
Technology Usage and Public Procurement Performance in Tanzania: The Moderating Role of Regulatory Pressure

Gerald Zachary Paga Tinali 

University of Dar es Salaam Business School, Tanzania
Email: geraldpaga@yahoo.com/tinali.gerald@udsm.ac.tz

Abstract

Given a number of challenges procurement in the public sector faces also in line with the current trend of globalization and innovation, organizations are trying much to improve their procurement practices through technological applications. However, still there are contradictory results on the role of technology usage on the performance of procurement. This study was aimed at investigating the public procurement performance in Tanzania by examining the roles played by technology usage and regulatory pressure. Drawing on institution theory with the support of empirical evidence from literature, a conceptual model with direct path and moderated paths was developed through which procurement regulatory pressure moderates the path from procurement technology usage to procurement performance. The study used partial least square structural equation modelling (PLS-SEM) aided by SmartPLS 3 to validate the measurement model and test the hypotheses using data from 207 key informants from procurement management units of the public procurement sector in Tanzania. The findings from this study with support from previous empirical studies indicated that too much regulatory pressure tends to weaken the application of technology in procurement. Moreover, these results have implications for methodology, practitioners, and policymakers.

Keywords: Regulatory pressure, technology usage, procurement performance, institution theory

<https://dx.doi.org/10.4314/udslj.v17i1.3>

Introduction

Public procurement as a field has been in great progression both within and outside the academia as it is directly linked to economic growth, environmental sustainability, and social inclusion (Flynn & Davis, 2014). Different organizations increasingly starting to realize the importance of procurement especially in managing their organization and performance (Harb *et al.*, 2019; Karthik & Kumar, 2013). In a public setting, procurement is being recognized as an essential business function (Duncombe & Searcy, 2007) and when compared to previous years, it has imitated some changes with the main reason being the rapid change of technological advancement (Guarnieri & Gomes, 2019; Presutti, 2003).

Globalization and stiff competition between companies have led many organizations to opt for technology usage in their operations to increase efficiency and hence be competitive in the marketplace (Gupta *et al.*, 2011). Many organizations have been derived from the power of technology and at the same time aimed at effective supply chain management, thus making the issue of technology applications in their supply chain a necessary component (Presutti, 2003). The reality of technology application in the supply chain, specifically procurement can be observed through doing online auctions, an application of online catalogues which facilitate purchasing documents exchange between parts (Baddeley & Kopelman, 2015; Ordanini &

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Rubera, 2008; Sánchez-Rodríguez et al, 2020; Tutu *et al*, 2019). Furthermore, opting for online requisition, follow-ups, and order management has led to higher operational efficiency and financial performance even for organizations faced with higher regulatory pressure (Wiengarten *et al*, 2015).

The key issue facing public entities with public procurement being the one is the trade-off between efficiency and accountability as a result, governments have introduced laws and regulations as one of the reforms to manage the conduct of the procurement process (Duncombe & Searcy, 2007). Furthermore, the inefficiencies in procurement have led many public authorities to find the mean of dealing with them among the means are the introduction of electronic procurement (Alsetoohy & Ayoun, 2018; Tutu *et al.*, 2019), the introduction of laws and regulations to govern the conduct of the procurement (Tutu *et al.*, 2019).

In developed countries, the low-value high volume procurement has stimulated many organizations to consider the introduction of electronic procurement due to its simplicity, speed, and cost-saving as compared to paper-based procurement (Moon, 2005). Therefore, with time governments, have been implementing some technological applications in procurement practices like electronic data interchange and web-based procurement practices, particularly electronic and reverse auctions, electronic requests for proposal and bidding, electronic signatures, electronic orders, and purchasing cards (Moon, 2005). Despite some expected benefits from electronic technology usage in procurement, the application of technology has been faced with many obstacles such as limited integrations among procurement stakeholders, legislative requirements, implementation costs, and security challenges (Mccue & Roman, 2012; Moon, 2005). These benefits were not achieved in some areas, though in other areas, there were success stories (Mccue & Roman, 2012; Moon, 2005).

In spite of many organizations worldwide investing much in information technology to gain a competitive advantage through information technology usage (Tippens & Sohi, 2003), there are conflicting views on whether technology usage can positively impact the organization's performance. This is due to the contradictory results as some studies support the significant contributions of technology usage towards the performance (Alsetoohy & Ayoun, 2018; Ateto *et al.*, 2013 & Quesada *et al.*, 2010) while others showed an insignificant relationship between technology usage and performance (Devaraj *et al.*, 2007; Jawabreh *et al.*, 2013 & Wang *et al.*, 2006). These conflicting views have alerted managers who now have realized a need to learn how best to strategically use information technology to realize a positive performance (Tippens & Sohi, 2003)

Due to these conflicting views on whether technology usage can enhance performance or not, this research with the help of theories and empirical evidence aimed at testing whether moderating effect of regulatory pressure on this relationship may yield significant recommendations regarding technology usage and performance relationships on public sector procurement systems. Unlike many private companies which face pressure from the competition or supply partners, public procurement faces regulatory pressure related to procurement; therefore, institution theory was relevant for explaining this phenomenon. Thus, the study provides a theoretical contribution by applying institution theory to clarify how the coercive/regulatory pressures moderate technology usage and performance relationships. The next sessions discuss the literature review, the methodology, results, the discussion, implications, and areas for further studies.

