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Exploring Key Factors Influencing Blockchain Adoption in E-Government: Pilot Study

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Abstract—E-government systems face numerous challenges, including trust, privacy, transparency, security, traceability, and service delays. Blockchain technology holds promise for revolutionizing these systems by addressing their long-standing vulnerabilities. Despite the acknowledged potential of blockchain in enhancing e-government systems via improved security and transparency, empirical research on the factors influencing its adoption within government remains scarce. This pilot study addresses this gap by constructing and validating a theoretical model and a corresponding questionnaire. The development of the model and questionnaire followed a four-step methodology. Initially, potential influencing factors were identified and collected. These factors were then filtered and categorized into four main groups: Technological Specific Factors (TSFs), Organizational Specific Factors (OSFs), Individual Specific Factors (ISFs), and Environmental Specific Factors (ESFs). The Analytic Hierarchy Process (AHP) was applied to rank these factors based on their relative importance. The fifteen top-ranked factors were then used to construct the model and develop the questionnaire. Finally, Structural Equation Modelling (SEM) was utilized to assess the reliability and validity of the constructs. The SEM results confirmed the reliability and validity of all model constructs, including the items. Based on these findings, a validated questionnaire has been formulated for future research. This questionnaire is designed to gather data to test hypotheses and identify statistically significant factors that influence the adoption of blockchain technology in e-government.

Keywords— E-government Systems; blockchain technology; adoption; analytic hierarchy process; structural equation modelling.

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I. INTRODUCTION

These Government organizations are pivotal in a nation's economic growth, particularly in economies with central and mixed planning where their role in citizen services is emphasized [1]. The emergence of cutting-edge technologies in the 21st century has introduced tools capable of enhancing the efficiency of government services. Therefore, these organizations must integrate modern technologies to improve service delivery to citizens [2]. Current e-government systems encounter numerous challenges, including trust, privacy, transparency, security, traceability, and service delays. These systems often rely on a centralized data management approach, which, despite its benefits, also presents several disadvantages, such as high costs and susceptibility to cyber threats [3]. Further, the involvement of multiple intermediaries between government entities and citizens can lead to data breaches, increased costs, and reduced trust [2].

Blockchain technology holds the potential to revolutionize traditional e-government systems by tackling their longstanding vulnerabilities [4], [5], [6]. The concept of blockchain was initially introduced in a 1991 paper titled "How to Time-Stamp A Digital Document" by Haber and Stornetta [7], published in the Journal of Cryptology. In recent years, blockchain has emerged as a distributed computing model and pioneering decentralized technology that primarily underpins digital currencies. It has attracted significant interest for its applications and research possibilities. The primary benefit of blockchain technology revolves around its ability to establish secure, reliable, and self-governing ecosystems and significantly better utilize existing infrastructures, devices, and resources [8]. Besides, blockchain serves not only as an enhancement to existing cybersecurity measures but also enhances transparency and security through new methods for data storage and transfer [7]. Blockchain is now acknowledged as the fifth major innovation in the computing era, joining the mainframe, computers, the internet, and social media as a fundamental driver of technological advancement and societal change [8]. As per studies, blockchain technology enables direct transactions between two parties through a system of duplicated, interconnected ledgers known as blockchain. This eliminates the need for centralized intermediaries and makes transactions more secure and transparent [3], [9]. As a result, transactions rely not on traditional trust (via a third party) but instead on a distributed consensus among network users.

Despite recognizing the potential of blockchain technology in enhancing e-government systems via improving security and transparency while reducing centralization, there is limited empirical research on the factors affecting its adoption within government settings. This gap is particularly evident in understanding the decision-making processes, stakeholder attitudes, and the regulatory environment that affects blockchain technology implementation. This pilot study seeks to explore these critical factors, construct a theoretical model and a questionnaire, and validate the questionnaire to gather data for further research.

II. Materials and Method

A. Blockchain in Government

Blockchain Technology represents a significant innovation in the ICT landscape of the 21st century [10]. Although blockchain is a distinct technology, its integration into e-government systems can offer several benefits due to its complementary nature with existing digital government infrastructures [11], [12]. Blockchain integration within e-government systems addresses critical issues like security, trust, and transparency. Blockchain can compensate for the technological gaps in e-government by leveraging its inherent features of decentralization and transparency. On the other hand, the nature of e-government systems enables the expansion of blockchain applications to real-world governance scenarios.

