

Effect of Environmental Sensing on Organizational Performance of Non-Commercial State Agencies in Kenya

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ABSTRACT

This study is grounded in the Strategic Agility Framework and examined the effect of environmental sensing on organizational performance in non-commercial state agencies in Kenya, as well as the moderating role of the institutional framework. Drawing on Organizational Information Processing Theory, Institutional Theory, and Public Value Theory, the study investigated how policy shift tracking, stakeholder feedback systems, and real-time crisis sensing influence service delivery effectiveness, operational and cost efficiency, and public value creation. The study adopted a pragmatism philosophy and a mixed methods explanatory design with a predominantly quantitative approach, undertaking a census of 131 non-commercial state agencies. The respondents comprised Chief Executive Officers, Directors, Heads of Departments, and senior managers responsible for strategic planning, operations, and organizational performance. Data were collected through semi-structured questionnaires and secondary sources, while a pilot study involving 14 agencies established instrument validity and reliability. Common Method Variance was assessed using Harman's single-factor test, which confirmed that common method bias was not a significant concern. The findings revealed that environmental sensing significantly improves organizational performance, with policy shift tracking emerging as the strongest sensing capability, while stakeholder feedback systems and real-time crisis sensing remained only moderately developed due to fragmented information systems and limited digital integration. The study further established that the institutional framework significantly strengthens the relationship between environmental sensing and organizational performance, with supportive governance structures, policy alignment, and accountability mechanisms enhancing performance outcomes. The study concludes that environmental sensing is a critical driver of organizational performance in non-commercial state agencies, but its effectiveness depends on enabling institutional conditions that facilitate information utilization, coordination, and responsiveness. The study recommends strengthening digital sensing systems, improving feedback-to-action mechanisms, enhancing inter-agency coordination, and undertaking institutional reforms that promote flexibility and evidence-based decision-making in the public sector.

Keywords: Environmental Sensing, Organizational Performance, Institutional Framework, Strategic Agility, Non-commercial state agencies, Kenya.

BACKGROUND OF THE STUDY

Non-commercial state agencies are government-owned institutions mandated to implement public policy, regulate strategic sectors, and deliver public services in the public interest rather than for profit generation. Within contemporary public administration scholarship, these agencies are conceptualized as core instruments of state capacity responsible for policy implementation, regulatory enforcement, and equitable service delivery. Their mandates are increasingly anchored on accountability, transparency, responsiveness, and efficiency within complex governance environments shaped by technological change, institutional reforms, and rising citizen

expectations (Cepiku & Mastrodascio, 2024; O'Flynn & Wanna, 2023). This reflects a broader global shift toward digitally enabled governance systems in which public agencies are expected to function as adaptive institutions capable of continuously generating and utilizing environmental intelligence for evidence-based and real-time decision-making (Margetts & Dunleavy, 2024; OECD, 2023).

Globally, public sector organizations operate in increasingly complex and volatile environments characterized by technological disruption, climate risks, fiscal uncertainty, and rising civic demands. Empirical governance research shows that governments have increasingly embraced data-driven models to strengthen service continuity, particularly following the acceleration of digital transformation during and after the COVID-19 pandemic (OECD, 2023; World Bank, 2022). Within this context, environmental sensing has emerged as a critical capability for enhancing public sector performance. International public sector contexts, particularly within European digital state architectures, demonstrate that the value of environmental sensing depends not entirely on data ingestion, but on an institution's capacity to embed information into decision routines and horizontal coordination structures (Weritz, Braojos, Matute, & Benitez, 2025). This operational reality is grounded in Organizational Information Processing Theory (OIPT), which suggests that when an organization encounters high environmental uncertainty, it must expand its internal information processing capability or face systemic performance degradation (Galbraith, 1973). While empirical evidence shows that agencies with structured policy tracking systems achieve higher implementation alignment (Howlett & Mukherjee, 2024), international studies caution that expanding front-end digital tools without a corresponding redesign of internal workflows leads to data hoarding rather than public value creation.

In Sub-Saharan Africa, environmental sensing capabilities within public sector organizations remain emerging but unevenly developed and weakly institutionalized. Empirical studies indicate that only about 30% to 45% of public sector organizations have fully functional policy monitoring systems capable of influencing real-time decision-making processes (Ayee & Crook, 2023). Furthermore, fewer than 50% of agencies systematically integrate stakeholder feedback into service improvement processes, reflecting gaps in participatory governance and organizational learning (Fourie, 2024). In crisis management contexts, evidence further shows that response delays in service disruptions are approximately 30% higher in Sub-Saharan Africa compared to global averages, largely due to weak digital infrastructure and fragmented data systems (Christensen & Lægreid, 2024; World Bank, 2022). From an OIPT perspective, this reflects a severe integrative mechanism deficit across the region, where state entities remain heavily reliant on rigid, vertical communication channels that slow down data synchronization and paralyse frontline responsiveness.

