
ICT INFRASTRUCTURE AND ADOPTION OF STRATEGIC PROCUREMENT PERFORMANCE METRICS IN THE KAKAMEGA COUNTY GOVERNMENT, KENYA

Kennedy Otemba Odongo¹ and Isaac Kazungu²

¹Postgraduate student, Department of Marketing Procurement and
Supply Management, Moshi Co-operative University,
Moshi - Tanzania

²Senior Lecturer, Department of Marketing Procurement and
Supply Management,
Moshi Co-operative University
Moshi - Tanzania

Abstract

Effective performance measurement in public procurement (PP) is the only avenue through which evidence-based improvement can be injected into the process. The over reliance of county governments on activity-based performance metrics has not only masked poor PP performance, but also hindered continuous improvement of the process. This study sought to determine the effect of ICT infrastructure on adoption of strategic procurement performance metrics (SPPM) in county governments, a case of Kakamega county government. This was achieved through the lenses of institutional theory and public sector scorecard model. A mixed method approach anchored on case study design was used to collect data from the Kakamega County Government. Inferential analysis was done using content analysis and ordinal logistic regression. The study revealed that procurement automation was unrelated ($0.235 \text{ Wald } \chi^2(1) = 0.37, p=0.543$) with adoption of SPPM. However, both procurement database ($0.859 \text{ Wald } \chi^2(1) = 9.608, p<0.05$) and procurement data sharing ($1.19 \text{ Wald } \chi^2(1) = 7.094, p<0.05$) were found to be significantly related with adoption of SPPM in county governments. The study concluded that functional ICT infrastructure within county governments is a prerequisite for effective adoption of SPPM. Basing on these findings, the study recommended that county governments should invest in developing a functional ICT

infrastructure to improve the technical capacity of adopting strategic procurement performance metrics.

Keywords: Public Procurement, Performance Measurements, ICT, Strategic, Metrics, County governments.

Introduction

Effective performance measurement in public procurement is the only avenue through which evidence-based improvement can be injected into the process (Ferguson, 2018). This requires the application of both transactional-based metrics (which assesses the performance of individual procurement professional and compliance rate) and strategic procurement performance metrics (which show the overall impact of procurement project on strategic goals of the government) (OECD, 2019). This emanates from the understanding that any form of public procurement at any level of government has a broader impact that touches on pertinent issues such as political stability, employment, labour productivity, equal distribution of resources and foreign direct investment among others.

With this realization, many developed countries are successfully adopting strategic procurement performance metrics that indicate the impact of public procurement expenditures to the long-term policies and goals of the government. Countries such as the United States of America and the United Kingdom are tapping into their technical capacity, particularly the information technology system to measure the performance of public procurement and report on range of strategic issues viz healthcare provision, crime rate, household income and unemployment among others (Performance.gov,2020; Phillips, 2018). This is not the case in Sub-Saharan Africa where activity-based performance metrics are the only ones applied in public procurement performance measurement. Power outages, resulting from defective power plants and transformers increase the cost of production and hinder the growth of industries. These cost Sub-Saharan countries 1-5% of their GDP annually (Blimpo and Cosgrove-Davies, 2019). Regardless, national grid companies only report on profit or loss yearly. Over the years, studies have shown that high interest debt funded infrastructural projects in Sub-Saharan countries experience more than 50% time and

cost overruns (Gbahabo and Ajuwon, 2017; Ngacho and Das, 2013; Love, Edwards and Irani, 2012; Flyvbjerg, Ho Im and Buhl, 2003). Yet, public procurement entities are only reporting on the number of procurement tenders awarded through competitive bidding, number of purchase orders raised in a month, number of procurement training programmes organized among other traditional performance metrics. Definitely, the public procurement process cannot be improved with over reliance on activity-based procurement performance metrics only.

