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Predicting Adoption Behaviour to Digital Government Transformation in Construction Sector

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Abstract: The acceptance of new technologies by targeted users has a substantial impact on the success of digital government transformation (DGT). Based on the integration of the Unified Theory of Acceptance and Use of Technology (UTAUT) and the information system (IS) success model, which are extended with trust, resistance and technology readiness factors, this paper proposes a factor model that predicts adoption behaviour for integrated IS as a DGT initiative. The case study was based on the use of an integrated IS in business licensing and public procurement for the Indonesian construction sector. The 1,656 respondents in this study represented construction companies, experts, project managers and procurement committees with varying levels of digital literacy, computer proficiency, educational backgrounds and technology experience. The model was analysed using structural equation modelling-partial least square (SEM-PLS). The findings showed that trust, technology readiness, performance expectancy and effort expectancy are the four main factors that positively influence behaviour intention in the system. However, users who have access to adequate resources persist in their adoption. The findings provide a solid foundation for future research on DGT in the construction sector.

Keywords: Digital government transformation, Information system success model, Technology readiness, Trust, Unified Theory of Acceptance and Use of Technology

INTRODUCTION

In many countries, digital government transformation (DGT) has emerged as a significant opportunity for improving public services. DGT strives to improve government accountability, efficiency and transparency by providing faster and more efficient services at a lower cost, as well as empowering citizens through inclusive governance. The value of a digital government project is realised when the intended users effectively adopt the concept (Al-Muftah et al., 2018; Aranyossy, 2022). Within this context, understanding user behaviour in adopting new technology-based systems is a complex subject (Shareef et al., 2011), since 20% of digital government value is generated during system development, while the remaining 80% is generated during its actual use.

The transformation process is particularly challenging in the context of collaborative and integrated information systems (IS), requiring a shift in paradigm and mindset not only at the government level but also among all connected

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stakeholders (Elnaghi et al., 2019; United Nations Department of Economic and Social Affairs, 2022). A thorough understanding of data and information openness in the digitalisation initiative is critical for the successful digitalisation of the construction sector (Nezami et al., 2022). The failure rate of DGT in various countries is relatively high (Rosacker and Olson, 2008). While 35% of developing countries failed to implement DGT, 50% succeeded partially, indicating an inability to achieve the primary benefits of DGT and only 15% succeeded (Kuldosheva, 2021; Twizeyimana and Andersson, 2019).

In 2017, through the Ministry of Public Works and Housing, the Indonesian government launched DGT's project by developing an Integrated Construction Services Information System (ICSIS). The system was designed primarily to improve the quality of business licensing and public procurement services. Still, it also has the potential to improve collaboration and assist government institutions in operating more effectively and efficiently. The primary users of ICSIS are construction companies and experts from the private sector, as well as project managers and procurement committees from the public sector. Users must adopt the system not only by using data and information for work purposes but also by sharing data with the system, resulting in a single set of construction data. Company managers are responsible for sharing company data in ICSIS, whereas construction experts, as individuals, must share professional data in the system. Meanwhile, the government mandates that project managers share contract implementation data, whereas the procurement committee is in charge of sharing construction project tender information. They use a single IT platform and the level of adoption and collaboration in sharing data with the system determines the quality of ICSIS.

As it enters its sixth year of operation, ICSIS utilisation remains below optimal, with only 32% of target users using it (Lembaga Pengembangan Jasa Konstruksi, 2023). The system has struggled to generate a significant value for DGT. Because of the low level of adoption and data sharing, the ICSIS data and information are highly inaccurate and incomplete. The data used is frequently extracted from multiple systems and manually entered, resulting in poor quality and delays in the tender process because business permits and expert competency certificates are the major tender requirements. This is demonstrated by the average number of public complaints (9,600 per month) about the validity of business permits issued in 2023. Data inconsistencies and manipulation to meet business licencing and tendering requirements remain common. Business permits were revoked in response to complaints about the invalidity of fulfilment requirements, such as company and expert experience data. Approximately 500,000 business permits and 1,640 expert competency certificates were revoked and declared invalid from 2022 to the middle of 2023 (Lembaga Pengembangan Jasa Konstruksi, 2023).

It is essential to study factors that are critical to successful integrated IS (Nnaji et al., 2023). Different adoption theories have been developed based on individual, technological and organisational perceptions. This study specifically delves into DGT initiatives in the construction sector, which are distinguished by complex interaction patterns, the inclusion of multiple stakeholders and a strong reliance on inter-organisational system interoperability. The novelty of this study is a new concept of the DGT adoption model, which is specifically aimed at the construction services sector by integrating variables and indicators that can explain perceptions from individual, organisational and technological contexts. We propose key success factors for system adoption by unified the UTAUT (Venkatesh, Thong and Xu, 2012) and the IS success model (DeLone and McLean, 2016) and integrating trust (Abu-Shanab, 2017; Nzaramyimana and Susanto, 2019; Verkijika and Wet, 2018), resistance (Rana, Dwivedi and Williams, 2017; Wang et al., 2020) and technology readiness variables (Parasuraman, 2000). The DGT in business licensing and public procurement in the Indonesian construction sector is the focus of our case study. The model was also designed with a focus on user groups, specifically public and business actors. The model analysis does not end with the intention to use technology; it also explains how it influences the actual use of the system. The integrated model should be able to fully describe the individual, organisational and technological contexts from the perspectives of public and private sectors.

We conducted a survey with construction companies, experts, project managers and procurement committees from 34 provinces as target respondents. The resulting adoption model can be used to assess the likelihood of success in adopting IS in the construction sector, as well as to gain insights into factors that influence acceptance. Such understanding enables the proactive design of interventions that are customised to users, encompassing improvements in the regulation, system interface, training initiatives, promotional efforts and the enhancement of digital government knowledge systems.