In Kenya, non-commercial state agencies function as central instruments of public governance responsible for implementing government policy, regulating strategic sectors, and delivering essential public services across diverse socio-economic domains. The country has approximately 131 non-commercial state agencies, which collectively form a critical layer of the public sector architecture supporting national development planning, regulatory enforcement, and service delivery across sectors such as health, education, agriculture, infrastructure, and public administration (Mwangi, Waweru, & Njogu, 2023; SCAC, 2023). To fully evaluate these entities, their performance must be anchored on objective organizational performance indicators, such as State Corporations Advisory Committee (SCAC) performance contract ratings, compliance with citizen service charters, and formal Auditor General audit opinions, rather than purely subjective manager perceptions. Despite their centrality, empirical evidence shows persistent variation in institutional capacity, efficiency, and performance outcomes across these agencies (Chepkirui, 2024; Ngari, Okeyo, & Wanjala, 2025).

The financing structure of these agencies is primarily derived from exchequer allocations, parliamentary appropriations, internally generated revenues, and development partner support. However, empirical public financial management studies show that delayed exchequer disbursements, fiscal constraints, and high recurrent expenditure obligations significantly limit operational flexibility and investment in digital infrastructure and performance management systems (Mwangi et al., 2023; National Treasury, 2024). In some cases, development budget absorption rates fall below 50% within financial cycles, reflecting inefficiencies in planning, coordination, and execution that constrain institutional capability for environmental sensing and adaptive governance (Chepkirui, 2024).

Kenya has undertaken significant public sector reforms aimed at improving efficiency, accountability, and service delivery. These reforms include the rationalization and merger of state corporations, strengthened governance and accountability frameworks, and the expansion of digital government services through platforms such as eCitizen, which now provides access to over 17,000 government services (Office of the Head of Public Service, 2024; Kenya News Agency, 2024; The Star, 2025). Empirical studies on public sector reforms in Kenya indicate that while these interventions have improved service accessibility and administrative efficiency in certain respects, they have not fully resolved structural challenges related to coordination, inter-agency integration, and real-time decision-making capacity (Okeyo, Ngari, & Wanjala, 2025; Ngari & Njoroge, 2024).

Despite these reforms, performance evidence indicates persistent inefficiencies across agencies. Empirical data shows that only about 38% of agencies consistently meet performance contracting targets, while approximately 60% to 62% of citizens report dissatisfaction with public service responsiveness and quality (Chepkirui, 2024; Mwangi et al., 2023). These outcomes suggest a persistent gap between institutional reforms and actual service delivery performance.

The Kenyan governance environment has also been shaped by recurring disruptions, including the COVID-19 pandemic, floods, cybersecurity threats, and socio-political protests, all of which have intensified demands for institutional responsiveness and resilience (Government of Kenya, 2024; World Bank, 2022). However, empirical studies indicate that fewer than 35% of agencies have integrated real-time monitoring and crisis sensing systems, with most still relying on periodic reporting cycles that delay response to emerging risks (Ngari & Njoroge, 2024). This limitation reduces the ability of agencies to respond proactively and adaptively to environmental changes.

Within these agencies, environmental sensing is operationalised through policy shift tracking, stakeholder feedback systems, and real-time crisis sensing. Empirical evidence shows that fewer than 50% of agencies consistently align operations with emerging policy changes, leading to implementation delays and inconsistencies in service delivery (Howlett & Mukherjee, 2024; Ngari et al., 2025). Although more than 75% of agencies have adopted digital feedback mechanisms, a unique contribution of recent empirical tracking reveals that only 40% to 50% of this feedback is actually converted into structural workflow redesigns. This reveals a profound "sensing-utilization paradox" within the Kenyan public sector: agencies have developed the capacity to ingest citizen data and track high-level policy directives, yet they lack the lateral integrative mechanisms required to process and execute this information down to the regional and operational levels. Consequently, a critical research gap remains regarding how institutional frameworks condition the path between multi-dimensional environmental sensing and actual, objective organizational performance within developing public sector contexts.

