

Impact of Organizational Innovativeness Practices on Performance of Commercial State-Owned Enterprises in Kenya: *Insights from a Machine Learning Approach*

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Abstract: Commercial state-owned enterprises significantly contribute to global economies by driving economic growth, industrial development, and employment. However, three out of every ten of these commercial SOEs in Kenya report financial losses despite operating in key economic sectors. This study examines the effect of organizational innovativeness, guided by innovation diffusion theory. The study applied a post-positivism research philosophy and across section approach to descriptive research design. The sampling frame and unit of analysis was the 41 commercial state-owned enterprises in Kenya. A closed ended questionnaire was used to collect primary data for the predictor and a secondary data collection sheet for the target variable. A pre-test for the questionnaire was carried out using managers of three non-commercial SOEs in Nairobi, Confirmatory Factor Analysis was used to test construct validity. Target variable was tested for normality using Kolmogorov-Smirnov and Wilk-Shapiro test, linearity using correlation coefficient, outliers using violin plot and test of autocorrelation using Durbin Watson-d- statistic. Ordinary Least Squares-simple linear regression was used for inferential analysis after testing the data for Gaussian distribution, linearity and autocorrelation. The study found that 24.6 % of the variations in SOE performance could be explained by organizational innovativeness practices and that there is a statistically significance and positive effect of these practices on SOE performance. Based on this study, a departure from best practices in organizational innovativeness can have a significantly effect on organizational performance if the following areas were improved; committing of resources for development /provision of new products, reviewing organizational structure to foster creativity within the company, engaging in knowledge exchange programs, supporting recycling and re-use of by products or wastes, deliberately investing in capacity building on culture of innovation to staff. Policies governing these drivers of innovation appeared to lag the impact of organizational innovativeness measures. This study recommends a focussed approach to review of policy/ies driving these practices relative to all others at entity level. Other studies could be carried using different theoretical underpinning beyond those postulated innovation diffusion

Keywords: Kenya, machine learning, ordinary least squares, organizational innovativeness, performance, state -owned-enterprises

1. Introduction

1.1 Background of the Study

State-owned Enterprises are key players in both emerging and developed economies. The percentage of SOEs among the world's largest firms has increased significantly over the past two decades, driven mainly by the rapid growth of SOEs in emerging markets (Gaspar et al. 2020; World Bank 2020). These institutions are said to also hold a dominant position among the world's largest firms. In the past two decades, the assets of the top 2000 global SOEs have doubled their assets upto 20% of the total assets accounting for approximately half of GDP worldwide (IMF, 2020), driven mainly by their rapid growth in emerging markets (Gaspar Medas, & Ralyea 2020; World Bank 2020). Globally, state-owned enterprises continue to control enormous bands of country's GDP, in, some African countries it controls more than 50 percent and up to 15

percent in Asia, Eastern Europe, and Latin America. Studies have shown that SOEs struggle to meet the private sector's performance levels, and as a result, potential profits remain unrealized (Mckinsey, 2018). In a survey on state moneys advanced to SOEs carried out by the Economist in 2012, the findings revealed that SOEs represent 80% of China's stock market capitalization, 62% of Russia's, and 38% of Brazil's. Additionally, cited that SOEs contribute approximately 10% of the world GDP. The percentage of SOEs among the world's largest firms has increased significantly over the past two decades, driven mainly by the rapid growth of SOEs in emerging markets (Gaspar et al. 2020; World Bank 2020). In some instances, SOEs hold a leading position in the market and are often a significant source of employment (World Bank, 2021).

In Sub-Saharan Africa, these SOEs play a significant role in public investment and on average accounts for over 30 percent of infrastructure investment (Harris Imbert, Medas,

Ralyea, & Singh., 2020), 5% of employment, and up to 40% of domestic output, on average internationally (IFC, 2018) and more than half of all infrastructure projects commitments in emerging market economies and low-income developing countries (IMF, 2020). Given these significant contributions, understanding and analysing the performance of SOEs is of utmost importance for policymakers, stakeholders, and investigators. tendency to underperform relative to private firms in terms of profitability (IMF, 2020). SOEs play a significant role in public investment and on average accounts for approximately over 30 percent of infrastructure investment in sub-Saharan Africa in 2017 (Harris et al., 2020). SOEs existence help in resolving market failures in some economies (IMF, 2020). SOEs have existed in Kenya since the colonial period. They play a crucial role of promoting social and economic development of the country. World Bank, (2021) report on Kenya state corporation review implied that the public sector in Kenya is very large, compared to its regional peers, Kenya has much larger number of SOEs, most of which are controlled by the central government. The report added that, Kenya's SOEs' portfolio has 242 SOEs majority owned by the government, 41 of these are commercial SOEs and 201 are non-commercial. IMF (2020) reported that ten largest SOEs in Kenya hold 92 percent of the total assets of all the SOEs. Further, in Kenya, there is evidence that these SOE's produce social benefits including: improved income distribution, technology transfer, and increased employment, contributions to regional equality and management training that might have offset or have justified the investment put in by the government (World Bank, 2021).

