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Assessing the Factors Influencing the Adoption of Digital Signatures Among Government Employees in Tanzania

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Abstract:

This study aimed at assessing the factors influencing the adoption of digital signatures among government employees in Tanzania. The study was guided by the technology acceptance model (TAM) with an additional of facilitating condition, a construct that was borrowed from the Unified Theory of Acceptance and Use of Technology (UTAUT). The quantitative research design was used by employing a purposive sampling technique to effectively identify cases that would use limited research resources. The study involved sample of 256 respondents drawn from selected government organizations. Findings indicated that the results are consistent with the original TAM framework and the additional factor – facilitating conditions fit well into the model. The results were discussed and recommendations as well as future research directions were suggested.

Keywords: *Digital Signatures, Government Employees, TAM, Facilitating Conditions, Tanzania.*

Introduction

A digital signature is an electronic form of a signature created through public key cryptography. To create a digital signature, the signatory utilises their private key to sign a document, and this signature can then be validated through the use of a corresponding public key. The purpose of digital signatures is to guarantee that the content of a document or message remains unaltered during transmission. (Pooja & Yadav, 2018). Digital signatures are alternative to a handwritten signature or stamped seal, but it offers greater inherent security measures such as authenticating and ensuring the integrity of software, messages, or virtual documents. (Santosa et al., 2022)

As part of larger e-government initiatives that simplify governance for government, citizens and business digital signatures are making it easier to move from paper-based documentation to electronic formats and automated workflow systems (Basu, 2011). This is achieved by decreasing the time it takes to process documents and ensuring the signed documents remain unchanged and trustworthy (Dzhangarov & Suleymanova, 2020).

According to Haryanto et al., (2020, Digital signatures have been slowly adopted until 2020. The number of organisations that utilise digital signatures in online transactions is minimal compared to the ones with online services.

As governments continue to automate and digitalise, digital signatures are a core enabling

technology for automating and digitising business and government processes. This has created challenges for government employees and reaching out to the entire population is still proving challenging (Zumofen et al., 2022).

The utilisation of digital signature technology is increasing due to advancements in legal and technological fields and a high demand for secure online transactions. However, its adoption by the government has been sluggish, while there is potential for its rapid expansion in the Business-to-Consumer (B2C) (Shiralkar, 2003).

Advancement in security infrastructure for an online business can boost e-commerce and help during emergencies such as the COVID-19 pandemic. This pressure has prompted the public sector to adopt the digital solution, and the government must implement strategic initiatives to sustain this transition in the future (Emerald Publishing, 2022). An instance of this is the healthcare sector, where the COVID-19 pandemic has led to swift adoption of digital technology tools (Golinelli et al., 2020).

Globally, governments have been increasing their online presence to improve their service delivery to citizens, such that services can be accessed from anywhere; the most significant concerns have been security. This necessitates the adoption of digital signatures, which will increase the security, reliability and non-repudiation of user data of information (Pancholi & Patel, 2018).

As the need for digitalisation rises, it becomes crucial to employ secure technology, such as digital signatures and encryption, to safeguard user identities, passwords, credit card numbers, bank account numbers, and other data transmitted over the internet and stored electronically to achieve security objectives in e-government applications (Ntulo & Otike, 2013).

Governments are automating numerous government systems to provide services to various beneficiaries such as Citizens (G2C), Government to Business (G2B), Government to Government (G2G) or Government to Employees (G2E). Implementing digital signatures can enhance the security, dependability, and non-repudiation of the users' digital information involved in the transaction (Pancholi & Patel, 2018).

Digital technologies play a pivotal role in supporting development, especially the development of physical infrastructures that rely heavily on government initiatives to establish a foundation for private businesses to advance digitalisation (Sepashvili, 2020).

Finally, the lack of infrastructure and technical support can also hinder government employees' adoption of digital signatures. This includes the need for adequate hardware and software and the lack of training and support to help employees learn how to use the technology effectively (Al-rawahna et al., 2019).

Since countries increasingly adopt digitalisation and automation of various processes, more digital documents are created. Still, there is a need for signing documents and maintaining their traceability, hence the need for digital signatures. Despite the numerous benefits digital signatures offer, such as increased security, efficiency, and cost savings, their adoption by the government could be faster in many countries. Government employees play a significant role in public service deliveries (Lionardo & Nasirin, 2020).