Literature Review

The section aimed at reviewing various theories and empirical issues related to the concepts used in this study. The focus was on integrating research outcomes related to our main variables and how the previous theories were integrated on explaining the variables under this study.

Theoretical Framework

Studies on how new technology affects the performance of an organization are dominantly explained by organization theories among them being Technology Organization and Environment (Tornatzky & Fleischer, 1990). Some scholars regard TOE framework as a better and more complete framework to explain technology adaption at the intra-firm level for the reason that it incorporates the environmental context where the diffusion of innovation (DOI) theory lacks (Oliveira & Martins, 2011). Meanwhile, since technology usage involves some resources, it can be analysed by using the resource-based view (RBV). The use of resources based view to examine the technology usage and its impact has been utilized by various researchers Yu, Mukhopadhyay, and Slaughter (2003) (use of IT in the procurement process), Mishra, Konana, and Barua (2007) (the effect of internet use in various procurement stages on the performance of procurement process). RBV has been extensively used in explaining the technology usage based on its argument of organizational resources affect a firm's performance.

The resource-based view has been opposed by researchers for overlooking the role of contextual variables like external environmental uncertainty that could also have an impact on the organization's benefits (Miller & Shamsie, 1996; Teece *et al.*, 1997). This study addresses some of these environmental factors such as regulatory pressures, thus the study further used the institution theory to explain the influence of coercive/regulatory pressure on the relationships between technology usage and procurement performance. The study attempts to link the resource-based view and the institution theory simply because institution theory provides explanations of how the external pressure affects an organization (Huang *et al.*, 2016). The inclusion of both institution theory and resource-based view in this study enabled the researcher to explore the relationships between institution pressure, resources, and operational performance.

Institution theory emphasizes institutions as critical components in the environment, and they exert a constraining influence over organizations (Hawley, 1968). Studies indicate the existence of several forms of institution theory (Kauppi & Hannibal, 2017). This study will focus on the institution pressure leading to isomorphism in organizational forms as advocated by DiMaggio and Powell (2000) who emphasized the originality of institution pressure to be from cultural practices, regulatory structures, and the influence of organizations that are dominant and explain the coherence of industries, fields, and organizations. The previous seminal work noted on Institutions to exert three types of pressure within organizations namely; normative pressure, mimetic pressure, and coercive pressure (DiMaggio & Powell, 2000).

Coercive/Regulatory pressure is a pressure that arises from both formal and or informal organizations on which the firm depends (DiMaggio & Powell, 2000) or in other words from the government with legislative power or from the critical sources of organization resources (Heugens & Lander, 2009) or multinational corporations (Perez-Aleman, 2011) or social movements. The pressure may appear in the type of rules or regulations put forth by the public body (Zhu & Sarkis, 2007). As per Wu, Ding, and Chen, (2012) coercive/regulatory pressure is viewed as important in imposing authorized standards to shape firm operational conduct through regulatory means. As proposed by Liang *et al.* (2007) coercive pressure may arise from

either primary agencies or industry or both. They further proposed that in developing countries coercive/regulatory pressures are likely to arise from the government. In Tanzania there are some provisions in the public procurement act on the use of electronic procurement (PPA, 2011) and the Public Procurement Regulatory Authority (PPRA) requires specific reports to be uploaded to the procurement management system (PMS). Additionally, the authority provides standard procedures and guidelines on procurement management in public procuring entities. Therefore, these regulatory pressures may influence technology usage and performance relationships.

Institution pressure is believed to be experienced by both external and internal organizations in the forms of policy rules and supervision (Kim, Kim, & French, 2015). With this study focusing on the pressure of compliance with regulations and laws, the relationship between technology usage and performance would be affected if regulatory pressure is of a great extent. Moreover, taking into consideration the innovation perspective, especially when chasing the current pace of technological advancement, especially in the public sector, the procurement institution environment could be among the innovation hindrance as regulatory pressure emphasizes more the act of compliance with laws, regulations, and rules. Studies revealed that institution pressure more specifically regulatory pressure tends to resist innovations as most of the actions are determined by the surrounding environment, the theory tends to influence whistleblowing behaviour in an organization which finally leads to compliance with the laws (Mbago *et al.*, 2016; Seo, 2002).

Empirical Literature and Hypotheses Development

Procurement Performance

Performance measurement is very critical to organizations as managers in most cases when making decisions mostly rely on performance results (Anuar, 2015). Given the power of technology, organizations are paying much attention to the importance of procurement performance as an important tool. Since firms/organizations have a desire for the best services and a desire to acquire goods or services of the right quality, price, and quantity and to be delivered at the right time, therefore opting for better procurement performance could lead to the achievement of these desires. As per literature, there is no specific method of defining procurement process performance (Kumar *et al.*, 2005).

Prior studies indicated procurement performance to include issues related to performance in terms of quality (reliability of the obtained product, conformance to specifications, supplier's efficacy), cost (low purchasing cost and low level of inventory), dependability (shorter lead time, adherence to the agreed schedule/delivery requirement) and flexibility (supplier's capability to accommodate changes) (Rodríguez-Escobar & González-Benito, 2015). Ordanini and Rubera (2008) measured performance using mult-construct items such as productivity, growth which involve the issues of revenue improvement, and financial equilibrium. Other studies categorized the procurement performance items into three groups namely internal performance, supplier-related performance, and customer-related performance (Alsetoohy & Ayoun, 2018; Quesada *et al.*, 2010; Tinali, 2021). For this study, the procurement performance was divided also into three parts namely internal customer performance, internal performance, and supplier's related performance. The items were applied to public procurement settings instead of manufacturing firms as discussed by prior studies.