In addition, the aggregate operational performance of SOE is negative in the recent years indicating pre-existing financial performance challenges (GoK, 2020). A fair majority of SOEs are making losses averaging to about 14.7 billion shillings per annum and a few are profitable, with total net profit of about 30.42 billion shillings for the period between, 2017-2021, (GoK, 2021). Benchmarking efficiency indicators with private sector counterparts in certain key industries have shown that SOE's are lagging behind. In the banking sector, state-owned banks showed lower rates of return on assets of about 2.2 per cent, compared to 2.6 per cent for private banks, but higher non-performing loans and non-performing earning assets compared with the private banks (KNBS 2021). Auditor general reports, 2017-2021, reveals that SOEs have sunk into insolvency at an alarming rate. Literature reviewed on studies in Africa have suggested the drivers of organizational performance to include; good corporate governance & autonomy of management (Abanga'a et al 2021), financial management practices (Boko & YuanJan, 2011), cost cutting measures, liquidity management & risk management, financing and reporting systems (Harris et al., 2020) and lastly strong internal controls (Ferina, 2021). The performance of the Kenyan SOEs deteriorated noticeably from 1990s, with growth falling below its potential and a number of factors contributed to this poor performance, (GoK 2006). The failure of SOE in in developing countries is likely to cause systemic problems for the economy (Magersa, 2020). A keen review of the organizational performance of the commercial forty-one (41) commercial SOEs in Kenya show

that on average, over the years (2017-2023) only 3 in every 10 of were profitable. This implies that approximately 70% of the commercial SOEs are loss making entities despite being in key sectors of the thriving economy. A study examining what the drivers towards performance could is hence necessary.

1.2 Problem Statement

Economic theory and literature suggest that organizational performance has known determinants. Most of these determinants are generic and are captured in institutional best practices. They are however could vary in terms of impact depending on the sectors and internal and external environment. Effective governance structures and management practices are essential for the efficient functioning of SOEs (Abanga et al 2022: Abanga & Wangombe 2021: Asenga 2018: Mbo 2017). State-owned Enterprises (SOE's) in Kenya are generally cited to be key in supporting the government to improve the citizens quality of lives. This is in line with United Nations 17 Sustainable development goals (SDGs), Africa Agenda 2063 for the "prosperous Africa that we want", Kenya Vision 2030 "transforming the County in key Social, economic and Political spheres", and the 2022-2030 government agenda of focusing on "five priority areas of social economic transformation of Kenya by 2027. Analysis en review of the organizational performance of the forty-one (41) commercial SOEs show that on average, over the years (2017-2023) only 3 in every 10 of the Commercial SOE s were profitable. This implies that approximately 70% of the commercial SOEs are loss making entities despite being in key sectors of the thriving economy. Forty percent (40%) of those in Education, Science and Technology industry, Fifty percent (50%) of those under National treasury, 57% in Energy and Petroleum sector, 73% of those Agriculture Livestock and Fisheries sector, 80% of those in East Africa Affairs, Commerce & Tourism were loss making. Further and surprisingly the commercial SOEs in Environment, water and natural resources, communication and Technology, industrialization and Enterprise Development were on average purely loss making. This implies that these entities are eroding resources from the government and other private investors. This implies that these institutions are not supporting the development agenda as expected and are not commercially sustainable enterprises. In spite of the dismal performance, there is no evidence that the are actually performing well in terms on non-financial measures of customer satisfaction, learning ang growth and internal business processes. The Government has attempted to re-engineer IFMIS implementation process in a bid to phase out manual systems in SOEs, establishment of the Public Procurement Oversight Authority to oversee public procurement, introducing Mwongozo Code of Corporate Governance (MCCG) of 2015 to address the weak governance structures among SOEs and many other innovative solutions including the establishment of the Kenya National Innovation Agency (KENIA), an institution set to support public and private sector innovations and entrepreneurship. Despite this, there is dismal evidence that the poor performance of these SOE's has changed in a notable way. This is a cause for great concern (World Bank, 2021, IMF 2020). Economic theories, point that

organizational innovativeness, financial management practices, governance practices among others institutional factors enhance the performance of SOEs. This study views that organizational innovativeness across all the drivers of organizational performance could support contribution towards better organizational performance among commercial SOEs in Kenya and equally enhance shared prosperity as enshrined in the sustainable development goals (SDGs) and other development framework targets.

