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Sensing Capability as a Predictor of Sustainability in Kenya's Water Service Providers

Francis Kiura[1], David Kiragu[2]

[1]PhD Candidate, School of Business Management and Economics, Dedan Kimathi University of Technology
Email: *fkiura[at]gmail.com*

[2]Ass. Professor, Department of Accounting and Finance, School of Business Management and Economics, Dedan Kimathi University of Technology
Email: *drkiragu[at]gmail.com*

Abstract: ***Sustainability of water utilities is vital in enhancing access to quality water, reducing pollution and supporting safe global reuse and recycling. This study evaluated sensing capability as a predictor of sustainability of water service providers in Kenya. The study used a cross-sectional descriptive research design and targeting 332 managers from 88 water service providers (WSPs). Primary data was collected using a structured email questionnaire. The tool was evaluated for stability using Cronbach alpha coefficient and for construct validity using Kaiser-Meyer Olkin Coefficient from Principal Factor Analysis. The weighted data from 67 WSPs was tested for multivariate normality, collinearity, pairwise linearity, outliers and autocorrelation. Bivariate Linear Discriminant Analysis was used for inferential analysis. The study found that Linear Discriminant analysis model had an associated canonical correlation of 0.926 and Wilks' Lambda of 0.143 with well differentiated functions at group centroids of (2.675), (.193) and 3.308 respectively for the three categories of sustainability. The study further found that the sensing capability explained approximately 85.74% of the variations in sustainability classifications among WSPs in Kenya. The hit ratio for the confusion matrix and Jack-Knife classifications showed 94% correct classifications for both initial and the cross-validated grouped cases. The study concluded that Sensing capability has a statistically significant discriminating power on sustainability of WSPs in Kenya. The study recommends that WSPs should enhance their ability to continuously identify and analyze opportunities in business environment to inform choices for competitive action as a key strategy towards driving firms' sustainability.***

Keywords: predictive analysis, sensing capability, sustainability, Kenya, water utilities

1. Introduction

1.1 Background of the Study

Sustainability of water firms is deemed key towards addressing the global water challenges. These challenges include; 2.2 billion People lack reliable access to quality drinking water, 25% of the cities in the world experience water insecurity (UNICEF, 2019). It is estimated that by 2050, urban water demand will increase in the ranges of 50-70% (World Health Organization, 2021). It is reported that "sub-Saharan Africa homes between 36% to 58% of the extremely poor globally (World Bank, 2021). In Kenya, there are several water sector state actors each serving to ensure the sustainability of the sanitation services and high standards provision in Kenya. The organization of the Kenyan water sector include; the Ministry of Water, Sanitation and Irrigation Services (State Department for Water and Sanitation), Water Services Regulatory Board (WASREB), Water Works Development Agencies (WWDAs), Water Sector Trust Fund (WSTF), Water Resources Authority (WRA), National Water Harvesting and Storage Authority, Kenya Water Institute (KEWI), The water Tribunal, Basin Water Resources Committees, Water Service Providers (WSPs) which provide Water Services and lastly Water Resource User Associations (WRUAs).

According to the Water Act 2016, "the responsibility for providing water services in Kenya is mandated to WSPs, which are licensed and regulated by WASREB" (WASREB, 2023). The WSPs are fully owned by County governments, reflecting the devolved function of water service provision as per the Constitution of Kenya. As of 2023, WASREB had licensed eighty-eight (88) public and 4 private public water companies in Kenya to operate and serve consumers within their assigned service areas (WASREB, 2023). Water companies operating within county government frameworks are expected to perform a crucial role in shaping national development initiatives, a responsibility extending beyond Kenya Vision 2030. Specifically, SDG_6, focusing on sanitation services and water, presents targets that serve as guiding principles for the strategic plans of water utilities operating within Counties (Union, 2015). This proactive approach is positioned to translate global sustainability goals into actionable local outcomes.

Socio-economic development strategy of Kenya recognizes; access to affordable and quality water in sufficient quantities as a crucial milestone to national transformation. However, a survey conducted by WASREB in 2023 indicates that the overall water coverage in all areas in the country is 62% which has been sluggish in improvement, despite increased funding (WASREB, 2023). There is a high probability that the water sector may not achieve universal access as per the 2030 target and their sustainability is hence questionable. The study sought to unravel the nuanced interplay between the specific dynamic capabilities in influencing the overall sustainability of WSPs in Kenya. The research study aimed to avail valuable information that would inform strategic decision-making and enhance the sustainability of WSPs in the Kenyan dynamic water service industry.

