

Promoting transparency and accountability towards anti-corruption in pharmaceutical procurement system: does e-procurement play a significant role?

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Abstract

Purpose – Understanding the interplay between transparency, accountability and e-procurement and their collective contribution to anti-corruption efforts in public procurement is crucial for developing effective strategies and policies. This research seeks to investigate whether e-procurement plays a significant role in enhancing transparency and accountability and subsequently reducing corruption risks in the public pharmaceutical procurement system.

Design/methodology/approach – The study employed a cross-sectional questionnaire survey to gather data from 274 procurement personnel and pharmacists working in 28 government-owned hospitals in the Southern Highlands of Tanzania. The collected data were then analysed using confirmatory factor analysis (CFA) and the Hayes PROCESS macro to test the study hypotheses.

Findings – The study findings revealed a negative and significant relationship between transparency and procurement corruption ($\beta = -0.117, p < 0.008$). Moreover, accountability negatively and significantly affects procurement corruption ($\beta = -0.162, p = 0.006$). Furthermore, the findings indicate that, at a high degree of e-procurement system implementation, transparency and accountability have a stronger impact on procurement anti-corruption measures.

Practical implications – Policymakers and decision-makers should implement robust mechanisms that enhance transparency, accountability and anti-corruption efforts. These may include providing clear and accessible information on procurement processes, efficient mechanisms for monitoring and reporting procurement irregularities and continuous improvement of e-procurement systems. By incorporating these measures and nurturing collaboration amongst procurement stakeholders, it becomes possible to foster a procurement environment characterised by integrity, fairness, accountability and reduced corruption.

Originality/value – Whilst previous studies delved into exploring the effect of transparency and accountability on procurement anti-corruption, the novelty of this study is the inclusion of e-procurement as a moderating variable in the relationship between transparency, accountability and anti-corruption. By so doing, this study adds to the existing body of knowledge regarding anti-corruption measures and offers valuable practical insights for policymakers and professionals aiming to enhance transparency, accountability and ethical conduct within the public pharmaceutical procurement system.

Keywords Transparency, Accountability, Pharmaceutical procurement, e-procurement, Anti-Corruption

Paper type Research paper



1. Introduction

Pharmaceutical procurement systems encompass the entire lifecycle of procurement, including planning, sourcing, contracting, purchasing and delivery of pharmaceuticals (medicines and medical supplies). This applies to all public healthcare facilities, such as hospitals and clinics, as well as public health programs and initiatives. Corruption in the public pharmaceutical procurement system has long been a critical concern worldwide, leading to increased costs of health services, financial losses, compromised quality of health services and erosion of public trust (Ashraf and Ong, 2021; Oleribe *et al.*, 2019; Littlejohns *et al.*, 2019). In light of this, empirical evidence indicates that corruption leads to an estimated loss of approximately 10–25% of the total value of any given contract (United Nations Office on Drugs and Crime (UNODC), 2013). Several reasons have been put forward for why the pharmaceutical procurement system is more prone to corrupt practices. Studies conducted by Kohler and Dimancesco (2020) and Nguyen *et al.* (2017) assert that the sensitivity, high value and complexity of pharmaceutical products make control measures towards anti-corruption difficult. Moreover, intensive competition, poor documentation and record-keeping, a high level of poverty and greed amongst actors, lack of transparency and inadequate or poorly enforced regulations and oversight mechanisms contribute to the rise of this incidence (Israel, 2021; Wilson, 2022; Zalvand *et al.*, 2022).

Procurement corruption involves various illegal or unethical activities that undermine the principles of competition, transparency and fairness in the procurement process. It is also described as the abuse of power by individuals for private benefits or personal gain in the process of procuring goods, services, or works (Nguyen *et al.*, 2017; UNODC, 2013). Anti-corruption, on the other hand, pertains to the characteristics or actions that serve to monitor or reduce the incidence of corrupt behaviours within the public procurement system. Some common forms of corruption in the pharmaceutical procurement system include informal payments made to suppliers to gain favouritism in the bidding process (bribery and kickbacks), collusion amongst bidders to eliminate competition and manipulate the bidding process (rigging and collusion), false recording, alteration and misrepresentation of information (fraud) and embezzlement of the budget allocated for procurement. Other studies by Israel (2021) and Martinez *et al.* (2017) identified conflict of interest, nepotism and favouritism as other forms of corruption in the public pharmaceutical procurement system. The efforts to combat corruption in this context require comprehensive strategies that address the underlying causes and promote transparency, accountability and good governance throughout the procurement process.

In recent years, e-procurement systems have gained prominence as technological solutions that can contribute to promoting transparency, accountability and reducing the incidences of corrupt practices in public pharmaceutical procurement processes (Alsac, 2007; O'Regan *et al.*, 2022; Fu *et al.*, 2019). E-procurement leverages digital platforms, automated processes and real-time monitoring tools that streamline and standardise procurement activities. More importantly, e-procurement systems enable centralised and easily accessible data, encourage data-driven analysis and improve oversight and control measures. As a result, studies regard e-procurement as a potential and valuable tool that plays a significant role in supporting anti-corruption initiatives within the public healthcare delivery system (Chilunjika *et al.*, 2023; Beaulieu and Bentahar, 2021; Beaulieu and Bentahar, 2021). This is attributed to the fact that the automated procurement process prevents unauthorised or maverick purchases, promotes competition amongst suppliers and reduces the likelihood of cartels, collusion and bid-rigging. Furthermore, e-procurement systems enhance quick access to procurement information and reduce the need for in-person interactions when procuring pharmaceutical products. Additionally, e-procurement operations enhance transparency and accountability, fostering an environment of integrity and fairness that deters corrupt practices and builds public trust in the public pharmaceutical procurement system (Ahmad *et al.*, 2023; Mansilla *et al.*, 2022; Saeed *et al.*, 2022).