1.3 Objective, Purpose and Significance of the Study

The general objective of the study was to evaluate the effect of organizational innovativeness practices on performance state-owned enterprises in Kenya. The purpose of the study was to inform policy and management practices which could reverse the trend in performance among the commercial state-owned enterprises in Kenya. The study highlights the critical role of organizational innovativeness in enhancing the performance of these commercial SOEs, addressing key economic challenges and contributing to sustainable development goals.

2. Literature Review

2.1 Innovation Diffusion Theory

The theory was proposed by Rogers E in 1995. The theory holds that firm innovation can help firms seize opportunities in uncertain environments, acquire competitive advantages over rivals, and have an important influence on firms' long-term performance (Rogers 2003). The Innovation Diffusion Theory focuses on how new ideas, products, processes, or practices spread within a social system and its fundamental purpose is to obtain potential social benefits (Zhang & Aumeboonsuke 2022). Based on this theory SOEs could leap the benefits of organizational innovativeness by building the culture of taking risks with new products, processes and practices, build capacity to innovate among the staff and institutional infrastructure and human capital. Similarly, SOE must be international to innovate. It is theorized that organizational-level innovativeness is a carefully planned, designed strategic phenomenon and that is excited artfully. Innovativeness can be thus conceptualized as the firm's intention to strategically act in an innovative manner leading to innovation; but it is not the innovation itself. From a behavioral perspective, Avlonitis, Kouremenos & Tzokas (1994) treated innovativeness as the behavioral willingness, intention, and commitment of the firm to innovate. Few researchers on innovation can find out exactly where innovation comes from (Damanpour & Gopalakrishnan, 2018). OECD Manual has categorized four types of innovation: product, process, marketing, and organizational innovations. The outcome of product innovation is the introduction of a either marginally or radically improved good or service with respect to functions, characteristics, or components (Hitt. et al., 2017). Product innovation is mostly induced by demand factor, but supply side could be a significant driver for this type of innovation as well. Upgraded technologies, changing customer tastes, and shortening product life cycles, combined with overall increased global and regional competition, force firms to innovate relentlessly (Langat & Gachunga, 2018). Process

innovation leads to improvements in the methods of production or delivery of products/services. The process could be new or significantly improved compared to the existing version. The theory of creative destruction by proposes that innovative firms have the competitive edge that enables them to replace non-innovative ones. Innovation has been identified as a sustainable channel to facilitate economic growth and corporate performance (Han et al., 2021). Theoretically, innovation is expected to facilitate enhancements in firm economic performance. Nonetheless, empirical results have not always been in line with this expectation, there are a number of studies that suggest that innovations do not necessarily bring better performance. Applying this theory to SOEs, the framework could explore how the level of innovativeness within an SOE affects its performance. It could delve into the factors that enable or inhibit the adoption of innovative practices within SOEs and how the diffusion of innovation influences their performance outcomes. The theory addresses the organizational innovativeness factor as a driver of organizational performance of SOEs in Kenya.

This theory supported the objective that analyzed the influence of financial management practices on performance of commercial state-owned enterprises in Kenya.

2.2 Balanced Scorecard

This is a classical model by Kaplan & Norton (1992) which aimed at adding leading measures that represented indicators of future financial performance to the traditional financial measures. Also, the scorecard is said to help in identification and measuring key and specific value-drivers that underpins organizational performance (Chartered Institute of Management Accountants, 2005). Asiedu (2015), affirmed that the tool is excellent in the customer perspective, internal business processes perspective and learning and growth perspectives. The BSC tool is said to support a dashboard that could monitor organizational past and strategic performance (Gawankar et al., 2015). This study used a balanced scorecard (BSC) as a classical model used to measure organizational performance and also sustainability. The scorecard developed over several years to support different organizational missions, from profit maximization, to service delivery in public, private, and not for profit, it played a role of realizing and integrating the contributions of all the relevant organizational value drivers that promote alignment between the non-financial and financial measures. This study adopted BSC methodology to measure SOEs performance using secondary data of financial performance and primary data in measuring the non-financial indicators of performances.

2.3 Empirical Literature

Several scholars and researcher have attempted to unpack what innovation is and its potential in driving organizational success. Innovation defined as new thing that organization can use to reduce costs, reduce risk or provide an improved product or service that better satisfies customers' demands (Boxu et al., 2022). Beaver (2002) believes that innovation is an essential element for economic progress of country and competitiveness of an industry. Organizational

Innovativeness is imperative in determining output variations at the firm performance. Subsequently technological change is a major force in shaping economies and histories of nations (Motohashi, 2018). Innovativeness is considered a critical factor for organizations to create value and sustainable competitive advantage in today's complex and changing environment (Farhang et al., 2018). Organizations with more innovation, in response to the changing environments and creating development of new capabilities will be more successful that allows them to achieve better performance (Gasper et al., 2020; Han & Gu, 2021). Goga, (2014) found that organizational innovativeness has a positive influence on organizational performance and recommends that commercial SOEs embrace technological advancements in supporting organizational effectiveness. Innovation at organizations can increase organizations' chance for survival and increase prosperity, competition, legitimacy, and trust to organizations (Ren et al., 2023). In addition, innovation can increase organizational productivity, efficiency, performance, and customer satisfaction, competition, and quality of services. Innovation can also reduce the costs of the products and services (Yu & Hu, 2022).