1.2 Problem Statement

UN Sustainable development goals point that access to water counts for over 6% of the contribution to GDP directly and indirectly and it is a key catalyst and a prerequisite for the attainment of all the SDGs. It is estimated that at least 4.3 Billion people in the globe (33%) live without access to safely managed sanitation. Additionally, 1 in 4 cities worldwide already experience water insecurity and this is estimated to experience an increase of 20-30% by 2050. Further statistics indicate that by 2050, declining access to water could reduce economic growth by 1/3. These statistics point that in part, sustainability of WSPs is a global interest and concern. "Africa has the least water distribution across the globe relative to other continents. The sustainability challenge of WSPs is deeper from a demographic point of view with 87% in the rural Africa experiencing poor access to water compared to 51% in urban populations. The urban population in Africa has a projected growth to 1.3 billion people by 2050 making the achievement of the SDG No. 6 a pipe dream which can only be surmounted through strategic planning, targeted investments and operationally sustainable WSPs.

While the world is focused on reaching the 2030 water target, Sub-Sahara Africa lags behind significantly. Kenya's ambitious Vision 2030 Development Agenda anticipates achievement of significant economic growth and improve the nation's overall well-being. Improving firm sustainability and access to water services is a major commitment of the country. Despite the rigorous water sector reforms which has achieved improvements, the challenges on coverage, quality and reliability still persist. Despite the significance of this problem, developed countries are the primary focus of the existing literature, operational management and financial management. None of the reviewed existing studies has provided insights into what factors can predict firm sustainability of these service providers. These studies have used models that do not address the principal issue which is firm sustainability sensing capability of these WSPs in Kenya. The analytical ability to predict this firm sustainability requires the application of robust models such as linear discriminant analysis. However, this model has so far not been utilized in the reviewed studies and more so in the context of water sector. To address these research gaps, this study proposed to explore the impact of dynamic capabilities on firm sustainability of public WSPs in Kenya. The research employed a discriminant analysis approach with a focus on the water sector within a developing country context, providing insights that are relevant and specific to the challenges faced by public WSPs in Kenya. The study sought to acquire valuable understanding that can help predict and consequently improve the firm sustainability of WSPs in Kenya.

2. Literature Review

2.1 Dynamic Capability Theory

Dynamic capabilities dimension is a theoretical framework that focuses on dynamic capabilities of organizations to adapt, innovate, and reconfigure or transform their competencies and resources in response to volatile external business environment. Teece et al. (1997) asserts that dynamic capabilities stress on two aspects; the volatility of business environment ('dynamic') and the part played by strategic management in adjusting to or adapting, integrating and transforming the business external and internal skills, competencies and resources towards the environment ('capabilities'). Dynamic Capabilities theory, as described by Misigo et al (2019), suggests that organizations, by sensing and seizing new opportunities, then reconfiguring resources in alignment to the volatile business environment, have the potential of achieving sustainable competitive advantage. The theory lays emphasis on the significance of an organization's ability to sense, seize, and transform or reconfigure opportunities and threats resulting to sustainable competitive advantage, excellent performance and firm sustainability. The theory remains a fundamental concept in explaining how firms can adjust and thrive in dynamic and uncertain environments.

Certain factors however, could have an adverse or positive impact on aspirations of dynamic capabilities including uncertainty, complexity, munificence in external business environments and path dependencies (Ambrosini & Bowman, 2009). In summary, dynamic capabilities framework is an appropriate theoretical framework for studying firms' identification and response to external business environment changes, those which could drive sustainability. This study contributes to existing literature by testing whether sensing—identified as a subset of dynamic capability—can predict the sustainability of water service providers in Kenya.