LITERATURE REVIEW AND RESEARCH HYPOTHESIS

Theoretical Background and Research Model

DGT implementation requires the effective use of information technology in government organisations and by all stakeholders, including government personnel, society and the private sector. It is critical to assess DGT's success from both (Burmeister, Drews and Schirmer, 2019; Gil-Garcia and Flores-Zúñiga, 2020) the government institution's (Lim et al., 2012; Susha et al., 2023) and the users' perspectives (Venkatesh, Thong and Xu, 2016). DGT is about transformation that is not only programme-centred but also user-centred, where the transformation is carried out on all parts of the technological system, processes and organisations that bring change (Hornstein, 2015; Sarantis et al., 2009; Takagi and Varajão, 2019).

Experience with digital government reveals that perceived usability, user-friendliness, computer self-confidence, subjective norms, perceived credibility, attitudes, behavioural tensions (Rabaa'i et al., 2016; Veeramootoo, Nunkoo and Dwivedi, 2018), technology readiness, culture and the values it generates (Malodia et al., 2021) influence service adoption. There are three primary types of adoption or rejection decisions in a social system: the first involves decision-making conducted independently by each individual, the second entails collective decisions based on the deliberation of system members and the third encompasses authority decisions made by a small number of individuals who hold dominance or technical competence in the system (Wang et al., 2020).

Over the years, the construction sector has made efforts to carry out digital transformation by collaborating data networks among all stakeholders in the business licensing process as a prerequisite for commencing any stage of construction project, as well as the entire project life cycle, including procurement process (Huang et al., 2021). Digitising all stages of the business licensing process can help overcome data inconsistencies from disparate sources and reduce lengthy validation times during the evaluation process (APEC [Asia-Pacific

Economic Cooperation] and Digital Economy Steering Committee, 2022). DGT is also prevalent in public procurement, which could benefit from using digital technology. This includes investigating and utilising tender evaluation decision support systems. As a result of an integrated IS, it is possible to determine what to do and how to outline infrastructure procurement strategies. Furthermore, several methods have been developed to forecast deviations in duration and cost during construction bidding (Ibem and Laryea, 2014).

The integrated IS system is constructed within an environment that actively encourages users to adopt the system as well as share data and information. This collaboration extends beyond merely opening digital communication channels; it spans processes, data and technology, symbolising a comprehensive approach to advancement in the construction sector. All shared data are accessible to the public, embodying a commitment to transparency and openness. Achieving digital transformation requires a collaborative regulatory framework that considers the diverse interests of construction stakeholders and balances any competing objectives (Bühler et al., 2023). System governance requires a comprehensive perspective encompassing various stakeholders (Adywiratama et al., 2022; Nyansiro, Mtebe and Kissaka, 2021). Enhancing integrated IS necessitates that one properly understands factors influencing the behavioural intention to use, along with the actual usage of, technology in the construction sector (Nnaji et al., 2023).

The IS success model, which focuses on the benefits created through a user-centric approach, forms the basis for assessing the success of information technology applications. This model is instrumental in quantifying the perceived value experienced by users and elucidating the benefits realised by the community (DeLone and McLean, 2016). Previous studies have assessed the IS success model, which includes information quality, service quality and system quality as endogenous performance expectations (Mensah, Zeng and Mwakapesa, 2022). However, this model fails to demonstrate user acceptance and use of IS. Meanwhile, The UTAUT model is a robust framework to comprehend user reactions to the adoption of new technology (Aranyossy, 2022; Veeramootoo, Nunkoo and Dwivedi, 2018; Witarsyah et al., 2017). However, it is important to note that UTAUT is specifically designed to assess user acceptance and is not intended to determine the success of an IS (Sawalha, Jamal and Shanab, 2019). Integrating the IS success model variables into UTAUT theory will strengthen the model's technological relevance. The UTAUT and IS success models do not account for individual characteristics. Previous research suggests that a person's attitude towards technology is important (Aranyossy, 2022; Kurfalı et al., 2017; Nookhao and Kiattisin, 2023; Nzaramyimana and Susanto, 2019; Samuel et al., 2020). As a result, this study is also taking into account digital literacy, computer proficiency, educational backgrounds, technology experience and network infrastructure among users spanning the 34 provinces of Indonesia. In doing so, we proposed that adoption behaviour to the system could be influenced not only by factors in the integrated model but also by such variables as trust, resistance and technology readiness. The combination of the model provides insights into IS success and acceptance, considering both the potential and actual system adoption**.** Figure 1 depicts the research model that explains the main variables in both theories and extended variables.

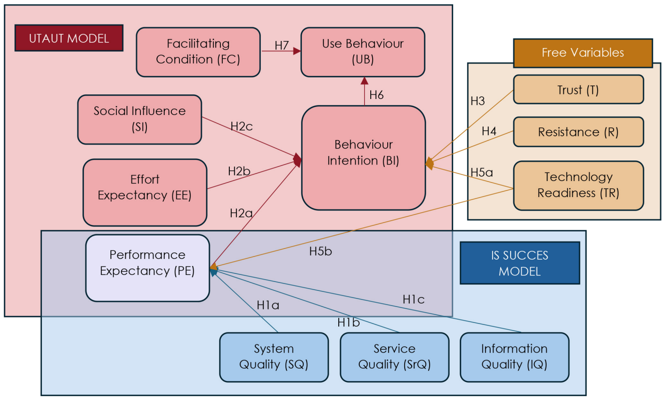

Figure 1. Research conceptual mode

The Success of Information Technology Through a User-Centric Approach

The IS success model, which refers to the benefits that are centred on users, is one of the most widely used models and serves as the foundation for adapting it in measuring the success of implementing IS. Model development generates six variables that influence system success: information quality, system quality, service quality, performance expectancy, usage intentions and system benefits. According to the model, information and system quality influences system adoption and performance expectancy (Al-Rahmi et al., 2022; DeLone and McLean, 2016; Mensah, Zeng and Mwakapesa, 2022; Veeramootoo, Nunkoo and Dwivedi, 2018; Witarsyah et al., 2017). Accountability and transparency ensured through traceable processes and clear communication that informs users about the services provided are some indicators of service quality, as are responsiveness, accuracy, reliability, technical competence and empathy of system management staff (Al-Rahmi et al., 2022). The performance expectancy variable is used in this study as a perception of an individual's belief that using an integrated IS will allow them to achieve increased performance in completing their work tasks and responsibilities (Ahmad, Waqas and Zhang, 2020; Aranyossy, 2022; Dwivedi et al., 2017; Kurfalı et al., 2017; Quaosar, Hoque and Bao, 2018; Venkatesh, Thong and Xu, 2012; Verkijika and Wet, 2018). This demonstrates the individual's belief that using the system will benefit them and it directly influences attitudes and intentions to use the system.