In Kenya, lack of essential medicine and family planning contraceptives in public hospitals have contributed to high mortality rates and unsustainable ballooning growth in population. This occurs despite the Kenya Medical Supplies Authority reporting year-on-year loss in expired drugs worth billions, with US \$ 12 million loss incurred in 2019. Delayed payment of suppliers by county governments have led to collapse of businesses especially small and medium sized enterprises with constrained working capital (Kenya National Chamber of Commerce, 2018). Many county governments do not realize the impact of delayed payment since they are only interested in measuring the number of SMEs who win public procurement contracts, thus failing to capture the period of payment and its eventual impact. It is therefore, undeniable that there is an urgent need among county governments to start incorporating SPPM in their performance measurement system.

Previous studies have emphasized the importance of functional information and communication technology (I.C.T) system in procurement functions. I.C.T has been found to influence various areas of procurement including implementation of e-procurement in public institutions, increasing transparency in public procurement, supplier relationship management and improving performance of procurement function among others (Muturi & Wanyonyi, 2015; Muriuki & Odari, 2018; Kibuine, Nyangau & Ouko, 2019). In the area of performance measurement, the effect of procurement automation is rarely addressed. Although Muriuki and Odari (2018) concluded that I.C.T was necessary for conducting procurement performance measurement in public technical training institutions in the Meru County, their regression analysis revealed that a unit increase in I.C.T leads to 12.5 per cent decrease in procurement performance measurement. This finding

contradicts earlier studies (Muturi & Wanyoyi, 2015; Ahmed *et al.*, 2016; Yang and Torneo, 2016) which have found a positive relationship between procurement automation and procurement performance. In particular, Yang and Torneo (2016) found the revolution of South Korean government performance measurement system through information technology. Certainly, as a support system, I.C.T is expected to influence almost every faction of public procurement. This led to the first hypothesis that;

H₀₁: *There is no significant relationship between procurement automation and SPPM adoption.*

H_{A1}: *Procurement automation significantly affects adoption of SPPM.*

Effective procurement performance measurement also calls for readily available and accurate procurement data. Without a functional ICT infrastructure, it may be difficult to collect and avail all the required data for holistic strategic procurement performance measurement. Anane and Kwarteng (2019), for instance, reported that the poor recording system of procurement data was a major challenge for conducting procurement performance measurement in public universities in Ghana. On another hand, a study by Mapoma (2017) in the Zambian public sector found that a functional I.C.T infrastructure helps by availing accurate and reliable data, analysing data, increasing efficiency in data collection, and enabling wide sharing of data and key performance indicators (KPIs) for comparative analysis. Similar findings were also reported by Yang and Torneo (2016) in the South Korean government. Phillips (2018), particularly finds the e-procurement platform very useful in collecting consistent sets of data that can be used for measuring procurement performance. Kaare and Koppel (2012) also found ICT system to improve collection and dissemination of real-time procurement data in Estonian national road performance measurement system. Using SPPM, which measures not only the output, but also the outcome and overall impact of public procurement spending, requires I.C.T system that can collect data from a wide range of stakeholders. The data collected should enable assessing the performance of public procurement on contracting authority inputs and outputs, and also the outcomes and impacts of the project at regional or national level. While extant literature shows that the ICT system increases availability of procurement data, there is no

empirical evidence that data availability can lead to adoption of SPPM in subnational governments. This therefore, led to the second hypothesis that;

H₀₂: There is no significant relationship between procurement database and SPPM adoption.

H_{A2}: Procurement database significantly affects adoption of SPPM.

Capturing the strategic impact of procurement processes and projects may require continuous access to real-time procurement data. For instance, Yang and Torneo (2016), who looked at the history and current practices of performance measurement in the Korean public sector revealed that information technology played an integral role in the South Korean government performance measurement. The government had established a central performance measurement platform anchored on electronic Integrated Public Evaluation System (e-IPSES). The system provided a nationwide database of sharing performance measurement information and reduced employees' workload by eliminating paperwork in performance measurement (Yang and Torneo, 2016). Kaare and Koppel (2012) also revealed that ICT systems such as Global Positioning System and radio frequency identification technologies were found useful in sharing real-time data in the national road PMS in Estonia. Although existing studies demonstrate that the ICT system can lead to real-time sharing of data, an empirical relationship with SPPM adoption in public procurement has not been established. Accordingly, this study sought to determine the effect of real-time procurement data sharing on adoption of strategic procurement performance metrics by hypothesizing that;

H₀₃: There is no significant relationship between real-time procurement data sharing and adoption of SPPM.