2.2 Empirical Literature

Dentoni, Bitzer and Pascucci (2016) carried out a study in the European Union on "the relationship between business experience in Cross-sector partnerships and the co-creation of dynamic capabilities for stakeholder orientation." In this study 'dynamic capabilities for stakeholder orientation,' were considered comprising four aspects of sensing, interacting with, learning from 44 and reorganizing based on stakeholders. This study found out that firm's stakeholder interaction capability increases with their sensing capability. Research conducted by Rehman and Saeed (2015) in Pakistan delved into "the impact of Dynamic Capabilities on firm performance and explored how organizational competencies moderated the relationship between Dynamic Capabilities and performance". The study categorized Dynamic Capabilities into several components, including sensing capabilities, knowledge acquisition abilities, coordinating capabilities, and integrating capabilities. Performance, on the other hand, was assessed using a combination of non-financial and financial metrics. The research outcomes indicated that there did not exist a statistically significant influence of Dynamic Capabilities, in isolation, on organizational performance. In a research study conducted by Marx (2019) in Germany, the researcher aimed to explore how and why certain organizations are successful in an environment experiencing digital disruption in which other firms are unable to succeed. The research investigated the part played by digital maturity state in shaping the performance impact of dynamic capabilities. The study's findings brought out a positive impact of both digital maturity and dynamic capabilities on firm competitive advantage. Moreover, the study identified that digital maturity significantly mediates the impact of dynamic capabilities on firm competitive advantage. This suggests that digital maturity, being an intermediate outcome of high dynamic capability levels, mediates the positive effects of dynamic capabilities, especially in industry contexts affected by digital disruptions. A study was carried out in Kenya by Kiiru (2015) on "Dynamic capabilities, strategic orientation and competitive advantage of small and medium-retail enterprises in Kenya." The study noted that there is a significant moderating effect of Strategic orientation, customer focus or commercial focus on the relationship between sensing capabilities and firm 45 Competitive advantage of medium and small-retail enterprises. In these studies, a positive impact of seizing dynamic capabilities on firm sustainability or firm performance was noted. However, none of these studies were carried out in Kenya's water sector. This literature advances that it is expected statistically that the scale of WSPs sustainability can be predicted by the level sensing capability of respective water service Providers.

2.3 Conceptual Framework of the Study

Sensing capability was conceptualized as the sensing capability for sustainability categories of Water Service Providers in Keny.

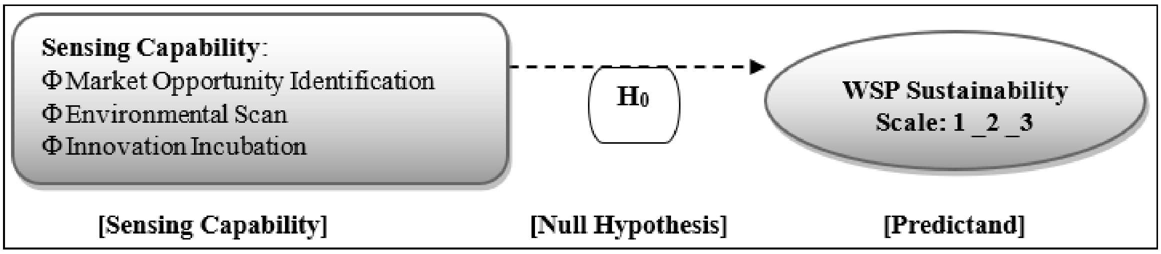

Figure 1: Conceptual Framework for Sensing Capability and Sustainability among WSPs in Kenya

2.4 General Objective

The general objective of this study was to assess the effect of sensing capability on sustainability of public water service providers in Kenya.

2.5 Research Hypothesis

This study tested the hypothesis that H0: Sensing capability is not statistically significant in predicting sustainability of Public Water Service Providers (WSPs) in Kenya.

2.6 Research Gaps

Many studies have been carried out to analyze the performance and sustainability of water sector in Kenya. However, the studies largely have used lagging and reactive measure of performance. A proactive approach would be the one which can be able to provide insights into the performance and even sustainability, based on current practices. As such a predictive model might add more value than an explanatory model. This study therefore supports seeking an answer to the question; does sensing capability predict sustainability of water service providers in Kenya? The results can provide insights if actually the initiatives of respective WSPs can explain sustainability levels in Kenya.

2.7 Significance of the Study

The research paper provides insights among the sector players in Kenya, in development of the sensing capability policies, and regulations for driving sustainability among Water Service Providers in Kenya. This significance lies in bridging empirical modeling with practical public service reforms, offering regulators predictive tools to assess and support sustainability in real time.