Statement of the Problem

Non-commercial state agencies in Kenya continue to experience persistent underperformance despite sustained public sector reforms, performance contracting systems, and extensive digital transformation initiatives, with empirical evidence showing that only about 38% of agencies consistently meet performance contracting targets while approximately 60% to 62% of citizens report dissatisfaction with service quality and responsiveness (Chepkirui, 2024; Mwangi et al., 2023), indicating enduring weaknesses in service delivery effectiveness, operational efficiency, and public value creation that suggest reform efforts have not translated into commensurate performance gains; at the centre of this problem is the weak and fragmented development of environmental sensing capabilities, operationalised through policy shift tracking, stakeholder feedback systems, and real time crisis sensing, yet evidence shows that fewer than 50% of agencies consistently track policy changes, only about 40% to 50% integrate stakeholder feedback into decision making, and fewer than 35% operate real time crisis monitoring systems (Howlett & Mukherjee, 2024; Ngari & Njoroge, 2024; Okeyo et al., 2025), resulting in limited situational awareness, delayed responsiveness, and weak evidence based decision making across agencies; this is further compounded by institutional framework conditions, including regulatory environments, governance structures, and policy support systems that determine how effectively sensing capabilities are embedded and utilized, with literature indicating that stronger institutional frameworks enhance coordination and data driven decision making while weaker frameworks constrain the effectiveness of such

capabilities (OECD, 2023; Cepiku & Mastrodascio, 2024), yet in Kenya inconsistencies in governance structures, fragmented implementation systems, and uneven regulatory enforcement weaken the translation of sensing into performance outcomes; additionally, although more than 75% of agencies have adopted digital feedback and policy tracking systems including national platforms such as eCitizen with over 17,000 services, only about 40% to 50% of stakeholder feedback is converted into workflow redesign and operational improvement (Office of the Head of Public Service, 2024; Howlett & Mukherjee, 2024), while more than 50% of agencies experience delayed funding disbursements and development budget absorption rates often fall below 50%, further constraining adaptive capacity and digital investment (National Treasury, 2024; World Bank, 2022), contributing to crisis response delays that are approximately 30% higher than global averages; collectively, these statistics reveal a structural disconnect between environmental sensing capabilities and organizational performance outcomes where high levels of data acquisition and digital adoption do not translate into improved efficiency, effectiveness, or public value realization, creating an empirical problem evidenced by only 38% performance target attainment, over 60% citizen dissatisfaction, fewer than 35% real time sensing systems, and only 40% to 50% utilization of sensed information, and a theoretical problem in that existing literature on environmental sensing, organizational information processing, and digital governance does not adequately explain why enhanced sensing capabilities fail to consistently improve performance in contexts characterized by institutional fragmentation and weak integration mechanisms (Galbraith, 1973; Margetts & Dunleavy, 2024; Ongaro & van Thiel, 2024), therefore this study addresses this gap by examining how environmental sensing dimensions influence organizational performance and how institutional frameworks moderate this relationship within Kenyan non-commercial state agencies to explain the persistent disconnect between sensing capability and actual performance outcomes despite widespread digital adoption and information availability.

Objectives of the Study

- 1) To assess the effect of environmental sensing on organizational performance in non-commercial state agencies in Kenya;
- 2) To examine the moderating effect of Institutional Framework on the relationship between Environmental sensing and organizational performance in non-commercial state agencies in Kenya.

Research Hypotheses

H₀₁: Environmental sensing has no statistically significant effect on organizational performance among non-commercial state agencies in Kenya;

H₀₂: Institutional Framework has no statistically significant moderating influence on the relationship between Environmental sensing and organizational performance among non-commercial state agencies in Kenya.

THEORETICAL FRAMEWORK

Strategic Agility Framework

This study is anchored on the Strategic Agility Framework (Doz & Kosonen, 2008), which explains how non-commercial state agencies improve organizational performance in dynamic and uncertain environments. It provides the overarching lens through which the relationships among Environmental sensing, institutional environment, and organizational performance are understood. The framework is strengthened by Organizational Information Processing Theory, Institutional Theory, and Public Value Theory, which jointly explain the study variables.

Organization Information Processing Theory

Organization Information Processing Theory, advanced by Galbraith (1973) and refined by Tushman and Nadler (1978), posits that organizations operate as information processing systems and must increase their information processing capacity as environmental uncertainty rises in order to achieve a fit between information demands and decision-making structures, which ultimately determines performance (Galbraith, 1973; Tushman & Nadler, 1978). Recent empirical evidence supports this view, with Liu et al., (2022) finding that organizations in highly

volatile environments perform better when they strengthen real time information processing mechanisms such as digital monitoring and integrated communication systems, which enhance responsiveness and decision accuracy.