H_{A3}: Real-time procurement data sharing significantly affects the adoption of SPPM

Theoretical Background

This paper was based on the institutional theory and public sector scorecard model. The institutional theory has been widely applied to explain how public organizations respond to changes in their operating

environment (Teeroovengadum, Nunkoo and Dulloo, 2019; Fahlevi et al., 2019). It is based on the belief that most public sector entities are under obligation to appear legitimate among their peers (Dubey, Gunasekaran and Ali, 2015). The whole argument of institutional theory is anchored on the concept of isomorphism, which Scott (1995) reiterated that it consists of three pillars, namely the normative, regulative and cognitive pillars. DiMaggio and Powell (1983) who first coined the term isomorphism, explain that it is a process where organizations facing same contextual conditions have a tendency of developing similar characteristics. In other words, institutional isomorphism makes organizations under similar environmental conditions to adopt similar structures and practices.

According to DiMaggio and Powell (1983), institutional isomorphism can be classified into three mechanisms; 1) normative isomorphism, 2) coercive isomorphism where organization adopt certain practices due to coercive pressure externally; and 3) mimetic isomorphism which occurs when organization copy their peers hence end looking the same. Normative isomorphism, which is the interest of this study, on another hand occurs when internally, the organization has the technical knowledge and capacity to adopt certain practices that will put it at par with peers (DiMaggio and Powell, 1983). Such technical capacity may include a competent workforce, functional support system like ICT infrastructure, and committed top leadership management among others. Through the lenses of normative isomorphism, county governments that possess technical capacity should be in a better position to adopt strategic procurement performance metrics. For instance, with a functional ICT infrastructure, county governments can automate their procurement processes ensuring every transaction can be evaluated and monitored. Furthermore, a working ICT system can increase efficiency in collection, sharing and storage of procurement data (Anane and Kwarteng, 2019; Muriuki and Odari, 2018; Mapoma, 2017) that is required for procurement performance measurement.

Whereas the major argument of institutional theory is widely acknowledged, it fails to explain whether these isomorphic forces lead to effective implementation of the new practices. To overcome this weakness, Public Sector scorecard (PSS) model was applied. PSS is a

contemporary model which has not been widely used. The model is a public sector version of Balance Scorecard model. It argues that an effective public performance measurement system must be linked to the long-term organization strategy through strategy mapping process (Moullin, 2017). Moreover, PSS elaborate that an effective PMS must consist of performance metrics that span beyond the transactional activities of the organization to include the service user outcomes, strategic key performance outcomes and the financial outcomes (Huy and Phuc, 2020; Moullin, 2017). As such, PSS model was used in this study to show the components of holistic strategic performance measurement system.

Methodology

A case study research design was applied, with Kakamega County Government being used as the unit of analysis. Kakamega County Government was selected because is one of the earliest adopters of county government performance management framework, which requires the utilization of strategic performance metrics (Centre for Economic Governance, 2018). The study used a structured questionnaire, to collect data from 87 respondents who were selected through purposive sampling technique. Purposive sampling was utilized to ensure that only respondents directly engaged in procurement performance measurement were selected, hence boosting the chances of getting the right information for the study (Gupta and Gupta, 2020). Key informant interviews and document analysis were also used to supplement data collected through the questionnaire. Content validity was checked by seeking expert advice, which led to rephrasing of three questions, while two questions were dropped for redundancy. Cronbach Alpha was applied to check for reliability of the questionnaire. Table 1 shows that the questionnaire was found reliable with Cronbach Alpha of 0.865 which is above the set limit of 0.7 (Creswell, 2014). Spearman rho's correlation coefficient was used to measure the degree of relationship between the regressor and regressed variables. Inferential statistics were analysed using ordinal logistics regression.