3. Method

3.1 Philosophy, Research Design and Measurement and Data collection

This study applied a positivism research paradigm and a cross-sectional descriptive research design. The unit of response was four senior officers from each of the Water Service Providers; chief executive or managing director and manager(s) in charge of corporate services, technical services and internal audit. The target population in this study consists of the 83Water Service Providers in Kenya, licensed by Water Service Regulatory Board (WASREB) as at December 2022. A census approach was taken in this study. Primary data (for the Sensing_capability) was collected using structured questionnaire through a drop and pick method. Measurement in primary data was based a five-point Likert scale with the equivalences of agreement to 'no extent at all, to a small extent, to a moderate extent, to a high extent and to a very high extent (Sekar & Anandakumar 2011). A secondar data collection sheet was utilized to summarize secondary data for the predictand. The study utilized the Statistical Package for Social Sciences (SPSS) version 26 and Python and a simple linear discriminant analysis model for inferential analysis. Use of SPSS enhanced the structuring of the LDA output while Python was useful in evaluating regression assumptions in a single step.

3.2 Reliability and Validity of Data Collection Instrument

The twelve measures used to measure sensing capability achieved a coefficient of 0.714 while the nine measures for sustainability generated a coefficient of 0.815. and the results are presented in Table 1. Confirmatory Factor Analysis (CFA) was used to analyze the construct validity. Kaiser-Meyer-Olkin (KMO) coefficient of 0.752, Chi- Square of 1319.492, 66 degrees of freedom and associated p-value of $p<0.001$ was generated for the sensing capability and a KMO of 0.831, Chi- Square of 1538.527, 28 degrees of freedom and an associated p-value of p<0.001 for sustainability measures. Confirmatory Factor Analysis (CFA), varimax rotation generated 4 components for sensing capability and one for the sustainability with Rotations Sums of Squared Loadings (RSSL) of 67.854% and 67.8655% respectively. The factor loadings range implies that all measures for the respective variables were greater 0.563> than 0.400 threshold for minimum acceptable factor loading for quality measures.

Table 1: Internal Consistency and Numerical Construct Validity Test Output

Variable	Number of Measures	KMO	Chi-Square & p-value	p-value	Rotations Sums of Squared Loadings (%)	Number of Components	Factor Loadings Range
Sensing Capability	12	0.714	1319.492	0.000	67.854	2	0.877 - 0.658
Sustainability	9	0.831	1538.527	0.000	67.8655	1	0.916 - 0.563

3.3 Data Analysis and Presentation of Results

Both descriptive analysis (means and standard deviation), test of regression assumptions and Linear discriminant analysis were carried out. Sensing capability and sustainability achieved a mean of 3.353 and standard deviations of 1.3546. Sustainability's nine measures achieved mean and standard deviations of: water coverage (58.3563%, 22.14), drinking water quality (81.62%, 16.9), hours of supply (16.55 hours, 5.03 personal expenditure % of operational and maintenance costs (1.721%, 0.35), operational maintenance cost % of coverage (96.268% ,16.02), revenue collection (61.845%, 7.35), non-revenue water (2.690%, 0.812), and staff productivity (92.27%, 0.0678), metering ration (67.000, 10.67). The simple linear discriminant equation used in this study was in the form; Df_WSP_Sust $= \alpha + V_1X_1 + \varepsilon$; where Df was WSP_Sustainability, the predictand, α denotes the constant level of sustainability unaffected by the sensing capability variable, V_1 represents the discriminant coefficient for WSP's sensing capability. This equation is supported by Montgomery, Peck, & Vining, 2001).

4. Results and Discussions

4.1 Response Rate

This study distributed three hundred and thirty-two (332) questionnaires, four to each WSP. Out of the 332 questionnaires distributed, 300 (from 75 WSPs) of them were properly filled and returned, giving a response rate of 90.36%. However, the study did not access secondary data from eight out of the seventy-five WSPs and hence were dropped from further analysis. This response rate was deemed as adequate for this study. (Charandrakandan, Venkatapirabu, Sekar & Anandakumar, 2011).

4.2 Test of Linear Discriminant Analysis Assumptions

Chatterjee & Simonoff (2013) advocate that prior to hypothesis testing for ratio-scaled data, it is crucial that statistical assumptions should be evaluated. Test of Gaussian Distribution, test of independence and test of linearity were carried out.