Further, blockchain enhances scalability, reliability, and availability in e-government, which are essential given the complexity and diversity of government operations [13]. These attributes, security, and trust, are critical drivers for its adoption in e-government [14]. The integration of blockchain technology enables new governmental services and systems that depend on secure, transparent, and efficient interactions across different governmental domains. It allows e-government systems to provide services more effectively [15]. Blockchain technology can revolutionize government and societal operations, representing a new phase in e-government development characterized by decreased complexity and costs, enhanced trust in shared processes, and better audit trails [16]. It can be applied in any governmental transaction or information exchange [17]. Besides, governments are actively experimenting with blockchain technology through various pilot projects. The applications of blockchain in government are varied, including digital identities, tracking financial transactions, electronic voting, land registry, and tax record management, as shown in Figure 1. As highlighted by Kassen [18], blockchain is poised to enable direct interactions between citizens and streamline service delivery without the need for traditional government intermediaries, which fosters a more customized approach to public services. Blockchain ensures a decentralized and transparent approach, where no third party or central authority can authorize, verify, or approve transactions.

Fig. 1 Blockchain applications in e-government

Despite these advantages, the literature on adopting blockchain in e-government is still evolving. The current body of research primarily focuses on blockchain's technical capabilities and potential applications but lacks a comprehensive theoretical model that addresses the intentions and behaviors of end-users in government settings. Besides, while previous studies have explored the functional aspects of blockchain in government, they have not sufficiently addressed how government employees and decision-makers adopt this technology.

B. Technology Adoption Models

Several models have been used to evaluate the acceptance of new technologies across various domains [19]. The Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Technology-Organization-Environment (TOE) framework are examples of these models. They have been applied to investigate the adoption of various technologies in different fields. However, these models have limitations where they concentrate on cognitive factors and deal with a limited set of variables. Venkatesh et al. [20] indicated that when employing a model to evaluate the adoption of a particular system or technology, it is necessary to extend or modify the model. Similarly, Cimperman et al. [21] argued that including extra contextual factors provides precise knowledge of end-user acceptance of field-particular technology.

Given the constraints of previous models and the need for a customized approach to evaluating blockchain adoption in e-government, this study proposes using the Analytic Hierarchy Process (AHP) to address specific challenges and refine our understanding of end-user adoption in this context. This approach will incorporate many factors and prioritize them to build a theoretical model from the top-ranked ones.

This aims to provide a deeper understanding of the factors influencing the acceptance of blockchain technology and will enhance the predictive accuracy of blockchain adoption in e-government systems.

III. Results and Discussion

This study is a pilot study to investigate the factors influencing the adoption of blockchain in e-government. To this end, a theoretical model and questionnaire have been developed using a four-step methodology (see Fig. 2). The potential factors are collected from the literature. Then, factors are filtered and categorized into four main categories in the second step. The third step uses AHP to define the relative weight and importance of collected factors and build the model from the top-ranked ones. In the fourth step, the SEM-measurement model is used to evaluate the reliability and validity of the questionnaire constructs.

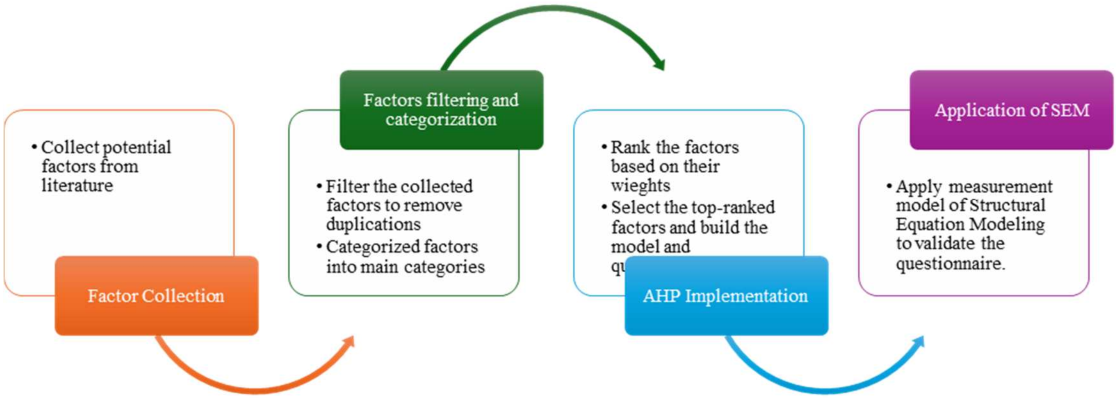

Fig. 2 The four-step methodology

Figure 2 above illustrates the four-step methodology, and the following subsections further discuss the method.