Similar studies indicate that there is a positive relationship between organizational innovation and performance through process innovation capabilities & product innovation and company performance (Farhang et al 2018). In this regard, managers and employees have to use the power of creativity and innovation in order to adapt and keep pace with rapid changes, product lines, management practices and production processes (Hazlett et al., 2005). In today's world, adaptability to change management is identified as a factor

of success and survival of any organization, and acquiring these capabilities requires the organization's attention to creativity and innovation of individuals. Successful organizations are organizations whose creativity and innovation make up the tip of their movement (Tabarsa & Dori, 2014). Considering the current global economic system and increasing competition, creativity and innovation considered the key of survival and success of the organizations (Luis, 2015). However, there has been a growing academic debate over whether these innovations are simply techniques or whether they really contribute to the effectiveness of organizational performance. Further, it is scanty known if the innovativeness could achieve the same results in SOEs as documented for the case of private enterprises. The results could inform policymakers to prescribe for adoption strategies to strengthen and improve uptake of organizational innovative as well as support anchors of the same in line with Kenya Innovation Agency (KENIA) agenda. Therefore, based on the reviewed literature, it was hypothesized that: Ho1: organizational innovativeness practices do not have a statistically effect performance of state-owned enterprises in Kenya.

2.4 Conceptual Framework

This study conceptualized commercial state-owned enterprises (SOEs) organizational innovativeness practices as the exogenous variable for weighted SOEs performance. SOE performance was measured using secondary data (Return on Investment-ROI) and also primary data (customer perspective, internal business process, learning and growth practices) for triangulation purposes.

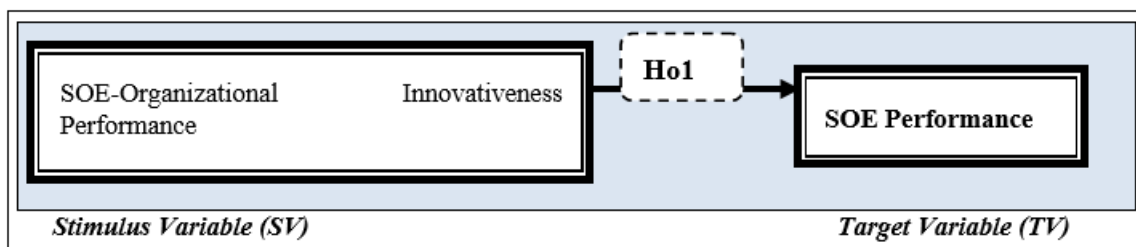


Figure 1: Conceptual Framework for SOEs Organizational innovativeness and Performance

2.5 Research Gaps

The evaluation of the subject matter of this study was implemented using precise parameters for the target variable, using lagging measures and strategic measures. In addition, the study triangulated the assessment of SOE performance by weighting the secondary data measures with the primary data measures to address methodological gaps in the study problem. This study used a machine learning model using python libraries to train and test the integration of the study variables using stats models and Ordinary Least Squares (OLS). This study sought to assess the impact of these innovativeness practices on performance among commercial state-owned enterprises in Kenya.

3. Research Methodology

3.1 Philosophy, Design and Instrumentation and Data collection

This research adopted a positivism philosophy, which is a research paradigm anchored on the principles of phenomenalism, objectivism, deductivism and inductivism and adopted cross-sectional approach to descriptive research design Mertens (2012). The respondents were five (5) SOEs managers from finance, internal audit, operations, information and communications and human resources. Population of the study was forty-one (41) licensed commercial state-owned enterprises in Kenya (RoK, 2022). The SOEs are classified by sectors by the government. Twelve percent (12%) of those in Education, Science and Technology industry, (10%) of those under National treasury, 17% in Energy and Petroleum sector, 27% of those Agriculture Livestock and Fisheries sector, 12% of those in