4.2.1 Test of Normality for Sustainability

The twelve measures for sustainability and the nine measures for sensing capability were weighted and each subjected to a Q-Q plot. The Kolmogorov- Smirnoff (K-S) statistics are presented in Table 2.

Table 2: Normality Distribution test for Sustainability and Sensing Capability

	Kolmogorov- Smirnoff	
Measure	Statistic	Sig.
Sustainability	0.1066	0.3016
Sensing capability	0.1585	0.0661

Table 2 shows that sensing capability had a K-S tests statistic of 0.1585 and a p-value of 0.0661. On the other hand, sustainability had a test statistic of 0.106 and associated p-values of 0.3016. These K-S tests statistics point that the two variables assumed a gaussian distribution. As such Linear Discriminant Analysis (LDA) could be carried out (Garson, 2012; Shapiro & Wilk, 1965)

4.2.2 Test of Autocorrelation for Sensing Capability

For this test, a Durbin-Watson *d* statistics of 1.931was extracted, confirming no autocorrelation. Based on this statistic, the assumption of absence of autocorrelation in the parameters measuring sensing capability was confirmed. (Argyrous, 2011).

4.2.3 Test of Outlier and Test of Homoscedasticity

This test of outlier for the study sensing capability and WSP sustainability was carried out using violine plots. The output is presented in Figure 2 below. The results Figure 2 show a bar cutting through the violine plot, and the interquartile range for the violin plots indicated that the medians were not affected by the extreme values in each of the variables. Based on this output, LDA linear model was deemed appropriate for testing the study hypothesis.

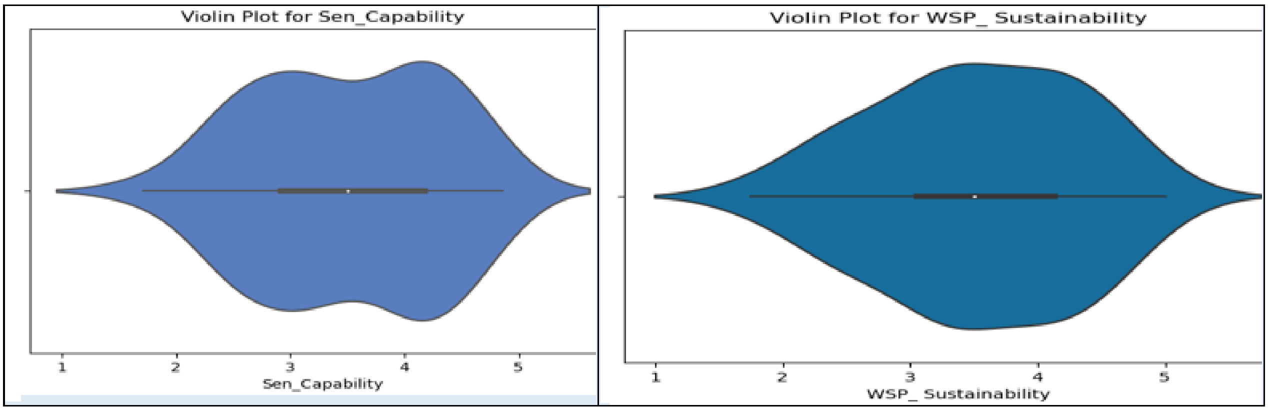

Figure 2: Violin Plots for WSP Sustainability and Sensing Capability

4.3 Results and Discussion

In order to identify unique categories of sustainability, the scores of the respondents from sixty-seven (67) WSPs were weighted. The weighted scores were grouped into three with the thresholds [IF(Y'i>=12, "3", IF (Y'i >=9,"2", IF Y'i<9, "1".Based on this logic formulae, three categories of sustainability were adopted. These categories were labeled as "Good", "Acceptable" and "Not Acceptable" in the rating scale by Water Sector Regulatory Board (WASREB) impact report 2021/22. Using SPSS, Linear Discriminant Analysis (LDA) was used to test the null hypothesis ***$H_0$1: Sensing capability is not statistically significant in predicting sustainability of Public Water Service Providers (WSPs) in Kenya.*** The results overall configuration of the LDA output, Table 3.

