**My firm has the right resources for BC **FAC2**My firm has the expertise for BC in case technical assistance is required **FAC3**My firm has the knowledge necessary for operating BC **FAC4**The management has expressed interest in BC
Trust in technology Adapted from Ooi & Tan (2016); Slade *et al.* (2015)	**TRS1** I have confidence in the use of BC **TRS2** I believe BC can keep the data secure and less prone to fraud **TRS3** I believe I am able to operate BC reliably or consistently without failing **TRS4** I am willing to depend on BC across a broad spectrum of situations and technologies in my work. **TRS5**I believe that BC will consistently operate, providing adequate and efficient results at work

http://doi.org/10.18080/jtde.v12n1.873

Appendix B: Smart Pls Output After Bootstrapping (Sample:5000)



Appendix C: The Loadings of the Items

	Behavioural intention to use blockchain technology	**Effort expectancy**	**Facilitating conditions**	**Performance expectancy**	**Social influence**	**Trust in technology**
BHINT1	0.829					
BHINT2	0.935					
BHINT3	0.835					
BHINT4	0.807					
EEXP1		0.846				
EEXP2		0.923				
EEXP3		0.937				
EEXP4		0.867				
FAC1			0.783			
FAC2			0.921			
FAC3			0.926			
FAC4			0.930			
PEXP1				0.920		
PEXP2				0.894		
PEXP3				0.886		
PEXP4				0.870		
SINF1					0.867	
SINF2					0.917	
SINF3					0.926	
TRS1						0.924
TRS2						0.920
TRS3						0.890
TRS4						0.922
TRS5						0.595