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Unobserved Heterogeneity in Public Procurement Governance and Value for Money

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Abstract The public procurement governance crisis in developing countries is typically triggered by unclear transparency and accountability, inadequate competitiveness procedures and weak legal frameworks. To address these challenges, unlikely other studies, we critically analyzed the effects' sizes and permutation tests to uncover unobserved heterogeneity. The motives behind this paper are to ascertain the unobserved heterogeneity in public procurement governance and to identify existence classes with homogeneous behavior patterns. REBUS-PLS was used to measure and assess the unobserved heterogeneity. In that premises, the paper critically assessed the measurement and structural models and explicitly analyzed the goodness of fit (GoF) index, group quality index (GQI), effects' sizes and permutation tests. The six tested hypotheses were significant at the global model after accustoms the bootstrap. By contrast, the local models show better performance compared to the global model. The paper contributes by providing original empirical findings to the main streams of the public procurement governance with REBUS-PLS which is not a common approach. The study concludes that significant unobserved heterogeneity existed regarding transparency, accountability, competition, legal frameworks and value for money from a viewpoint of local government in Tanzania.

Keywords: • unobserved heterogeneity • procurement governance • transparency • local government • value for money • REBUS-PLS

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1. Introduction

Public procurement and whether funds are well managed by government units are increasingly considered core elements of accountability in the public sector (Ukwandu & Jarbandhan, 2016). As explained by Boehm & Olaya (2006), it has been opined that Africa's public procurement crisis about governance is due to a lack of transparency and accountability, a weak legal framework and inadequate competitive procedure which propelling high levels of corruption. The emerging economy including Tanzania fails to mediate this crisis regarding the public procurement governance in local government despite amended the public procurement acts (Zadawa, Hussin, & Osmadi, 2018; Hughes, Morrison, & Ruwanpura, 2018). These problems have spillovers and hindered procurement efficiency in local government (see Janggu, Darus, Mohamed, & Sawani, 2014; Israr & Islam, 2006; National Audit Office, 2018). Meanwhile, examining the pillars of the core governance principles with respect to public procurement and value for money is pivotal for local government performance evaluation.

Procurement governance in the local government is vital in managing finances and public operations. This is the decisive feature for gaining a citizens' trust (Khalid & Said, 2016). Juiz, Guerrero, and Lera (2014) had recently advocated the implementation of procurement governance principles and aired the significance of governing information in the public sector. A framework for information governance on procurement is a stepping stone for rebuilding and strengthening accountability, transparency, competition, legal frameworks and value for money in the local government (e.g., Brinkerhoff & Wetterberg, 2015; Fairbanks, Plowman, & Rawlins, 2007). Meanwhile, there are some limitations in developing countries regarding the implementation of procurement governance, such as clarity of communication and public asset mismanagement, which retard the best procurement governance practices (Estache & Bank, 2009; Galletta, Jammeti, & Redonda, 2015; Crawford, Lille, & Systems, 2009; Heald, 2018). The foundation and formation of the public sector should adhere to the principles of public procurement governance and financial governance. However, public procurement governance in a viewpoint of local government in Tanzania has been challenged with a disfigured public procurement report (National Audit Office, 2018). To address these challenges in the local government few studies have been paid attention regarding the public procurement governance and value for money (e.g., Pitelis, 2004; Hughes et al., 2018; Demirag & Khadaroo, 2008; Atta-panin, 2015). However, these studies fall short on examining public procurement governance in a view point of local government and precisely applying the Response-Based Unit Segmentation - Partial Least Squares (REBUS-PLS) to uncover the unobserved heterogeneity.

In those premises, this paper addressed these gaps by building on the REBUS-PLS and assessing unobserved heterogeneity in public procurement governance.

And determining the existence of latent classes with homogeneous behaviors in public procurement governance from a local government perspective. Examining heterogeneity using the REBUS-PLS is significant in identifying the critical source of heterogeneity which is ideal for a practical and managerial implication. In a similar critic, treating the whole sample as homogeneous is not appropriate and might influence outcomes and yields a wrong conclusion (Trinchera, 2011; Sanchez, 2013). Indeed, assessing unobserved heterogeneity in this paper is unlikely to previous studies, and we made a further step of uncovering the quality of unit partitions for local models using the effects' sizes (f^2) and permutation tests with regards to legal frameworks and value for money which is quite infrequent. REBUS-PLS was used to measure and assess the units of the model residuals, which are referred to as closeness measures and help in detecting local models that perform better in terms of measurement and structure parameters compared to global models. The local models were assessed implicitly with a global model and analysis basing on the goodness of fit (GoF) index and group quality index (GQI), an effects' sizes and permutations tests (Trinchera, 2007; Vinzi, Ringle, Squillacciotti, & Trinchera, 2008; Assaker & Hallak, 2016).

This study applied REBUS-PLS and identified four latent classes that show heterogeneous behavior patterns. The path coefficient of the global model between accountability and the legal frameworks are strongly correlated and paper labeled this as; "accountability-legal frameworks driven individual" (Venugopal & Yilmaz, 2010; Hyndman & Ireland, 2008; Atta-panin, 2015; Gaventa & Mcgee, 2013). The paper affirms that all six tested hypotheses were significant at the global model after executes the bootstrap. By contrast, the local models show better performance in the outer and inner structures compared to the global model. Local models reveal a better observation performance and particularly the classes 3 and 4 compared to the global model, these discrepancies cast light on existence unobserved heterogeneity in public procurement governance realm in local government. The study uncovers substantial influence dependent variables using the effects' sizes (f^2). The class three and four as regarded to have strong effects' sizes implicitly with the global model. Indeed, there is a great improvement of the GQI which surpassed the GoF index at the aggregate level. The GQI after partitioning was 28%, which was far above of thresholds (Vinzi, Trinchera, & Amato, 2010; Trinchera, 2007; Assaker & Hallak, 2016; Trinchera, 2011; Sanchez, 2013). The permutation tests result for four class solutions singled out the rejection of the null hypothesis.