Technology Usage in Procurement

There is no clear unique way of classifying technology application in procurement or supply chain as it has been conceptualized differently by each scholar (Oh *et al.*, 2013). Reviewed studies indicate some studies referred to technology application as the use of the Internet, while others add to the body of knowledge by further extending the concept of technology application by referring to the Internet as a complementary tool that could be used together with other technology such as electronic data interchange and other systems that are directly used to facilitate the procurement process (Presutti, 2003; Quesada *et al.*, 2010). Johnson *et al.* (2011) pinpointed some technological tools that could be used in purchasing among which include electronic procurement systems, electronic data interchanges, electronic marketing places, online catalogues, commodity coding schemas as well as online reverse auctions. This lack of consensus is partly attributed to the fact that technology has different dimensions.

In an attempt to overcome the revenue and cost pressure, firms are doing their best to improve their operations and among the efforts is the application of technological innovation in their procurement operations (Mishra *et al.*, 2013). Studies have indicated that the implementations of electronic procurement in organizations have benefited them through increasing transparency, cost savings, reduction in procurement time and efforts, and improved convenience (Cholette *et al.*, 2019) while other studies tend to challenge the applications of electronic procurement as it possesses limited functionality and in some cases, it has caused the reduction in the number of firms who participated in the tendering process (Gurakar & Tas, 2016; Tutu *et al.*, 2019).

Studies on technology usage in procurement, supply chain management, and value chain indicate the existence of a positive relationship between technology usage and public procurement performance (Alsac, 2007; Alsetoohy & Ayoun, 2018; Ateto *et al.*, 2013; Belisari *et al.*, 2019; Cholette *et al.*, 2019; Gardenal, 2013; Gupta & Gupta, 2012; Hsiao & Teo, 2005; Karthik & Kumar, 2013; Mäkinen *et al.*, 2011; Marinagi, Trivellas, & Sakas, 2014; Quesada *et al.*, 2010; Singer *et al.*, 2009; Svidronova & Mikus, 2015; Yu *et al.*, 2016). Despite significant studies concluding on a positive association between technology usage in procurement and procurement performance yet still some studies provide ambivalent results on the relationship between technology usage in procurement and or supply chain performance.

Studies in developing countries more specifically in the private sector have indicated some positive benefits of technology usage with the majority of these studies being conducted in Asia with just limited studies in Africa (Gupta & Narain, 2012; Gupta *et al.*, 2011; Karthik & Kumar, 2013; Yu *et al.*, 2016). By considering public sector procurement reviewed literature indicated the number of studies conducted in the developed countries' public sector whereby, some of these studies also support a positive association on the relationship between technology usage, especially electronic procurement on the performance (Cholette *et al.*, 2019; Dooley & Purchase, 2006; Singer *et al.*, 2009; Svidronova & Mikus, 2015).

A study by Singer *et al.* (2009) using the output from the Chilean e-procurement agency, noted some savings generated as a result of price reductions due to the higher number of bidders participating in the bidding process and savings in administration costs as a result of centralization of procurement purchase and paperwork reduction which all of these has been attributed by application of technology in the purchasing process. Furthermore, a study conducted in Slovakia suggested that technological innovation especially electronic procurement can enhance a very competitive and more transparent environment in public settings (Svidronova & Mikus, 2015). Cholette *et al.* (2019) using a case study of the University of California procurement system revealed some benefits generated as a result of using

electronic procurement among them being the reduction in procurement time and efforts, improved convenience when ordering, delivery accuracy, and increased invoice automation which has significantly reduced the number of paper invoices. Dooley and Purchase (2006) in their study based on a web survey from purchasing professionals in Australia identified some significant driving forces towards usage of technology, especially internet use in a public procurement among them being the supplier's willingness, expected benefits, internal support, and convenience in procurement activities.

Of studies on technology usage in procurement, most of them were from private sector organizations through which the level of innovation especially advanced technology applications in their process is at an advanced level compared to public organizations (Cholette *et al.*, 2019). Also, the literature indicates limited research on the benefit accrued through technology implementation in public procurement settings especially in public sector procurement in developing countries. Moreover, of these reviewed studies majority of them operationalized technology usage as electronic procurement only limiting other procurement-related technologies. Based on these empirical shreds of evidence and theoretical analysis the following hypothesis was developed specifying technology usage and procurement performance relationship targeting the data from the public organization in developing countries specifically in Tanzania.

H₁: Procurement technology usage positively relates to public procurement performance

Regulatory Pressure

The variable regulatory/coercive pressure in empirical research has been used as an independent variable (Liang *et al.*, 2007; Yu *et al.*, 2016; Zhu *et al.*, 2013), mediator variable, and moderator variable (Shamsuddina, 2013; Wiengarten *et al.*, 2015; Zhu & Sarkis, 2007) and as a dependent variable (Sarawa & Mas'ud, 2020). But given the nature of this study and based on the theoretical evidence the variable regulatory pressure under this study has been used as a moderator variable. The application of the variable regulatory pressure as a moderator has been supported by the reviewed institution theory and previous scholarly articles that used the construct regulatory pressure.

