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Assessing Behavioral Drivers of Intention to Adopt Blockchain-Based Certificate Verification: A Pilot Study Integrating TRI and DOI Theories

Husam Abdulhameed Hussein [1,2], Zahurin Mat Aji [1] ,Hapini Awang [1] ,Shakiroh Khamis [1]

[1] School of Computing, University Utara Malaysia, Sintok, Malaysia.
[2] College of Education for Pure Sciences , University of Samarra, Samarra, Iraq.

Corresponding author: husam.hs24@uosamarra.edu.iq (https://orcid.org/0000-0002-4524-4856)

Abstract

The promise of blockchain technology to revolutionise data security, transparency, and trust in a variety of fields has drawn a lot of interest. Blockchain-Based Certificate Verification (BBCV), which provides a safe and impenetrable mechanism for keeping academic credentials, is one of the new uses. Despite this possibility, BBCV is still not widely used in higher education. By looking at important organizational and technological aspects that affect BBCV adoption, this study explores the desire to embrace it. This pilot study evaluates the validity and reliability of an instrument designed to assess adoption motivations and challenges, drawing on the Technology Readiness Index (TRI), Diffusion of Innovation Theory (DOI), and insights from open-source software (OSS) development and social cognitive theory. To collect data regarding people who are familiar with blockchain development and deployment in educational settings, a survey methodology was used to gather 109 valid replies. IBM SPSS version 29.0.0.0 for Windows was used to analyses the data. The results validate the good reliability and construct validity of the modified measuring tools. Moreover, The EFA results provided preliminary empirical evidence supporting the construct validity of the measurement instrument. The findings offer a basis for comprehending important elements that affect the desire to implement BBCV in higher education institutions, including perceived complexity, compatibility, reluctance to change, and technical readiness.

Keywords: *Blockchain, Certificate Verification, pilot study, instrument, reliability*

1. INTRODUCTION

The fundamental characteristics of digital information system (IS) artefacts that were first created for cryptocurrencies are displayed by blockchain technology [1]. Beyond cryptocurrencies, however, the technology may find application in supply chain management [2], identity management [3], smart contracts [4], and the Internet of Things (IoT) [5]. Higher education certificate verification systems are one of the new uses of blockchain technology, which provides a decentralised, tamper-proof method of handling academic credentials. Open-source software (OSS), or software created by various groups, is frequently the foundation of blockchain projects. Ethereum and Bitcoin are well-known instances of open-source blockchain initiatives [6] . Similar to the conventional OSS ideas seen in the literature, Bitcoin is a public decentralised database project whose source codes are frequently free to alter. The interest in blockchain projects has been increasing [7] since the introduction of Bitcoin in 2008 by anonymous individuals and groups of developers [8]. The global open-source software (OSS) community's efforts are what ultimately drive its evolution [9], [10]. Blockchain relies upon the voluntary collaborative actions of thousands of developers [11], and the idea of OSS as software that has diverse individual developers is discussed in [12]. Therefore, developers constitute essential critical actors in the successful evolution of blockchain projects [7]. Currently, there are more than 3,000 blockchain projects being hosted on the GitHub development platform [13]. Nevertheless, unlike traditional OSS, blockchain developers need to be cautious about the security and reliability of the software by designing efficient and reliable protocols for immutable distributed databases [14]. Many scholars have considered how crucial it is to understand intention to adopt new technology, specifically blockchain [15], given that blockchain has the ability to disrupt a wide range of industries, notably in the financial sectors [16]. Blockchain technologies are disruptive, but the adoption rate still outpaces the success rate [17]. According to some studies, the success of blockchain projects depends on creative, community-driven initiatives [18], which are hampered by a lack of technical expertise, especially in the higher education sector [19]. Managing certificates presents special issues for higher education institutions, which makes it extremely difficult to validate academic qualifications. These difficulties include the lack of specialised tools because the majority of current tools are made for conventional verification systems, a lack of cryptographic knowledge, the high expense of certificate verification, and laborious procedures because current systems are centralised [20].