H1a: System quality is positively related to performance expectancy.
H1b: Service quality is positively related to performance expectancy.
H1c: Information quality is positively related to performance expectancy.

User Reaction to the New Technology

UTAUT combines variables to form four constructs: performance expectancy, effort expectancy, social influence and facilitating conditions. The effort expectancy of the system demonstrates that an individual is more likely to adopt a system that requires little effort to implement. Existing theories and models show that the more accessible a technology is, the greater its adoption and acceptance become (Ahmad, Waqas and Zhang, 2020; Dwivedi et al., 2017; Sawalha, Jamal and Shanab, 2019; Venkatesh, Thong and Xu, 2012; Verkijika and Wet, 2018). We further use the notion of social influence, referred to here as the extent to which an individual believes that other people important to them believe in using the new system. Social influence can also be measured by a sense of superiority when using the system (Ahmad, Markkula and Oivo, 2012; Kurfalı et al., 2017; Quaosar, Hoque and Bao, 2018; Venkatesh, Chan and Thong, 2012; Verkijika and Wet, 2018). We expect UTAUT to be a useful tool for managers who need to assess the likelihood of success in introducing new technology.

H2a: Performance expectancy is positively related to behaviour intention.
H2b: Effort expectancy is positively related to behaviour intention.
H2c: Social influence is positively related to behaviour intention.

Trust holds significance in the context of collaborative digital government since stakeholders share data transparently with the public. This variable represents a cognitive force that comes before potential behaviour and the acceptance of the IS. For collaborative services to thrive in digital government, users must have trust, which encourages the government to create and communicate data and information. Trust, in this context, is defined by two key factors: government and internet trust (Nzaramyimana and Susanto, 2019; Verkijika and Wet, 2018). Government trust reflects users' subjective belief in the government's honesty and its ability to provide digital government services (Lallmahomed, Lallmahomed and Lallmahomed, 2017). Meanwhile, trust in the internet represents a subjective belief that using online systems is secure and ensures privacy (Abu-Shanab, 2017). This trust dynamic is particularly relevant in various digital transactions services, such as those involving taxes and pension funds, where trust in the government often outweighs trust in the internet itself (Aranyossy, 2022).

Resistance to change is another significant factor affecting the adoption of digital government services (Alomari, 2014; Tangi et al., 2021) and contributing to the failure of a new system (Rana, Dwivedi and Williams, 2017). The primary dimension of resistance is behaviour that opposes changes related to digital transformations, such as IS (Wang et al., 2020). When confronted with change, some users prefer to maintain the status quo, while others actively resist it. The evaluation of a new system takes into account its features, along with personal and organisational circumstances. Users subsequently form expectations about the outcomes of their actions and when a perceived threat is present, resistance to change may arise. Perceptions of digital government services can also influence resistance, whether it is in response to positive or negative changes (Lallmahomed, Lallmahomed and Lallmahomed, 2017). User resistance to change may decrease when digital government services demonstrate improved performance or are simple to learn and use. Conversely, negative expectations about performance or the effort required tend to foster greater resistance to change. It plays a pivotal role in determining the success of the adoption of digital government services.

H3: Trust is positively related to behaviour intention.
H4: Resistance is negatively related to behaviour intention.

From a technological standpoint, the failure to adopt technology can lead to resistance and negative attitudes towards new systems. Users may struggle to comprehend the economic benefits of digital government when lacking technology knowledge (Shareef et al., 2011). Despite digital government being grounded in computer and internet technology, traditional government service users may not be familiar with these concepts. Therefore, technology readiness (TR) plays a key role in predicting the adoption of digital government.

Technology readiness is defined as people's inclination to embrace and use new technology to achieve goals, both personally and professionally (Parasuraman, 2000). By incorporating technology readiness as a construct, the model aims to describe the users' state when adopting information technology more precisely. The first two dimensions that may increase technology readiness are optimism and innovativeness, whereas discomfort and insecurity are considered barriers to using technology (Lin, Shih and Sher, 2007; Nugroho and Fajar, 2017; Parasuraman, 2000). Technological optimism is defined as a favourable attitude toward technology and the belief that it can provide people with greater flexibility, control and efficiency. The ability to pioneer in the use of technology and lead in ideas and thoughts is often referred to as innovativeness. Discomfort is caused by a sense of helplessness and being overwhelmed by technology. Insecurity is defined by distrust of technology and doubts about its ability to function properly. Several studies on adoption barriers have concluded that technology readiness can create a sense of insecurity regarding digital systems (Shareef et al., 2011).

H5a: Technology readiness is positively related to behaviour intention.
H5b: Technology readiness is positively related to performance expectancy.

Individuals who have a positive assessment of an integrated IS will have a high intention to adopt the system and vice versa. This behaviour is determined by their frame of mind, which is shaped by the convenience and utility of the offered innovation (Rabaa'i et al., 2016; Venkatesh, Chan and Thong, 2012; Verkijika and Wet, 2018). However, adequate resource variables, such as organisations and infrastructure that can support system adoption in order to facilitate access to services, are variables that determine system users' actual adoption.