Studies indicate uncertain conclusions on the direct link between technology usage with performance with some studies indicating a significant effect on performance (Marinagi *et al.*, 2014), while others indicate an insignificant effect on performance (Jawabreh *et al.*, 2012; Wang *et al.*, 2006) and some indicating indirect effect on performance (Devaraj *et al.*, 2007). Wang *et al.*, (2006) in their research based on Taiwanese manufacturing firms one of their conclusions was on the insignificance result of the direct effect of virtual integration on cost advantage. A study by Kim *et al.* (2015) drawing data from information security users from global organizations in Korea indicated regulatory pressure poses a positive effect as a moderator of information security management awareness and information security management development. A study by Karthik and Kumar (2013) found environmental factors such as regulations provided by the government have a significant effect on the use of electronic technology in procurement together with the perceived benefit.

Many studies which used RBV on analysing the direct role of Information technology in the firm's performance resulted in weak or insignificant results (Devaraj *et al.*, 2007). These inconclusive results on the direct relationship between technology and performance have created a call for research to consider moderation models to better explain the moderation effect between the two variables. The role of external environment factors in the organization's supply chain has been to a great extent and significantly ignored because scholars argue that the outside environment that which an organization operates shapes its structure and process



(Donaldson, 2001). A study by Wiengarten *et al.*, (2015) argues that organizations situated in an environment characterized by a high coercive environment may acquire more performance benefits through electronic business applications value creation process. It has been further argued by scholars that the role of the government in creating supportive laws and legal systems is pivotal in electronic business use. Moreover, the government creates an environment through which legal issues can prevent procurement contracts hence establishing a trustworthy avenue for an organization to give and take financial data (Kaynak, Tatoglu, & Kula, 2005).

Regulation, especially the more complex one makes the procurement process to be more inflexible and hence could be an obstacle to procurement innovation as practitioners will try to avoid more risks and problems in the procurement process (Aschhoff & Sofka, 2009; Knutsson & Thomasson, 2014). A study by Mccue and Roman (2012) based on data from Canada and the United States revealed insignificant changes as a result of procurement digitalization in public settings, the main hindrance being institutional resistance, and detachment of key stakeholders such as procurement professionals in the digitalization process.

With the existence of many regulations and laws that monitor and govern the use of technology in procurement we expect those laws and regulations to weaken the speed of technology usage, hence users will not devote themselves completely to using technology innovatively rather than they will use as per guidelines and law's requirement. Thus, we expect the existence of these regulatory pressures to weaken the relationship between technology usage and performance. Therefore, based on these facts, the following hypothesis was developed to test the moderating effect of regulatory pressure.

H₂: Regulatory pressure moderates the relationship between procurement technology usage and public procurement performance; such that the relationship is weaker when regulatory pressure is high.

Research Model

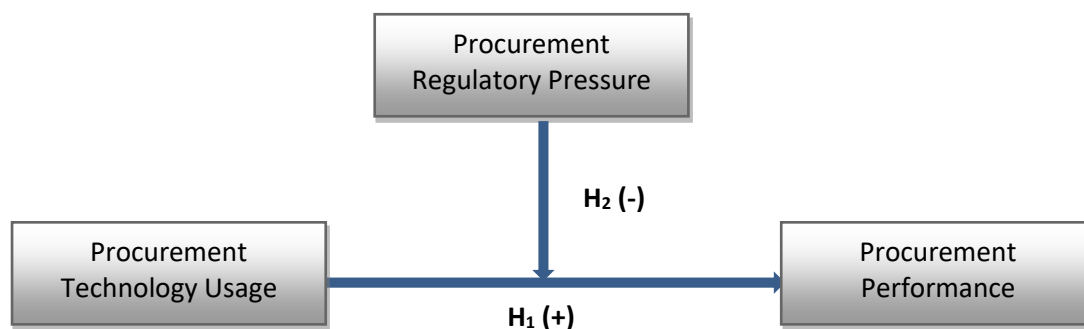


Figure 1: Research Model Developed by the Researcher based on the Reviewed Literature

Methodology

This study is quantitative in nature and built upon the positivism paradigm. Given time and cost constraints, the study opted for a cross-sectional design. The study population was drawn from registered public procurement entities in mainland Tanzania whereby as per Tanzania Public Procurement Regulatory Authority (PPRA) in 2018 there were 540 registered procuring entities. To avoid the issue of some respondents being reluctant in responding to questions and to allow the researcher to select a sample or unit based on a specific purpose rather than random

(Teddlie & Yu, 2007) a non-probabilistic sampling strategy based on judgmental sampling was used to draw a sample of 207 procurement management units from the registered procuring entities in mainland Tanzania. Studies indicate a sample size of at least 100 respondents is suitable when using structural equation modelling (Hair *et al.*, 2006; Schumacker & Lomax, 2004).

Due to its simplicity in administering, reliability, and cost-saving, a structured questionnaire was used to collect data from key informants, one from each procurement management unit and it was administered in person. The questionnaire initially was sent to three academicians who are experts in the area of procurement and three practitioners who have been practicing public procurement for several years. All of the recommendations from the reviewers were incorporated into a modified questionnaire. Furthermore, a pre-testing of the research instrument was done for 30 procuring entities to diagnose the scale-related problems and to ensure reliability and validity. The feedback obtained from the pre-testing was examined and incorporated into a final questionnaire.