Table 1: Reliability test

Cronbach's Alpha	N of items	Comment
0.865	7	Highly Accepted

Findings and Discussions

The objective of this study was to establish how ICT system affects the adoption of strategic procurement performance metrics in KCG. Therefore, the study formulated a number of questions entailing the automation of procurement system, existence of central record management system, real-time data sharing, and automatic generation of operational procurement performance metrics, which were measured through a 5-point Likert scale ranging from strongly disagree to strongly agree. The perceptions were rated from 1-5 with '1' representing strongly disagree, '2' disagree, '3' neutral, '4' agree and '5' strongly agree. A mean of 1 to 2.4 was used to represent disagree, a mean of 2.5 to 3.4 indicated neutrality, while 3.5 to 5.0 represented agree.

Table 2: Perceptions on Influence of ICT infrastructure on adoption of SPPM

Statements on Procurement automation	Likert Mean	Std. Deviation
Automation of procurement processes increases the accuracy of data for procurement performance measurement	4.46	0.74
Automatic generation of operational procurement performance metrics allows the utilization of strategic procurement performance metrics.	4.57	0.69
Existence of central procurement record management system has improved availability of data essential for using high quality procurement performance metrics.	4.28	0.91
Training in using ICT system for performance measurement has enhanced the utilization of strategic procurement performance metrics.	4.49	0.68
ICT system reduces time required for procurement performance measurement improving attitude towards the practice.	4.48	0.61

ICT system enables easy collection and sharing of information required for holistic procurement performance measurement.	4.58	0.72
ICT infrastructure positively affects the adoption of strategic procurement performance metrics within this county government.	4.48	0.73
Average	4.48	0.73

The statement that automation of procurement processes increases the accuracy of data for procurement performance measurement, had a mean of 4.46 and standard deviation of 0.74. This indicates that automation of procurement processes improves performance measurement. According to one of key informant interviewees,

“...automation of procurement has improved procurement performance measurement data generation. With enterprise resource planning (ERP) and IFMIS, procurement data generation is real-time. One can access information on approved orders and payments done by just logging into the system. It has also enabled easy sharing of information across finance and procurement departments...” (3 June, 2021).

Mapoma (2017) also reported similar findings stating that, automation of procurement process increases transparency and eliminates repetitive paperwork creating time for more strategic activities. Muriuki and Odari (2018) also linked procurement automation with improved procurement performance measurement in tertiary institutions, Meru County.

The statement that automatic generation of operational procurement performance metrics allows the utilization of strategic procurement performance metrics, was rated highly. With a mean of 4.57 and standard deviation of 0.69, this study shows that automatic generation of input and output metrics directly influences the adoption of outcome and impact metrics. The finding corroborates those reported by earlier studies (Anane and Kwarteng, 2019; Muriuki and Odari, 2018; Kaare and Koppel, 2012). Specifically, Muriuki and Odari (2018), ICT infrastructure makes procurement performance measurement efficient.

The statement that existence of central procurement record management system has improved availability of data essential for using high quality procurement performance metrics was also highly rated. With a mean of 4.28 and standard deviation of 0.91, this finding is similar to that of Anane and Kwarteng (2019) who reported that ICT increases availability of data. The statement that training in using ICT system for performance measurement has enhanced the utilization of strategic procurement performance metrics was also highly rated. As shown in table 11, the statement had a mean of 4.49 and standard deviation of 0.68. This finding reinforces earlier studies which found staff training important in improving the effectiveness of PMS (Fahlevi *et al.*, 2018; Eliuz *et al.*, 2017).

It was also found that ICT system reduces time required for procurement performance measurement improving attitude towards the practice. This statement had a mean of 4.48 and standard deviation of 0.61. The statement that ICT system enables easy collection of information required for holistic procurement performance measurement had the highest mean of 4.58 and standard deviation of 0.72. Regarding these statements, one of the key informant interviewees also noted that,

“...The ICT system we are using stores all procurement information making it easy to compare performance of procurement from one period to another...”

(Key informant interviewee, Field Data, KCG, 27 May, 2021). A study by Mapoma (2017) also reported similar findings associating functional ICT infrastructure with efficiency in procurement performance measurement. Lastly, the statement that ICT infrastructure positively affects the adoption of strategic procurement performance metrics within KCG, had a mean of 4.48 and standard deviation 0.73. This study shows that ICT infrastructure can lead to adoption of SPPM. Yang and Torneo (2016), also reached the same conclusion in their study ascribing the effectiveness of South Korean government PMS to the existence of central e-Integrated Public Evaluation System (e-IPSES).