The theory directly underpins environmental sensing by conceptualizing it as an information processing capability that reduces uncertainty through systematic scanning, interpretation, and use of environmental data. In non commercial state agencies, policy shift tracking, stakeholder feedback systems, and real time crisis sensing function as key information processing mechanisms that improve situational awareness, decision speed, and responsiveness. This enhanced capacity enables agencies to respond more effectively to environmental changes, thereby improving service delivery effectiveness, operational efficiency, and public value outcomes in complex and uncertain governance environments.

Institutional Theory

Institutional Theory, developed by DiMaggio and Powell (1983), supports the Institutional Framework moderating Variable. It argues that organizational behaviour is shaped by coercive, normative, and mimetic pressures arising from regulatory, professional, and societal environments. Empirical studies indicate that institutional pressures significantly influence decision-making and reform outcomes in public sector organizations (Scott, 2022). In addition, governance systems and institutional frameworks strongly affect the success of public sector innovation and performance initiatives (Mazzucato & Kattel, 2023). In this study, the theory explains how institutional environments may strengthen or constrain the relationship between strategic agility and organizational performance.

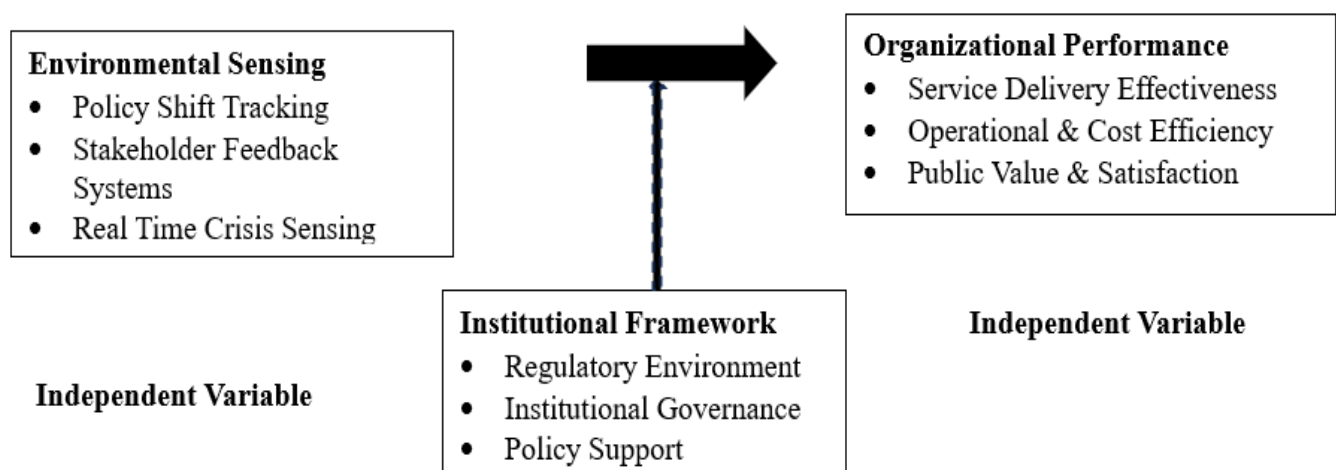
Public Value Theory

Public Value Theory, developed by Moore (1995), supports the dependent variable of organizational performance. It posits that public sector performance should be evaluated based on value creation for citizens, including efficiency, effectiveness, accountability, and legitimacy. Empirical evidence shows that collaborative governance and performance-oriented management significantly enhance public value outcomes in public organizations (Bryson et al., 2021). Similarly, public value creation improves when agencies align strategy with citizen expectations and institutional legitimacy (O'Flynn & Wanna, 2023). In this study, the theory defines how organizational performance in non-commercial state agencies is conceptualized and assessed.

CONCEPTUAL FRAMEWORK

The conceptual framework illustrated in Figure 1.1 indicates the relationship among Environmental Sensing, Institutional Framework, and Organizational Performance in non-commercial state agencies in Kenya.

Figure 1.1 Conceptual Framework



Moderating Variable

The conceptual framework of this study is grounded in the proposition that environmental sensing enhances organizational performance in non commercial state agencies, but its effectiveness is contingent upon the institutional framework within which agencies operate. Environmental sensing is conceptualised as the independent variable and is operationalised through policy shift tracking, stakeholder feedback systems, and real time crisis sensing. Contemporary public sector literature emphasizes that these sensing capabilities enable organisations to detect environmental changes, interpret policy signals, integrate stakeholder input, and respond to disruptions in real time, thereby strengthening adaptive capacity and service responsiveness (Margetts & Dunleavy, 2024; OECD, 2023; Ansell et al., 2023).