The questionnaire items for the key latent variables were organized in a 5-point Likert scale with 1 indicating not at all and 5 indicating to the great extent. The procurement performance (PROPERF) variable was adapted as a second-order construct constituting three first-order constructs namely internal customer performance (ICPERF), internal performance (INTPERF), and supplier-related performance (SRPERF), and all items for these first-order constructs were adopted from previous studies with minimal modifications (Alsetoohy & Ayoun, 2018; Mishra *et al.*, 2007; Quesada *et al.*, 2010). For the procurement technology usage (TECUSG) variable this study adopted measurement proposed by Quesada *et al.*, (2010), Marinagi *et al.*, (2014) and preliminary recommendations from public procurement experts and practitioners. For the variable procurement regulatory pressure (REGPRE) the study adopted measurement items proposed by Kim *et al.*, (2015), Zhu, Sarkis, & Lai, (2013), Huang *et al.*, (2016), and preliminary recommendations from public procurement experts and practitioners to measure the extent of public procurement regulatory pressure.

Results

Data Screening

The data collected were inspected for data entry accuracy, missing data, suspicious response pattern, outliers assessment, normality assessment, and finally the study assessed the issue of common method bias as advocated by scholars (Hair *et al.* 2017; Hair *et al.*, 2014; Tabachnick & Fidell, 2013).

Reflective Measurement Model Evaluation

Under this study, the researcher used the criteria proposed by Jarvis *et al.*, (2003) and insights from other studies to arrive at appropriate modelling of all indicators in the measurement model as reflective. Reliability assessed the outer loadings that show the absolute contribution of an item towards the definition of its latent variable. Thus under this study, the items TECUSG2, TECUSG 6, TECUSG 7, TECUSG 8, and SRPERF1 were removed from the model for two main reasons, first items were below the loadings of 0.4, and items with values between 0.4 to 0.7, but their eliminations resulted into an increase in composite reliability (Hair *et al.*, 2017). The other items retained as shown in Table 1 most of them were having loadings above 0.7 except for TECUSG1, TECUSG3, INTPERF4, and INTPERF6 which contain loadings above 0.6.

Table 1: Construct Reliability and Validity

2 nd Order Construct	CR ^b	AVE ^c	Construct	Item	Loading ^a	CR ^b	AVE ^c		
Public Procurement Performance (PROPERF)	0.861	0.678	Procurement Technology Usage (TECUSG)	TECUSG1	0.636	0.918	0.584		
				TECUSG3	0.634				
				TECUSG4	0.784				
			Internal Performance (INTPERF)	TECUSG5	0.811				
				INTPERF1	0.760				
				INTPERF2	0.833				
				INTPERF3	0.810				
				INTPERF4	0.660				
				INTPERF5	0.812				
				INTPERF6	0.684				
				INTPERF7	0.788				
			Supplier Related Performance (SRPERF)	INTPERF8	0.751				
				SRPERF2	0.883			0.87	0.691
				SRPERF3	0.854				
				SRPERF4	0.750				
			SRPERF1	0.805					
Internal Customer Performance (ICPERF)	ICPERF2	0.769							
	ICPERF3	0.807	0.943	0.675					
	ICPERF4	0.794							
	ICPERF5	0.836							
	ICPERF6	0.877							
	ICPERF7	0.873							
	ICPERF8	0.803							

Notes

- Items Excluded: Items below 0.5 and those between 0.5 and 0.7 that negatively affect the average variance extracted (AVE); TECUSG 2, TECUSG 6, TECUSG 7, TECUSG 8, SRPERF 1
- 'a': all items loading above 0.5 indicate indicator reliability
- 'b': All composite reliability (CR)>0.7 indicates internal consistency
- 'c': all average variance extracted (AVE)>0.5 indicates convergence validity (Hair et al., 2017)

Discriminant validity was assessed by using the Heterotrait-Monotrait ratio of correlation (HTMT) as advocated by Henseler et al, (2014). The rule of thumb for the assessment of the discriminant validity under the Heterotrait-Monotrait (HTMT) approach is that, the HTMT value below 0.9 if the path model includes very similar constructs or the HTMT value below 0.85 when the path model is conceptually more distinct to indicate the discriminant validity between reflective constructs (Hair *et al.*, 2017; Hair, Sarstedt, & Ringle, 2019; Henseler *et al.*, 2014). Table 2 shows under the model of this study the highest HTMT value is 0.687, thus

providing a clear indication that the latent variables' discriminant validity is acceptable hence indicating a clear satisfactory measurement model quality.

Table 2: Discriminant Validity on Heterotrait-Monotrait Ratio (HTMT)

	ICPERF	INTPERF	SRPERF	TECUSG
ICPERF				
INTPERF	0.687			
SRPERF	0.569	0.550		
TECUSG	0.426	0.437	0.321	

Notes

- The HTMT value should be a value below 0.85 to indicate the establishment of the discriminant validity between reflective constructs.

Model Estimation and Findings

As indicated in Table 3 and Figure 2, estimation of the model relationships was significant, thus supporting the hypotheses stated in the study. Public procurement technology usage (0.406) indicated a strong relationship with public procurement performance.