A. *Factors Collection*

The literature review collected all potential factors that may influence the adoption of blockchain technology in e-government. As a result, 87 factors shaped our initial pool.

B. *Factors Filtering and Categorization*

Our initial pool has experienced further analysis and filtering to remove duplicates and select the most relevant factors to our research context. Following that, the surviving factors were categorized into four main categories: Technology-specific factors (TSFs), individual-specific factors (ISFs), organizational-specific factors (OSFs), and environmental-specific factors (ESFs). Figure 3 shows the surviving factors organized into four main categories.

Fig. 3 Potential factors organized into four main categories

C. *AHP Implementation*

AHP is a structured method for managing and analyzing complex decisions. It involves decomposing the problem under investigation into a hierarchy of more easily comprehended sub-problems, each of which can be explored independently [22], [23], [24]. The use of AHP to prioritize the factors in this study includes many steps. First, we built a three-level AHP model hierarchy to assess factors affecting blockchain adoption in e-government systems, as shown in Figure 4. Second, we collected expert judgment through pairwise comparisons using a nine-point scale questionnaire (ranging from 1 to 9) from 13 domain experts.

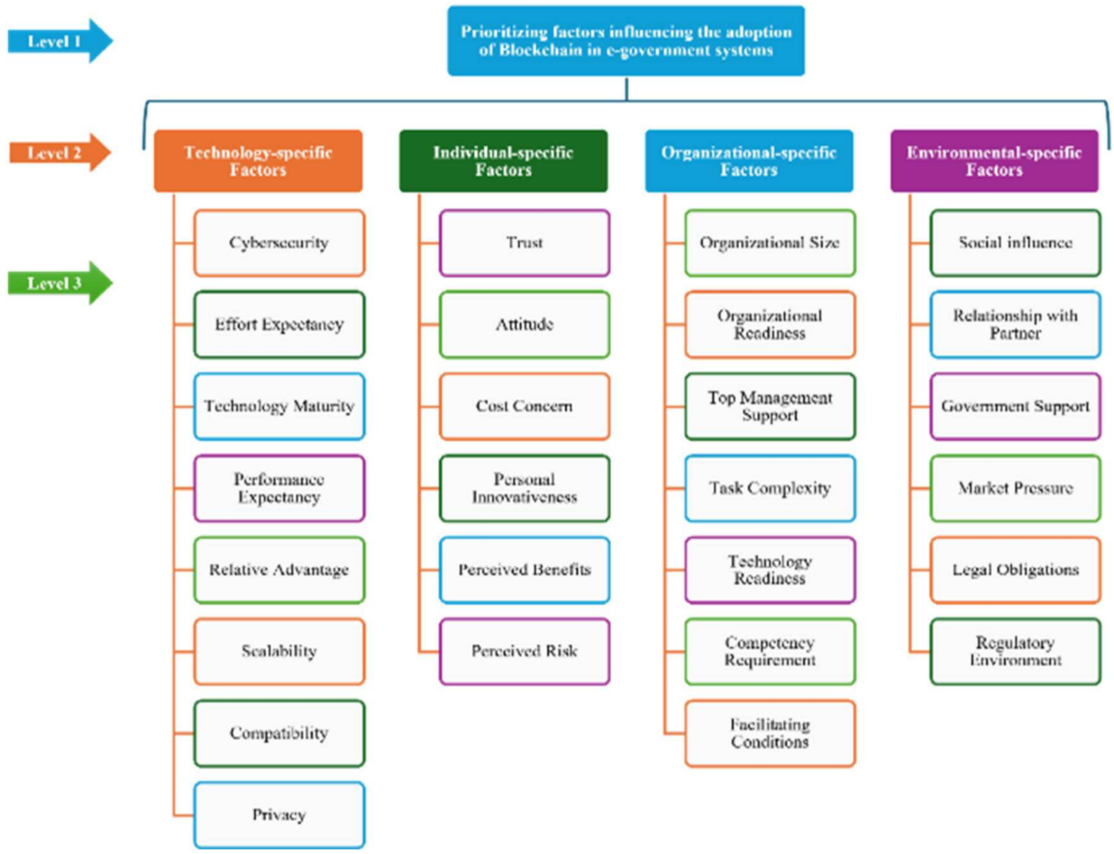

Fig. 4 Three-level AHP model hierarchy to assess factors affecting blockchain adoption in e-government

Then, the pairwise comparison matrices were developed from the collected questionnaires, and their consistency was checked. Afterward, the group judgment matrices were built using the geometric mean from the pairwise comparison matrices. Finally, the weight of each category and factor was calculated. The AHP results are shown in Table 1.