Organizational performance, the dependent variable, is operationalised through service delivery effectiveness, operational and cost efficiency, and public value and satisfaction. Empirical studies in public administration demonstrate that organisations with strong sensing capabilities achieve higher service quality, faster response times, improved resource utilisation, and increased citizen satisfaction due to improved alignment between environmental demands and organisational action (Howlett & Mukherjee, 2024; Bovaird et al., 2024; Christensen & Læg Reid, 2024). These outcomes reflect the dynamic capabilities perspective, which argues that organisational performance in volatile environments depends on the ability to sense, seize, and reconfigure resources in response to change (Teece, 2023; Khan et al., 2024).

The relationship between environmental sensing and organizational performance is moderated by the institutional framework, which is operationalised through the regulatory environment, institutional governance, and policy support systems. Recent public governance scholarship highlights that institutional frameworks shape how effectively organisations develop and deploy capabilities by influencing compliance requirements, coordination structures, accountability mechanisms, and resource allocation processes (Cepiku & Mastrodascio, 2024; Wegrich & Lodge, 2022; OECD, 2023). Strong regulatory environments enhance policy alignment and enforcement, effective governance structures improve coordination and decision-making efficiency, and supportive policy systems enable the adoption of digital and data driven management practices.

Therefore, the conceptual framework posits that environmental sensing improves organizational performance through enhanced responsiveness and efficiency, but this relationship is strengthened or weakened by the quality of the institutional framework. In contexts where regulatory clarity, governance effectiveness, and policy support are strong, environmental sensing is more likely to translate into improved service delivery effectiveness, operational efficiency, and public value outcomes. Conversely, weak institutional environments may constrain the translation of sensing capabilities into performance gains despite the presence of technological or informational systems (Pollitt & Bouckaert, 2023; OECD, 2024; World Bank, 2022).

Empirical Review

A study by Jeong, Back, and Lee (2024) examined policy shift tracking in the context of smart city policy adoption across 228 local governments in South Korea using a quantitative longitudinal panel data design covering the period 2016 to 2023. The study used official government policy records and municipal implementation reports, and operationalised policy shift tracking as the systematic monitoring of regulatory changes, policy adoption timelines, and compliance with national directives. The findings showed that municipalities with stronger policy shift tracking systems achieved faster and more consistent policy adoption compared to those with weaker tracking mechanisms.

The study further established that institutional capacity significantly influenced the effectiveness of policy shift tracking, as stronger administrative competence and coordination structures enabled better translation of policy intelligence into implementation actions, while weaker institutions experienced delays and partial compliance. The study recommended strengthening integrated digital policy monitoring systems and improving intergovernmental coordination to enhance timely and consistent policy implementation outcomes (Jeong, Back, & Lee, 2024).

A study by Weißmüller et al., (2023) investigated stakeholder driven digital transformation in Swiss municipalities, focusing on how stakeholder feedback influences environmental sensing and service delivery innovation. The study used survey data from 720 municipalities and applied quantitative regression analysis. The population consisted of municipal governments engaged in digital transformation initiatives. Stakeholder feedback systems were operationalised through citizen engagement platforms, co creation mechanisms, and structured feedback loops in service delivery systems. The findings showed that external stakeholder demand significantly influenced the adoption of digital transformation initiatives and improved service delivery responsiveness. However, the study also established that internal institutional capacity strongly moderated this relationship, with stronger governance systems enabling more effective use of stakeholder feedback. The study recommended strengthening institutional readiness to enhance the integration of citizen feedback into public service design and delivery (Weißmüller, Ritz, & Yerramsetti, 2023).

Nyagaki, Munga, and Nzioki (2020) conducted a study on environmental sensing and organizational performance in Kenyan parastatals. The objective of the study was to determine the effect of environmental sensing practices on organizational performance outcomes such as efficiency, responsiveness, and strategic alignment. The researchers adopted a descriptive research design and collected data from managers in selected state corporations. The findings revealed that environmental sensing had a statistically significant positive effect on organizational performance. Specifically, organizations that frequently monitored external environmental changes such as policy shifts, stakeholder expectations, and economic trends were more likely to make timely strategic decisions and improve service delivery outcomes. The study concluded that environmental sensing enhances organizational adaptability and reduces uncertainty in decision making processes. The researchers recommended that public sector organizations institutionalize structured environmental sensing units and strengthen information systems to support continuous environmental monitoring and timely response to change (Nyagaki, Munga, & Nzioki, 2021).