H6: Behaviour intention is positively related to user behaviour.
H7: Facilitating condition is positively related to user behaviour.

RESEARCH METHODOLOGY

Measurement Development

A questionnaire was created using the research model, with respondents providing feedback on a Likert scale rating. The study used a nominal scale of 1 to 4 to collect data via questionnaires, with "Very Low" being scored as 1 and "Very High" being scored as 4. An even-point Likert scale was used to eliminate the neutral option. The questionnaire's content was validated through expert consultation and semi-structured interviews to obtain more detailed information on adoption behaviour in some of the 30 targeted respondents. A pre-test involving 10 construction company managers, 10 experts, five project managers and five procurement committees was conducted to ensure the validity and reliability of the question items. The measurement items are shown in Table 1.

Table 1. The measurement item

Construct	Indicator	Code	Sources
User behaviour	IS is employed in the automation of work processes	UB_1	Veeramootoo, Nunkoo and Dwivedi (2018)
	IS usage habit	UB_1	
	IS is a requirement	UB_1	
	The necessity of using IS	UB_1	
Behaviour intention	Intention to obtain services and information through IS	BI_1	Nzaramyimana and Susanto (2019); Veeramootoo, Nunkoo and Dwivedi (2018)
	Trust in IS to share data and information	BI_2	
	Intention to use IS in the future	BI_3	Mensah, Zeng and Mwakapesa (2022); Mensah, Zeng and Luo (2020); Verkijika and Wet (2018)
Facilitating condition	Have sufficient resources (e.g., computer equipment, internet connection, etc.) to run IS	FC_1	Ahmad, Markkula and Oivo (2012); Quaosar, Hoque and Bao (2018); Verkijika and Wet (2018)
	Have sufficient knowledge to use IS	FC_2	
	When you are having trouble using IS, it is simple to get help	FC_3	
Trust	The intention to use IS services is driven by trust in the government	T_1	Verkijika and Wet (2018)
	Belief that the government will always provide the best service and will never harm users	T_2	
	Trust that the government will protect users' interests and privacy	T_3	

(*Continued on next page*)

Table 1. *Continued*

Construct	Indicator	Code	Sources
	Trust in the internet's environment and security system to support the use of IS services	T_4	Nzaramyimana and Susanto (2019); Verkijika and Wet (2018)
	Belief that Indonesia's legal system and technology can protect users from online system abuse	T_5	
Resistance*	The impact of information sharing on: 1. Business competition (questions for construction companies and experts) 2. Performance evaluation (questions for project manager and procurement committee)	R_1	Al-Muftah et al. (2018)
	The disclosure of data of business entities/experts in the IS has legal implications for existing procurement processes and construction contracts	R_2	
	The transition from the manual system to digitalisation resulted in a service slowdown	R_3	
	Workload impact of mandatory data input into IS	R_4	
Social influence	The intention to use IS from the fact that work partners already use IS for business licensing and tendering	SI_1	Nzaramyimana and Susanto (2019)
	Instruction to use IS	SI_2	Dwivedi et al. (2017); Mensah, Zeng and Luo (2020); Nzaramyimana and Susanto (2019); Sawalha, Jamal and Shanab (2019); Verkijika and Wet (2018)
	The intention is to use IS because work partners experience improved performance after using IS	SI_3	Ahmad, Markkula and Oivo (2012); Dwivedi et al. (2017); Nzaramyimana and Susanto (2019)

(*Continued on next page*)

Table 1. *Continued*

Construct	Indicator	Code	Sources
Effort expectancy	Ease of access to IS services	EE_1	Dwivedi et al. (2017); Mensah, Zeng and Luo (2020); Sawalha, Jamal and Shanab (2019); Verkijika and Wet (2018); Witarsyah et al. (2017)
	The operating system is simple to learn	EE_2	
	Ease of use IS	EE_3	
Performance expectancy	1. The impact of using IS on the ease of obtaining business permits or tender awards (specific questions for construction companies and experts) 2. The impact of using IS on the ease of completing the procurement process: Preparing owner estimate, preparing and carrying out tenders' process, contract implementation, etc. (specific questions for project managers and procurement committee)	PE_1	Belanche, Casaló and Flavián (2012); Dwivedi et al. (2017); Sawalha, Jamal and Shanab (2019)
	The impact of IS on work completion time	PE_2	Ahmad, Markkul and Oivo (2012); Mensah, Zeng and Luo (2020); Sawalha, Jamal and Shanab (2019); Verkijika and Wet (2018)
	The impact of IS on improving work quality	PE_3	Dwivedi et al. (2017); Sawalha et al. (2019)
	IS's impact on the cost efficiency of business licensing and public procurement process	PE_4	Kurfalı et al. (2017)
Information quality	Accuracy of data and information	IQ_1	DeLone and McLean (2016); Mensah, Zeng and Mwakapesa (2022)
	Relevance of data and information	IQ_2	DeLone and McLean (2016)
	The comprehensiveness of data and information	IQ_3	DeLone and McLean (2016); Mensah, Zeng and Mwakapesa (2022)
	Updated data and information	IQ_4	Mensah, Zeng and Mwakapesa (2022)
	Reliability of data and information	IQ_5	Aranyossy (2022)

(*Continued on next page*)