Table 3: Group Statistics and Test of Equality of Means- Sensing capability

	Group Statistics				
WSP_Sustainability		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
1	Sensing_capability	2.50665	0.46258	23	23
2	Sensing_capability	3.24513	0.152092	24	24
3	Sensing_capability	4.28695	0.150062	20	20
Total	Sensing_capability	3.30261	0.775544	67	67
	Tests of Equality of Group Means				
	Wilks' Lambda	F	df1	df2	Sig.
Sensing_capability	0.143	192.14	2	64	0

The results in Table 4 shows that the group statistics for the sensing capability across the three different classifiers of sustainability. The table shows that the first category of good sustainability category was associated with a mean of 2.50665, lower than the one achieved by the acceptable level category with 3.24513. This was followed by an even higher mean of 4.28695 for the not acceptable category of sustainability. The Table further shows that the three categories had a variation in the standard deviations associated with the group means, ranging from a low of 0.150062 for the not acceptable category of sustainability, followed by a standard deviation of 0.152092 for the acceptable sustainability category. These statistics show that sensing capability can be good classifier in the Linear Discriminant Model as the means are fairly different and the standard deviations are low, (<0.462580) for all the three categories of WSP sustainability.

The Table further presents the test of equality of group means for sensing capability. The purpose of these results was to determine if the average values (group means) of the three categories of sustainability were statistically significant from each other. This test checked whether the observed diferentce in group means were likely to be due to a random occurance, chance or a actual and real effect. The Tables shows that Wilk's Lambda (Λ) was 0.143 with an associated p-value of $p<0.001$. This means that a significant proportion of the variations in the WSP sustainability is explained by the independent variable (sensing capability) among WSPs in Kenya. The coefficient of Wilk's Lambda is closer to zero [($\rightarrow$ 0)]. This imply that sensing capability has a strong discriminant power in the LDA model. In addition to these findings, the associated summary of Canonical Discriminant Function coeficients were generated and the results are presented in Table 4.

Table 4: Summary of Canonical Discriminant Functions- Sensing Capability

Eigenvalues				
Function	Eigen value	% of Variance	Cumulative %	Canonical Correlation
1	6.004[a]	100	100	0.926

a. First 1 canonical discriminant functions were used in the analysis

Wilks' Lambda				
Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	0.143	124.578	2	0

	Structure Matrix	Canonical Discriminant Function Coefficients	Functions at Group Centroids*		
	Function	Function	WSP Sustainability		
	1	1	1	2	3
Sensing_ capability	1	3360	-2.675	-0.193	3.308
(Constant)*		-11.098			

The results in Table 4 shows that the sensing capability had an Eigenvalue of 6.004[a] and an associated canonical correlation of 0.926, meaning that the discriminant function of sensing capability had high discriminant power in the different categories on sustainability. It also implies that the sensing capability explained a higher proportion of variance between the three groups of sustainability. This Eigenvalue implies that sensing capability contributed a ratio of 6.004 to the between groups sums of squares to the within-group sum of squares and the overall classification accuracy of the Linear Discriminate Model of this sensing capability and sustainability.

The Table further shows that Wilk Lambda associated with the LDA was 0.143 with and related p-value of $p<0.001$. This means that approximately 14.3% of the variation in the WSP sustainability categories (Good, acceptable and not acceptable categories) is not explained by the function between sensing_ capability and sustainability among Water Service Providers in Kenya. These results mean that the LDA model can explain approximately 85.7% of the variations in the different categories of sustainability. Based on these statistics, this study ***rejects the null hypothesis that sensing capability is not statistically significant in predicting sustainability among Water service Providers in Kenya.***

The Table further show that the structure matrix/ structure coefficient loadings associated with Sensing_capabilityis 1.00. This indicates that sensing_capabilitycontributes a weight of 1.00 in the discriminant model of sustainability among the three categories of WSPs -sustainability. This loading is greater than a loading of 0.30 meaning that it has a strong positive influence (coefficient >0.85) in the discriminant model. Similarly, the Table shows the canonical discriminant function coefficients. These coefficients indicate the contribution of sensing capability in the LDA function. The Table shows that the sensing capability is associated with a coefficient of 3.3605, and a constant of -11.098, meaning sensing capability contributes towards the separation of the three categories of sustainability among WSPs. The Table also shows that the functions at group centroids for the three categories of WSP's sustainability. The three categories of WSPs sustainability were well differentiated as reported in the centroids and they do not overlap at all.