Whilst there is a growing body of literature (Kohler and Dimancesco, 2020; Aduwo *et al.*, 2020; Mackey and Cuomo, 2020; Koller *et al.*, 2020; Nunes *et al.*, 2023) exploring the effects of transparency, accountability and e-procurement individually in relation to anti-corruption measures, yet there is a need for research that investigates the combined impact of these factors within the specific context of the pharmaceutical procurement system. Understanding the interplay between transparency, accountability and e-procurement and their collective contribution to anti-corruption efforts in this domain is crucial for developing effective strategies and policies. Therefore, this research addresses this gap by examining the role of transparency, accountability and e-procurement in promoting anti-corruption measures within the pharmaceutical procurement system in Tanzania. The research investigates whether e-procurement plays a significant role in enhancing transparency and accountability and subsequently reducing corruption risks in the public pharmaceutical procurement system. To achieve the study's objectives, this study is guided by three central research questions. These are:

- RQ1.* Does transparency have a significant direct effect on procurement anti-corruption?
- RQ2.* Does accountability have a significant direct effect on procurement anti-corruption?
- RQ3.* Does e-procurement system moderate the relationship between transparency, accountability and procurement anti-corruption?

By exploring the effects and interactions between these factors, the research aims to provide valuable insights and practical recommendations to policymakers, managers and practitioners in the pharmaceutical procurement sector. Ultimately, the goal is to contribute to the development of a more transparent, accountable and corruption-resistant pharmaceutical procurement system, ensuring the delivery of high-quality and affordable pharmaceutical products for the benefit of societies. Following this introduction, the next section presents the literature review, which provides a full spectrum of the theoretical perspective and hypotheses development. Section 3 conveys the research methodology, which includes the research design, study areas, sampling approach, data collection, variables used and data analysis approach. Section 4 presents the results and discussion of findings, including the model's fit and hypothesis testing outcomes. The last part delves into the conclusion, implications, limitations and directions for further studies.

2. Literature review and hypothesis development

2.1 Theoretical underpinnings

The current study adopts the theory of regulatory compliance (TRC) to address the relationships between transparency, accountability, e-procurement and anti-corruption in the pharmaceutical public procurement system. The TRC was proposed in the 1970s to emphasise the significance of complying with established regulations, policies and laws in human service delivery and economic domains. The theory asserts that adopting best practices (regulations, policies and laws) and ensuring compliance with them are key success factors for improving organisational performance (Fiene, 2019). Public pharmaceutical procurement system is subject to operational laws, procedures and regulations, which procurement officials and suppliers are obligated to comply with. Public procurement regulations emphasise the need to promote transparency and accountability as fundamental pillars of improved health service delivery (URT, 2013; Vian *et al.*, 2017; Yang, 2018). Additionally, the regulations and guidelines emphasise the use of e-procurement system as a strategic tool to reduce corruption and enhance transparency and accountability in public procurement (URT, 2013; World Bank, 2014).

The public pharmaceutical procurement system often experiences corrupt practices, poor quality services, delays and increased costs of procured medicines and medical supplies (Martinez *et al.*, 2017; Israel *et al.*, 2019; Vian, 2020; Saeed *et al.*, 2022). This is attributed to the lack of accountability and transparency within the system. It is believed that adhering to specified procurement guidelines and regulations in a transparent and accountable manner significantly reduces corrupt practices in public pharmaceutical procurement (Kohler and Dimancesco, 2020; Paschke *et al.*, 2018). Studies have revealed that transparency and accountability in public pharmaceutical procurement strengthen public officials' ethical behaviour and commitment, serving as the foundation for ethical practices (Sekalala *et al.*, 2020; Vian, 2020). With these regards, the burden of accountability and transparency lies with procurement practitioners, who must act in the public interest and in accordance with principles and regulations. In the context of this research, the TRC provides insights into the influence of transparency and accountability on compliance with anti-corruption and how e-procurement systems can facilitate and promote such compliance.

2.2 Hypothesis formulation

2.2.1 Transparency and corruption in pharmaceutical procurement. Transparency in pharmaceutical procurement refers to the openness and accountability of the processes involved in acquiring medicines and healthcare-related products (Vian, 2020; Paschke *et al.*, 2018). It encompasses making information readily available, ensuring fair and competitive practices and promoting accountability throughout the procurement cycle. Existing literature recognises the positive and significant role of transparency in reducing corruption in public health service delivery (Yang, 2018; Kohler and Dimancesco, 2020; Lega and Castellini, 2022). When pharmaceutical procurement is fair and transparent, it becomes easier to identify and expose corrupt practices or suspicious activities by making procurement processes and decisions visible to stakeholders and the public. This scrutiny acts as a deterrent against corruption and encourages responsible behaviour amongst procurement officials. Studies by Saeed *et al.* (2022) and Alexiadou (2023) have reported that transparent procurement processes enhance public trust by demonstrating accountability and reducing the potential for unethical practices such as favouritism, manipulation, bribery, or fraud based on privileged information. The fear of detection and subsequent consequences serves as a warning against potential corrupt behaviour (Koller *et al.*, 2020). Transparency fosters a culture of integrity and ethical behaviour within the procurement process, thereby creating an environment that discourages corruption. Based on these arguments, the study hypothesises that: -

H1. Transparency is negatively related to procurement corruption.