The paper fills the gap to the main streams of the public procurement governance by providing original empirical findings on unobserved heterogeneity with REBUS-PLS from a viewpoint of local government which is not a common approach. Take, the paper suggested the countermeasures rejuvenate procurement ethics and wipe out existing unobserved heterogeneity in a local government such as: regular monitoring of best procurement practices, the evaluation of

accountability and the regulatory framework, procurement integrity and consistency adhering to procurement ethics. The future direction is to conduct a binary segmentation tree analysis using the demographic variables such as age and gender to uncover heterogeneity (Pathmox).

The article is structured as follows. The next section presents the theoretical background and hypothesis development, and the research model. Subsequently, the article presents the methodology, a description of the REBUS-PLS, data and description analysis, measures, and the model estimations for REBUS-PLS. In the results section, the paper evaluates the measurement and structure of the global and local model (REBUS-PLS) and presents findings. The paper finishes by presenting a discussion, conclusion, future research direction and study limitations.

2 Theoretical Background and Hypothesis Development

2.1 Public procurement transparency and value for money

Transparency is the key feature for procurement governance in the local government and also sustaining the value for money. Williams-elegbe (2015) asserted that the local government needs public procurement reforms and precisely reviewing transparency frameworks with regards to existing challenges. He compares and highlights trends of the procurement reforms in Africa. Indeed, the paper uncovers that there is void of transparency about regulations, procedures and effective processes sharing information across divisions in local government. Fairbanks, Plowman and Rawlins (2007) labeled the role of transparency across government communication units and they identified that the governance platform structure helps promote transparency in the public sector. To this end, transparency is often suggested as a tool to wipe out corruption in the local government (see Neupane, Soar & Vaidya, 2014; Estache & Bank, 2009; Galletta, Jammeti & Redonda, 2015; Crawford, Lille, & Systems, 2009). Transparency procurement procedures contribute to resource mobilization and a high level of competition among bidders and propel the public procurement governance quality (Imperial et al., 2016). By contrast, the public procurement reforms are affected by geopolitical influences across African regions. This weakens the best practices of procurement governance in the local government (Williams-elegbe, 2015). In a similar vein, the harmonization approach to public procurement governance might be diminished by ongoing geopolitical influence, but the lack of solid transparency frameworks exacerbated further the governance limbo (Venugopal & Yilmaz, 2010). Take, the public procurement depends largely on transparency to be more effective while this is a missing part of the puzzle in local government. As labelled by Filgueiras (2016) the principle rules of good governance includes transparency and accountability. These two principles are influencing the public opinion and trust. Therefore, the best public procurement governance in a local

government is an outcome of the effectiveness and efficiency of transparency and accountability (Gaventa & Mcgee, 2013). Therefore, we hypothesize the following:

Hypothesis 1: Public procurement transparency has a significant positive effect on the value for money.

2.2 Public procurement transparency and legal frameworks

The quality of the legal and regulatory framework is a key indicator in governing public procurement transparency. For example, Bröchner, Camen, Eriksson & Garvare (2016, pp.649) focused on the "evaluation in the quality of the legal aspects in public procurement governance." And their findings show that legal frameworks with regards to transparency lead to equal consideration of tendering processes in the local government. While Rothery (2003) has recently described the legal frameworks for public procurement governance and revealed existing of the unique challenges about legal frameworks in Mainland China. The two systems of laws exist in Mainland China and precisely tendering and bidding law falls short to govern the level of transparency and best procurement practices. To this end, the role of transparency implicitly with legal frameworks to strengthening the good governance in local government. The blueprint for public procurement transparency and legal framework in the local government is significant to rebuilds the procurement transparency and legal frameworks in the local government (Boehm & Olaya, 2006; Noor, 2009; Heald, 2018). Therefore, we hypothesize the following:

Hypothesis 2: Public procurement transparency has a significant positive effect on the legal framework.

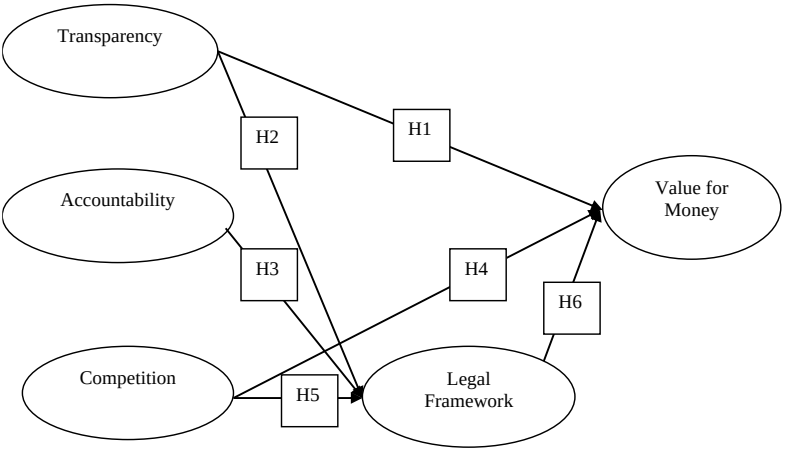
2.3 Public procurement accountability and Legal frameworks

The attempts made by Venugopal and Yilmaz (2010) to evaluate the local government procurement accountability in various procurement units revealed that the sub-national governance accountability structures are not well organized and coordinated. In those premises, the immature decentralization policy of local government has substantial ramifications for efficiency on public procurement accountability and legal frameworks. Mahieu and Yilmaz (2010) aired a similar critic when determined decentralized units' level in Burkina Faso, where great challenges were uncovered regarding weak principles of public procurement accountability. To this end, the public procurement accountability and legal frameworks are two equal sides in the same coin, and urges to coexist in the local government and influence the level of public procurement governance (see Zadawa, Hussin, & Osmadi, 2018; Hughes, Morrison, & Ruwanpura, 2018). Take, the public information is pivotal to the public procurement accountability structure in the local government. A clear public procurement accountability structure improves operational performance and reduces fraud in local

government units. In contrast, Anand and Sossin (2018,pp.16) described that "procurement accountability should be implemented by an independent entity." However, the public procurement officers in local government have limited independence entity regarding public procurement scope. To this end, procurement accountability and legal frameworks are blurring from unorganized operations frameworks at the local government. Therefore, we hypothesize the following:

Hypothesis 3: Public procurement accountability has a significant positive effect on legal frameworks.