Table 1. *Some empirical studies on intention to adopt technologies*

Study	Context	Findings	Limitations
[21]	E-health in Iraqi healthcare	Four dimensions: core intention, environmental, individual, and technological intention to adopt.	Lacks evaluation of technological competency, access, and motivation.
[22]	Cloud Computing Electronic Learning (CCEL) in Iraq	Subjective norms, perceived ease, perceived usefulness impact intention and actual use; technology readiness moderates.	Does not address obstacles teachers and students face in implementing CCEL.
[23]	IT adoption by accountants in war-torn Iraq	Positive correlation between accountants' IT competencies and technology readiness.	No practical suggestions for increasing IT competency or adoption readiness.
[24]	E-commerce readiness in Iraq	Evaluates Iraq's preparedness for e-commerce adoption using international indicators.	Lacks detailed assessment of critical factors such as access, infrastructure, and motivation for e-commerce.
[25]	SMEs in Iraq	Technological readiness influences desire to adopt information systems and knowledge management capabilities.	Lacks consideration of access, motivation, and cognitive development in technology adoption.
[26]	E-learning readiness in Iraqi universities	Proposes e-learning assessment model with 86 measures, validated using fuzzy Delphi method.	Does not outline practical steps for model implementation or organizational readiness.
[27]	Middle Eastern public universities' use of e-learning	identifies obstacles to the implementation of e-learning and offers optimisation options.	fails to incorporate important elements such as system compatibility, motivation, expertise, and digital infrastructure.
[28]	Remote education throughout several nations	evaluates six nations' preparation for online learning during COVID-19 and finds inadequate preparedness.	doesn't get into specifics on challenges like internet access or how prepared teachers and students are for remote learning.

[29]	Kenyan certificate verification using blockchain technology	suggests using the BBCV approach to validate diplomas in Kenyan public universities.	lacks evaluation of implementation difficulties, training, financial concerns, and preparedness
[30]	BlockCert mechanism for verifying certificates	ensures safe, unchangeable academic certificates by using the open standard BlockCert.	fails to evaluate staff and organisational preparedness for using blockchain.

Although a number of empirical studies have been conducted on the intention to adopt technology in the context of Iraq [31, 33], the majority of these studies do not examine how prepared a group or population is to embrace new technology using TRI, a universally recognised measurement tool used to assess willingness and ability of individuals or organisations to adopt the use of technology by evaluating factors such as access, motivation, and competency. In order to develop a model of intention to adopt BBCV and investigate the moderating effect of resistance to change on the relationship among perceived compatibility, perceived complexity, and intention to adopt BBCV, this pilot study proposed to incorporate the Technology Readiness Index [34], Diffusion of Innovation [35], and trans theoretical model of change.

2. METHODOLOGY

This pilot study aimed to assess the opinion of university student record employee on the reliability and validity of a set of questionnaires. As a pilot study's sample size was relatively small [36], the current pilot study distributed 140 questionnaires to student record employee via platform of Google forms. A total of 109 employee was contacted via the platform, but 31 employees not contact the platform. In order to increase the validity and reliability of the developed instrument, this study adopted a multi-stage technique as suggested by [37]. The research process consists of three main phases: 1) instrument development, 2) content validity, and 3) pilot study.

2.1 Instrument Development

The important elements for identifying the factors in the current study are the Technology Readiness Index (TRI) [38] in the IS literature and research goal. The goal of earlier research was to demonstrate TRI's full potential, which had not yet been realised because the full TRI model had not been taken into account. The emergence of the Internet has led to the management and uptake of web-based technologies. As a result, the TRI is used from a different angle, with the upkeep of web-based systems like blockchain being depicted as an evolving process. An individual's behaviour, cognitive and emotional activities, and technology environment are all interconnected and have an impact on one another. A systematic literature review (SLR) was carried out based on the TRI in order to determine the variables that might affect the intention to adopt BBCV. To create the instrument, a review of pertinent literature was conducted in addition to the SLR.