2.2.2 Accountability and corruption in pharmaceutical procurement. Accountability involves a wide range of practices that hold individuals and entities responsible for their actions and ensure that they are answerable for any misconduct or wrongdoing (Adil and Haliah, 2022; Kohler and Dimancesco, 2020). It entails establishing clear roles and responsibilities for all stakeholders involved in the procurement process and ensuring strict adherence to applicable laws, regulations and ethical standards by procurement officials, evaluators, decision-makers and oversight bodies. Literature emphasises that accountability is a fundamental component in the fight against corruption in the health service system (Vian, 2020; Rahman *et al.*, 2021; Sekalala *et al.*, 2020). When each party understands their responsibilities and held accountable for their actions, it becomes more difficult for corruption to occur unnoticed. Effective oversight mechanisms, such as independent regulatory bodies, audit institutions, or ethics committees, play a crucial role in enhancing accountability in pharmaceutical procurement (Kohler and Dimancesco, 2020; O'Regan *et al.*, 2022; Saeed *et al.*, 2022). These

entities have the responsibility to monitor procurement activities, conduct audits and investigate allegations of corruption. By holding individuals and entities accountable for their misconduct, including initiating disciplinary actions, legal proceedings, or administrative penalties, the risk of corruption in pharmaceutical procurement is reduced (Paschke *et al.*, 2018; Pomegbe *et al.*, 2023; Vian *et al.*, 2017). This leads to more transparent, fair and ethical procurement practices, ultimately safeguarding public health service delivery and ensuring the efficient allocation of public resources. It is thus hypothesised that:

H2. Accountability is negatively related to procurement corruption.

2.2.3 Moderating role of e-procurement system. E-procurement, which refers to the use of electronic systems and technologies in procurement processes, can make significant contributions to transparency, accountability and anti-corruption efforts in pharmaceutical procurement. Previous studies have recognised e-procurement systems as strategic tools for promoting transparency, accountability and anti-corruption in universal health service delivery (Mackey and Cuomo, 2020; Koller *et al.*, 2020; Cholette *et al.*, 2019). E-procurement platforms provide an open, centralised and accessible repository of information related to the procurement process for all suppliers. This includes published tender notices, bid evaluations, contract awards and supplier performance evaluations in digital format. Of greater significance, e-procurement systems offer suppliers equal opportunities to participate in the procurement process, effectively eradicating unfair treatment and biases (Fu *et al.*, 2019; Svidronova and Mikus, 2015). This system fosters consistency in both procurement methods and documentation, ensuring a standardised and transparent approach. Through e-procurement, all stakeholders gain convenient access to standardised procurement tender documents and assessment criteria, thereby lessening the possibility of manipulation or concealed information. This transparency serves as a strong deterrent against corrupt practices such as bid-rigging or collusion, as any irregularities become easily noticeable to those involved (Spacek and Spackova, 2023; Ratiko and Setiyawati, 2022; Wahyuningsih *et al.*, 2023).

Besides that, studies reveal that robust e-procurement systems enhance the accuracy of record-keeping, tracking capabilities and the auditability of procurement activities (Alsac, 2007; Beaulieu and Bentahar, 2021; Koggalage *et al.*, 2021). This guarantees the availability of relevant documents and accurate information for auditing purposes that capture all steps within the procurement process, including document revisions, approvals and communications. Moreover, these audit trails provide a complete historical record of procurement processes, thus enabling effective monitoring, evaluation and accountability. By automating specific steps in pharmaceutical procurement system, e-procurement system reduces the potential for human interference and bias (Penttrakan *et al.*, 2022; Tinali, 2022). This, in turn, helps in mitigating the risk of corruption stemming from personal connections or undue influence. Additionally, e-procurement platforms often support the use of electronic signatures and encryption, ensuring the authenticity and integrity of procurement-related documents (Cholette *et al.*, 2019; Koggalage *et al.*, 2021). This reduces the possibility of document tampering or fraudulent activities. By leveraging electronic technologies, organisations can enhance integrity, reduce corruption risks and ensure a fair and efficient procurement environment in the pharmaceutical sector. In light of this literature, we hypothesised that:

H3. E-procurement significantly moderates the relationship between transparency and procurement corruption.

H4. E-procurement significantly moderates the relationship between accountability and procurement corruption.

2.3 Conceptual framework

The conceptual framework of this study, as shown in [Figure 1](#), was constructed based on the findings of the literature review and the formulated hypotheses. The framework posits that transparency and accountability are significantly associated with anti-corruption within pharmaceutical public procurement system. Additionally, the framework theorises that e-procurement system moderates the relationship between transparency, accountability and procurement anti-corruption.