Correlation Analysis between ICT Infrastructure and SPPM adoption

As shown in table 3, Spearman rank-order correlation coefficient was conducted on data covering 87 respondents to find out the correlation between ICT infrastructure and SPPM adoption. There was a weak positive significant relationship between ICT Infrastructure and SPPM adoption ($r_s(85) = 0.223, p = 0.038$). With significance relations, this finding implies that there can be an expected increase in SPPM adoption with every unit increase in ICT infrastructure.

Table 3: Correlation between ICT Infrastructure and adoption of SPPM

			ICT Infrastructure	SPPM adoption
Spearman's rho	ICT Infrastructure	Correlation Coefficient	1.000	.223
		Sig. (2-tailed)		.038
		N	87	87
	SPPM adoption	Correlation Coefficient	.223	1.000
		Sig. (2-tailed)	0.038	
		N	87	87

**Correlation is significant at the 0.05 level (2-tailed)*

Inferential Analysis

The study used ordinal logistic regression to measure the relationship between the predictor variables (procurement automation, procurement database and procurement data sharing) and the outcome variable. As indicated in table 4 (footnotes) a test to determine the fitness of the model was conducted. The -2 log likelihood null model was compared to the final model which comprised of the three predictor variables explicitly; procurement automation, procurement database and data sharing; to assess whether the final model showed significant improvement over the intercept only model. Basing on the results of Chi-square test, the results in table 4 shows that the final model used in the study depicts remarkable enhancement in its fit over the intercept only model ($\chi^2(9) = 25.708, p < 0.05$). A goodness-of-fit test was also conducted to establish whether the model was a good fit to the collected

data. Field (2018) explains that ordinal logistic regression model is deemed fit for the data when the test is non-significant ($p > 0.05$). As shown in table 2 (footnotes), the results indicate that the model is fit to the data with non-significant values of both Pearson $\chi^2 (151) = 150.277$, $p = 0.501$ and deviance test $\chi^2 (151) = 103.554$, $p = 0.999$.

The study also tested the overall effect of the independent variables on dependent variable through Pseudo R-Squared values. As indicated in table 2, Nagelkerke value of 0.27 was found, implying that at 95% confidence interval, 27% variation in SPPM adoption can be ascribed to changes in procurement automation, procurement database and procurement data sharing within the organization. While 27% variation is relatively smaller, this study portrays a real picture of the role of various predictors that ought to be considered to encourage the adoption of SPPM. In nutshell, no single factor is capable of influencing the adoption of SPPM adoption in county governments alone.

As shown in table 4, parameters of estimates helped to identify which aspects of ICT infrastructure were significantly related to the adoption of SPPM. To begin with, procurement automation portrayed a positive and nonsignificant relationship with SPPM adoption, log odds of 0.235 Wald $\chi^2 (1) = 0.37$, $p = 0.543$. This result supported the null hypothesis while the alternative hypothesis was rejected. This study, therefore, cannot predict increase in log odds of falling on higher level of SPPM adoption basing on a unit increase in procurement automation. This conclusion is cognizant of earlier studies by Muriuki and Odari (2018), which reported that a unit increase in procurement automation was associated with 12.5 decrease in performance measurement. On the contrary, other studies (Anane and Kwarteng, 2019; Mapoma, 2017; Yang and Torneo, 2016) found automation of procurement processes associated with high utilization of outcome metrics. In particular, Mapoma (2017), established that automation of procurement processes increased procurement data availability, and enabled wide sharing of data within the organization.