As a result, it is vital to understand the factors that influence government employees' adoption of digital signatures to facilitate the successful implementation and widespread use of the technology in the government sector (AlAwadhi& Morris, 2009).

This study employed one the theories that have been widely guided researchers in the pursuit of uncovering factors that influence users to adopt technologies i.e. Technology Acceptance Model (Davis et al., 1989). Specifically , the current study intended to: 1) determine the influence of the Perceived Ease of Use and perceived Usefulness on the Attitude towards adopting digital signatures among government employees in Tanzania, 2) determine the influence of the Perceived Ease of Use and perceived Usefulness on the Attitude towards adopting digital

signatures among government employees in Tanzania, and 3) determine how Perceived Usefulness impacts attitudes on adopting digital signatures by government employees in Tanzania. Also the study sought to: 4) explore the influence of facilitating conditions on government employees' adoption of digital signatures in Tanzania.

This paper is organized as follows: In section 2 we present the digital signatures, Technology Acceptance Model (TAM), empirical research, and hypotheses of the present study. Section 3 describes survey procedures, data analyses, and presents the results. In section 4 we discuss the implications of results, and in the last section, we make a conclusion, recommendations, and suggest directions for further research.

Literature Review

Digital Signatures

As Schneier (1998) says, a digital signature is a mathematical technique used to legalise the legitimacy and integrity of a digital document or message (Schneier, 1998). It uses public key cryptography to create a unique and secure signature for a document, allowing recipients to verify that it has not been tampered with and that it came from a trusted source.

Digital signatures have been widely adopted in many industries, including finance, healthcare, and government, to establish trust and security in electronic transactions (AlAwadhi & Morris, 2009). They can help reduce the risk of fraud, increase efficiency, and provide a secure and verifiable method of authenticating the signer's identity (Scheau et al., 2020).

The use of digital signatures is governed by various legal and regulatory frameworks around the world, including the Electronic Signatures in Global and National Commerce (ESIGN) Act in the United States and the European Union's Electronic Identification and Trust Services Regulation (eIDAS), (Dahabiyeh & Constantinides, 2022). These frameworks set standards for creating and using digital signatures, ensuring they are legally binding and enforceable (Basu, 2011).

Previous studies have focused on the technology acceptance model (TAM) framework to understand technology adoption but have yet to fully consider the role of facilitating conditions, specifically in Tanzania. This gap in knowledge highlights the need for further research to understand better the factors that influence the adoption of digital signatures among government employees in Tanzania.

The author, Santosa et al, (2022) examined the factors influencing the adoption of digital signatures by using the Technology Acceptance Model (TAM) as a theoretical framework, the authors found that the Perceived Usefulness of digital signatures and the Perceived Ease of Use were the main factors influencing adoption (Santosa et al., 2022). The significant positive impact of these consumers' attitudes had relevant implications for the sustainable adoption of the signature system (Santosa et al., 2022).

Facilitating conditions, such as government support, availability of resources, and user support, can also play a key role in technology adoption (Rogers, 2003). In the context of digital signatures, these factors impact the ease with which government employees can use and benefit from the technology. The study by Kabir et al., (2017) shows that TAM with facilitating conditions has influence on behavioural intention to use the system. However, research on the TAM framework and specific facilitating conditions that influence the adoption of digital signatures is limited, particularly in Tanzania.

In light of these gaps in the literature, this study aimed to fill a crucial need by validating the TAM framework and examining the role of facilitating conditions in digital signature adoption by government employees in Tanzania.

Through a comprehensive understanding of these factors, this study makes valuable contributions to technology adoption. It provides essential insights for researchers, policymakers, managers, and technology developers in Tanzania and beyond.

Technology Acceptance Model

The Technology Acceptance Model (TAM) has been widely used to study technology adoption in various domains, including digital signatures (Venkatesh& Davis, 2000). TAM posts that the Perceived Ease of Use and Perceived Usefulness of technology are the key drivers of its adoption and usage.

The TAM framework provides a basis for understanding technology adoption factors, including Perceived Ease of Use and Perceived Usefulness. It has been widely used in various fields, including information systems and healthcare, to predict user acceptance and usage behaviour of technology (Davis, 1989)

Empirical Research on Digital Signatures

The empirical literature review for the study on the factors influencing the adoption of digital signatures by government employees in Tanzania using TAM framework focuses on examining various constructs that determine the usage behaviour of digital signatures.