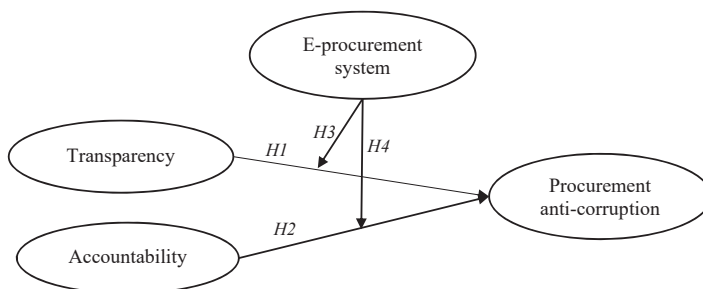
3. Methodology

3.1 Research design and study area

This study employed a cross-sectional research design and an epistemological-positivism research paradigm. According to [Eichelberger \(1989\)](#), the epistemological-positivism research paradigm enables researchers to collect quantitative data and test hypotheses between the variables under investigation. The current study collected and utilised quantitative data to determine the significant effect of the e-procurement system in promoting transparency, accountability and anti-corruption in the pharmaceutical procurement system. Conversely, the use of a cross-sectional research design was considered appropriate because the authors aimed to capture a snapshot and make inferences on the status of variables under study at a single period in time ([Saunders et al., 2019](#)). The study was carried out in the Southern Highland zone of Tanzania, specifically in the Rukwa, Songwe, Ruvuma, Njombe, Iringa and Mbeya regions. The analysis encompassed a total of 28 government-owned hospitals, consisting of 1 referral hospital, 5 regional hospitals and 22 district hospitals drawn from the aforementioned regions. The selection of the study areas was based on the considerable number of government-owned hospitals in this zone compared to other zones ([URT, 2022](#)). Moreover, the chosen hospitals in the study areas have successfully implemented e-procurement systems for the procurement and distribution of medicines and medical supplies.

3.2 Sampling, sample size and data collection

The unit of analysis in this study comprises 28 government-owned hospitals from the Southern Highland zone in Tanzania. At the outset, a total of 308 respondents, consisting of 142 procurement officers and 166 pharmacists from the selected 28 government-owned hospitals were initially identified. For each hospital, a census approach was utilised, where all procurement officers and pharmacists with sufficient knowledge of public pharmaceutical procurement procedures were included to participate in the study as the units of observation. Data collection took place from September to December 2022. In order to leverage the cost-effectiveness and geographical diversity of the study areas, a self-administered survey



Source(s): Figure by authors

Figure 1.
Conceptual framework

questionnaire with closed questions was employed for data collection. The questionnaire was created using Google Forms and distributed to the 308 pre-identified respondents via email and WhatsApp platforms. However, the final analysis included only 274 responses from the surveyed entities, resulting in an 88.9% effective response rate. Out of the 274 responses received, 151 (55.1%) were from pharmacists, whilst 123 (44.9%) were from procurement officers. The final sample size included in the analysis was deemed adequate for the use of confirmatory factor analysis (CFA) and moderation effects which require a minimum sample size of 200 or more (Wolf *et al.*, 2013; MacKinnon *et al.*, 2002).

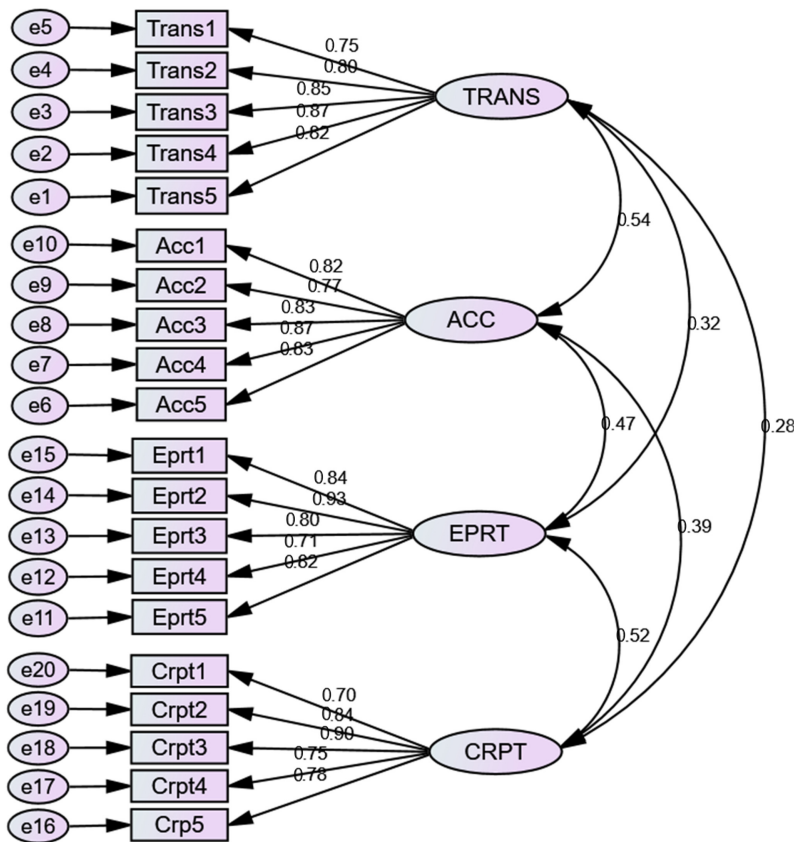
3.3 *Measurements, reliability and validity*

The items used for the measurement scales in this study were adapted from relevant literature and previous works on transparency, accountability, e-procurement and anti-corruption in the public pharmaceutical procurement system (Adil and Haliah, 2022; Kohler and Dimancesco, 2020; Mackey and Cuomo, 2020; Koller *et al.*, 2020; Nunes *et al.*, 2023; Rahman *et al.*, 2021; Martinez *et al.*, 2017; Paschke *et al.*, 2018). To assess face validity, the questionnaire was reviewed by six procurement managers and five pharmacists with adequate knowledge and experience in the public pharmaceutical procurement system. Refinements were made based on the comments received. During the data collection process, respondents were requested to assess the extent to which government-owned hospitals adopt the e-procurement system to enhance transparency, accountability and reduce corruption in the public pharmaceutical procurement system. Each item relating to the observable constructs was measured using a 5-point Likert-type scale labelled with “5 = to a very great extent” and “1 = not at all” to test the relevance of TRC in examining the effect of transparency and accountability on anti-corruption with a moderating role of e-procurement. In particular, TRC emphasises the importance of observing and complying with established regulations, policies and laws as a key driver to improved organisational performance (Fiene, 2019).