East Africa Affairs, 10% in the transport and infrastructure, Commerce & Tourism, 5% in communication and technology, 7% in industrialization and enterprise development, 2% in the environment, water and natural resources. The study adopted a census approach as the target population was regarded as small (Bryman, 2012). Primary data was collected using a structured questionnaire and in the case of secondary data, secondary data collection sheet. The measurement of the financial management practices was based on opinion, belief and an attitude based on the SOEs managers. These practices and constructs do not have a direct measure. As such, a five-point ordinal- scaled tool was used with the equivalences of strongly disagree (1) on one side with a scale, followed by disagree (2), neutral (3), agree (4) and strongly agree (5) on the other side of the scale (Charandrakandan, Venkatapirabu, Sekar & Anandakumar 2011). The measure for SOE performance was triangulated in measurement by using a secondary measure in addition to a primary measure. The study utilized the Statistical Package for Social Sciences (SPSS) version 26 and Python Libraries, that is pandas, statsmodels.api, statesmodels.formula.api, statsmodel.api and statsmodel.stats. Anova. This study applied a .20 to 0.80 proportions for the train and test respectively using the algorithm (X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42). The transcendental number 42 was used because it is theoretically said to guarantee that the same sequence of random numbers is generated each time the

Python code for the model is run. The results of the Statsmodel Linear Summary -Ordinary Least Squares Regression Results were generated for each null hypothesis in data analysis process. SPSS was preferred owing to its systematic capabilities on a wide range of statistical analyses and presentations (Porter & Gujarat, 2009).

3.2 Stability and Validity of Instrumentation of Data Collection Tool

Instrument internal stability was tested using Cronbach Alpha Coefficient. Reliability test results are presented in Table 1. The results in this Table show that reliability of this construct using Cronbach was 0.772 Mertens, (2010) view that a Cronbach’s coefficients of 0.7 should be acceptable as a rule of thumb to indicate a threshold for acceptable level of stability assessment. The eight measures for this variable were; The entity commits resources for development /provision of new products over the last five years, annually/regularly invests in technology for costs management, has cultivated new partnerships to enhance product/service provision, reviews organizational structure to foster creativity within the company, engages in knowledge exchange programs, supports recycling and re-use of byproducts or wastes, has expanded/ developed new revenue streams from new products/ services in the last five years and finally the company invested in capacity building on culture of innovation to staff.

Table 1: Reliability test Results

Variable	Before CFA	After CFA	KMO	Chi-Square & P-value	P-value	Cronbach Alpha Coefficient
	Number of Items					
Organizational Innovativeness	08	08	0.778	1677.145	0.000	0.778

Kaiser-Meyer-Olkin (KMO) coefficient was used to assess the construct validity of organizational innovativeness. A KMO coefficient of 0.778, Chi- Square of 347.636 and associated p-value of .000 was generated indicating a satisfactory Validity and sampling adequacy for factor

analysis. Confirmatory Factor Analysis (CFA), varimax rotation generated two components with Rotations Sums of Squared Loadings (RSSL) of 70.280 which was greater than the recommended RSS of 60%. (Koshy, 2010, Tabachnik & Fidell, 2014).

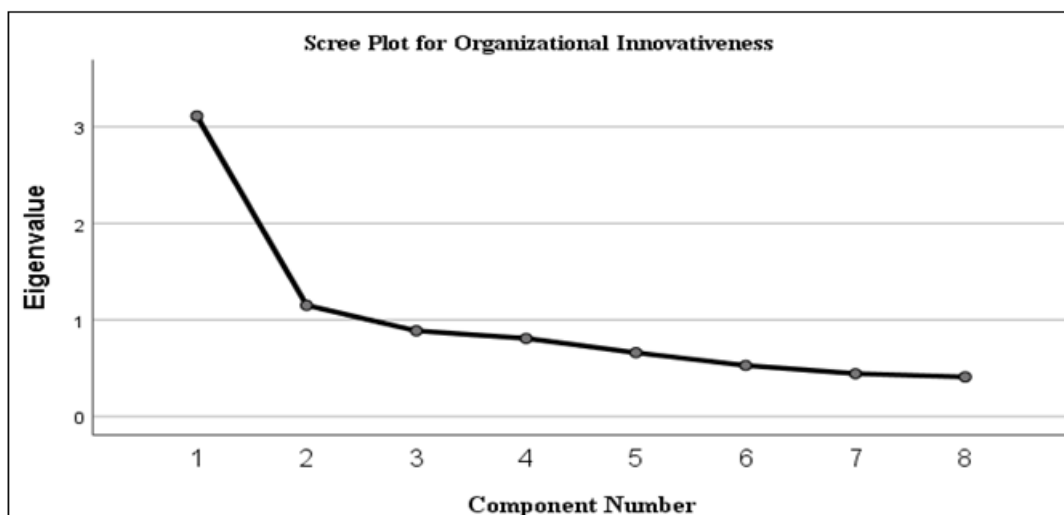


Figure 2: Scree Plot for Organizational Effectiveness

The output of the scree plot presented in Figure 2 shows an initially steep downward slopping curve from the point (1, 3.1) with a knee-jerk and appearing asymptotic to the origin after the second (2nd) component and significantly appears to