2.2 Justification of Combining TRI and DOI

Previous IS research has concentrated on identifying the factors influencing technology adoption using various IS theories and models [39- 43]. For instance, TRA, TAM, TPB, SCT, TRI, and DOI have proved especially illuminating in IS research, with a particular emphasis on technology adoption. Each theory offers insightful information about different facets of human behaviour, which makes them helpful resources for comprehending situations involving technological readiness. However, TPB and SCT use the idea of perceived outcomes to predict behaviour, whereas TRA and TAM focus only on ideas about technology. Both theories contend that people's decisions to utilise a particular technology are mostly impacted by their confidence that it will help them achieve their goals. TRA, TAM, SCT, and TPB differ significantly from TRI and DOI theories in that they concentrate on describing and predicting individual attitudes, intentions, and behaviours related to technology adoption [40], [44], [45]. In contrast, the TRI assesses people's general inclination towards technology and their broad technological beliefs, while the DOI primarily concentrates on evaluating preparedness and understanding the diffusion process of innovations [46], [47]. Again, TRI and DOI addressing readiness and diffusion aspects that precede the adoption process [38], [48], and the others TRA, TAM, TRA, SCT and TPB focusing on factors influencing actual technology adoption and usage [49]–[51]. [52] contend that both these frameworks offer a degree of adaptability and interdisciplinary applicability, thus facilitating a holistic exploration of blockchain technology readiness through both quantitative and qualitative analyses. Nevertheless, the rapid evolution of the Internet, catalyzing the emergence of web-based technologies such as blockchain [53], accentuates the pivotal role of technology readiness in ensuring that individuals and organizations are adequately prepared for technology adoption [44]. Neglecting the aspect of intention to adopt can result in a plethora of challenges, resistance, and inefficiencies during the adoption process [54,55]. When evaluating preparedness and adoption, integrating TRI and TAM may overlap. [56] examine the moderating role of attitude, resistance to change (RTC), DOI, TRI, and TAM on the intention to adopt innovative learning in the United Arab Emirates (UAE). Structural equation modelling was used to analyse the data collected from 301 respondents. The results demonstrate that attitudes towards creative learning are positively impacted by TRI and DOI, and that attitudes mediate their effects on behavioural intention. The conversion of behavioural preparedness intention into actual use is greatly influenced by RTC. A limitation is using cross-sectional data from the UAE during the COVID-19 pandemic. The study can help government stakeholders and administrators enhance smart learning implementation for strategic goals.

In sum, integrating TRI and DOI is justified because it combines an individual-level perspective on readiness with a broader contextual and social framework, offering a nuanced and comprehensive approach to studying complex technology readiness, particularly in the context of advanced technologies like blockchain. This integration addresses both micro-level and macro-level factors that influence technology adoption, reducing uncertainty and providing valuable insights into the adoption process. In the end, this proposed study might present a fresh feature: how the integration lowers uncertainty. There are a lot of perceived hazards and uncertainties associated with complex technologies like blockchain. By analysing each person's intention to adopt BBCV, the combined application of TRI and DOI can resolve this issue. A more precise and thorough knowledge of how and why people or organisations decide to embrace or reject complicated technology like blockchain may eventually result from this decrease in ambiguity.

2.3 Expert Review

A small sample of blockchain practitioners and a panel of academic experts were invited to remark on the suitability of the adopted items. Academic experts include two experts from Universiti Utara Malaysia's School of Computing (SOC) and associate professors and assistant professors in the fields of computer science, software engineering, and information systems from Tikrit University, University of Samarra, and Imam Jaafar Al-Sadiq University. Factors and their items that should be taken into account when assessing the indicated constructions were included to the instrument to help with comprehension. To make sure that all the constructions follow the experts' suggestions, some factors and their assessment items were reworded before to the pilot study.