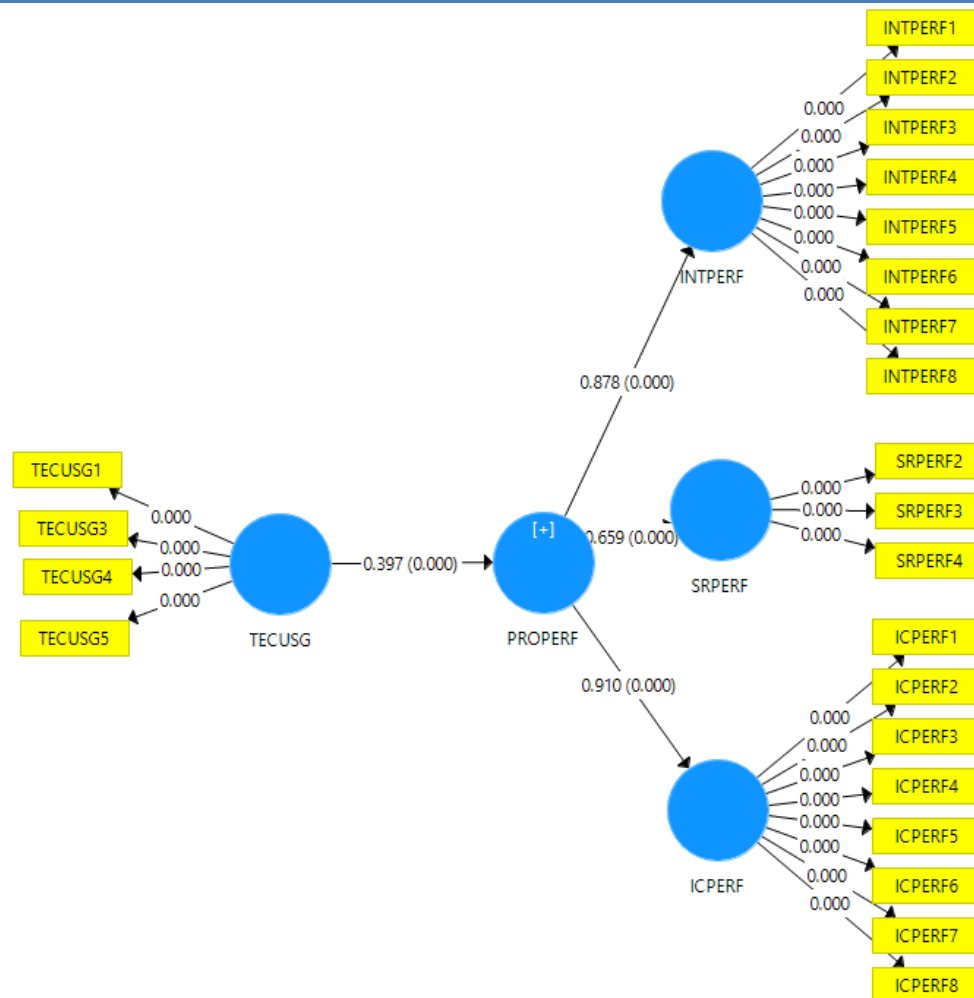


Figure 2: PLS Path Model Results

Table 3: Direct Relationship for Hypothesis Testing

Hypothesis	Relationships	Standardized Beta	Standard Error	t Value	f ²	95% Confidence Interval
H1	TECUSG -> PROPERF	0.406	0.071	5.553*	0.187	[0.242 ; 0.525]

Notes

- * p<0.01
- Effective size (f²) measures the effect of the specific predictor on an endogenous construct (0.02 small, 0.15 medium, 0.35 large (Hair, Risher, et al., 2019).
- TECUSG=Procurement Technology Usage, PROPERF= Public Procurement Performance,

Moderation

The aim was to analyse the moderation effects of the regulatory pressure on the relationship between procurement technology usage and public procurement performance, such that the relationship is weaker when regulatory pressure is high. To avoid inflating the impact of the moderator variable on the relationship between exogenous and endogenous variables under consideration it is important to include the direct relationship between the moderator and an endogenous construct (Hair *et al.*, 2017). Furthermore, it should be noted that when adding an interaction effect to the model, the effect of exogenous construct on endogenous construct and the effect of moderator on endogenous construct will no longer be unconditional effects (main effects) rather than be counted as conditional effects or simply known as simple effects.