Past research has found that technology's Perceived Usefulness and Ease of Use significantly impact users' adoption behaviour (Davis, 1989). Perceived Usefulness refers to the extent to which a technology is perceived as beneficial to the user in performing his or her job tasks. On the other hand, Ease of Use refers to the perceived ease of learning and using the technology (Venkatesh& Davis, 2000).

Similar findings have been reported in other studies on digital signature adoption. For example, (Chong et al., 2021) found that the Perceived Usefulness and Ease of Use of digital signatures influenced adoption in South Korea, while Ojha et al (2009) and Rehouma & Hofmann (2018) found that Perceived Usefulness and Perceived Ease of Use were the main drivers of adoption in India.

However, recent research has shown that the traditional TAM model may only partially capture the complexity of technology adoption in practice, particularly in the context of digital signatures. That is why the researcher recommended modifying the model by adding another factor, the facilitating conditions borrowed from UTAUT (Venkatesh et al., 2003).

Intention to use technology has also strongly predicted actual usage behaviour (Ajzen, 1991). Intention to use digital signatures can be influenced by the technology's Perceived Usefulness and Ease of Use, as well as by attention and subjective norm (Riedl et al., 2010). Attention refers to the extent to which the user is aware of the technology and its capabilities. Subjective norm refers to the perceived social pressure to adopt technology (Beldad & Hegner, 2018).

Previous research has also highlighted the importance of considering actual system usage when studying technology adoption. Actual system usage refers to the extent to which the user uses the technology after initial adoption (Venkatesh& Davis, 2000).

Facilitating conditions refer to the resources, support, and infrastructure available to support technology adoption and usage (Venkatesh & Davis, 2000). In the case of digital signatures, access to training, technical support, and the availability of necessary infrastructure can impact the adoption of the technology.

Past literature on individual user intention was thoroughly reviewed, and it found that TAM appropriately explains the phenomenon under study. Based on the reviewed literature, it is expected that Perceived Usefulness and Perceived Ease of Use will positively impact the intention of users (government employees) to use digital signature systems in their day-to-day job tasks in the government (Kabir et al., 2017).

Research Model and Hypotheses Development

TAM is a framework that can be used to understand and predict technology adoption (Davis, 1989). The original TAM concept used here consists of five main components: Perceived Usefulness, Perceived Ease of Use, Attitude, intention and actual system use. In this section, we will develop six hypotheses based on the original TAM that could be tested to understand the factors influencing the adoption of digital signatures among government

employees in Tanzania while limiting the focus to Perceived Usefulness, Perceived Ease of Use, and Attitude, intention, facilitating conditions and actual use of digital signatures by the government employee.

Use Behaviour

This concept refers to employees' actual use of digital signatures (Venkatesh& Davis, 2000). In this study, actual system use can be measured by tracking the use of digital signatures by employees over time (Venkatesh& Davis, 2000).

By incorporating these concepts into the research framework, the study comprehensively examined the factors influencing the adoption of digital signatures among government employees (Davis, 1989; Venkatesh & Bala, 2008). This information can be used to develop strategies for increasing the adoption and use of digital signatures in the government sector (Venkatesh& Davis, 2000). Actual system use of digital signatures will be influenced by Perceived Usefulness, Perceived Ease of Use, Attitude, and intention to use among government employees.

Behaviour Intention

This concept refers to the employee's plans to use digital signatures in the future (Venkatesh& Davis, 2000). In this study, intention to use can be measured by asking employees about their plans to adopt and use digital signatures (Venkatesh& Davis, 2000). The study by Amir et al., (2020) showed that there is a significant relationship between perceived Usefulness and behaviour intention, such that it significantly impacts an individual's behaviour intention to use a particular technology, hence the hypotheses:

H1: Intention to use digital signatures positively and significantly affect employees' actual use of the technology.

H8: Perceived Usefulness of digital signatures positively and significantly affects employees' behaviour intention the technology.

Attitude

Attitudes towards digital signatures can be measured by asking employees about their overall feelings and opinions about the technology (Venkatesh& Davis, 2000). This study measured the Attitude by asking employees about digital signatures' perceived risks and benefits (Venkatesh& Davis, 2000).