TABLE I
FACTORS WEIGHTS AND RELATIVE IMPORTANCE

Category	Weight	Factor	Weight: Local	Weight: Global	Global Ranking
TSFs	49.2	Cybersecurity	26.9	13.2348	1
		Privacy	24	11.808	2
		Scalability	21.3	10.4796	3
		Compatibility	11.4	5.6088	6
		Performance Expectancy	4.7	2.3124	12
		Relative Advantage	4.4	2.1648	14
		Effort Expectancy	4.1	2.0172	15
		Technology Maturity	3.3	1.6236	19
ISFs	18.1	Trust	44.5	8.0545	4
		Perceived Benefits	25.4	4.5974	10
		Attitude	11	1.991	16
		Personal Innovativeness	9.2	1.6652	17
		Cost Concern	6.6	1.1946	22
		Perceived Risk	3.3	0.5973	26
OSFs	16.8	Facilitating Conditions	37.1	6.2328	5
		Top Management Support	28.8	4.8384	9
		Technology Readiness	9.7	1.6296	18
		Organizational Readiness	8.5	1.428	20
		Task Complexity	7.9	1.3272	21
		Organizational Size	4.1	0.6888	23
		Competency Requirement	3.9	0.6552	25
ESFs	15.9	Government Support	32.4	5.1516	7
		Regulatory Environment	30.6	4.8654	8
		Legal Obligations	14.9	2.3691	11
		Social influence	14.4	2.2896	13
		Relationship with Partner	4.2	0.6678	24
		Market Pressure	3.6	0.5724	27

We have chosen to focus on the top-ranked 15 factors identified through AHP to build our research model because of the importance and impact of these factors in blockchain adoption based on experts' opinions. Focusing on these factors ensures comprehensive coverage of the main elements for the successful adoption of blockchain. This enhances the model's manageability and clarity. Further, it ensures that our efforts are concentrated on the areas with the highest potential impact. Consequently, maximizing the efficacy of the model in real-world applications. Figure 5 shows the proposed research model.

Following the model's building, a questionnaire was designed to collect data. The questionnaire comprised 60 items, each corresponding to specific constructs. These items were either adapted from previous technology acceptance studies or developed by the authors to fit the context of blockchain adoption in e-government systems. The responses were measured on a five-point Likert scale, ranging from (1 = "strongly disagree") to (5 = "strongly agree").

To ensure the content validity of the questionnaire, it was reviewed by a panel of five academic experts specializing in technology adoption and information systems. These experts provided valuable feedback on the items' clarity, relevance, and appropriateness in capturing the intended constructs. Based on their recommendations, several modifications were made to improve the questionnaire, particularly concerning item length and avoiding double-barreled questions. For instance, the original item for cybersecurity, "I believe that implementing blockchain enhances the cybersecurity of our e-government systems," was refined to clarify the scope of "cybersecurity" by specifying the context in which blockchain would operate. Another example is an item under privacy, which originally read, "Blockchain technology ensures the privacy of sensitive data in e-government operations." Based on expert feedback, this was revised to "Blockchain technology is crucial for maintaining the privacy of sensitive data in e-government operations" to emphasize the importance of privacy within the context of blockchain.

Additionally, experts highlighted instances where items were overly lengthy or contained multiple ideas, potentially confusing respondents. For example, an item like "Blockchain technology is effective in safeguarding against unauthorized access and improving the system's resilience to attacks" was split into two separate items to ensure each question addressed a single concept. This reduced the cognitive load on respondents and enhanced the precision of the data collected. The developed questionnaire is provided in Table 2.