To assess the convergent validity and unidimensionality of constructs, validity tests were performed on the measurement scales and the model's fit using CFA. The results presented in Figure 2 and Table 1 provide sufficient evidence for the unidimensionality of the measurement scales in this study, with all observed items demonstrating factor loadings (λ) greater than 0.7 (Hair *et al.*, 2020). Furthermore, the study successfully met the criteria for convergent validity, as the average variance extracted (AVE) values for all constructs surpassed the recommended threshold of 0.5 (Fornell and Larcker, 1981). Additionally, both the composite reliability (CR) and Cronbach's alpha (α) values for each of the four constructs used in this study exceeded the suggested threshold of 0.70, indicating that the measures exhibit internal consistency, reliability and credibility (Fornell and Larcker, 1981; Hair *et al.*, 2020). Moreover, Table 2 demonstrates the achievement of the model's discriminant validity based on the Fornell-Larcker criterion. The square root of the AVE for each construct is greater than the correlation value with other constructs in the model, further confirming the attainment of discriminant validity (Fornell and Larcker, 1981).

3.4 *Data analysis*

Confirmatory factor analysis (CFA) was conducted to evaluate the measurement model and determine its fit with the data. CFA enables the identification of the underlying dimensions of latent constructs and how they interrelate (Fan *et al.*, 2016). In this stage, factor loadings were generated for each item of the latent constructs, which were then used to assess the model's fitting indices, as well as the validity and reliability of the data. Furthermore, the moderating effect of e-procurement on the relationship between transparency, accountability and procurement anti-corruption was analysed using Hayes PROCESS macro. The PROCESS macro is a robust and up-to-date tool for performing regression analysis that accommodates additional variables such as moderators, mediators and covariates (Hayes, 2022).



Source(s): Figure by authors

Figure 2.
Measurement model

4. Results

4.1 Measurement model assessment

The overall measurement model for the first-order constructs demonstrated a satisfactory fit. The model's chi-square (χ^2) value was 463.826, with a degree of freedom (df) of 164 at $p < 0.000$. Other model fit measures, including $\chi^2/\text{df} = 2.828$, goodness-of-fit index (GFI) = 0.937, Tucker–Lewis index (TLI) = 0.913, comparative fit index (CFI) = 0.925, incremental fit index (IFI) = 0.925, normed fit index (NFI) = 0.939, relative fit index (RFI) = 0.923, standardised root mean square residual (SRMR) = 0.037, root mean square error of approximation (RMSEA) = 0.072 and $P_{\text{close}} = 0.109$, collectively demonstrating a good fit between the data and the model. This analysis suggests that the data used in this study align well with the proposed model. Additionally, the correlation values between the construct variables in Figure 2 were all below 0.85, suggesting that multicollinearity was not a significant issue of concern in this study (Sarstedt *et al.*, 2014).

4.2 Hypotheses testing and discussion

We used Hayes PROCESS macro v.4.2 to test the direct effect and moderating effects. The β coefficients and their associated statistical significance values were used to assess and test the four hypotheses. The results in Table 3 demonstrate the direct effect of transparency and

Table 1.
Confirmatory factor
analysis results

Construct and items	Code	λ	α	CR	AVE
<i>Transparency in pharmaceutical procurement (TRANS)</i>			0.766	0.912	0.675
• General procurement notes are readily available to all suppliers	TRAS1	0.754			
• Suppliers are given equal chances to participate in bidding process	TRAS2	0.802			
• Tender notices are publicly available to all pharmaceutical suppliers	TRAS3	0.850			
• PE carries public bid opening immediately after submission deadline	TRAS4	0.875			
• PE ensures competitive bidding in pharmaceutical procurement	TRAS5	0.821			
<i>Accountability in pharmaceutical procurement (ACC)</i>			0.853	0.914	0.680
• PE comply with pharmaceutical procurement laws and guidelines	ACC1	0.820			
• PE have robust internal controls and transparency mechanisms	ACC2	0.766			
• Officials accept liability to sanctions resulted from corrupt practices	ACC3	0.830			
• PE has clear roles for all stakeholders involved in the procurement	ACC4	0.874			
• PE have efficient procedures for reporting procurement malpractices	ACC5	0.831			
<i>Perceived capabilities of e-procurement system (EPRT)</i>			0.807	0.911	0.674
• Efficient monitoring of pharmaceutical procurement process	EPRT1	0.842			
• Increased transparency in pharmaceutical bidding process	EPRT2	0.925			
• Robust managerial control and audit of procurement process	EPRT3	0.795			
• Reduction of falsifications and alternation of facts	EPRT4	0.709			
• Reduced collusion and bid-rigging practices	EPRT5	0.820			
<i>Extent corrupt practices in pharmaceutical procurement (CRPT)</i>			0.766	0.896	0.636
• Informal payments (bribery) to gain favouritism in bidding process	CRPT1	0.700			
• False recording, alteration and misrepresentation of information	CRPT2	0.841			
• Illicit payment to buyers in return of favouring award of contract	CRPT3	0.899			
• Embezzlement of budget allocated for pharmaceutical products	CRPT4	0.747			
• Collusion amongst bidders to determine the winning bidder	CRPT5	0.784			
Source(s): Table by authors					