The Attitude to use digital signatures will positively influence government employees' intentions. This hypothesis suggests that the more employees in the government sector have a positive attitude towards using digital signatures, the more likely they are to adopt them. Intention to use may be influenced by factors such as the Perceived Usefulness and Ease of Use of digital signatures and the perceived security and cost savings they offer.

H2: Employee's Attitude toward digital signatures positively and significantly affect his/her intention to use the technology.

Perceived Usefulness

This concept refers to the extent to which government employees believe that using digital signatures will improve their job performance and lead to more favourable outcomes (Davis, 1989). This study measured Perceived Usefulness by asking employees about the benefits of using digital signatures, such as improved efficiency and security (Venkatesh& Davis, 2000).

The Perceived Usefulness of digital signatures will positively influence their Attitude towards adoption within selected government agencies.

This hypothesis suggests that the more government employees perceive digital signatures to be useful, the more likely they are to adopt them. Perceived Usefulness may be influenced by factors such as the speed and convenience of using digital signatures, the security they provide, and the potential cost savings they offer. The Perceived Usefulness of digital signatures will positively influence the intention of government employees.

Hence the, we hypothesise that:

H3: Perceived Usefulness of digital signatures positively and significantly affects Attitude toward the technology.

Perceived Ease of Use

The Perceived Ease of Use of digital signatures will positively influence their Usefulness at by

government employees. This hypothesis suggests that the more employees at the selected government entities perceive digital signatures to be easy to use, the more likely they are to be useful to them. Perceived Ease of Use may be influenced by factors such as the simplicity of the digital signature process, the availability of training and support, and the compatibility of digital signatures with existing systems and processes. The Perceived Ease of Use of digital signatures will positively influence government employees.

This hypothesis suggests that the more employees within the government sector perceive digital signatures to be Ease of Use, the more likely they are to influence their Attitude to adopt them. Perceived Usefulness may be influenced by factors such as the speed and convenience of using digital signatures, the security they provide, and the potential cost savings that they offer.

H4: Perceived Ease of Use of digital signatures positively and significantly affects its Perceived Usefulness.

H5: Perceived Ease of Use of digital signatures positively and significantly affects the employee's Attitude toward the technology.

Facilitating Conditions

This concept refers to the external factors that can influence the adoption of digital signatures (Venkatesh& Davis, 2000). In this study, facilitating conditions can be measured by asking employees about the support and resources available for using digital signatures, such as training and technical assistance (Venkatesh& Davis, 2000).

H6: Facilitating Conditions for Use of digital signatures positively and significantly affects the employee's intention to use of the technology.

H7: Facilitating Conditions for Use of digital signatures positively and significantly affects the employee's actual use of the technology.

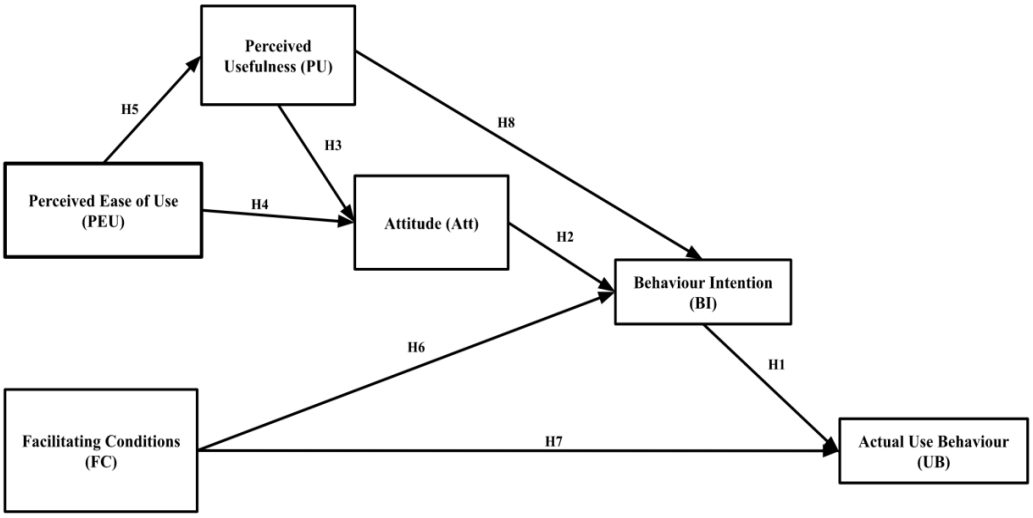

Figure 1. Research Model

Note: Modified from (Davis, 1989) to accommodate facilitating conditions for the study.