level further afterwards from the 3rd component to the 8th component

3.3 Data Analysis and Presentation of Results

Data analysis was phased out four; that is, descriptive analysis (means and standard deviation), Confirmatory Factor Analysis (CFA), test of regression assumptions and then inferential analysis. The eight (8) parameters' mean of 3.465 and standard deviation of 1.199 were generated for preliminary evaluation. Hypothesis testing was done using simple OLS linear model variate. OLS were extracted and interpreted. The equation used in this study was in the form; $Y/\text{SOE Performance} = \alpha + \beta_1 X + \epsilon$; where SOEs performance (Perf) is (predictor) and β_1 is SOE organizational innovativeness practices (target variable). This equation is supported by Montgomery, Peck, & Vining, 2001; Garson, 2012; Argyrous, 2011).

4. Findings & Discussions

4.1 Response Rate

A total of 205 questionnaires were distributed to the 41 SOEs, one hundred and ninety-six (196) questionnaires were totally filled and returned giving a satisfactory composite response rate of 95.61%. Therefore, the response rate was regarded good for this study; an indicator that hypothesis testing could be carried out on the results of this analysis. This high response rate was attributed to anonymity and self-administration of the instrument. (Charandrakandan, Venkatapirabu, Sekar & Anandakumar, 2011).

4.2 Test of Regression Assumptions

Chatterjee & Simonoff ,2013; Miles and Shevlin, 2010) propose a test of regression assumptions before hypothesis testing. These statistical assumptions are about the distribution and univariate statistical features of study

variables. This stage is crucial as it informs the adequacy and suitability of the metrics for the model once generated.

4.2.1 Test of Normality for Loan Performance

Performance among commercial SOEs was measured using both primary data and also secondary data for the years 2018-2023. The primary data was weighted for the four sub-constructs used to measure them, that is, the financial perspectives, customer perspective, internal business processes perspective and finally learning and growth perspective. The output from the weighting was labeled Organizational performance – Primary measures. Average SOE measures were computed for the five years and termed as “secondary measures of LP”. state owned enterprises, performance measures that is (average profit after tax / Average Total Assets)*100 were computed for the five years period, that is (financial years 2018 to financial years 2023). Some of the returns were negative (-ve) while others were positive (+ve). The negatives arose as some the SOE had losses and the positives arose because of the SOE that have a resultant profit on average. In order to ensure that all data was positive, the entire data was pulled and/extrapolated by adding a coefficient ensuring that all the values were positive. Through a (+ 1.0376) additional across all the resultant values. As such this measure was arrived as [LogY + 1.0376]. the case of the assets, the average total assets figure in (millions) was transformed to its Log10) and the resultant log values labelled average assets. Finally, a composite measure incorporating the primary measures and the secondary measures was computed and labeled SOE organizational performance -weighted measure. The Kolmogorov-Smirnov and Shapiro-Wilk statistics for numerical tests of normality for SOE are presented in Table 2.

Table 2: Normality Test for SOE Performance Measures

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
SOE Performance: Primary Measures	.270	39	.200*	.855	39	.252
SOE-Performance: Secondary Data Measures	.254	39	.149	.838	39	.243
Org. Performance: Weighted Measures	.243	39	.200*	.858	41	.284

Table 2 shows that the statistics are insignificant with p-values of Kolmogorov – Smirnov coefficients of .200*, .149 and .200* respectively for the three (3) measures of SOE performance, that is, primary data measures, secondary data measures and the weighted scores, respectively. Similarly, the Table shows that the coefficient of Shapiro –Wilk statistics were .858 for the case of primary data measures, .838 in the case of secondary data measures and .958 in the case of weighted scores for SOE performance. These three statistics indicate that the three measures of loan performance were normally distributed in general, implying that the data was adequate for a Structured Equation Modeling (SEM)using OLS. (Shapiro & Wilk, 1965; Garson 2012); Tabachnick & Fidell (2014).

4.2.2 Test of Autocorrelation for Financial Management Practices

The test of independence for financial management practices was carried out using Durbin-Watson *d* statistics. A Durbin-Watson *d* statistics of 1.596 was extracted and was within the range of 1.5 and 2.5 for an acceptable level of no

autocorrelation in a variable measure. Based on this statistic, the assumption of absence of autocorrelation in the parameters measuring the study variables was achieved (Bhattacharyya, 2011; (Argyrous, 2011).