Table 4: Parameters of estimates

	Estimate	Std. Error	Wald	Df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Threshold	6.273	2.713	5.348	1	0.021	0.956	11.590
[SM=2.50]	7.666	2.690	8.118	1	0.004	2.393	12.939
	9.376	2.751	11.618	1	0.001	3.984	14.767
[SM=3.00]	11.692	2.857	16.744	1	0.000	6.092	17.291
	12.700	2.887	19.351	1	0.000	7.042	18.359
[SM=3.50]							
	0.235	0.386	0.370	1	0.543	-0.522	0.992
[SM=4.00]							
	0.859	0.277	9.608	1	0.002	0.316	1.402
[SM=4.50]							
Procurement automation	1.190	0.447	7.094	1	0.008	0.314	2.066
Procurement database							
Data sharing							

*Model fitting information (Chi-square=25.708; Sig 0.002; Loglikelihood = 138.555) Goodness-of-Fit (Pearson=, $\chi^2(151) = 150.270$, $p = 0.501$; Deviance= $\chi^2(151) = 103.554$, $p = 0.999$), Cox & Snell R-Square = 0.256; Nagelkerke R-Square=0.270 McFadden R-square= 0.100)
 Where SM represent Strategic procurement performance metrics*

Secondly, central procurement database within the organization was found to positively and significantly (0.859 Wald $\chi^2(1) = 9.608$, $p < 0.05$) predict the adoption of SPPM. This led to rejection of the null hypothesis while the alternative hypothesis was accepted. This indicates that county governments maintaining central procurement database are more likely to adopt SPPM than those that did not. Further, it implies that having a functional central procurement database can encourage the adoption of outcome and impact procurement metrics by making

procurement data easily available for performance measurement. In their study, Anane and Kwarteng (2019) reported that poor documentation of procurement data adversely affected procurement performance measurement in public universities in Ghana. A study by OECD (2019) also showed that a functional e-procurement platform is indispensable in collecting consistent set of data that can be used for measuring procurement performance. This finding was also backed by one of the key informant interviewees who stated that:

“...The existence of central procurement database for all county government procurement activities has aided a great deal in utilizing impact metrics. Currently we are monitoring the impact of our procurement methods and processes on growth of SMEs...” (Key informant interviewee, Field Data, KCG, 19 May, 2021).

Thirdly, real-time procurement data sharing was found to positively and significantly predict the adoption of SPPM (1.19 Wald χ^2 (1) =7.094, $p < 0.05$), rejecting the null hypothesis and the alternative hypothesis accepted. The finding infers that it can be predicted that there will be 1.19 log odds increase in adoption of SPPM for each unit increase in real-time procurement data sharing. These findings help to reinforce earlier studies which reported increase in effectiveness of procurement performance measurement with improved sharing of data. Ideally, real-time sharing of data enables monitoring of public procurement effect on various strategic issues, such as healthcare, unemployment, and political stability (Alsaid, 2021; Philip, 2018). For instance, associating growth in SMEs with public procurement opportunities within a county government requires access to real-time procurement information on total procurement spend on SMEs, and average period of payment among others.

Conclusion, Recommendations and Policy Implications

This study laboured to determine the effect of information communication technology infrastructure on the adoption of strategic procurement performance metrics in the Kakamega County Government. Through ordinal logistics regression model, statistical

findings revealed that procurement automation was not significantly related with adoption of SPPM in county governments. However, both procurement database and procurement data sharing were found to have a statistically significant relationship with adoption of SPPM. The study, therefore, concludes that functional ICT infrastructure within county governments is a requirement for effective adoption of SPPM. From these findings, the study recommends that county governments should invest in developing a functional ICT infrastructure to improve their technical capacity of adopting strategic procurement performance metrics. Such an ICT infrastructure ought to facilitate collection, storage and real-time sharing of procurement data. The study also recommends that county governments in Kenya should strive to automate the entire procurement process. Automation of procurement process will enhance efficiency in collection of procurement data and generation of performance measurement results, increasing productivity of employees. Conclusively, the role of an effective public performance measurement in county governments cannot be underestimated. Linking public procurement projects and processes to the strategic goals of county governments through strategy-based performance metrics is without doubt quintessential to achieve the goals of devolved governance in Kenya. This study has demonstrated that modern ICT infrastructure can enable county governments to adopt high-quality procurement performance metrics, which eventually may lead to improvement of public procurement processes within county governments.

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