Table 1. *Continued*

Construct	Indicator	Code	Sources
System quality	Intensity of interference/bugs	SQ_1	Al-Rahmi et al. (2022)
	Interface consistency	SQ_2	Al-Rahmi et al. (2022); DeLone and McLean (2016); Veeramootoo, Nunkoo and Dwivedi (2018)
	Documentation quality	SQ_3	Al-Rahmi et al. (2022)
	Ease and quick access to the IS	SQ_4	DeLone and McLean (2016); Veeramootoo, Nunkoo and Dwivedi (2018)
Service quality	Ease of communication with IS managers about the services (interactivity)	SrQ_1	Al-Rahmi et al. (2022); DeLone and McLean (2016); Scott, DeLone and Golden (2016)
	The responsiveness of IS's management to user complaints	SrQ_2	
	IS's business processes are interoperable with other institution's systems (reliability and accuracy)	SrQ_3	
	System managers are technically competent in dealing with user complaints	SrQ_4	
	The licensing and tendering processes that are in place are traceable (accountable and transparent)	SrQ_5	
Technology readiness	The impact of technology on the efficiency of work processes	PTR_1	Buyle et al. (2018); Chen, Liu and Lin (2013); Lin, Shih and Sher (2007); Shareef et al. (2011); Verkijika and Wet (2018)
	The impact of technology on individual productivity	PTR_2	
	The impact of technology on work flexibility and freedom	PTR_3	
	The intention to learn and use the latest technology	PTR_4	Buyle et al. (2018); Chen, Liu and Lin (2013); Lin, Shih and Sher (2007)
	Ability to learn new technology products without assistance from others	PTR_5	
	Capability to keep up with the most recent technological developments	PTR_6	

(*Continued on next page*)

Table 1. *Continued*

Construct	Indicator	Code	Sources
	Technology is intentionally designed to be too complex for the average person to comprehend*	NTR_1	Parasuraman (2000)
	Technology allows others or specific institutions to easily monitor personal data*	NTR_2	Buyle et al. (2018); Chen, Liu and Lin (2013); Parasuraman (2000)
	Technology reduces the importance of interpersonal interactions in organisations*	NTR_3	Buyle et al. (2018); Parasuraman (2000)
	Technology makes it easier to misinterpret publicly available data*	NTR_4	Chen, Liu and Lin (2013); Parasuraman (2000)

**Note*: Score in reverse.

Sampling and Data Collection

Purposive sampling methods were used, selecting specific elements from the population based on their unique characteristics rather than using random selection. We used the Cohran method to determine the minimum sample size. The required level of confidence in the sample was set at 95%. The online survey was conducted from August 2022 to February 2023. The 1.800 targeted respondents were contacted through network-based channels (including email and WhatsApp). Responses were collected from 1,656 respondents, which included 35% of the private sector (586 construction company managers and experts), as well as 65% of government officials (1,070 procurement committees and construction project managers). The demographic sample characteristics are shown in Table 2. Respondent characteristics were determined using the following criteria: age, gender, educational level and work experience. Responses were obtained from respondents from 34 provinces of Indonesia.

Table 2. Sample characteristics

Variable	Category	Government Official	Private Sector
		%	%
Age	21 years old to 30 years old	10	11
	31 years old to 40 years old	36	32
	41 years old to 50 years old	36	34
	51 years old to 60 years old	18	20
	More than 60 years old	–	3
Gender	Male	77	87
	Female	23	13

(*Continued on next page*)

Table 2. *Continued*

Variable	Category	Government Official	Private Sector
		%	%
Education	Bachelor's degree	47	76
	Master's degree	53	21
	Doctor of Philosophy (PhD)	–	3
Working experience	Less than five years	22	35
	Five years to 10 years	5	16
	More than 10 years	73	49

RESULTS AND DISCUSSION

Measurement Model

A structural equation model (SEM) was employed to explore the relationships between constructs, as assessed by various indicator variables. We analysed data responses by using the partial least square (PLS) approach via SMART PLS version 4.0. All variables examined in the study were operationalised as multi-item reflective constructs.

According to the SEM analysis results, the model exhibits outer loading values greater than 0.5, thereby meeting the criteria for convergent validity. Furthermore, as presented in Table 3, the values of Cronbach's alpha and composite reliability exceed 0.7, indicating that the model is acceptable.

Table 3. Composite reliability

Construct	Cronbach's Alpha		Composite Reliability (rho_a)	
	A	B	A	B
Behaviour intention	0.853	0.911	0.856	0.912
Effort expectation	0.929	0.957	0.931	0.957
Facilitating condition	0.822	0.810	0.824	0.817
Information quality	0.941	0.959	0.941	0.960
Performance expectation	0.900	0.897	0.904	0.902
Resistance	0.645	0.700	0.701	0.797
Social influence	0.682	0.700	0.685	0.797
System quality	0.869	0.905	0.883	0.912

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Table 3. *Continued*

Construct	Cronbach's Alpha		Composite Reliability (rho_a)	
	A	B	A	B
Services quality	0.906	0.922	0.908	0.927
Trust	0.886	0.909	0.893	0.913
Technology readiness	0.926	0.927	0.930	0.931
Users' behaviour	0.861	0.900	0.861	0.902

Notes: A = Government official: Project managers and procurement committees; B = Private sector: Construction company managers and experts.

The average variance extracted (AVE) value demonstrates good convergent validity (> 0.5), signifying that each latent variable can explain more than half of the variances on average. Based on the Fornell-Larcker criterion, the results of the discriminant validity test showed that the square value of AVE for each construct is greater than the correlations between constructs (as shown in Tables 4 and 5). This confirms that the measurement model satisfies discriminant validity.

Table 4. Output Fornell-Larcker criterion: Government officials

	BI	EE	FC	IQ	PE	R	SI	SQ	SrQ	T	TR	UB
BI	0.88											
EE	0.54	0.94										
FC	0.58	0.61	0.86									
IQ	0.62	0.61	0.61	0.90								
PE	0.65	0.66	0.65	0.80	0.88							
R	–0.29	–0.27	–0.31	–0.33	–0.32	0.86						
SI	0.47	0.53	0.47	0.55	0.58	–0.38	0.87					
SQ	0.55	0.66	0.62	0.76	0.71	–0.29	0.51	0.85				
SrQ	0.55	0.62	0.62	0.78	0.73	–0.29	0.50	0.84	0.85			
T	0.74	0.54	0.58	0.66	0.64	–0.29	0.45	0.59	0.59	0.83		
TR	0.65	0.50	0.66	0.64	0.67	–0.29	0.44	0.60	0.61	0.60	0.86	
UB	0.57	0.61	0.78	0.60	0.64	–0.29	0.44	0.61	0.62	0.54	0.62	0.84

Notes: BI = Behaviour intention; EE = Effort expectation; FC = Facilitating condition; IQ = Information quality; PE = Performance expectation; R = Resistance; SI = Social influence; SQ = System quality; SrQ = Services quality; T = Trust; TR = Technology readiness; UB = Users' behaviour.