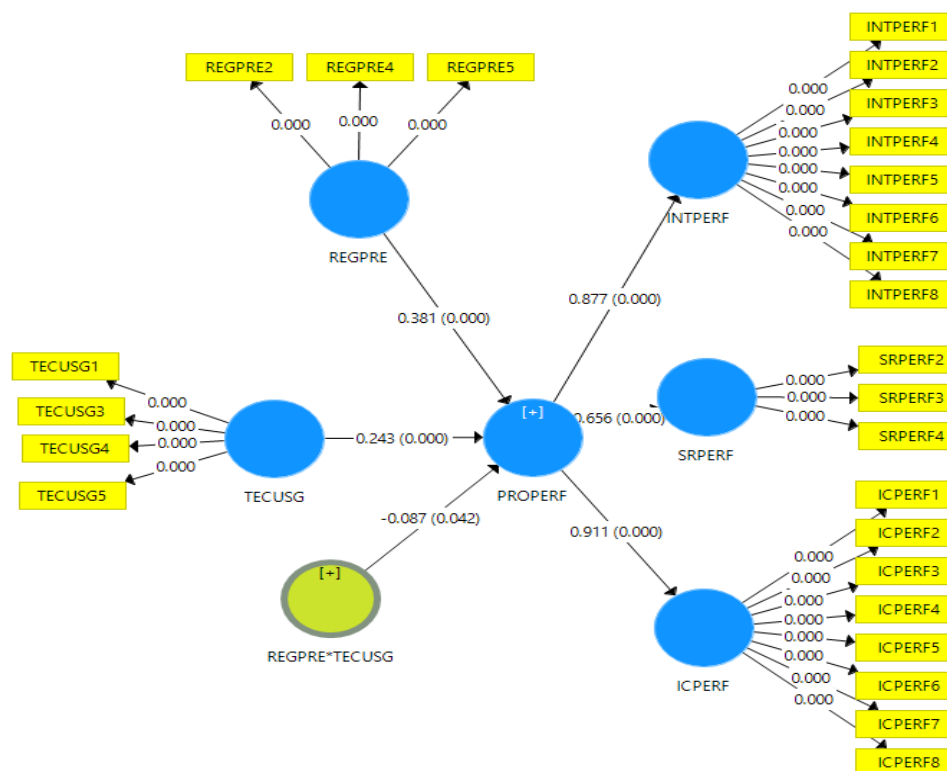


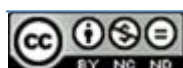
Figure 3: PLS Path Model Results

Table 4 indicates the interaction effect is significant which justifies the presence of the moderation effect in our model. As shown in Table 4 the relationship of the path from REGPRE*TECUSG to PROPERF is (-0.079) and statistically significant ($t = 2.038$; $p < 0.05$). Furthermore, on checking whether the moderator is relevant the study used the generated effective size (f^2). As shown in Table 4, the effective size of the interaction term REGPRE*TECUSG on public procurement performance (PROPERF) indicated a medium effect ($f^2=0.020$). This justifies that our moderation effects understudy was relevant and significant.

Table 4: Moderation Analysis Report

Hypothesis	Relationships	Standardized Beta	Standard Error	t Value	f^2	90% Confidence Interval
H2	REGPRE*TECUSG -> PROPERF	-0.079	0.043	2.038*	0.020	[-0.179 ; -0.013]

Note



- * $p < 0.05$
- Effective size (f^2) for the interaction term whereby $f^2 = 0.005$ or higher denotes small effect, $f^2 = 0.01$ or higher denotes medium effect and $f^2 = 0.025$ or higher denotes strong effect (reference Kenny, D.A. (2018))
- REGPRE=Procurement Regulatory Pressure, TECUSG=Procurement Technology Usage, PROPERF= Public Procurement Performance,

Post-hoc Analysis of Moderation Effects

When a significant moderation effect is achieved, it is further suggested to assess the high and low effects of the moderation effects on the relationship between exogenous and endogenous latent variables. Thus taking that into attention this study employed a graphical method for post-hoc analysis of the moderation effect. Mathematically the path model for our moderation effect of procurement regulatory pressure (REGPRE) is represented as follows:

$$\text{PROPERF} = a\text{TECUSG} + b\text{REGPRE} + c\text{REGPRE} * \text{TECUSG}$$

This equation can be further rewritten as:

$$\text{PROPERF} = (a + c\text{REGPRE})\text{TECUSG} + b\text{REGPRE}$$

Thus, considering the above expression on plotting the graph of an endogenous construct (PROPERF) against the exogenous construct (TECUSG) the slope will no longer be constant rather that it will now depend on the moderator variable (REGPRE). Taking into considerations that, in partial least square structural equation modelling all variables are standardized, then;

- a : represents a simple effect of procurement technology usage on public procurement performance when procurement regulatory pressure is at its mean. That is $\text{REGPRE} = 0$
- b : represents a simple effect of procurement regulatory pressure on public procurement performance when procurement technology usage is at its mean. That is $\text{TECUSG} = 0$
- c : represents a change in the simple effect of procurement technology usage on public procurement performance when procurement regulatory pressure changes by one standard deviation

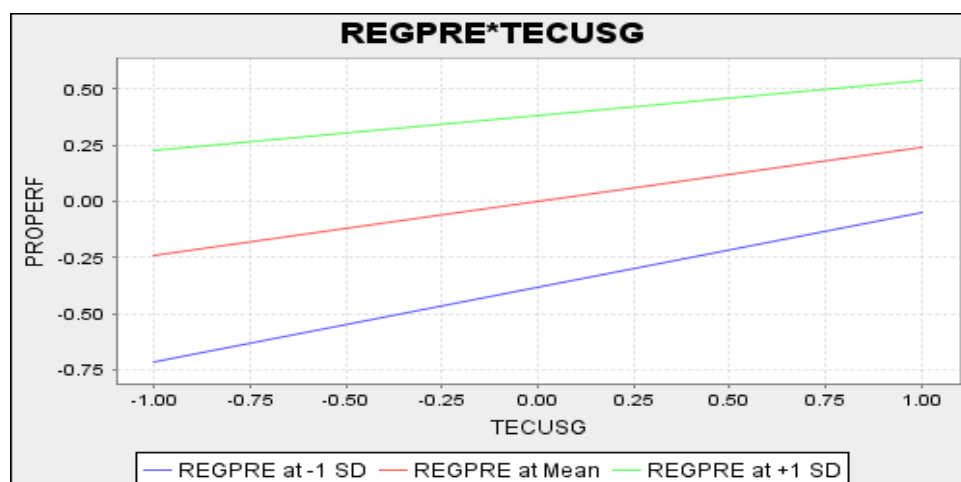


Figure 4: Interaction Effect REGPRE (Two Stages) ->TECUSG

Notice: REGPRE=Procurement Regulatory Pressure, TECUSG=Procurement Technology Usage

$$\text{Model: PROPERF} = (0.246 - 0.079\text{REGPRE})\text{TECUSG} + 0.387\text{REGPRE}$$