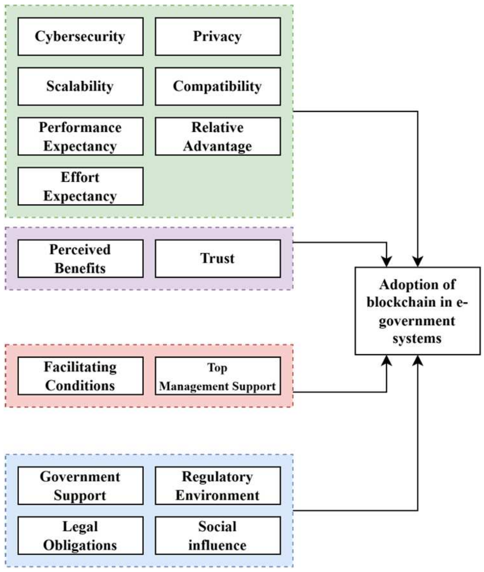

Fig. 5 Proposed model for the adoption of blockchain in e-government

TABLE II
THE DEVELOPED QUESTIONNAIRE FOR BLOCKCHAIN ADOPTION IN E-GOVERNMENT

Factor	Code	Item	Source
Cybersecurity (CSec)	CSec1	I believe that implementing blockchain enhances the cybersecurity of our e-government systems	Developed by authors
	CSec2	The potential of blockchain to prevent data breaches is critical to its adoption in e-government	
	CSec3	Blockchain technology is effective in safeguarding against unauthorized access in e-government systems	
	CSec4	The adoption of blockchain would improve our response to cybersecurity threats in e-government	
Privacy (Priv)	Priv1	Blockchain technology ensures the privacy of sensitive data in e-government operations	[25]
	Priv2	The immutable nature of blockchain is crucial for protecting citizens' privacy in e-government services	
	Priv3	I am confident in blockchain's ability to maintain user confidentiality in e-government transactions	
	Priv4	The privacy benefits of blockchain influence my positive perception of its adoption in e-government	
Scalability (Scal)	Scal1	Blockchain technology can handle the increasing amount of data in e-government systems efficiently.	[26]
	Scal2	The scalability of blockchain technology meets the growing demands of e-government services	
	Scal3	Blockchain solutions can be easily scaled to accommodate different e-government service levels	
	Scal4	Scalability issues in blockchain technology are manageable in the context of e-government	
Compatibility (Comp)	Comp1	Blockchain technology is compatible with existing e-government infrastructure	[27]
	Comp2	Integrating blockchain with current technologies in e-government systems is feasible	
	Comp3	Blockchain complements other technologies used in e-government	
	Comp4	The success of blockchain adoption relies on its compatibility with current e-government systems	
Performance Expectancy (PE)	PE1	Blockchain technology meets the performance standards required by e-government systems	[25]
	PE2	The efficiency of e-government services would significantly improve with blockchain adoption	

Factor	Code	Item	Source
	PE3	Blockchain technology could handle e-government tasks more effectively than current systems	
	PE4	The expected performance benefits of blockchain justify its integration into e-government	
Relative Advantage (RA)	RA1	Blockchain offers significant advantages over traditional systems used in e-government	[28]
	RA2	The benefits of blockchain, compared to current e-government systems, are clear and substantial	
	RA3	Blockchain technology provides superior features that are beneficial for e-government	
	RA4	The adoption of blockchain would lead to better e-government services than existing solutions	
Effort Expectancy (EE)	EE1	Learning to use blockchain technology in e-government will be easy	[25]
	EE2	The ease of adopting blockchain technology is fundamental for its implementation in e-government	
	EE3	Training staff to use blockchain in e-government will not require excessive effort	
	EE4	The simplicity of integrating blockchain into existing e-government processes is encouraging	
Trust (TR)	TR1	I trust that blockchain technology will function reliably in e-government systems	[25]
	TR2	Blockchain's ability to record transactions transparently increases my trust in e-government services	
	TR3	The use of blockchain would make me more confident in the integrity of e-government operations	
	TR4	Trust in blockchain technology is essential for its successful adoption in e-government	
Perceived Benefits (PB)	PB1	The benefits of adopting blockchain in e-government outweigh any potential drawbacks	[27]
	PB2	Blockchain technology offers significant improvements in efficiency for e-government services	
	PB3	The strategic advantages of blockchain are important for its adoption in e-government	
	PB4	The adoption of blockchain will lead to cost savings in e-government operations	
Facilitating Conditions (FC)	FC1	Adequate resources are available to support blockchain implementation in e-government	[25]
	FC2	The technical infrastructure in our organization supports the adoption of blockchain	
	FC3	There is sufficient support from IT staff for integrating blockchain into e-government systems	
	FC4	External support for blockchain adoption in e-government is readily available	
Top Management Support (TMS)	TMS1	Senior management is committed to the adoption of blockchain in e-government	[27]
	TMS2	Top management provides the necessary resources for blockchain integration	
	TMS3	There is strong leadership support for blockchain technology in our e-government initiatives	
	TMS4	Management's enthusiasm for blockchain boosts my confidence in its successful adoption	
Government Support (GS)	GS1	Government policies are favourable towards blockchain adoption in e-government	[27]
	GS2	Financial incentives from the government are available to support blockchain initiatives	
	GS3	Government leadership actively promotes the use of blockchain in public services	
	GS4	There is a clear governmental strategy for integrating blockchain into e-government systems	
Regulatory Environment (RE)	RE1	The current regulatory environment supports the adoption of blockchain in e-government	Developed by authors
	RE2	Regulations are adapting to accommodate blockchain technology in public services	
	RE3	Legal frameworks are in place that facilitate blockchain integration into e-government	
	RE4	Regulatory compliance issues with blockchain are manageable within e-government frameworks	
Legal Obligations (LO)	LO1	Blockchain helps e-government systems meet their legal obligations	Developed by authors
	LO2	Legal requirements encourage the adoption of blockchain in e-government	
	LO3	Blockchain technology aligns with national and international legal standards for e-government	
	LO4	The legal framework is prepared to evolve with the adoption of blockchain in e-government	
Social Influence (SI)	SI1	My colleagues' support for blockchain affects my views on its adoption in e-government	[25]
	SI2	The success stories of blockchain in other government sectors influence my support for its adoption	
	SI3	There is widespread professional endorsement for blockchain in the e-government community	
	SI4	Media and social media coverage shape my support for blockchain implementation in e-government	
Behavioral Intention (BI)	BI1	I intend to support the use of blockchain technology in our e-government systems in the future	[25]
	BI2	I will recommend the adoption of blockchain technology to peers and superiors within my organization	
	BI3	I believe using blockchain technology will enhance our e-government services, and I am willing to advocate for it.	
	BI4	I plan to use blockchain technology in my work processes as it becomes available.	