Methodology

Context

The research model was tested in using data collected from government organizations with wider coverage in the country, namely, TANESCO, BOT, COSTECH, eGA, TCRA and TTCL (see table 1) with a total number of 256 respondents. The research was conducted using the purposive sampling technique due to limited resources, including time, and funds, to mention a few. However, for this technique, the

sample was carefully selected to provide reliable data. The questionnaire was used to collect data from the respondents. For convenience, an online version of the questionnaire was used.

Measures

The operationalization of the constructs/factors of this study was mainly based on the existing and validated instruments particularly basing on the TAM model. These instruments were re-worded to fit the context of the study. The questionnaire items were gauged from 1 to 5 (Likert scale). The numbers 1 - Strongly Disagree to 5 - Strongly Agree, whereas the middle number 3 - Neutral. The questionnaire was developed using google forms and distributed online, ensuring convenience to respondents, and no item should not be attended.

Samples

The study employed the Cochran formula (Cochran, 1977) for an unknown population and the known proportion, i.e.

$$n = \frac{p(1-p)z^2}{e^2}$$

$$n = \frac{(0.1)(1-0.1)(2.58)^2}{(0.05)^2} = 240$$

Whereas;

n = sample size

p = the population proportion ($p = 0.1$)

e = acceptable sampling error ($e = 0.05$)

The sample considered the selected entities: TANESCO, BOT, COSTECH, eGA, TCRA and TTCL. From the targeted sample size, 280 employees responded and filled the questionnaire.

Reliability of Measurement

The internal consistency of the variables in the questionnaire was evaluated using Cronbach's Alpha to ensure the dependability of the data. According to Saunders et al., (2012, a dependable data scale should have a minimum Cronbach's Alpha score of 0.7. Cronbach's Alpha assesses the consistency among items and assumes that all items in the questionnaire are equally reliable. All cronbach'alpha coefficients were within the acceptable minimum threshold (See Table 1).

Table 1. Data Reliability

Construct	Cronbach Alpha Coefficient	Number of Items
PU	0.837	4
PEU	0.858	4
ATT	0.875	4
BI	0.892	4
FC	0.866	6
UB	0.825	4

Results

In this section, data analysis is performed based on the findings obtained from 256 respondents who are government employees based in the organisations shown in Table 2. The IBM SPSS Software 27 was used to perform descriptive and regressional analysis on the collected data. The analysis. The overall number of respondents was 280; however, after data cleaning, obtained 256 respondents.

Demographics

Table 3 displays the characteristics and traits of respondents in terms of their age, gender, ethnicity, education level, and income. The study findings show that the majority were male, 63.3% and female, 36.7%. The ratio of the respondents may be associated with the number of employees in the surveyed organisations. The findings reveal that the largest proportion of participants, 43.8%, fall within the 41-50 age range, while 30.9% fall between 31-40 years old. This suggests that the respondents are predominantly mature, which enhances the credibility of the dependability of the data collected for the study.

Regarding the participants' educational attainment, the findings indicate that most respondents possess master's degrees (50.0%), followed by degree holders or equivalent at 38.7%.

On the other hand, most respondents were technical staff (46.5%) and most reported that they have used digital signatures for more than five years (34.8%). The smallest group of respondents in positions held in an organisation is directors (6.3%). This may be attributed to their proportion in the organisations.

Table 2. Characteristics of Respondents (N=256)

Variable	Category	Freq	%
Age	21 - 30 Year	41	16.0%
	31- 40 Years	79	30.9%
	41 - 50 Years	112	43.8%
	51+ Years	24	9.4%
Gender	Male	162	63.3%
	Female	94	36.7%
Occupation	Director	16	6.3%
	Manager	48	18.8%
	Technical	119	46.5%
	Other	73	28.5%
Organization	TANESCO	130	50.8%
	BOT	27	10.5%
	COSTECH	40	15.6%
	TCRA	16	6.3%
	eGA	15	5.9%
	TTCL	28	10.9%
Education	Degree or Equivalent	99	38.7%
	Masters	128	50.0%
	PhD	4	1.6%
	Other	25	9.8%
Experience	0 - 1 Year	41	16.0%
	2 - 3 Years	45	17.6%
	4 - 5 Years	9	3.5%
	Above five years	89	34.8%
	Never	72	28.1%

Source: Data gathered through field research (2023)

Regression Analysis

The purpose of performing regression analysis was to determine the actual influence or causal effect of the independent variables on the dependent variable (s), as hypothesised in Figure 1. The results of the structural model are summarised in Table 3.