Figure 1: Theoretical Research Model



2.4 Public procurement competition and value for money

Public procurement competition is developed through rules of procurement and designed to encourage the full participation of all the possible key potential players to the public procurement cycle. The integration of public procurement competition into procurement regulations with the intention of obtaining the best price, quality, and contract terms improve credibility with regards to value for money (Williams-elegbe, 2015). Take, the sign of a positive impression of the level of procurement competition on the discrepancy between the anticipated and award revenue highlights the need for local government to use open procedures involving adequate applicants as a primary option whenever possible. Some of the benefits of procurement competition include potential savings and competitive tendering which lead to substantial value for money in the local government (Pitelis, 2004). In a similar context, Galletta, Jametti and Redonda (2015,p.240) stated, in reference to "public works tenders and bidders in the Democratic Republic of the Congo (DRC)" and uncover procurement competition

significantly reduces the contract price. On the other hand, Johansson and Siverbo (2018) had investigated procurement competition in a supplier alignment and reveals that controlling alignment decreases with supplier competition. To this end, the interplay of public and private partnerships (PPPs) and public procurement competition is decisive for bidding and tendering procedures. Furthermore, the analysis of procurement competition in a spectrum of PPP procurement and value for money through a periodic strategic is significant in the viewpoint of local government (Mols, 2010). Therefore, we hypothesize as follows:

Hypothesis 4: Public procurement competition has a significant positive effect on value for money.

2.5 Public Procurement competition and Legal frameworks

The public procurement competition task can be regarded as competitively if moderated by legal frameworks. Wan (2014) has advocated that the procurement competition, if not considered, might be lessening the legal frameworks as an effective instrument in public procurement. The public procurement competition is an effective instrument and furthering refines the market structure for local government. Take, Johansson and Siverbo (2018) had recently labeled the significance of balancing between public procurement competition with transparency from the viewpoint of the European Union (EU) and shows that unorganized competition frameworks lead to fragmented public procurement governance. These disclosure rules may help in the moderation between procurement competition and transparency. Certainly, the procurement competition influenced by the strength of institutions and organizations about local government. As suggested by Skuhrovec and Soudek (2016) that the institutional procedures for procurement competition influence the final unit price and the final price is decreased when the procurer attracts more competitiveness that is governed by pre-defined legal frameworks. Therefore, we hypothesize the following:

Hypothesis 5: Public procurement competition has a significant positive effect on legal frameworks.

2.6 Public procurement legal frameworks and value for money

Legal frameworks act as the hub in controlling the level of public procurement transparency. Ibrahim et al. (2017) had recently connoted public procurement laws and value for money. They reveal that legal frameworks are not a predetermining factor for value for money in the local government. And the evidence of compliance in developing countries is a façade. Take, although the legislative and regulatory framework is fundamental pillars in the local government, but the central government faces governance void on procurement standard procedure (Zadawa, Hussin, & Osmadi,2018). The aims of the

procurement rules and regulations are to ensure that transparency and accountability are uniformly achieved in procedures and fairness among stakeholders (see Gaventa & Mcgee,2013; Janggu, Darus, Mohamed, & Sawani, 2014; Israr & Islam, 2006). To this end, legal frameworks and value for money from a viewpoint of local government have shown a downward trend and public procurement legal frameworks might be a façade (Venugopal & Yilmaz, 2010; Ibrahim et al., 2017). Therefore, we hypothesized the following:

Hypothesis 6: Public procurement legal frameworks have a significant positive effect on value for money

This paper is unlikely to previous studies **(**Gaventa & Mcgee,2013; Janggu, Darus, Mohamed, & Sawani, 2014; Israr & Islam, 2006; Venugopal & Yilmaz, 2010; Demirag & Khadaroo, 2008). We critically applied the REBUS-PLS, and the paper reveals the quality of local unit partitions using the effects' sizes and permutation tests which is not a common approach. Moreover, the paper uncovers the original empirical findings regarding unobserved heterogeneity and precisely on transparency, competition, accountability, legal frameworks and value for money which remains underdeveloped and under-researched in the context of the local government. The next section paper presents the methodological underpinnings.

3 Methodology

3.1 A Description of REBUS-PLS

The Response Based Unit Segmentation in Partial Least Squares (REBUS-PLS) – Path Modeling is an iterative algorithm that starting from the global model and enhancing the detecting of local models by performing simple partial least squares - path modeling analysis. Indeed, the algorithm set the cluster of study samples. This procedure sheds light on the performance of local models compared to the global model (Vinzi, Ringle, Squillacciotti & Trinchera, 2007). The second step is the commonality and structural residual of each unit at the global model are uncovered. The numbers of classes were identified through cluster analysis obtained from the computed residual of the structural and measurement model (Trinchera, 2007). Simple PLS-PM analysis was calculated in each class, and the local models were estimated. Communality and structured residual in each local model were highlighted, certainly, the closeness measures were revealed. The closeness measure was allegedly described according to the GoF Index (Tenenhaus, Amato & Vinzi, 2000). The set of units were assigned to the closest local models. Subsequently, the quality of the unit partitions of the local model can be evaluated by the new index (GQI) (Trinchera, 2011). Indeed, the permutation procedure was calculated and applied to a GQI for the purpose of validating the detected classes (Chin & Dibbern, 2010). If the concomitant variables exist, an e*x-post* analysis might be performed in the latent classes. The

paper used REBUS-PLS because it is significant in identifying the critical source of unobserved heterogeneity which is ideal for a practical and managerial implication. Furthermore, the REBUS-PLS approach is a distribution-free methodology and assessing the quality needs varieties of parameters to specify model fit.

3.1 Sample and Descriptive Analysis of the Variables

Table 1: Descriptive Analysis of Demographic Profile

Demographic	Sample=*N*	Minimum	Maximum	Mean	Std. Deviation
Sex	269	1.00	2.00	1.3420	.47527
Age	269	10.00	59.00	39.1859	8.64445
Experience	269	1.00	37.00	10.1264	7.02174
Valid N	269				

The study used the administered survey questionnaire and data collected from 269 respondents randomly selected from the various government departments in the local government of three regions in northern Tanzania namely: Tanga, Arusha, and Kilimanjaro. The Composition of the participants involved in this study was randomly and stratified selected from three regions respectively. The participants include members of the tender committee, Public Procurement Unit (PMU) members, public procurement officers, suppliers, consultants, contractors and assembly members. The demographic profiles analysis of the respondents is presented in table 1; 66% are male, and 34% are female. The mean scores are as follows: gender 1.34, age 39.18, and experience 10.12. The standard deviation score: gender 0.47, age 8.64 and experience 7.02. Appendix A presents a description of the latent construct codes with a set of Manifest Variables (MVs).