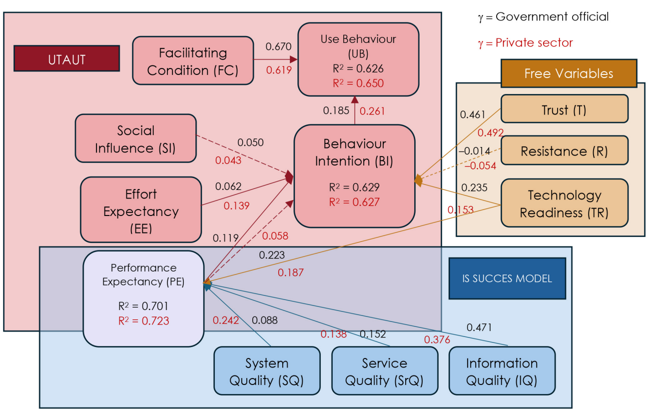
Table 5. Output Fornell-Larcker criterion: Private sector

	BI	EE	FC	IQ	PE	R	SI	SQ	SrQ	T	TR	UB
BI	0.92											
EE	0.61	0.96										
FC	0.61	0.70	0.85									
IQ	0.66	0.69	0.66	0.93								
PE	0.65	0.74	0.67	0.80	0.88							
R	–0.40	–0.34	–0.35	–0.35	–0.40	1.00						
SI	0.52	0.59	0.60	0.59	0.67	–0.44	0.79					
SQ	0.60	0.75	0.70	0.81	0.78	–0.37	0.56	0.88				
SrQ	0.57	0.72	0.69	0.76	0.75	–0.42	0.59	0.86	0.87			
T	0.75	0.60	0.59	0.70	0.67	–0.41	0.50	0.69	0.67	0.86		
TR	0.61	0.59	0.63	0.68	0.69	–0.36	0.53	0.64	0.64	0.59	0.86	
UB	0.64	0.72	0.78	0.73	0.74	–0.31	0.64	0.72	0.72	0.63	0.71	0.88

Notes: BI = Behaviour intention; EE = Effort expectation; FC = Facilitating condition; IQ = Information quality; PE = Performance expectation; R = Resistance; SI = Social influence; SQ = System quality; SrQ = Services quality; T = Trust; TR = Technology readiness; UB = Users' behaviour.

STRUCTURAL MODEL ANALYSIS

The resulting PLS model includes two models for government and private sector samples. Figure 2 depicts the outcome of the PLS analysis for the research model.



Notes: ——▶ = Significant path; - - -▶ = Insignificant path.

Figure 2. Result of PLS analysis for the research model

The R^2 values for the dependent variables of government official samples (performance expectancy, behavioural intention and user behaviour to adopt the IS) are 0.701, 0.629 and 0.626, respectively. Likewise, for the private sector, the R^2 values are 0.723, 0.627 and 0.650, respectively. This indicates that both research models explain more than half of the variance in the construct.

Standardised root mean square residual shows values as 0.060 (< 0.1), indicating no difference between the observed correlation and the model's implied matrix. The normed fit index value is close to one (0.820), which indicates a good fit model.

Hypotheses are tested to determine their acceptance or rejection and this study uses a significance value (α) of 5%. The relationship between variables is considered significant when the *p*-value is less than the predefined value ($p < 0.05$). Table 6 displays the hypothesis testing results for government officials and the private sector.

Table 6. Output path coefficient

Hypothesis	Original Sample (O)		Standard Deviation (STDEV)		T-Statistics (|O/STDEV|)		*p*-Values (1 Tailed)		Decision	
	A	B	A	B	A	B	A	B	A	B
BI→UB	0.185	0.261	0.032	0.049	5.784	5.292	0.000	0.000	Accepted	Accepted
EE→BI	0.062	0.139	0.029	0.058	2.096	2.402	0.018	0.008	Accepted	Accepted
FC→UB	0.670	0.619	0.029	0.041	23.054	14.965	0.000	0.000	Accepted	Accepted
IQ→PE	0.471	0.376	0.048	0.075	9.729	5.000	0.000	0.000	Accepted	Accepted
PE→BI	0.119	0.058	0.039	0.066	3.027	0.882	0.001	0.189	Accepted	Rejected
R→BI	–0.014	–0.054	0.022	0.043	0.001	1.266	0.256	0.103	Rejected	Rejected
SI→BI	0.050	0.043	0.031	0.052	1.588	0.827	0.056	0.204	Rejected	Rejected
SQ→PE	0.088	0.242	0.052	0.092	1.710	2.621	0.044	0.005	Accepted	Accepted
SrQ→PE	0.152	0.138	0.054	0.064	2.840	2.156	0.003	0.016	Accepted	Accepted
T→BI	0.461	0.492	0.042	0.054	10.892	9.147	0.000	0.000	Accepted	Accepted
TR→BI	0.235	0.153	0.042	0.054	5.545	2.860	0.000	0.002	Accepted	Accepted
TR→PE	0.223	0.187	0.034	0.055	6.580	3.369	0.000	0.001	Accepted	Accepted

Notes: A = Government official – Construction project managers and procurement committees; B = Private sector – Construction company managers and experts; BI = Behaviour intention; EE = Effort expectation; FC = Facilitating condition; IQ = Information quality; PE = Performance expectation; R = Resistance; SI = Social influence; SQ = System quality; SrQ = Services quality; T = Trust; TR = Technology readiness; UB = Users' behaviour.