4.2.3 Test of Linearity

The predictor variable (organizational innovativeness practices) and the target variable (SOE performance) were subjected to a pair-wise linearity test using Pearson's correlation coefficient (*r*). A correlation coefficient of 0.480** was generated at p-value of .000. This statistic implied existence of linear relationship between organizational innovativeness practices and SOE performance. As such OLS simple linear model was deemed appropriate for testing the study hypothesis. (Chatterjee & Simonoff 2013).

4.2.4 Univariate Test of Outliers

In order to safeguard the effect of outliers in a model, the test of outliers was carried out using violon plots. The output is presented in Figure 4.2.

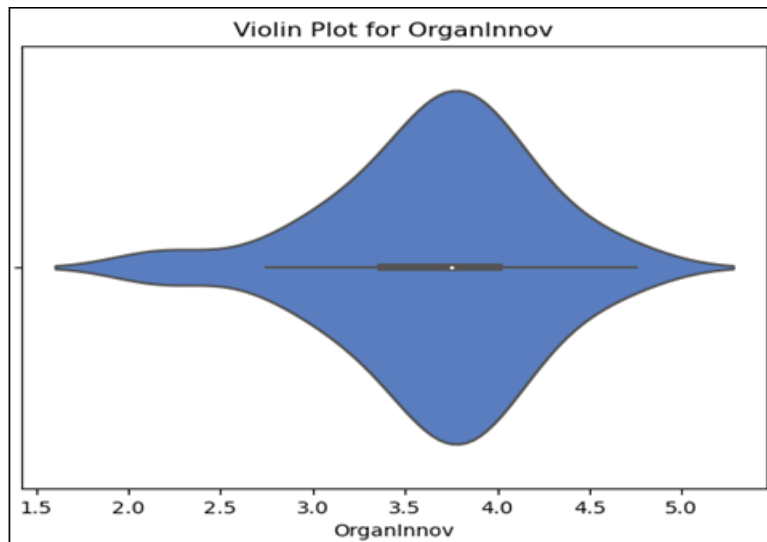


Figure 2: Univariate Test of Outliers for Organizational Innovativeness

The results in Figure 2 (violin plot) shows the interquartile range for organizational innovative data point, represented by a black bar. The plot further show that stretched bar for the lower and the upper adjacent values. The violine plot for show a high-density distribution of values around the mean values represented by the white dot in the middle/centres of the violin plot. It is also observable that organisational innovation, thereover no significant cases of outliers. median was largely not affected by the outliers and that the outliers did not require any treatment (trimming or winsorizing).

4.3 Inferential Results

This study tested the null hypothesis H_01 : *Organizational Innovativeness practices do not have a statistically significantly effect organizational performance among commercial state-owned enterprises in Kenya*. The weighted scores of organizational innovativeness practices were processed using that is, pandas, statsmodels.api, statesmodels.formula.api, statsmodel.api and statsmodel.stats. Anova. This study applied a .20 to 0.80 proportions for the train and test respectively using the algorithm (X_{train} , X_{test} , y_{train} , y_{test} = train_test_split (X , y , test_size=0.2, random state=42) and the OLS output generated. The results overall configuration of the OLS linear regression output, overall model performance metrics and statistical significance of the coefficients of the model are presented in Table 3.

The R-Squared coefficient of 0.246 mean that approximately 24.6% of the variability in performance of commercial state-owned enterprise can be explained by SOE organizational innovativeness practices. An assessment of the trade -off between model complexity and predictive power shows that the Adj. R-Squared is 0.221, meaning that addition of other

random variables would not significantly improve the predictive power of the predictor variable. The Table further shows that the F-statistics of 9.786 and an associated Prob (F-statistic) of 0.00389. This means that the simple linear measures in the restricted model of organizational innovativeness practices and weighted performance have a 0.00% chance that they are random / happened by chance. This indicate that overall model is adequate for evaluating the effect of SOE innovativeness practices on performance of commercial state-owned enterprises in Kenya. Based on these statistics, this study rejects the null hypothesis that *organizational innovativeness practices do not have a statistically significant influence on performance of state-owned enterprises in Kenya and indeed confirms that SOE innovativeness practices have a statistically significant influence on commercial state-owned enterprises*.

The Table also shows that the Akaike's Information Criteria (AIC) and the Bayesian Information Criteria (BIC) were – 8.049 and -5.118 respectively. These two metrics are relatively low and indicate a good balance between simple linear OLS model parsimony and complexity. The study was further interested in determining the significance of the simple linear OLS regression between the predictor and SOE Performance. The Table shows that coefficient (β) for organizational innovativeness was 0.1921 and an associated, $p > |t|$ value of 0.004 < p-value of 0.05. This implies that organizational innovativeness practices are significant in the ols model. These ols regression model coefficients show that a 0.1940 change in the predictor variable is associated with a unit change increase in performance of commercial SOE in Kenya. The results further shows that while the estimated beta coefficient is 0.1921, we can be 95% confident that the true value will always be in the confidence interval (0.067, 0.371).