3.2 Measures

The paper measured each construct in the model with the set of an indicator block. Moreover, the indicators were measured from scale scores of one to ten. The MV's were classified into five blocks that referred to as latent constructs (Assaker & Hallak, 2016). The exogenous variable includes transparency, accountability and competition while the endogenous variables are legal frameworks and value for money. The indicators were distributed to each construct as follows; transparency (nine indicators), accountability (eight indicators), competition (nine indicators), legal frameworks (eight indicators), and value for money (seven indicators). The paper set a measurement model of five latent variables as a reflective indicator (Sanchez, 2013). The study prepares the global model observations (N=269) using the path matrix, the list of blocks and the vectors modes. The clustering analysis was conducted using the ward method to validate the steps of REBUS-PLS. The

paper used "plspm" package in R for model estimations and result from analysis (Sanchez, Trinchera, & Russolillo, 2017).

3.3 Model Estimations for REBUS-PLS

The paper used the REBUS-PLS to explain the performance of the measurement and structural models regarding public procurement governance in a local government. The REBUS-PLS identified four classes which referred to as the local models. The paper assesses and estimates the distance among the units identified in the model focusing on residuals (closeness measures) (Vinzi & Trinchera, 2006). The REBUSS-PLS model estimations qualities are furthering using a GoF index, an effects' sizes, a GQI and permutation tests.

3.3.1 Goodness of Fit (GoF) Index

The model estimation and validation are determined by the prediction capability; the proposed fit index is the GoF index (Vinzi et al., 2008). The GoF index has two parts: the performance model and the inner structure. The left side includes performance model observations (average communality), and the right side is the inner or structural model (coefficient determination). The paper explains the closeness measure in the model using the structure of the GoF index, the average communality index and the coefficient determination (R^2), which measure the qualities of the inner structural (Tenenhaus, Amato, & Vinzi, 2000; Ringle, Squillacciotti, & Trinchera, 2007). In a similar vein, Tenenhaus et al. (2000) presented the GoF structure as follows:

$$\mathrm{GoF} = \sqrt{\frac{\sum_{q=1}^{Q}\sum_{p=1}^{Pq}\mathrm{Corr}^2(X_{pq},\xi_p)}{\sum_{q=1}^{Q}P_q} X \frac{\sum_{m=1}^{M}R^2\left(\xi_m\left\{\xi_{j's\ \text{explaining}\ \xi_m}\right\}\right)}{M}} \quad \ldots\ldots\ldots\ldots \quad (1)$$

From the above GoF structure, the Q=5 represents the total number of latent classes, namely, accountability, transparency, competition, legal framework and value for money, in the estimated global model (see figure 1). M=2 is the endogenous class (legal framework and value for money), while $P_{q=}$ 41 is the total number of MVs. In these premises, the residual was obtained after the cluster analysis of the global model. The evaluation of the closeness measure shed light for further analysis and paper identified four latent classes (K=4), and for that reason, the GoF index was reformulated using the REBUS-PLS leading to the GQI (Trinchera, 2007).

3.3.2 Group Quality Index (GQI)

The quality of the four identified latent classes was determined using the GQI. After the ex-post analysis, the detected classes were analyzed. If the local model

performs better than the global model, the detected GQI will surpass the GoF at the aggregate level. Tenenhaus et al. (2000) have singled out the GQI of the K classes can be expressed as:

$$GQI = \sqrt{\frac{1}{\sum_q p_{q>1} p_q} \sum_{qp_{q>1}} \sum_{p=1}^{P_q} \left(1 - \frac{\sum_{i=1}^{N} e_{ipq}^2}{\sum_{i=1}^{N} (x_{ipq} - x_{pq})^2}\right) x \frac{1}{j} \sum_{j=1}^{j} \left(1 - \frac{\sum_{i=1}^{N} f_{ij}^2}{\sum_{i}^{N} (\xi_{ij} - \xi_{pq})^2}\right)} \quad ..(2)$$

The paper computed the GQI of the global model which is equal to the GoF of the whole sample model (N=269). The GQI has considered the mean of the class identified GoF index (Vinzi et al., 2008). The Equation (2) provides the mandate to investigate and compare the units' partitions of (K= 4) basing on measurement and structural parameters.

3.3.3 Permutation Testing

The study conducted permutation tests and measured the quality of the detected partitions of the local models. The paper conducted T random replications between local models 1 and 2, local models 1 and 3, local models 1 and 4, local models 2 and 3, local models 2 and 4, and local models 3 and 4 applying the REBUS-PLS for unit partitions while the group proportions were held constant, and the empirical GQI was successfully obtained. However, the null hypothesis was rejected. According to Trinchera (2007), if empirical distributions are lower than the normal thresholds of P <0.5, this propels the rejection of the null hypothesis. The null hypothesis considering partition models is homogeneity, while the alternative takes into account the heterogeneity of local models after a permutation test procedure (Lamberti, 2015). Indeed, the total units for each class were local model 1 (N=95 units), local model 2 (N=74 units), local model 3 (N=55 units) and local model 4 (N=44 units). The next section presents the results of the global model and REBUS-PLS (local models) with respect to the GoF index, effects' sizes, GQI and permutation tests.

4 Results

The paper presents the results of the global model and REBUS-PLS (local models): local model 1, local model 2, local model 3, and local model 4. Furthermore, we address the measurement and structural parameters of the global and local models by focusing on the path coefficient distributions, GoF index, effects' sizes, GQI, and permutation testing.