The influence of the system, service, information quality and technological readiness on performance expectation are all positive, implying that Hypotheses H1a, H1b, H1c and H5b are all accepted for both models at the 5% level. It is also shown that while all the influences of the four perception constructs on performance expectancy are accepted, the influence of information quality and technology readiness, respectively, are the strongest than those of the two other constructs.

For the official government adoption model, except for resistance ($\gamma = -0.014$; $p > 0.05$) and social influence ($\gamma = 0.050$; $p > 0.05$), the association of the other four variables: effort and performance expectancy, trust and technology readiness to behaviour intention is statistically significant. Therefore, Hypotheses H2a, H2b, H3, H5a are accepted, but Hypotheses H4 and H2c are rejected. In the private sector model, performance expectancy is also insignificant ($\beta = 0.058$; $p > 0.05$). Thus, Hypothesis H2a for the private sector model is rejected. When compared to other variables that influence behavioural intention, trust and technological readiness have the strongest influence.

In terms of the two variables' influence, it was hypothesised that behaviour intention (Hypothesis 6) and facilitation conditions (Hypothesis 7) are both positively associated with user behaviour construct. Figure 2 shows that both hypotheses can be accepted. However, the influence of facilitation conditions is three times stronger ($\gamma = 0.670$; $p < 0.05$) than the influence of behaviour intention ($\beta = 0.185$; $p < 0.05$).

DISCUSSION

Performance expectancy is understood as the belief that the use of digital technology empowers project managers, procurement committees, construction companies, and experts to enhance their performance and fulfil their respective duties. As proposed in the hypothesis, the positive influences of the three examined perception constructs of the IS success model (system, service and information quality) and technology readiness variable on performance expectancy are all found to be significant. The information quality scored the highest significance. Therefore, the accuracy, relevance, comprehensiveness, up-to-datedness and reliability of data and information are crucial aspects for enhancing performance in carrying out responsibilities. Previous research has reported that the quality of information in digital government significantly influences users' perceptions of performance expectancy (Mensah, Zeng and Mwakapesa, 2022; Qutaishat, 2012; Witarsyah et al., 2017). In this study, information quality emerged as a strong predictor, particularly in the context of business licensing and procurement processes. The use of inaccurate data and information can introduce risks or legal consequences for the procurement committees, project managers, construction companies and engineers, directly impacting their work performance.

Technology readiness has a positive and the second-highest significant effect on performance expectancy. Consequently, the technology readiness of users can significantly influence their performance, leading to improved work processes, increased productivity and greater freedom and flexibility in their work. The respondents, hailing from 34 provinces and of varying educational backgrounds and ages, have exhibited diverse abilities in using technology. It is essential to recognise that the benefits of digital government cannot be fully realised in the absence of technology knowledge (Shareef et al., 2011). Users' proficiency and understanding of information technology are valuable assets for the further adoption of the system.

Service quality affects performance but with a lower level of significance compared to information quality and technology readiness. This variable reflects the government's ability to address user requirements effectively (Al-Rahmi et al., 2022). It is crucial to consider service quality from the outset of system development since digital government necessitates the reorganisation of business processes, system optimisation and work unit integration. This result aligns with a study by Veeramootoo, Nunkoo and Dwivedi (2018), where a positive user experience improved the perceived quality of online systems for digital government services, including data sharing by users.

System quality evaluates the characteristics of the IS, including factors such as a low occurrence of bugs, a consistent interface with a user-friendly platform offering easily understandable instructions, high-quality documentation and straightforward content navigation. Despite having the lowest score, system quality exhibits a positive and significant effect on performance expectancy. This result is supported by previous studies, highlighting a positive relationship between system quality and the performance expectancy constructs (Al-Rahmi et al., 2022; Mensah, Zeng and Mwakapesa, 2022; Rana, Dwivedi and Williams, 2015; Veeramootoo, Nunkoo and Dwivedi, 2018; Witarsyah et al., 2017). The significance of the system quality variable is relatively lower when compared to the information and service quality constructs. This is because users prioritise the quality of information and services, as these directly impact business licensing and tender or selection processes. Nonetheless, system quality remains a primary concern for system owners, even though its influence on users' performance is somewhat smaller in comparison.

According to the findings, the four main factors that positively influence government officials' behavioural intention to adopt integrated IS are trust, technology readiness, performance expectations and effort expectations. Notably, the resistance variable does not exhibit a positive relationship in any of the models developed in this study. Performance expectancy and social influence also have no influence on the potential for the private sector's behavioural intention.

Trust is the most significant factor among the four and positively influences behaviour intention. This effect is consistent with previous studies where trust in government and the internet has a significant impact on the potential for digital government adoption (Aranyossy, 2022; Verkijika and Wet, 2018). This predictor is manifested in the trust placed in the government, which enhances the intention to adopt digital government services. This trust is grounded in the belief that the government consistently delivers optimal services, enhances the well-being and privacy of its users, provides adequate safeguards and ensures a secure online environment. Moreover, this predictor relies on the conviction that the legal framework and technology infrastructure are capable of safeguarding users against potential abuses within the online system. These results indicate that the interaction between the public and the government through digital government initiatives depends on the foundation of trust built on a history of reliable performance (Chen, Liu and Lin, 2013). This institutionalised trust is a critical component and this predictor is a rational variable in potential adoption behaviour.

Consistent with the findings of Rana, Dwivedi and Williams (2015), users' trust in the internet plays a crucial role in influencing digital government use behaviour, which includes their willingness to share their personal data. Trust is reflected in the belief in the commitment to safeguarding privacy rights and preventing data misuse within the system, trust in the internet's reliable security measures and the presence of regulations designed to protect users from potential abuse. Verkijika and Wet (2018) demonstrated that poor security and privacy protection on Sub-Saharan African websites resulted in digital government failures. Given the risk of data misuse in online systems, trust becomes a critical factor (Aranyossy, 2022; Shareef et al., 2011; Verkijika and Wet, 2018; Witarsyah et al., 2017).