Table 2.
Discriminant validity
based on Fornell–
Larcker criterion

	CR	AVE	MSV	ASV	ACC	TRANS	EPRT	CRPT
ACC	0.914	0.680	0.293	0.224	0.825			
TRANS	0.912	0.675	0.293	0.132	0.541	0.821		
EPRT	0.911	0.674	0.223	0.109	0.472	0.322	0.821	
CRPT	0.896	0.636	0.155	0.052	0.394	0.283	0.525	0.797
Note(s): The square root of AVE is on the diagonal								
Source(s): Table by authors								

accountability on procurement anti-corruption. Additionally, the results show the moderating effect of the e-procurement system on the relationship between transparency and procurement anti-corruption (Model 1), as well as the moderating effect of the e-procurement system on the relationship between accountability and procurement anti-

Variables	Coefficient	Se	T	p	LLCI	ULCI
<i>Model 1: main effects</i>						
TRANS	-0.117	0.044	-2.669	0.008	-0.203	-0.031
EPRT	0.456	0.058	7.869	0.000	0.342	0.570
TRANS*EPRT	-0.062	0.062	-1.011	0.013	-0.358	-0.184
R^2	0.271					
F(sig.)	33.443			0.000		
R^2 change	0.028					
<i>Model 2: main effects</i>						
ACC	-0.162	0.047	-3.451	0.006	-0.254	-0.070
EPRT	0.416	0.062	6.682	0.000	0.294	0.539
ACC*EPRT	-0.084	0.056	-0.151	0.018	-0.301	-0.118
R^2	0.311					
F(sig.)	35.234			0.000		
R^2 change	0.039					

Source(s): Table by authors

Table 3.
Regressions results on
the relationships
between study
variables

corruption (Model 2). Model 1 was found to be statistically significant with an R^2 value of 0.271 ($p = 0.000 < 0.05$) and an F value of 33.443, indicating that 27.1% of the variation in anti-corruption was explained by transparency. Furthermore, Model 2 in Table 3 indicates that accountability accounts for 31.1% of the variation in anti-corruption ($R^2 = 0.311$, $p = 0.000 < 0.05$, $F = 35.234$).

4.2.1 Transparency and procurement anti-corruption. In Model 1, H1 stated that “H1: transparency is negatively related to procurement anti-corruption”. The results presented in Table 3 reveal a significant and negative effect of transparency on procurement corruption ($\beta = -0.117$, $p = 0.008 < 0.05$). Therefore, H1 is confirmed, indicating that improved transparency practices contribute to a reduced rate of corruption in the public pharmaceutical procurement system. These findings align with previous studies conducted by Mackey and Cuomo (2020), Rahman *et al.* (2021), Sekalala *et al.* (2020) and Vian (2020), all of whom reported transparency as a potent tool in combating corruption within the domain of public service procurement. These results are consistent with the argument that transparency fosters accountability amongst procurement officials and suppliers by making them aware that their decisions and actions are being monitored. This increased awareness promotes ethical behaviour and adherence to established rules and procedures, thereby reducing the likelihood of corrupt practices such as bid collusion or bid suppression. Moreover, promoting openness and public participation helps to prevent fraudulent activities, ensures fair competition and enhances the overall integrity of the pharmaceutical procurement system (Ahmad *et al.*, 2023; Mahuwi and Israel, 2023; Yang, 2018).

4.2.2 Accountability and procurement anti-corruption. The second hypothesis in Model 2 states that “H2: accountability is negatively related to procurement anti-corruption”. The study findings in Table 3 indicate a negative and statistically significant effect of accountability on procurement corruption ($\beta = -0.162$, $p = 0.006 < 0.05$). Therefore, H2 is supported. This implies that increased accountability practices contribute to the promotion of anti-corruption measures within the public pharmaceutical procurement system. Consistent with existing literature (Kohler and Dimancesco, 2020; Koller *et al.*, 2020; Mackey and Cuomo, 2020), the findings of this study recognise accountability as a fundamental and critical element in enhancing efforts to combat procurement corruption. When effectively enforced and upheld in procurement processes, accountability establishes a system of checks and balances that

acts as a deterrent against corruption and encourages ethical behaviour amongst individuals involved. Through clear delineation of roles and responsibilities, implementation of robust internal control mechanisms such as regular internal audits and independent oversight committees, and the use of sanctions and penalties, deviations or misconduct can be more easily identified and addressed (Paschke *et al.*, 2018; Siwandeti *et al.*, 2023; Saeed *et al.*, 2022).

4.2.3 Testing the moderation effect. The results of the moderating effect are presented for three conditions: one standard deviation below the mean (−1.54), the mean (0.0) and one standard deviation above the mean (1.54). According to Hayes (2022), a value one standard deviation below the mean represents a low degree of the moderating variable, whilst a value one standard deviation above the mean indicates a high degree of the moderating variable. Figure 3 illustrates the results of slope plotting for the interaction effect of e-procurement on transparency and anti-corruption. The results demonstrate that at a high degree of e-procurement system (standard deviation = +1.54), the effect of transparency on procurement anti-corruption is stronger compared to a low degree of e-procurement system (standard deviation = −1.54). Based on the results of Model 1 in Table 3, the interaction term between transparency and e-procurement was found to be negative and statistically significant ($\beta = -0.062, p = 0.013 < 0.05$), with confidence intervals ranging from −0.358 to −0.184. Since the confidence intervals do not include zero, the results suggest that e-procurement significantly moderates the relationship between transparency and procurement anti-corruption, thereby supporting H3, which states that “H3: e-procurement significantly moderates the relationship between transparency and procurement corruption”. Additionally, R^2 in model 1 was improved by 2.8%, indicating that a significant change in the variance of anti-corruption was due to the interaction between e-procurement and transparency.