Table 3: OLS Regression Summary for Financial Management Practices

OLS Regression Results						
Dep. Variable:	OrgPerf_Weighted_Measures	R-squared:	0.246			
Model:	OLS	Adj. R-squared:	0.221			
Method:	Least Squares	F-statistic:	9.786			
Date:	Mon, 25 Nov 2024	Prob (F-statistic):	0.00389			
Time:	14:48:57	Log-Likelihood:	6.0246			
No. Observations:	32	AIC:	-8.049			
Df Residuals:	30	BIC:	-5.118			
Df Model:	1					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	0.5756	0.224	2.565	0.016	0.117	1.034
OrganInnov	0.1921	0.061	3.128	0.004	0.067	0.317
Omnibus:		2.003	Durbin-Watson:		2.185	
Prob(Omnibus):		0.367	Jarque-Bera (JB):		1.318	
Skew:		-0.227	Prob(JB):		0.517	
Kurtosis:		2.115	Cond. No.		24.1	

Based on these statistical features of the bivariate model, the reviewed model for financial management practices and performance is;

$$SOE_Performance = 0.5756 + 0.1921 (Organ_Inno_Pract) \pm (0.152)$$

.....Model 1

This study further evaluated the model's assumptions and validation of the model. The Omnibus coefficient of 2.003 has an associated Prob. (omnibus) of 0.367 which is not too close to a Prob.(Omnibus) of 1.00. Similarly, the results shows that the Jarque -Bera (JB) test had a coefficient of 0.1318 with an associated Prob (JB) of 0.517 > p =.05. These two tests show that the ols model residuals were normally distributed, implying a good model fit for simple linear regression between organizational innovativeness and SOE performance. This is further reinforced by the skewness measure of -0.227 \approx 0, indicating a good indicator for a nearly normal perfect distribution of model residuals (homoscedastic) . The Kurtosis measure of 2.115 is less than a kurtosis of 3.00, indicating that the distribution of the model residuals was mesokurtic in curvature and peakiness, indicating a good model fit.

These results agree to the findings by Han & Gu (2021) who found that an entity's innovativeness is associated with better use of resources and inherently better performance. Beaver (2002) found that organizational innovativeness was associated with economic progress of an entity and also competitiveness. Studies have found that organizational innovativeness has a relationship and variation with organizations performance, Motohashi (2018). This study found that there exists such a relationship between organizational innovativeness and performance among commercial SOE's in Kenya. Similarly, Farhang etal (2018) found that there is a positive relationship between an entity's innovativeness and organizations ability to create value and its competitiveness. An entity's performance is an indirect, measure for its ability to create value. This is

because value is determined by discounting a firms cashflows with its cost of capital, consistent with capital structure theory. Goga (2014) found that there is a positive and statistically significant relationship between an SOE's innovativeness and its performance. The study however focused on technological innovativeness as the driver for organizational innovativeness. These findings are further supported by Ren et al (2023) who found that organizational innovativeness has the effect of influencing an entity's effectiveness, increasing survival a capability, increase competitiveness, and increases economic prosperity. On the other hand, Yu & Hu (2022) positive that organizational innovativeness can help reduce a firms costs and hence increase profitability. This, study used measure that also assessed SOE's practices n costs management. As such, the findings of this study do support the findings by You & Hu (2022).

5. Conclusions and Recommendations

5.1 Conclusions

The predictors ANOVA results were associated with F statistic of 9.786 and associated Prob (F-statistic) p-value of 0.00389, that is, \approx 0. Based on these two statistics, this study therefore concluded on the first study hypothesis (H01); SOE organizational innovativeness practices do not have a statistically significant influence on performance of state-owned enterprises in Kenya was rejected, and the study confirmed that indeed, there is a statistically significant influence of SOEs organizational innovativeness practices on organizational performance of commercial state -owned enterprises in Kenya. Further it was found that, there is a positive and statistically significant relationship between this predictor and SOEs performance in Kenya. The study further concludes that the measures of organizational innovativeness practices used are relevant and could be adopted with variation for valid measure of best practices among SOEs in Kenya.

5.2 Recommendations

This study confirms the positive impact of organizational innovativeness on SOEs performance. Policies promoting commitment of resources for development /provision of new products, creativity within the company, knowledge exchange programs, circular economy, capacity building on culture of innovation should be prioritized to enhance SOE effectiveness in Kenya. Policies governing these drivers of innovation appeared to be lag effect of organizational innovativeness measures. This study recommends a focussed approach to review of policy/ies driving these practices relative to all others entity level. Other studies could be carried using different theoretical underpinning beyond those postulated innovation diffusion theory.

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