D. Application of Structural Equation Modelling

The descriptive analysis and structural model were ignored since this research is a pilot study. Using SmartPLS software, the measurement model was applied to assess the reliability and validity of the questionnaire constructs. The measurement model is usually applied to test the reliability and validity of the constructs. Item's reliability refers to the consistency of a group of variables (items). More specifically, it is the degree to which variables that measure the same construct are consistent [29]. Three tests must be undertaken to assess item reliability, including factor loading, Cronbach's alpha, and composite reliability. The item is considered reliable if the factor loading, Cronbach's alpha, and composite reliability values are greater than 0.7 [30].

Convergent validity indicates the extent to which a construct's items converge and relate [29]. When a single construct is measured using multiple items, it is essential to determine whether those items have convergent validity. The Average Variance Extracted (AVE) determines the convergent validity degree inside the construct, where the AVE must be greater than 0.5 to ensure good convergent validity [30]. Discriminant validity requires a test to determine whether every construct is distinct or not from other constructs [29]. The AVE's square root is used to assess the discriminant validity, where its value must be for each construct greater than the values of the correlations with other constructs, as suggested by Fornell and Larcker [31].

1) Measurement model results:

The findings of the measurement model analysis showed that all the constructs' reliability values were greater than the acceptable threshold, as shown in Table 3. The minimum value for the factor loading in the questionnaire was Comp2=0.723, while the maximum value was LO3=0.969. Compatibility had the lowest Cronbach’s Alpha value (0.823), whereas Government Support had the greatest Cronbach’s Alpha value (0.958). In addition, Compatibility had the lowest composite reliability value (0.875), in contrast, Government Support had the highest (0.969). The next was the constructs validity, where the results showed that all the constructs exceeded the AVE acceptable criterion for convergent validity, as shown in Table 3. The lowest value of the AVE in the questionnaire was for Compatibility (0.637), while the highest value was for Government Support (0.887). For discriminant validity, as shown in Table 4, the AVE square root for each construct (marked in bold) was greater than the values of the correlations with other constructs, indicating that the constructs met the discriminant validity criterion.

The application of the measurement model shows that all constructs and items have met the reliability and validity criteria. Thus, the questionnaire is reliable and valid for data collection. Figure 6 depicts the measurement model.