3.RESULTS

3.1 Development of Instrument

There were found to be around 210 papers (from IEEE, 53; Springer, 35; Elsevier, 29; AIS, 13; Emerald, 38; Taylor and Francis, 42) that reported research on creating the many constructions of the theory that support its authority. Based on the important pieces of evidence for determining the criteria in the review, the publications that integrated a review of technological intention to adopt literature were carefully chosen. Nonetheless, it was decided to use the following criteria to find and extract elements from earlier research in information system views that affected the intention to deploy blockchain-based applications:

1. Only papers published in the Scopus or Web of Science indexes journals between 2018 and 2025 were taken into consideration in order to guarantee a high-quality study.
2. The chosen papers included empirical research, conceptual frameworks, systematic reviews, and English-language studies on the desire to adopt blockchain applications.

47 of the 136 studies were deemed irrelevant because they lacked specific methodology or empirical support. Additionally, the methodology of the remaining 89 papers was evaluated; 41 of these were eliminated, leaving 48 studies.

The full text was thoroughly examined against the inclusion criteria, leading to the rejection of 23 more papers. The quality of the remaining 25 was then appraised, based on publications, resulting in the exclusion of another 3 papers. Only the remaining 22 papers that met the inclusion criteria were chosen for the BBCV adoption factors. The study scrutinized and mined 8 constructs. These include the intention to adopt BBCV, innovativeness, optimism, discomfort, insecurity, perceived complexity of BT, perceived compatibility of BT and resistance to change. To make sure that the purpose to apply BBCV elements was comparable to those examined by other researchers, the adopted definitions and their conformance with the employed measurement were assessed [57], [58]. The eight selected constructs emphasised their connections to the organisations' project abandonment, which was comparable to the current study's setting. There are three pieces that make up the entire instrument. Items pertaining to the eight structures are included in Section 1. Items pertaining to the intention to implement blockchain-based certificate verification are included in Section 2. In the meantime, section 3 includes questions about the respondents' demographics.

3.2 Expert Review Results

All of the constructions were deemed to be significant once the data gathered from experts was analysed. A thorough explanation of the steps of expert evaluation and instrument development is still pending publication in a respectable journal.

3*.3 Pilot Study Results*

3.3.1 Respondents Demographic

Males largely dominate females (53.2% vs. 46.8%), according to the student record employee sample's demographic distribution (N = 109). 68.8% of participants were between the ages of 20 and 39, while 31.2% were above the age of 40. The majority of participants (97.3%) have at least a bachelor's degree, and only 2.8% have only completed high school. This indicates that the participants are well educated. This may have an impact on the sample's awareness of or participation in certificate verification procedures because it indicates that they are well educated. The majority of employees have either less than a year's experience (33.0%) or one to five years' experience (34.9%), suggesting a relatively youthful or newly involved population in the certificate verification domain. Table 2 displays the demographic respondent's results.

Table 2. *Respondent's demographics*

Variables	**Frequency**	**Percentage**
Gender		

Male	58	53.2%
Female	51	46.8%
Age		
20–29 years	29	26.6%
30-39 years	46	42.2%
40-49 years	23	21.1%
50 years and above	11	10.1%
Education Level		
High School	3	2.8%
Bachelors	68	62.4%
Masters	32	29.4%
PhD	6	5.5%
Experience in Certificate Verification		
Less than one year	36	33.0%
1 - 5 Years	38	34.9%
6 - 10 Years	13	11.9%
11 Years and above	22	20.2%
Type of University		
Public	90	82.6%
Private	19	17.4%
Name of State of Iraq		
Baghdad	65	59.6%
Salah El-Din	44	40.4%

Public universities account for a sizable majority (82.6%), suggesting either institutional bias or a lack of representation from private schools. Participants are geographically concentrated in Baghdad (59.6%), followed by Salah El-Din (40.4%), which may be due to the areas' higher education services or population density. Overall, the demographic profile points to an early-career, highly educated cohort that is mostly associated with public colleges in metropolitan areas.

3.3.2 Reliability Test

The reliability analysis of the study's constructs is shown in Table 3, with Cronbach's Alpha values ranging from 0.853 to 0.921. Strong internal consistency and trustworthy measurement scales are shown by all constructs exceeding the well-recognised criterion of 0.70. Interestingly, the greatest alpha values (0.921 and 0.920, respectively) for Perceived Compatibility (PCOM) and Intention to Adopt BBCV (INT) indicate that respondents gave extremely consistent responses to these questions. On the other hand, although still respectable, Innovativeness (INNV) and Perceived Complexity (PCXT) had the lowest alpha values (0.853 and 0.863), which would demonstrated the value remained satisfactory, indicating acceptable internal consistency. Consistent reliability across dimensions supports the use of these factors in predictive modelling and strengthens the validity of the study's conclusions.