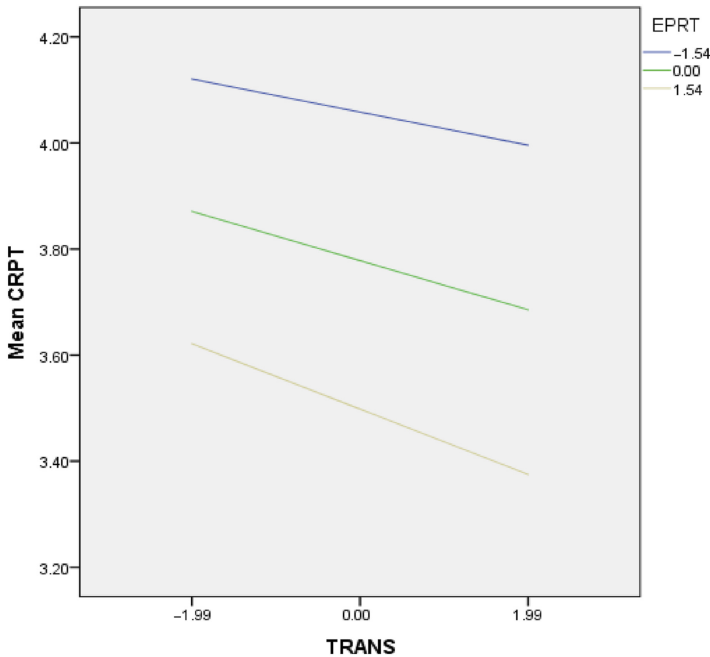
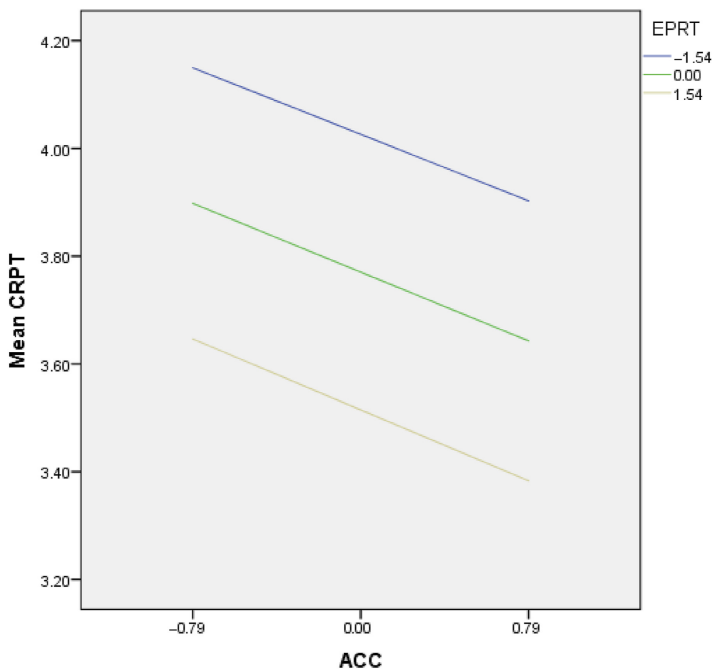


Figure 3.
Moderation effects of
EPRT on TRANS
and CRPT

Source(s): Figure by authors

Lastly, H4, which states that “H4: *e-procurement significantly moderates the relationship between accountability and procurement corruption*,” was also supported. The results in Model 2 of Table 3 reveal a negative and statistically significant interaction term between accountability and e-procurement ($\beta = -0.084$, $p = 0.018 < 0.05$), with confidence intervals ranging from -0.301 to -0.118 . Since the confidence interval values do not include zero, the results imply that the e-procurement system serves as a significant moderator of the relationship between accountability and procurement anti-corruption. The inclusion of the interaction term increased the R^2 value in Model 2 by 3.9%, which was attributed to the interaction between accountability and the e-procurement system. Subsequently, slope plotting was carried out to illustrate the moderating effect of EPRT on the link between ACC on CRPT at one standard deviation above the mean ($+1.54$), the mean (0.0) and one standard deviation below the mean (-1.54). The results in Figure 4 illustrate that EPRT enhances the positive relationship between accountability and anti-corruption. Accordingly, when EPRT is at a high level (standard deviation = $+1.54$), the influence of accountability on anti-corruption is more pronounced compared to when EPRT is at a low level (standard deviation = -1.54). These findings are in line with the perspectives of Alsac (2007), Ali *et al.* (2022) and Svidronova and Mikus (2015), who suggest that e-procurement systems provide a robust framework to combat corruption in procurement and enhance public service delivery. E-procurement contributes to accountability, transparency and anti-corruption efforts by offering centralised platforms, standardised processes, real-time monitoring, automated evaluations, reliable audit trails and data-driven analysis. Therefore, leveraging e-procurement system promotes integrity, reduces human bias and improves the overall efficiency and fairness in pharmaceutical procurement processes (Maran and Lowe, 2022; Tinali, 2022; Israel, 2023; Aduwo *et al.*, 2020).