4.1 Global Results (Partial Least Squares- Path Modeling)

The global model (aggregate level) results are presented using a partial least squares-path modeling approach. The block homogeneity in the global model is measured by three indexes, namely, Cronbach's alpha, Dillon Goldstein's rho and Average Variance Extracted (AVE) (see table 3). The Cronbach's alpha at the global level was above the normal threshold of 0.70, and the factor loadings that measure indicator reliability was above >0.5 (see Appendix B) (Hair, Ringle & Sarstedt, 2014). The composite reliability captured by Dillon Goldstein's (rho) is higher than 0.7 (Assaker et al., 2018). The average variance extracted was greater than 0.5, indicating that the execution of the constructs was satisfactory (Henseler & Sarstedt, 2013). The reliability and validity of the global model were accepted and satisfactory. These results on block homogeneity demonstrated the convergent validity enough and thus, the inner structure of the global model and REBUS -PLS can be estimated.

The results of the path coefficient distributions at the global model are comprehensively presented as follows (see table 3): accountability and legal frameworks (0.410**); competition and legal frameworks (0.205**); transparency and legal frameworks (0.169**); competition and value for money (0.411**); transparency and value for money (0.159**); and the legal framework and value for money (0.271**). The paper affirms that all six tested hypotheses (*H=6*) were significant at the global level (*N=269*) after applied 1000 resamples (bootstrap) with a percentile of 95.5 (see table 3).

Table 2: Cronbach's Alpha, rho DG, and AVE values

	C. alpha					**DG.rho**				
Global/Local model	**GM**	**LM 1**	**LM 2**	**LM 3**	**LM 4**	**GM**	**LM 1**	**LM 2**	**LM 3**	**LM 4**
Number of units	**269**	95	75	55	44	**269**	95	75	55	44
Latent Class/Mode	**A**	A	A	A	A	**A**	A	A	A	A
Transparency	**0.9**	0.9	0.8	0.9	0.9	**0.9**	0.9	0.9	0.9	0.9
Accountability	**0.9**	0.9	0.9	0.9	0.9	**0.9**	0.9	0.9	0.9	0.9
Competition	**0.9**	0.9	0.8	0.9	0.9	**0.9**	0.9	0.9	0.9	0.9
Legal Frameworks	**0.9**	0.8	0.7	0.9	0.9	**0.9**	0.9	0.8	0.9	0.9
Value for Money	**0.9**	0.9	0.9	0.9	0.8	**0.9**	0.9	0.9	0.9	0.9

	AVE				
Global/Local model	**GM**	**LM1**	**LM2**	**LM3**	**LM4**
Number of units	**269**	95	75	55	44
Latent Class/Mode	**A**	A	A	A	A
Transparency	**0.6**	0.6	0.5	0.6	0.7
Accountability	**0.7**	0.6	0.6	0.7	0.8
Competition	**0.6**	0.6	0.5	0.6	0.6
Legal Frameworks	**0.7**	0.5	0.3	0.7	0.80
Value for Money	**0.7**	0.7	0.6	0.7	0.6

Note: Bold values represent global model results, MV=manifest variables; C. alpha= Cronbach's alpha; DG.rho= Dillon Goldstein's rho; AVE=average variance extracted, GM=Global Model, LM=Local Model

The paper presented the predictive performance of the global model by evaluating the average communality, average redundancy and inner structure (GoF and R^2). The global model's coefficients of determination (R^2) for the two endogenous constructs are legal frameworks (0.53) and value for money (0.58), while the GoF index is (0.604) for the global model (see table 3). The average commonality at the global level was transparency (0.617), accountability (0.688), competition (0.571), legal frameworks (0.704) and value for money (0.699) (see table 3); the average redundancy for the endogenous constructs was legal frameworks (0.378) and value for money (0.408) (see table 3). The global model performance observations and inner structure are considered moderate (R^2 0.5 - 0.6) (Hair et al., 2014). The next section presents the REBUS-PLS (local models).

4.2 REBUS -Partial Least Squares-Path Modeling (Local Models)

Table3: Permutations Test

Latent Class	Path Coefficients		Path Coefficients	
	LM1	**LM2**	**LM2**	**LM3**
Transparency-legal Frameworks	0.4073	0.1378***	0.1378	0.5061***
Transparency-Value for Money	-0.1157	-0.1907***	-0.1907	0.9693***
Accountability-legal Frameworks	0.3653	0.3727***	0.3727	-0.3089***

Latent Class	**Path Coefficients**		**Path Coefficients**	
	LM1	**LM2**	**LM2**	**LM3**
Competition-Legal Frameworks	0.1559	0.3171***	0.3171	0.7211***
Competition -Value for Money	0.3836	0.2967***	0.2967	0.5110***
Legal Frameworks-Value for Money	0.5614	0.6472***	0.6472	-0.6038***
GoF	**0.65**		**0.56**	
	LM1	**LM3**	**LM2**	**LM4**
Transparency-legal Frameworks	0.4073	0.5061***	0.1378	0.3857***
Transparency-Value for Money	-0.1157	0.9693***	-0.190	0.5815***
Accountability-legal Frameworks	0.3653	-0.3089***	0.3727	1.0699***
Competition-Legal frameworks	0.1559	0.7211***	0.3171	-0.5837***
Competition -Value for Money	0.3836	0.5110***	0.2967	0.3176***
Legal Frameworks-Value for Money	0.5614	-0.6038***	0.6472	0.0803***
GoF	**0.65**		**0.61**	
	LM1	**LM4**	**LM3**	**LM4**
Transparency-legal Frameworks	0.4073	0.3857***	0.5061	0.3857***
Transparency-Value for Money	-0.1157	0.5815***	0.9693	0.5815***
Accountability-legal Frameworks	0.3653	1.0699***	-0.3089	1.0699***
Competition-Legal Framework	0.1559	-0.5837***	0.7211	-0.5837***
Competition -Value for Money	0.3836	0.3176***	0.5110	0.3176***
Legal Frameworks-Value for Money	0.5614	0.0803***	-0.6038	0.0803***
GoF	**0.65**		**0.66**	

Note: *P-value less than 0.1; **P-value less than 0.05; ***P-value less than 0.01: LM= local model

The REBUS-PLS measures the unit distance of the model considering structural, and measurement models (Vinzi et.al, 2008; Assaker & Hallak, 2016). The study customized REBUS-PLS and uncovered four classes with heterogeneous behavior patterns in the structural and measurement models. The block homogeneity in the local models is measured by three indexes, namely, Cronbach's alpha, Dillon Goldstein's rho. Dillon Goldstein's rho and Cronbach's alpha are above

thresholds of 0.7 and thus, confirmed the reliability and validity of constructs (Fosso, Bhattacharya, Trinchera, & Ngai, 2017) (see table 3). The indicators reliability is above the normal threshold of 0.5 (see Appendix B), this indicates that more than 50% of the latent constructs are justified (Henseler & Sarstedt, 2013). These results on block homogeneity of local models demonstrated the convergent validity enough and inner structure can be estimated.