Table 3. Structural Model Analysis

		B	SE	β	
1	**(Constant)**	**-.016**	**.221**		**-.073**
	FC→UB *(H7)*	.707	.088	.570	7.985***
	BI→UB *(H1)*	.246	.084	.209	2.932**
	R^2	0.562			
	Adj R^2	0.558			
ANOVA	*F-Value*	162.134			
	Sig.	0.000			
2	**(Constant)**	**.167**	**.133**		**1.263**
	FC→BI *(H6)*	.349	.050	.331	7.025***
	ATT→BI *(H2)*	.478	.059	.480	8.101***

	PU→BI *(H)*	.143	.053	.144	2.715**
	R^2	0.795			
	Adj R^2	0.792			
ANOVA	*F-Value*	324.793			
	Sig.	0.000			
3	**(Constant)**	**.431**	**.145**		**2.983**
	PU→ATT *(H3)*	.601	.052	.602	11.505***
	PEU→ATT *(H4)*	.294	.052	.298	5.705***
	R^2	0.733			
	Adj R^2	0.731			
ANOVA	*F-Value*	346.810			
	Sig.	0.000			
4	(Constant)	1.031	.161		6.401***
	PEU→PU	.773	.038	.784	20.098***
	R^2	0.614			
	Adj R^2	0.612			
ANOVA	*F-Value*	403.909			
	Sig.	0.000			

Notes: * = p< 0.05, **= p< 0.01, *** = p< 0.001, SE = Standard Error, B = Un-standardized Coefficient, H=Hypothesis Number; β = Standardized Coefficients

Discussion and Implications

The analysis is divided into four models determined by the dependent variables. Model 1 is based on UB as a dependent variable; in model 2, the dependent variable is BI; in model 3, the dependent variable is Att; in model 4, the dependent variable is PU.

The results show that in model 1, all independent variables positively and significantly impact the dependent variable. Specifically, the results show that FC has a significant and positive impact on UB such that $\beta = 0.570$, $p = 0.000$; hence confirming hypothesis *H7* as predicted in figure 1. Likewise, the results confirmed hypothesis *H1:* $\beta = 0.209$, $p = 0.004$. Furthermore, the results showed that FC and BI explain up to 55.8% of the variance on UB.

Model 2 consists of three independent variables – PEU, PU, Att, and a dependent variable BI. The results show that all independent variables positively and significantly influence the dependent variable. Specifically, the results show that FC has a significant and positive impact on BI ($\beta = 0.331$, $p = 0.000$), *hence* confirming hypothesis *H6;* PU has a significant and positive impact on BI ($\beta = 0.144$, $p = 0.007$), hence confirming hypothesis *H8;* and Att has significant and positive impact on BI ($\beta = 0.480$, $p = 0.000$), *hence* confirming hypothesis *H2.* Furthermore, the results showed that PEU, PU and Att explain up to 79.2% of the variance on BI.

On the other hand, model 3 consists of two independent variables – PEU and PU, and a dependent variable Att. The results show that all independent variables positively and significantly influence the dependent variable. Specifically, the results show that PU has a significant and positive impact on Att ($\beta = 0.602$, $p = 0.000$), *confirming hypothesis H3; and PEU has a* significant and positive impact on ATT ($\beta = 0.298$, $p = 0.000$), hence confirming hypothesis *H4.* Furthermore, the results showed that PEU and PU explain up to 73.1% of the variance on Att.

Finally, the last model i.e., model 4 consists of one independent variable – PEU and a dependent variable PU. the results show that PEU has a significant and positive impact on PU ($\beta = 0.602$, $p = 0.000$), *hence* confirming hypothesis *H3;* and PEU has a significant and positive impact on ATT ($\beta = 0.7848$, $p = 0.000$), hence confirming hypothesis *H5.* Furthermore, the results showed that PEU explains up to 61.2% of the variance on PU.