Figure 4 represents the simple effect of procurement technology usage (TECUSG) at different levels of the procurement regulatory pressure (REGPRE). When procurement regulatory pressure (REGPRE) is at the mean level (REGPRE=0), the simple effect of procurement technology usage on public procurement performance will be 0.246. When procurement regulatory pressure (REGPRE) is at one standard deviation above the mean (REGPRE=1), the simple effect of procurement technology usage on public procurement performance will be 0.167. When procurement regulatory pressure (REGPRE) is at one standard deviation below the mean (REGPRE=-1), the simple effect of procurement technology usage on public procurement performance will be 0.325. This implies that when there are high regulatory pressures, the increasing technology usage tends to increase the public procurement performance at a small level. Alternatively, when there are low regulatory pressures increasing technology usage tends to increase the public procurement performance at a high level.

Discussion of the Findings

Concerning technology usage, the resource-based view and information technology-related literature predicted that technology usage in an organization could lead to improved performance in an organization. The finding under this study supports the proposed prediction that technology usage could lead to procurement performance. The finding is also consistent with previous studies which proposed that the use of technology in procurement management could contribute to the performance of procurement (Alsetoohy & Ayoun, 2018; Ateto *et al.*, 2013; Gardenal, 2013; Gupta & Gupta, 2012; Hsiao & Teo, 2005; Karthik & Kumar, 2013; Mäkinen *et al.*, 2011; Mishra *et al.*, 2013; Quesada *et al.*, 2010; Yu *et al.*, 2016). Previous studies also conducted specifically in the public sector also were in support of the hypothesis that technology usage in the public sector procurement had a positive impact on performance (Alsac, 2007; Belisari *et al.*, 2019; Cholette *et al.*, 2019; Dooley & Purchase, 2006; Svidronova & Mikus, 2015). This finding is also consistency with the resource-based view predictions which are based on the argument that technology usage involves some necessary resources and these resources can enhance other resources and capabilities hence leading to performance

Additionally, as hypothesized in hypothesis 2 (H2) the result on the relationship of the path from REGPRE*TECUSG to PROPERF was (-0.079) and statistically significant ($t = 2.038$; $p < 0.05$). This implies that when there are high regulatory pressures, the increasing technology usage tends to increase the public procurement performance at a small level. Alternatively, when there are low regulatory pressures increasing technology usage tends to increase the public procurement performance at a high level. The findings are in line with previous studies arguing on the presence of institution pressure tends to affect the strength of the relationships between the independent variable under investigation and on the other end organization performance as a dependent variable (Shamsuddina, 2013; Zhu & Sarkis, 2007). The significant result of the moderation effect in the relationships between procurement technology usage and procurement performance is in line with institution theory which emphasizes the role of the external environment in an organization. These external factors such as regulatory pressure could have an impact on the daily undertakings of the organization.

The Implications of the study

The study used a reflectively higher-order construct and the analysis was done by using smart PLS3. Many studies in the partial least square use the first-order constructs, thus the study adds

to methodological applications of partial least square research, especially those involving higher-order constructs. The study also apart from calculating the convergent validity and the internal consistency reliability of the lower order constructs it also calculated the values of the internal consistency reliability and the convergent reliability of the higher-order constructs. This is the addition to this research as many studies involving higher-order constructs included only the convergent validity and the internal consistency reliability of the lower-order constructs. The positive impact of technology usage on performance suggests that the ability of procurement practitioners to achieve higher procurement performance depends on their application of technology.

The negative interaction effect (REGPRE*TECUSG) of regulatory pressure on the relationship between procurement technology usage and procurement performance provides an alert to policymakers, especially those proposing policies relating the technology usage. The findings have indicated that the existence of many regulatory pressures such as laws, regulations, and directives on the application of technology especially in public sectors leads to the poor realization of the contribution of the technology usage to the performance of an organization. Thus, policymakers could use the findings of this study to come up with clear policies and regulations that could help to improve the relationships between technology usage and procurement performance rather than shrinking this relationship. Generally, all policy stakeholders such as the government should support the technological development, especially in procurement management; these technological advancements may lead to timely access to information between procurement stakeholders and hence improve the procurement performance as proposed in this study in support of previous studies.

Conclusion

This study was aimed at investigating the public procurement performance in Tanzania by examining the roles played by technology usage and regulatory pressure. The study found a significant relationship between procurement technology usage and public procurement performance. Furthermore, the study found a significant moderation effect on the relationship between procurement technology usage and procurement performance. The findings have indicated that too many regulatory pressures could result in the poor realization of the contribution of the technology usage to the performance of procurement specifically in the public sector. The study calls for further comparative studies between private and public sector procurement.

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