Class 1 comprised 95 units (35%) of the whole sample. The path coefficient distributions in (class 1) as follows: transparency and legal frameworks (0.407), legal frameworks and value for money (0.561), competition and value for money (0.383) and accountability and legal frameworks (0.365), are greater than those of the global model (see table 3). There was a weak correlation between transparency and value for money (-0.115). The predictive capability of class 1 considering average communality, average redundancy and AVE was greater than 0.5 and was accepted (see table 3); the average redundancies of the endogenous constructs were legal frameworks (0.422) and value for money (0.45). The inner structures of class 1 (R^2) were legal frameworks (0.77) and value for money (0.63), which were greater than those of the global level. The GoF index of class 1 was 0.70, which surpassed the GoF at the global level (see table 3).

Class 2 was characterized by 75 units (28%) of the whole sample from the global model (see table 3). The path coefficient distributions in (class 2) were legal frameworks and value for money (0.647), accountability and legal framework (0.372), competition and legal frameworks (0.317), and competition and value for money (0.296); and there was a weak relationship between transparency and value for money (-0.190). The performance observation with regards to average communality and average redundancy of the endogenous variable was accepted (see table 3). The structural model in class 2 (R^2) for the legal frameworks is 0.53.7 (54%) and for value for money 0.54 (54%); the GoF index is 0.53. The coefficient of determination (R^2) and GoF are substantially lower in class 2 than in the class 1 global model (see table 3).

Class 3 comprised 55 units (20%) of the whole sample from the global model (see table 3). The coefficient distributions in (class 3) were transparency and value for money (0.969), competition and legal frameworks (0.721) and competition and value for money (0.511), which were substantially higher than those in class one, class two and the global model. Even though there was a strong link between the path coefficients, weak relationships do exist: legal frameworks and value for money (-0.603) and accountability and legal frameworks (-0.308). The performance observations about constructs were above 0.7 and were accepted. The inner structure (R^2) for a legal framework was 0.88 (88%), value for money 0.83 (83%) and GoF index 0.76. The predictive performance and inner estimates were higher than those in class 1, class 2 and at the aggregate level (see table 3).

Class 4 was characterized by 44 units (16%) of the whole sample from the global model (see table 3). The path coefficient distributions in (class 4) were as follows: accountability and legal frameworks (1.069), transparency and value for money (0.581), transparency and legal frameworks (0.385), competition and value for money (0.317), and legal frameworks and value for money (0.080). A weaker relationship does exist in the link between competition and legal frameworks (-0.583). The performance observation about average communality and average communality is above 0.7 for the latent constructs was accepted. The inner structure (R^2) for legal frameworks is 0.87 (87%) and for value for money is 0.85 (86%), and the GoF index was 0.77. The inner and outer structures of class 4 were better than those of classes 1, 2, 3 and the global level (see table 3).

The paper made an auxiliary step of inspecting quality of unit partitions of local models using the R^2 metrics of the endogenous variables implicitly with the global model. From the local models R^2 we revealed substantial influence dependent variables using the effects' sizes (f^2) (Fassott, Henseler, Hubona & Coelho, 2016). The effects' sizes in class three and four regarded as strong effects' sizes. We uncover the following classifications: class 3 legal frameworks (f^2= 0.7) and value for money (f^2= 0.5), class 4 legal frameworks (f^2= 0.7) and value for money (f^2= 0.6). The class three and four effects' size are above 0.35 which is considered strong (Cohen, 1988). However, findings uncover weaker effects' sizes in class one and two: class one legal frameworks (f^2= 0.5) and value for money (f^2= 0.1), and class two legal frameworks (f^2= 0) and value for money (f^2= 0.02). These effects' sizes regarded as weak (Chin, Marcolin & Newsted, 2003). We suggest the weaker effects' sizes in class one and two as an outcome of unobserved heterogeneity in public procurement governance in a view point of local government in Tanzania. In that premises, the exogenous variables; transparency, accountability and competitions were the strong predictors in local model compared to the global model, the similar result were organized by Bröchner et al. (2016).

4.3 The Group Quality Index (GQI)

The study further reveals unobserved heterogeneity after group partitions (GQI) (Vinzi et al, 2008). The GQI (see table 3) is 0.77, which is higher than the GoF index at the global model, which was 0.604. There was great improvement in the GQI, which was 28% and above the normal thresholds after the local model class partitions. The improvement in the GQI of greater than 25% after the group partitions is considered to be significance (Trinchera, 2007).

Figure 2: Cluster Dendrogram for four class solutions

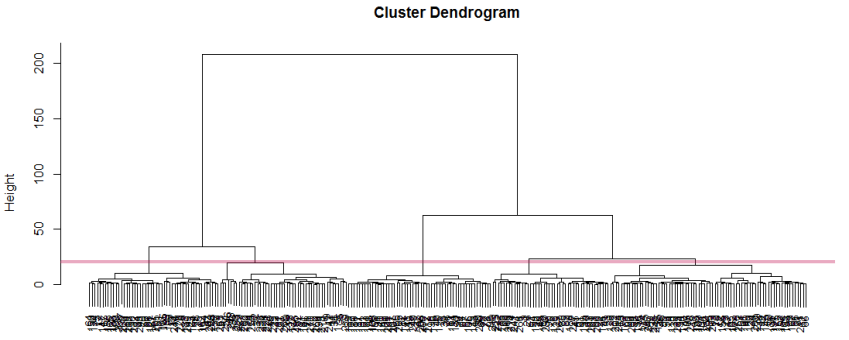


Figure 2 describes the cluster dendrogram and shows the ab line cut on four specific segments that represented our chosen latent classes $n=k$ of the model. The residuals were obtained after we had conducted a cluster analysis of the global model. The four local model quality results with regards to performance observation and inner structures surpassed the global level (see table 3). This further cast light on the existing unobserved heterogeneity. (Vinzi et al., 2010).