TABLE III

RESULTS OF RELIABILITY AND CONVERGENT VALIDITY

Factor	Item	Reliability			Convergent Validity	Factor	Item	Reliability			Convergent Validity
		Factor Loading	Cronbach’s Alpha	Composite Reliability	AVE			Factor Loading	Cronbach’s Alpha	Composite Reliability	AVE
Cybersecurity	CSec1	0.798	0.924	0.925	0.755	Perceived Benefits	PB1	0.755	0.886	0.904	0.703
	CSec2	0.845					PB2	0.829			
	CSec3	0.953					PB3	0.863			
	CSec4	0.871					PB4	0.899			
Privacy	Priv1	0.886	0.896	0.926	0.759	Facilitating Conditions	FC1	0.921	0.904	0.927	0.762
	Priv2	0.916					FC2	0.867			
	Priv3	0.818					FC3	0.827			
	Priv4	0.862					FC4	0.875			
Scalability	Scal1	0.863	0.903	0.93	0.769	Top Management Support	TMS1	0.857	0.869	0.897	0.686
	Scal2	0.919					TMS2	0.776			
	Scal3	0.852					TMS3	0.938			
	Scal4	0.871					TMS4	0.726			
Compatibility	Comp1	0.786	0.823	0.875	0.637	Government Support	GS1	0.954	0.958	0.969	0.887
	Comp2	0.723					GS2	0.946			
	Comp3	0.813					GS3	0.941			
	Comp4	0.865					GS4	0.926			
Performance Expectancy	PE1	0.734	0.928	0.94	0.798	Regulatory Environment	RE1	0.832	0.891	0.914	0.727
	PE2	0.895					RE2	0.831			
	PE3	0.965					RE3	0.872			
	PE4	0.959					RE4	0.874			
Relative Advantage	RA1	0.879	0.912	0.938	0.792	Legal Obligations	LO1	0.852	0.93	0.928	0.764
	RA2	0.938					LO2	0.908			
	RA3	0.891					LO3	0.969			
	RA4	0.85					LO4	0.752			
Effort Expectancy	EE1	0.817	0.88	0.91	0.717	Social Influence	SI1	0.861	0.871	0.911	0.719
	EE2	0.834					SI2	0.832			
	EE3	0.812					SI3	0.888			
	EE4	0.919					SI4	0.808			
Trust	TR1	0.849	0.918	0.936	0.786	Behavioral Intention	BI1	0.807	0.889	0.923	0.75
	TR2	0.833					BI2	0.913			
	TR3	0.906					BI3	0.887			
	TR4	0.953					BI4	0.853			

TABLE IV

RESULT OF DISCRIMINANT VALIDITY

	BI	Comp	CSec	EE	FC	GS	LO	PB	PE	Priv	RE	RA	Scal	SI	TMS	TR
BI	**0.866**															
Comp	-0.078	**0.798**														
CSec	0.183	0.279	**0.869**													
EE	-0.277	-0.328	-0.332	**0.847**												
FC	-0.138	0.045	-0.071	0.244	**0.873**											
GS	0.209	0.085	-0.044	-0.098	0.228	**0.942**										
LO	0.267	-0.06	0.036	-0.175	-0.192	0.328	**0.874**									
PB	-0.154	-0.002	0.244	-0.134	-0.125	-0.213	-0.12	**0.838**								
PE	-0.292	-0.001	-0.236	0.11	-0.192	-0.475	-0.241	0.395	**0.893**							
Priv	-0.224	0.023	0.074	0.078	-0.249	-0.244	-0.093	0.11	0.247	**0.871**						
RE	0.113	0.189	0.148	0.216	0.055	0.152	0.064	-0.054	-0.143	0.124	**0.852**					
RA	0.129	-0.053	-0.071	0.226	0.163	0.168	0.111	-0.094	-0.13	-0.141	0.34	**0.89**				
Scal	0.293	-0.069	-0.126	-0.089	0.033	-0.027	0.138	-0.117	0.178	0.24	-0.129	-0.307	**0.877**			
SI	-0.205	-0.35	-0.075	-0.28	-0.049	-0.09	0.066	0.099	0.019	-0.117	-0.27	-0.119	-0.138	**0.848**		
TMS	-0.259	0.178	0.174	-0.04	-0.141	-0.022	0.108	-0.166	-0.018	-0.192	-0.077	0.046	-0.477	-0.073	**0.828**	
TR	0.223	-0.273	0.067	-0.411	0.032	0.173	0.039	-0.023	-0.123	-0.071	-0.356	-0.186	0.172	0.142	-0.032	**0.887**