Regarding the ANOVA test taking Alpha as 0.05, the regression model for the variance of the predicators for the four models was as follows:

Model 1 – significant, $F(256) = 162.134$, $p < 0.001$; model 2 – significant, $F(256) = 324.793$, $p < 0.001$; Model 3 – significant, $F(256) = 346.810$, $p < 0.001$, and model 4 – significant, $F(256) = 403.909$, $p < 0.001$. The variance of the independent variables as a whole was, therefore significant as it was less than the Alpha.

The study results suggest that as digital technologies are made simple to use, the employees find them useful. Additionally, the study results indicate that employees will use digital signatures as Facilitation Conditions are improved. Here employees expect support from the technical support team and training on using the available technology.

Conclusions

This research aimed to evaluate the factors that affect the uptake of digital signatures by government workers in Tanzania, utilising the Technology Acceptance Model (TAM) structure with the facilitating conditions included. This chapter contains a recap of the results, the deductions drawn from them, and suggestions for future actions. The research was conducted in alignment with its intended aims and objectives.

According to the TAM model, the anticipated and observed behaviours regarding digital signatures are influenced by three attitudinal factors that impact the adoption of digital signatures: perceived Usefulness, perceived ease of use, and Attitude (Davis, et al., 1989).

The correlation analysis results were consistent with the TAM model, indicating a significant and affirmative correlation between the utilisation of digital signatures and factors such as perceived ease of use, perceived Usefulness, Attitude, behavioural intention, facilitating conditions and conditions and the actual system use. This was evident when a two-tailed test with a correlation output set at 0.01 level was performed. The analysis done from four models is summarised as follows:

The first model's findings suggest that all independent variables positively and significantly impact the dependent variable. FC has the most substantial impact on actual system usage behaviour (UB) with a beta coefficient of 0.570 and a p-value of 0.000, confirming hypothesis H7. The results also support hypothesis H1, with a beta coefficient of 0.209 and a p-value of 0.004. Together, FC and BI account 55.8% of the variance in UB.

The second model has four independent variables (PEU, PU, Att) and one dependent (BI). All independent variables have a positive and significant impact on BI. FC has the strongest impact ($\beta=0.331$, $p=0.000$), followed by Att ($\beta=0.480$, $p=0.000$), and PU ($\beta=0.144$, $p=0.007$). PEU, PU, and Att together account for up to 79.2% of the variance in BI.

The third model comprises of the dependent variable, Att, and two independent variables, PEU and PU. The outcome indicates that all independent variables positively and significantly influence the dependent variable. The findings confirm that PEU and PU positively and significantly impact Att, thus supporting hypotheses H3 and H4. Additionally, the results suggest that PEU and PU can explain up to 73.1% of the variance in Att.

The fourth model involves one independent variable, PEU and the dependent variable PU. The findings indicate that PEU has a significant and positive impact on PU, which supports hypothesis H3. Additionally, the results suggest that PEU significantly and positively impacts Att, thus confirming hypothesis H5. Furthermore, the findings indicate that PEU alone can explain up to 61.2% of the variance in PU.

Consequently, technology providers must guarantee that their technologies are user-friendly and come with the necessary technical assistance. This would result in more staff members being inclined to adopt the technologies. Furthermore, the research finds that implementing these measures leads to

integrating digital signatures into government employees' work settings and fosters an appreciation of the technology's worth.

Recommendations and Future Studies

Based on the findings of this study, it is recommended that public sector institutions in Tanzania should focus on promoting the factors that influence the adoption and use of digital signatures. The study, however, had a limitation as it only used a small sample of government organisations. Therefore, future studies should consider expanding the sample to include a more diverse range of organisations for more specific and conclusive results.

To increase the adoption and use of digital signatures among government employees, public institutions need to invest more in facilitating conditions. These conditions should enable entities to benefit from the advantages that come with the adoption of digital signatures in the public sector. This could include training and awareness programs, ensuring adequate infrastructure, and streamlining the digital signature acquisition process.

To achieve a more comprehensive understanding of the factors that influence the adoption of digital signatures among government employees in Tanzania, future studies should consider incorporating the Unified Theory of Acceptance and Use of Technology (UTAUT) model. This model includes more variables and can validate the findings generated by this study. Additionally, incorporating a more diverse sample of government entities within specific sectors of the country can provide a deeper understanding of the specific facilitating conditions that influence digital signature adoption in the public sector. Overall, investing in digital signature adoption can improve government operations' efficiency and security.

Conflict of Interests

No conflict of interest.

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