This study measured sensing capability using a five-point Likert scale and the weighted score used in the LDA model. These statistics imply that the Linear Discriminant Model for government financing g mechanism and sustainability among STPs in Africa is.

Open_ Innovation = - 11.098 + 3.360 (Sensing Capability ……………………………………….Model 1

To evaluate the performance of the LDA function for the sensing capability, the confusion Table and the 'Jack-Knife'/ cross validated classification Table was extracted. The results are presented in Table 5.

Table 5: Confusion Matrix and Jack-Knife Classification Table for Sensing Capability

Classification Results[a,c]						
		WSP_ Sustainability	Predicted Group Membership			Total
			1	2	3	
Original	Count	1	19	4	0	23
		2	0	24	0	24
		3	0	0	20	20
	%	1	82.6	17.4	0	100
		2	0	100	0	100
		3	0	0	100	100
Cross-validated[b]	Count	1	19	4	0	23
		2	0	24	0	24
		3	0	0	20	20
	%	1	82.6	17.4	0	100
		2	0	100	0	100
		3	0	0	100	100

a. 94.0% of original grouped cases correctly classified.
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case
c. 94.0% of cross-validated grouped cases correctly classified.

The Tables shows the observed categories of WSP sustainability and the predicted categories. The counts and the percentage of corrected predicted cases are presented in the diagonal line. The table shows that 100% of the cases in original count in category 2 (acceptable) and count in category three (not acceptable) are correctly classified, while 82.6% in the count for category one (good) are correctly classified. This means that sensing, capability, the good (category one) of WSP sustainability achieved a less discriminant accuracy relative to category 2 (acceptable) and category (not acceptable. Overall prediction shows that the cross validated results achieved a 94% correct classification. Sensing capability and WSP sustainability achieved a hit ratio of 94%. This 'hit ratio' is > a hit ratio of 33.33% which can be achieved by chance in an equal sample size. This hit ratio is also greater that a hit ratio of 75% which is the minimum acceptable for a good classifier.

These results imply that sensing capability is a strong classifier for the WSP sustainability and that the higher the sensing capability practices, the higher the WSP's sustainability level. Such a high hit ratio confirms the adequacy and reliability and dependability of the regulator's (WAREB) rating criteria for the good, acceptable and not acceptable evaluation methodology. These results align with previous findings by Kiiru (2015), Rehman and Saeed (2015), and Dentoni and Pascucci (2016) who also found that certain practices enhanced a firm's sensing capability and consequently a firm's performance and sustainability. These results also agree to Muriithi and Irungu (2025) who found that linear discriminant analysis model can be used as a proactive model to inform a firm's performance trajectory and that it can be a good classifier for a firm's outcomes, informed by prior practices.

5. Conclusions and Recommendations

5.1 Conclusions

The test of equality of group means and summary of canonical discriminant functions had a Wilk's Lambdas (Λ) of $0.143 \approx 0$, Chi- Square of 192.140 and a p-value of $p<0.001$ at 95% degree of confidence. The associated canonical correlation for this variable was 0. 926.Based on these statistics, this study rejected the null hypothesis that sensing capability is not statistically significant in predicting sustainability of Water Service Providers in Kenya. This research confirms that sensing capability is a robust predictor of sustainability outcomes among public water utilities in Kenya. By integrating this dimension into regulatory and operational frameworks, sector stakeholders can proactively navigate performance challenges and align with long-term national development goals.

5.2 Recommendations

Sensing capability is a good classifier of sustainability of WSP in Kenya. Policymakers and the regulator (WASREB) could design incentive mechanisms, such as performance-based tariff adjustments and performance-based grants, to reward utilities that demonstrate strong sensing capabilities. This research found that there are certain practices in which firms did not score favorably despite their importance in measuring the strength of the respective dynamic capability dimension. These include; carrying out internal environmental scans regularly, conducting internal and external environmental scan in a comprehensive manner and not piecemeal, existence of a department charged with executing identified innovations in the case of sensing capability. Managers should invest in integrated data systems to enhance sensing capability and strategic decisions and responses are grounded in reliable information.

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