Technology readiness refers to users' willingness to embrace new technology and it emerges as the second most influential predictor of the intention to adopt integrated IS. Users who display a keen interest in exploring digital government services to streamline work processes, enhance productivity and offer flexibility can significantly improve their overall performance. These results align with previous studies that indicate individuals with high technology innovation scores are more inclined to adopt DGT services (Buyle et al., 2018). Consequently, targeting individuals with a propensity for technology adoption and a willingness to embrace the system should be a primary focus for adoption efforts. Leveraging these individuals can not only influence their peers but also facilitate a smoother adoption process.

Effort expectancy, while having the lowest significance when compared to other influential factors, still has a positive and notable impact on behaviour intention. Effort expectancy pertains to the perceived simplicity of the system, where individuals are more inclined to adopt digital government services that demand minimal effort during the adoption process. This construct encompasses the ease of understanding how to interact with digital government, as well as the learning curve and usability of the operating system. Established theories and models consistently emphasise that users are more likely to embrace digital government services that require minimal effort (Dwivedi et al., 2017; Quaosar, Hoque and Bao, 2018; Venkatesh, Thong and Xu, 2012; Verkijika and Wet, 2018). Therefore, it is important to determine the complexity of digital government services in terms of the difficulty level of understanding and use.

As indicated by previous research and consistent with the perspective of government officials, performance expectancy has a positive and significant impact on the behavioural intention to adopt the system (Ahmad, Waqas and Zhang, 2020; Mensah, Zeng and Luo, 2020; Sawalha, Jamal and Shanab, 2019). Project managers and committees express their intention to use digital government with the aim of enhancing their performance in managing the business licensing process and procurement of goods and services. This leads to the expectation of more predictable and dependable outcomes. In contrast, when viewed from the perspectives of construction company managers and experts, performance expectancy does not have a significant influence on the likelihood of digital government adoption. This implies that while performance expectations are considered important in the organisational context, particularly for acquiring company permits and securing tender awards, they do not significantly impact the individual's behavioural intention for adoption.

Social influence appears to have a negative impact on the usage behaviour of government officials. This variable serves as a motivating factor for behavioural intention but loses its relevance once individuals have adopted digital government. Social influence can manifest through directives from top management, endorsements from partners and concerns about falling behind in performance after realising the benefits of system adoption. In situations where digital government adoption is mandatory, there are no other options for processing business licensing and procurement. According to government officials, behavioural intentions are less likely to develop when system use is voluntary. In contrast, social influence does not appear to have an impact on private sector stakeholders. Neither construction company managers nor experts seem to be influenced by leadership instructions or peer pressure in shaping their individual behavioural intentions.

The resistance variable was initially included in the hypothesis as a potential barrier to the intention to adopt digital government services. However, the results of the study indicated that resistance did not have an impact on behavioural intention. It appears that the factor of trust in the government's ability to protect users is more influential than the resistance factor in shaping behavioural intentions.

The hypothesis proposed in this study is that facilitating conditions and behavioural intention have a positive influence on actual user adoption. User behaviour represents the actual decision made after establishing a behavioural intention. Although its significance level is lower than facilitating conditions, behavioural intention still exhibits a positive and substantial influence on usage behaviour. Facilitating conditions refer to users' perceptions of the availability of resources and organisational support. This variable has a score three times higher than behavioural intention. The results of this study align with the hypothesis and are consistent with previous research (Dwivedi et al., 2017; Lallmahomed, Lallmahomed and Lallmahomed, 2017; Venkatesh, Thong and Xu, 2012; Verkijika and Wet, 2018). Users who perceive that they have access to adequate resources, such as computers, internet networks and a supportive organisational environment, are the ones that persist in their adoption. This perception not only facilitates their understanding of the system but also provides easy access to assistance when they encounter difficulties. These findings highlight the importance of a strong and supportive environment in fostering user engagement with the system, as the level of adoption may not reach its full potential without these facilitating conditions.

CONCLUSIONS

DGT is a collaborative service system that encourages interactivity, simplifies business processes and integrates processes, data and technology across various institutions. This initiative actively engages construction stakeholders not only as system users but also as parties who share data and information. According to the models, the trust and technological readiness of construction stakeholders have the greatest influence on the success of system adoption. Law enforcement to protect personal data in electronic systems should be strengthened in order to increase trust in the government. As evidenced by the rise in cybercrime incidents such as hacking, which endangers personal data, there is a perception that data protection is inadequate, resulting in frequent data breaches. There is, therefore, a need to implement measures to reduce data leaks and improve system security in order to boost internet trust and behavioural intentions to use digital government services. This should be supplemented by educational campaigns for users to raise awareness about data and privacy protection.

It is assumed that the use of digital government will not provide any benefits due to a lack of social and cultural understanding of modern technology, as well as a lack of necessary skills. As a result, capacity-building programmes in IS technology for government officials and private stakeholders are critical. The government is campaigning for changes in behaviour and mindset as a result of technological advances to ensure equal distribution of technological readiness across users. Initiatives to provide electronic devices, particularly in areas with low computer efficacy, are required to overcome aversion to modern technology. Even if the technology is not yet available, users should be aware of its importance. The government must improve its maturity index by developing performance indicators that are prepared from the government's perspective and are user-centred, such as readiness to improve facilities, trust in government and the internet and technological readiness.

Limitations and Future Research Direction

The questionnaire was only distributed to project managers, procurement committees, construction companies and experts, which is one of the study's limitations. This may have an impact on the generalisability of results to other stakeholders. It is important to note, however, that this study is exploratory in nature and lays a solid foundation for future research in the field of digital government in the construction sector.

To investigate and explain users' intentions to use digital government initiatives in the construction sector better, future research should take cultural, socioeconomic and political contexts into account. Furthermore, benchmarking studies with digital government initiatives in the construction sector in other developing countries in the region could provide valuable insights for comparative analysis.

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