Table 3. *Results of Reliability Analysis*

Constructs	Items Number	Cronbach's Alpha
Intention to Adopt BBCV (INT)	4	0.920
Innovativeness (INNV)	4	0.853

Optimism (OPTM)	5	0.878
Discomfort (DCFT)	5	0.869
Insecurity (INSC)	7	0.864
Perceived Complexity (PCXT)	6	0.863
Perceived Compatibility (PCOM)	5	0.921
Resistance to Change (RTC)	5	0.884

3.3.3 Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was conducted to provide preliminary empirical evidence of the construct validity of the measurement instrument. The adequacy of the data for factor analysis was first assessed using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's Test of Sphericity. The KMO values ranged from 0.804 for (DCFT) to 0.857 for (INSC), indicating adequate sampling adequacy across all constructs. Furthermore, Bartlett's Test was statistically significant for all constructs ($p < 0.001$), confirming that the correlations among the measurement items were sufficient to justify factor analysis.

The factor loading results further demonstrated an acceptable factor structure. The standardized factor loadings ranged from 0.532 to 0.887 across the measurement items. All items loaded on their respective constructs at acceptable levels, with the highest loading observed for DCFT2 (0.887), followed by INT3 (0.880), PCXT5 (0.878), and PCXT3 (0.875). Although some items exhibited relatively lower loadings, such as INSC7 (0.532), INSC3 (0.552), and INSC2 (0.570), these values remained within an acceptable range and therefore did not provide sufficient justification for item deletion. The communalities ranged from 0.527 to 0.850, indicating that an adequate proportion of the variance in each item was accounted for by the extracted factor. In addition, the eigenvalues ranged from 2.788 to 3.866 across the constructs, with all values exceeding the commonly used threshold of 1.0. Overall, the EFA results provide preliminary support for the underlying factor structure of the measurement instrument and indicate that the retained items adequately represent their respective constructs, see Table 4. Therefore, during this procedure no item was deleted.

Table 4. *Summary of Results for EFA*

VAR	KMO	Bartlett Test	Eigen Value	Item	Factor Loading	Communalities	Deleted Item
INT	0.839	< 0.001	3.239	INT1	0.855	0.794	Nil
				INT2	0.862	0.769	Nil
				INT3	0.880	0.799	Nil
				INT4	0.865	0.800	Nil
INNV	0.809	< 0.001	2.788	INNV1	0.736	0.717	Nil
				INNV2	0.723	0.707	Nil
				INNV3	0.606	0.689	Nil
				INNV4	0.639	0.692	Nil
OPTM	0.813	< 0.001	3.396	OPTM1	0.712	0.527	Nil
				OPTM2	0.793	0.769	Nil
				OPTM3	0.596	0.717	Nil
				OPTM4	0.630	0.840	Nil
				OPTM5	0.688	0.846	Nil
DCFT	0.804	< 0.001	3.301	DCFT1	0.820	0.757	Nil

				DCFT2	0.887	0.850	Nil
				DCFT3	0.821	0.794	Nil
				DCFT4	0.606	0.656	Nil
				DCFT5	0.731	0.764	Nil
INSC	0.857	< 0.001	3.866	INSC1	0.672	0.738	Nil
				INSC2	0.570	0.709	Nil
				INSC3	0.552	0.681	Nil
				INSC4	0.803	0.749	Nil
				INSC5	0.729	0.640	Nil
				INSC6	0.621	0.720	Nil
				INSC7	0.598	0.535	Nil
PCXT	0.816	< 0.001	3.621	PCXT1	0.532	0.684	Nil
				PCXT2	0.612	0.661	Nil
				PCXT3	0.875	0.806	Nil
				PCXT4	0.805	0.738	Nil
				PCXT5	0.878	0.823	Nil
				PCXT6	0.840	0.787	Nil
PCOM	0.842	< 0.001	3.816	PCOM1	0.581	0.704	Nil
				PCOM2	0.619	0.752	Nil
				PCOM3	0.781	0.844	Nil
				PCOM4	0.760	0.848	Nil
				PCOM5	0.744	0.838	Nil
RTC	0.844	< 0.001	3.427	RTC1	0.772	0.660	Nil
				RTC2	0.850	0.751	Nil
				RTC3	0.786	0.700	Nil
				RTC4	0.836	0.812	Nil
				RTC5	0.716	0.759	Nil