4.4 Permutation Tests

Table 4: Quality of Classes

Group Quality Index (GQI) =0.77	**GM**	**LM1**	**LM2**	**LM3**	**LM 4**
Number of Units	269	95	74	55	44
Proportions %	100	35	28	20	16
Latent Class/path coefficients					
Transparency-Legal Frameworks	**0.1691**	0.4073	0.1378	0.5061	0.3857
Transparency-Value for Money	**0.1597**	-0.1157	-0.1907	0.9693	0.5815
Accountability-Legal Frameworks	**0.4109**	0.3653	0.3727	-0.3089	1.0699
Competition-Legal Frameworks	**0.2056**	0.1559	0.3171	0.7211	-0.5837
Competition-Value for Money	**0.4112**	0.3836	0.2967	0.5110	0.3176
Legal Frameworks-Value for Money	**0.2718**	0.5614	0.6472	-0.6038	0.0803
Aver. Communality					
Transparency	**0.617**	0.643	0.525	0.607	0.675
Accountability	**0.688**	0.662	0.619	0.743	0.769
Competition	**0.571**	0.591	0.504	0.618	0.576
Legal Frameworks	**0.704**	0.543	0.344	0.697	0.827
Value for Money	**0.699**	0.706	0.639	0.690	0.587
Aver. Redundancy					
Legal Frameworks	**0.378**	0.422	0.185	0.613	0.720
Value for Money	**0.408**	0.449	0.347	0.571	0.502
Coefficient Determination (R^2)					
R^2 Legal Frameworks	**0.537**	0.777	0.537	0.879	0.870
R^2 Value for Money	**0.583**	0.636	0.542	0.828	0.855
Goodness of the Fit Index (GoF)					
GoF	**0.604**	0.667	0.533	0.757	0.770
Group Quality Index Improvement	**28%**				

Note: GoF=Goodness of the Fit Index, R^2= Coefficients determination, GM=Global Model, LM=Local Model

The permutation tests of the local models focusing on four class solutions included local models one and two, local models one and three, local models one and four, local models two and three, local models two and four, and local models three and four. We reject the null hypothesis and aligned with the alternative hypothesis (heterogeneity) among the latent class detected. The GoF indexes after the permutation tests were as follows: local model one and two (0.65), local model one and three (0.65), local model one and four a (0.65), local model two and three (0.56), local mode two and four (0.61), and local model three and four (0.66) (see table 4). The GoF yields a higher score in the latent classes after the permutation tests compared to the global model. The next section closed with the discussion, conclusion, future research directions and study limitations.

5 Discussion and Conclusion

The main objectives of the paper were to apply REBUS-PLS and examine the unobserved heterogeneity in the public procurement governance. And identify if there are existing classes in the procurement governance with homogeneous behavior patterns. The paper uncovered unobserved heterogeneity by analyzing the local models considering the inner structure and coefficients distribution. The paper made a further step of accustoming the GQI, effects' sizes and permutation tests to reveal the quality of REBUS-PLS regarding the unobserved heterogeneity. Therefore, the following are discussions of the REBUS-PLS (local models) implicitly with the global model:

5.1 Class Coefficient Distribution and Inner Structure

Class 1 comprised 35% of the whole sample from the global model and showed a strong relationship between legal frameworks and value for money. This finding timidly suggests that individuals belong to the group of “legal frameworks-value for money driven individuals.” This result entails the consistent legal frameworks should be considered as tool to wipe out corruption measure and upholding of procurement ethics in Tanzania (Boehm & Olaya, 2006; Fairbanks *et al.*, 2007). In a similar vein, the paper suggests legal frameworks are one of the key pillars in public procurement governance in Tanzania (Zadawa, Hussin & Osmadi, 2018). Furthermore, there is a weak correlation between transparency and value for money. We apprehensively argue that there is limited access to public information flow in the public procurement system in the local government in Tanzania (Gaventa & McGee ,2013).

Class 2 contains 28% of the whole sample from the global model, with a strong correlation between legal frameworks and value for money. This result is comparable to that of the class one “legal frameworks-value for money driven individuals.” However, this result contradicts to those obtained by Awino and Marendi-getuno (2014) uncovered weak enforcement of public procurement legal

framework in government in Kenya. The paper also labelled other individuals to this class as "accountability and legal frameworks driven individuals." This finding suggests that there is effective internal audit, commitment and responsibility regarding the accountability in public procurement decisions in local government in Tanzania (Crawford & Helm,2009). The paper further suggesting existence of high performance of procurement system and accountability procedures for bidder's selection in local government in Tanzania.

Class 3 comprised 20% of the whole sample from the global model. The path that links transparency and value for money was considered the strongest relationship. The paper labelled the Individuals in class 3 as "transparency-value for money driven individuals." This reveals existence of clear open bidding procedure accessed to public policy and dissemination of procurement information in local government in Tanzania. We argue that this contributes to the procurement ethos and performance in local government (Demirag & Khadaroo 2008). This groups of individuals in this class subsequently uncovered clear communication, trust and credibility (see Fairbanks, Plowman, & Rawlins, 2007). By contrast, there is weak relationship does exist in the path of accountability and legal frameworks. This suggests that in local government there are gaps regarding the procurement system, inadequate accountability and commitment of procurement officers (Mahieu & Yilmaz 2010).

Class 4 consisted of 16% of the whole sample from the global model and is characterized by a strong link between accountability and legal frameworks. The individuals in this class are classified as "accountability-legal frameworks driven individuals." This outcome is comparable with regards to class three. This advocate that public procurement officers are responsible in public procurement cycle. The procurement ethics are highly emphasized among the individuals in the local government in Tanzania. However, these findings are contradicting compared to those labelled by Anand and Sossin (2018). Certainly, the paper uncovered the weak relationship in the link of the competition and legal frameworks. We suggest that there is lack of participation of bidders in public procurement process in local government in Tanzania and the policy on bidding procedure is a façade (see Ganuza, 2007; Galleta, Jametti & Redonda, 2015).