Source(s): Figure by authors

Figure 4.
Moderation effects of
EPRT on ACC
and CRPT

5. Conclusion, implications and direction for further studies

5.1 Conclusion

This study sought to investigate how the use of e-procurement systems contributes to enhancing transparency and accountability in the fight against corruption in the pharmaceutical procurement system. The study results provide valuable insights into the collective influence of transparency, accountability and e-procurement on anti-corruption efforts. The findings demonstrate that accountability and transparency are complementary principles that mutually strengthen the fight against corruption in the pharmaceutical procurement system. The study reveals that advocating for transparency and accountability encourages openness, responsibility and accessibility to information amongst those involved in the procurement process. In particular, these principles promote fair competition, discourage corrupt behaviour, facilitate the reporting of irregularities, support effective investigations and foster public trust in the pharmaceutical procurement process. Moreover, the study highlights the significant role played by e-procurement in moderating the relationship between transparency and anti-corruption, as well as between accountability and anti-corruption in the pharmaceutical procurement landscape. The results suggest that extensive implementation of e-procurement systems amplifies the impact of transparency and accountability on anti-corruption measures. Through technology utilisation, e-procurement enhances integrity, reduces human biases and improves the overall efficiency and fairness of pharmaceutical procurement procedures. Consequently, this diminishes the likelihood of corrupt practices such as bid collusion, bid suppression, bribery and embezzlement.

5.2 Theoretical implications

Overall, the study contributes to the TRC by providing empirical evidence and theoretical insights into the role of transparency, accountability and e-procurement in promoting compliance with regulations and reducing corruption in the pharmaceutical procurement system. It extends the understanding from previous studies of how these factors can work together to create a conducive environment to reinforce each other and enhance anti-corruption efforts in the pharmaceutical procurement landscape (Sekalala *et al.*, 2020; Nunes *et al.*, 2023; Kohler and Dimancesco, 2020; Koller *et al.*, 2020). The study findings demonstrate that by implementing transparent practices, robust accountability mechanisms and an e-procurement system, organisations can enhance fairness, openness, responsibility and compliance with regulatory requirements, thereby reducing the likelihood of corrupt behaviours. This supports the underlying assumptions of the TRC, which posits that effective regulatory mechanisms and oversights promote adherence to ethical standards and discourage non-compliance behaviour (Fiene, 2019). The study's findings highlight that e-procurement systems provide centralised platforms, standardised processes and real-time monitoring mechanisms, which promote integrity, reduce human bias and enhance efficiency and fairness. It elucidates that the interplay between transparency and accountability when supported by e-procurement systems, creates a more robust framework that encourages reporting and effective investigation of irregular procurement practices. Subsequently, these foster public trust and compliance efforts, thus reducing corruption risks in the public pharmaceutical procurement system, which are one of the core principles of TRC.

5.3 Managerial implications

This research has several important managerial implications. First, procurement managers and policymakers should prioritise initiatives that promote transparency, fairness and openness practices in the course of pharmaceutical procurement processes. These may include providing clear and accessible procurement information, bid evaluations and supplier selection criteria. This creates an environment of trust, integrity and fair competition, thereby reducing opportunities for unethical and corrupt practices. Second, managers should consider

establishing robust mechanisms of accountability practices that clearly define the roles and responsibilities in procurement decision-making processes. These measures could include enforcing robust mechanisms for monitoring and accessible channels for reporting procurement irregularities such as internal control and audit systems, sanctions for any procurement deviations or misconduct. This creates a culture of responsibility and integrity within the organisation by holding individuals accountable for their actions and consequences for unethical behaviour. Besides, it is crucial to establish an independent oversight committee to provide objective assessments of ethical procurement practices and enforce accountability measures.

Furthermore, procurement managers should invest in the adoption and continuous improvement of e-procurement platforms to achieve centralised and standardised procurement processes, automated evaluations and reliable audit trails for monitoring transparency and accountability practices. This can be enhanced by offering adequate training and support to procurement staff and pharmacists to ensure effective utilisation of e-procurement system, compliance to transparency, accountability and anti-corruption measures. Lastly, procurement managers should also foster collaboration and cooperation amongst stakeholders involving in the pharmaceutical procurement system. This could include engaging with suppliers, procurement officials, regulatory bodies and other relevant parties to promote a collective commitment to transparency, accountability and anti-corruption measures. Building strong partnerships and open lines of communication can facilitate the sharing of best practices, knowledge and experiences in combating corruption in the pharmaceutical procurement process.

5.4 Limitations and direction for further studies

The study mainly utilised a cross-sectional questionnaire survey with a sample consisting solely of procurement officers and pharmacists from government-owned hospitals in Tanzania. Other data collection methods, such as interviews and focus group discussions involving various procurement stakeholders, were not considered. Therefore, we recommend conducting longitudinal and in-depth case studies to investigate the long-term sustainability and mediating role of e-procurement on transparency, accountability and anti-corruption in pharmaceutical procurement system across different jurisdictions. Additionally, further studies could explore the perceptions and experiences of various stakeholders, including pharmaceutical suppliers and civil society organisations, to gain insights into their perspectives on the benefits, challenges and potential risks of e-procurement in relation to transparency and accountability. Second, the findings are confined to the moderating role of e-procurement system in promoting transparency, accountability and anti-corruption pharmaceutical procurement system. In order to provide valuable insights into the relative effectiveness of e-procurement in promoting transparency, accountability and anti-corruption, we recommend a comparative analysis studies between e-procurement and traditional systems. By addressing these limitations and exploring these research directions, a comprehensive understanding of the role of e-procurement system in the pharmaceutical procurement system can be achieved.

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