The EFA results indicate that the measurement items demonstrate an acceptable factor structure. The factor loadings were examined to determine the extent to which each item represented its intended construct. Overall, the findings provide preliminary empirical support for the construct validity of the measurement instrument.

3.3.4 Normality Assessment

Additionally, Table 5 uses the skewness and kurtosis values for each variable to shed light on the dataset's distribution features. The majority of variables show skewness and kurtosis in the ±2 range, which suggests that they are roughly normal and appropriate for parametric analysis. Intention to Adopt BBCV (INT) shows the highest negative skewness (-1.029) and elevated kurtosis (1.877), suggesting that responses are left-skewed and slightly peaked indicating strong agreement or interest among respondents. Insecurity (INSC), Perceive compatibility (PCOM) and Resistance to Change (RTC) exhibit near-zero skewness and kurtosis, reflecting balanced and normally distributed responses. These values suggest that the data is reasonably well-behaved and supports the assumptions required for advanced statistical analyses such as SEM or regression. The skewness of INT, however, would suggest that sample bias favouring early adopters or ceiling effects need to be investigated.

Table 5. *Skewness and Kurtosis Standards*

Variable	Skewness	Kurtosis
INT	-1.029	1.877
INNV	-0.773	0.895
OPTM	-0.563	1.002
DCFT	-0.959	0.874
INSC	-0.077	0.304
PCXT	-0.807	0.283
PCOM	-0.360	-0.008
RTC	0.133	0.026

4.CONCLUSION, LIMITATION, AND FUTURE RESEARCH

The demographics and attitudes around the deployment of blockchain-based certificate verification systems are fundamentally revealed by this pilot research. The 109 respondents in the sample provide a strong starting point, especially for evaluating the internal consistency and structure of the instrument. The majority of constructs achieved acceptable to outstanding Cronbach's alpha values, indicating that the instrument is generally dependable.This suggests that important characteristics like intention to adopt, perceived compatibility, insecurity, and reluctance to change are appropriately captured by the instrument. The pilot sample was predominantly drawn from public higher education institutions and was geographically concentrated in Baghdad and Salah El-Din. Therefore, the findings should be interpreted as preliminary evidence from the pilot phase rather than as nationally representative evidence of blockchain-based certificate verification adoption across all Iraqi higher education institutions. There are still constraints even if the sample size of 109 is sufficient for pilot research. In this early stage, broader applicability may be limited by the demographic concentration in particular regions and institutional kinds. Furthermore, the Innovativeness scale's marginally lower reliability indicates a need for improvement even if the majority of constructs showed excellent internal consistency. The cross-sectional design of the study and its dependence on self-reported data may potentially restrict the breadth of insights into causal linkages or induce bias. But as a pilot, the main objective was to evaluate the instrument's viability and dependability, which was accomplished. In order to improve generalisability, future research should employ a larger and more geographically diverse sample and apply Structural Equation Modeling (SEM) to empirically examine the hypothesized relationships among the constructs and assess the proposed theoretical model. A more thorough knowledge of blockchain usage in higher education would result from expanding to include respondents from private institutions, different Iraqi governorates, and a range of educational backgrounds. It could be necessary to further develop the Innovativeness concept, perhaps with the help of focus groups or qualitative interviews. Examining how user views change as a result of greater exposure to and usage of blockchain technology in educational settings may potentially benefit from longitudinal research.

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