5 Conclusion

The paper concludes that unobserved heterogeneity does exist in the public procurement governance in Tanzania. The global model results are inadequately to address the challenges in local government and local models have demonstrated unobserved heterogeneity enough and precisely on transparency, competition, accountability, legal frameworks and value for money. This study fills the void of knowledge with the robust methodological frameworks and original empirical findings regarding the unobserved which have been previous relatively rare.

Moreover, the paper advocates the countermeasures to reduce the curtailing of the unobserved heterogeneity in public procurement governance in local government in Tanzania such as continual procurement reforms regarding the regulatory frameworks for public procurement systems, regular evaluation of public procurement audit, governance integrated frameworks, and clear vertical and horizontal procurement audit information.

The future research direction is to conduct a binary segmentation tree analysis (Pathmox) and uncover heterogeneity using the demographic variables such as age and gender (Lamberti, Sanchez & Alluja, 2016). However, this study has some limitations. The REBUS-PLS distributed samples frame in each latent class does not take into consideration the total number of units in each class and measures the partition-based number of classes ($n=k$) instead of the classes based on the merits of the units. Meanwhile, REBUS-PLS is conditioning the groups' latent classes in the reflective mode and fall short with regards to a formative modeling.

Conflicts of Interest: Declare conflicts of interest or state "The authors declare no conflict of interest."

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Appendix A: Factor Loadings

	GM	**LM1**	**LM2**	**LM3**	**LM4**
Number of Units	**268**	**95**	**75**	**55**	**44**
Transparency					
1 T1	**0.822**	0.864	0.647	0.791	0.915
1 T2	**0.810**	0.814	0.733	0.817	0.900
1 T3	**0.736**	0.787	0.724	0.709	0.585
1 T5	**0.778**	0.790	0.639	0.813	0.881
1 T6	**0.801**	0.827	0.743	0.829	0.802
1 T7	**0.706**	0.729	0.638	0.687	0.712
1 T8	**0.828**	0.810	0.791	0.848	0.888
1 T9	**0.778**	0.790	0.823	0.743	0.748
1 T10	**0.800**	0.802	0.757	0.761	0.905
Accountability					
2 A1	**0.798**	0.861	0.604	0.797	0.909
2 A3	**0.815**	0.800	0.779	0.872	0.825
2 A4	**0.828**	0.807	0.775	0.902	0.897
2 A5	**0.840**	0.814	0.851	0.855	0.877
2 A6	**0.822**	0.800	0.802	0.874	0.841

2 A7	**0.865**	0.875	0.791	0.864	0.926
2 A8	**0.839**	0.761	0.834	0.895	0.885
2 A9	**0.829**	0.787	0.834	0.834	0.851
Competition					
3 C1	**0.757**	0.782	0.724	0.853	0.700
3 C2	**0.744**	0.762	0.769	0.828	0.545
3 C3	**0.734**	0.746	0.722	0.786	0.721
3 C5	**0.768**	0.741	0.712	0.852	0.835
3 C7	**0.679**	0.721	0.455	0.774	0.711
3 TR	**0.763**	0.861	0.710	0.615	0.720
3 CO	**0.763**	0.732	0.738	0.751	0.843
3 NTA	**0.800**	0.719	0.795	0.865	0.871
3 VFM	**0.789**	0.842	0.715	0.724	0.829
Legal frameworks					
4 L1	**0.813**	0.662	0.489	0.850	0.902
4 L2	**0.824**	0.660	0.609	0.770	0.920
4 L3	**0.831**	0.769	0.556	0.816	0.819
4 L4	**0.842**	0.723	0.545	0.832	0.935
4 L5	**0.868**	0.797	0.567	0.902	0.908
4 L6	**0.868**	0.742	0.681	0.866	0.940
4 L7	**0.856**	0.777	0.644	0.810	0.918
4 L9	**0.809**	0.752	0.584	0.829	0.931
Value for Money					
5 V1	**0.851**	0.857	0.777	0.853	0.809
5 V2	**0.816**	0.794	0.747	0.883	0.782
5 V3	**0.847**	0.855	0.824	0.824	0.811
5 V4	**0.831**	0.831	0.820	0.796	0.772
5 V5	**0.865**	0.886	0.819	0.850	0.760
5 V6	**0.871**	0.873	0.854	0.863	0.820
5 V9	**0.766**	0.781	0.750	0.741	0.582

The standardized loading measures the correlation between the manifest variable and the related latent variable

Appendix B: Description Latent Constructs and Manifest Variables

Transparent	**Accountability**	**Competition**	**legal frameworks**	**Value for money**
Codes/indicators	**Codes/indicators**	**Codes/indicators**	**Codes/indicators**	**Codes/indicators**
T1-acess to procurement policy	A1-accountability on procurement decision	C1-participation of bidders in procurement	L1-clarity to PPLF	V1-qulaity control system on procurement
T2-access to public information	A3-responsibility on procurement cycle	C2- transparency on procurement methods	L2- no overlapping conflict clauses	V2-community involvement on procurement
T3-publiccation of procurement budget	A4- effective internal audit	C3- policy on bidding procedure to stakeholders	L3- framework on selection procedure	V3- overpricing on BOQ
T5-open bidding procedure	A5-efficient mechanism for audit	C5-qualification on pre-qualification procedure	L4-legal procedure on effective auditing	V4- selection procedure of bidders in tender
T6-informartion dissemination on procurement procedure	A6- commitment and responsibility	C7- focus on short run price	L5-legal procedure from supplier complaints	V5-construction contracts and consultancy service
T7-access to key procurement notice	A7- systems and procedure	TR- bid rigging among public staff	L6-procurement ethics	V6-contracts monitoring and evaluation
T8-clear and comprehensive bidding procedure	A9- system and procedure for bidders	CO- collusive corruption on public procurement	L7-anti-corruption measure	V-9-honesty and integrity on public projects
T9-clear recording of procurement T10- clear documents and contracts activities	A9-accountability of procurement officers	NTA- transparent procedure on bid acceptance and rejection VFM- long run non price competition	L8-independency and consistency of framework	V8-adequate records for projects