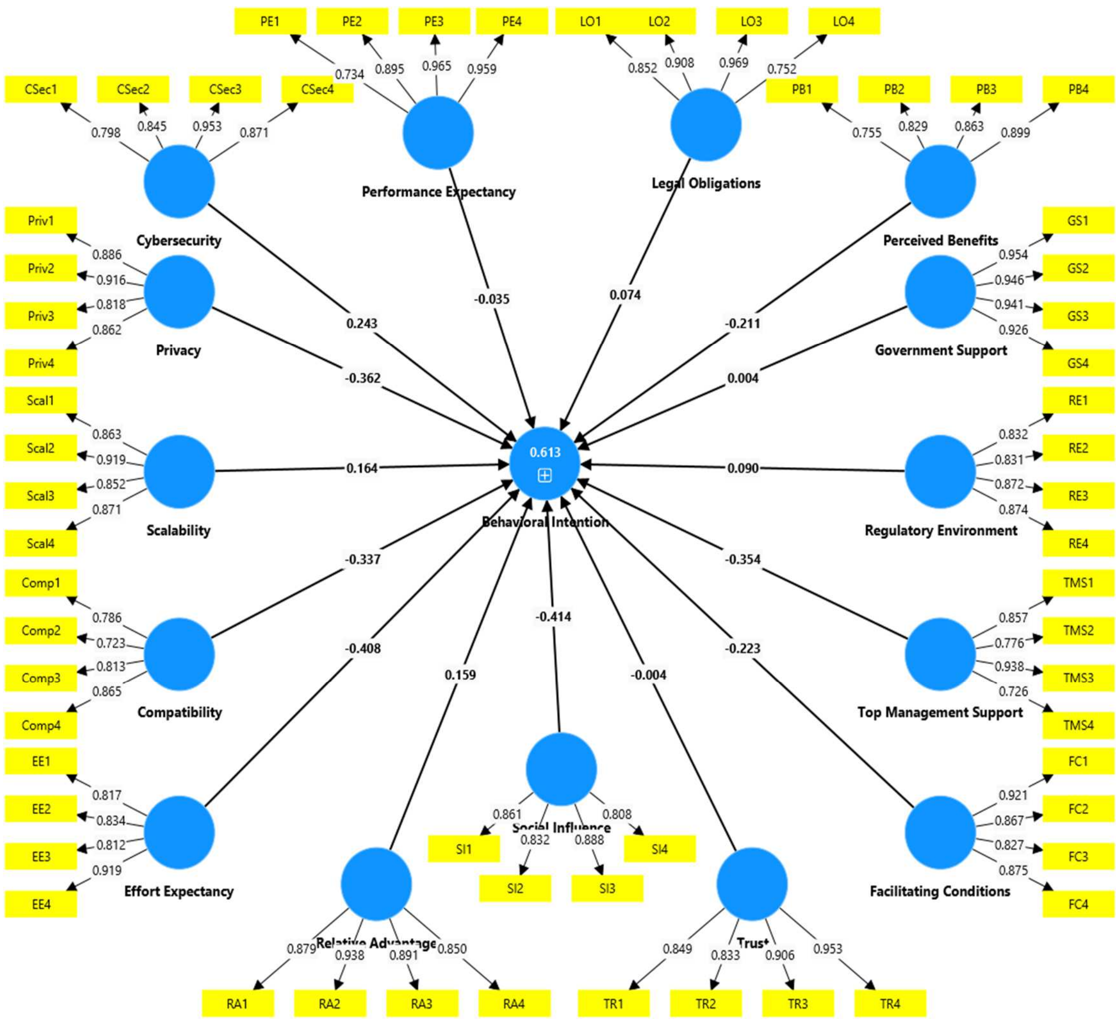

Fig. 6 The measurement model

IV. Conclusion

This pilot study has built and tested a model and questionnaire to investigate the factors affecting the adoption of blockchain in e-government. The proposed model and questionnaire were built and validated using a four-step methodology; potential factors were collected in the first step. The second step involved filtering and categorizing the factors into four main categories: TSFs, OSFs, ISFs, and ESFs. The AHP was applied in the third step to identify the factors' relative importance, followed by building the model from the 15 top-ranked factors and the related questionnaire. Then, SEM was employed in the fourth step to measure the reliability and validity of the constructs.

SEM was used to test the measurement model empirically. The results of the SEM measurement model showed that all the model constructs, including the items, are reliable and valid. Thus, based on the result obtained from SEM, a questionnaire instrument was validated to collect data, test the hypotheses, and validate the proposed model in future research.

This research has theoretical implications. It builds a conceptual model using a four-step methodology to investigate the adoption of blockchain in e-government. In addition, this research has practical implications, as it validates the constructs, including items, used in the proposed model. Consequently, it presented a questionnaire to collect data to test the hypotheses and determine the statistically significant factors influencing the adoption of blockchain in e-government in future research.

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