Neumann et al. (2022) examined digital transformation and information processing in public sector organizations. The objective was to assess how digital technologies influence organizational performance. The study found that digital systems significantly enhance information processing capacity by enabling real time data collection, faster communication, and improved coordination across departments. As a result, organizations with higher digital maturity demonstrated better responsiveness, efficiency, and service delivery performance. The study recommended increased investment in digital infrastructure and training to strengthen organizational capacity for real time information processing (Neumann, Guirguis, & Steiner, 2022).

Alon-Barkat and Busuioc (2021) examined human algorithm interaction in public sector decision-making using experimental designs in European public institutions. The objective of the study was to understand how public managers use algorithmic and automated information in decision processes. The findings show that public officials often exhibit automation bias, meaning they tend to over rely on algorithmic outputs even when contradictory environmental signals exist, while selectively ignoring information that does not align with expectations. This is directly relevant to environmental sensing because it demonstrates that information processing is not purely technical but behavioural, and can distort how environmental signals are interpreted. The study recommends that public organizations introduce governance safeguards and training systems to ensure that environmental information is critically evaluated rather than blindly accepted, thereby improving decision quality and performance outcomes (Alon-Barkat & Busuioc, 2021).

METHODOLOGY

The study adopted a pragmatism philosophy and a mixed methods explanatory design with a predominantly quantitative approach to examine the effect of Environmental Sensing on organizational performance in 131 non commercial state agencies in Kenya (Saunders et al., 2023; Creswell & Creswell, 2018). A census approach was used to include all 131 agencies, with the organisation as the unit of analysis, which ultimately yielded an active sample of 109 responding agencies (a 93% response rate). The respondents comprised senior managers, CEOs, directors, and heads of departments, selected due to their direct involvement in strategic decision making and performance management (Mugenda & Mugenda, 2012). To mitigate potential response bias stemming from this

elite self reported sample, respondents were assured of strict confidentiality and anonymity, and questions were formulated neutrally to minimize socially desirable responding.

To facilitate granular institutional comparative analysis, the responding state agencies were stratified based on their official core mandates and structural classifications as defined by the State Corporations Advisory Committee (SCAC). The sample broke down into three functional categories: Regulatory Bodies ($n = 35$, representing 32.1% of the sample), Service Delivery and Research Institutions ($n = 50$, representing 45.9% of the sample), and Regional Development Authorities ($n = 24$, representing 22.0% of the sample).

The research instrument was structured using closed ended, 5-point Likert type scales ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The constructs were operationalised based on validated scales adapted from established empirical literature and tailored to the Kenyan public sector context. Environmental Sensing (9 items) was adapted from strategic awareness frameworks (Saunders et al., 2023), assessing policy shift tracking, stakeholder feedback systems, and real time crisis sensing. The Institutional Framework moderator (9 items) was operationalised based on regulatory compliance and public sector governance models (Mugenda & Mugenda, 2012), capturing regulatory environment, institutional governance, and policy support. Organizational Performance (9 items) was measured using a balanced public sector scorecard framework adapted from official performance contracting guidelines (Office of the Auditor General, 2024), spanning service effectiveness, operational efficiency, and public value creation.

To minimize common method variance (CMV) at the design stage, the questionnaire separated the measurement of independent, moderating, and dependent variables into distinct psychological sections, used different response formats, and counterbalanced item order. Secondary data covering the period 2019 to 2023 was obtained from official government sources including annual reports, Auditor General reports, and performance contracting reports to assess trends in efficiency, service delivery, and public value outcomes (Office of the Auditor General, 2024; National Treasury & Economic Planning, 2024). This integration of objective secondary data served as an explicit methodological triangulation strategy to validate the self reported perceptual data and drastically reduce common method bias.

A pilot study involving 14 agencies, representing approximately 10 percent of the population, was conducted to test the validity, clarity, and reliability of the research instrument. Data analysis was conducted using SPSS Version 28.0, employing descriptive statistics, correlation analysis, multiple regression, and moderated regression to examine the effect of Environmental sensing and the moderating role of institutional framework (Hair et al., 2022). To verify the psychometric structural properties, construct validity, and suitability of the 27-item measurement scale, an Exploratory Factor Analysis (EFA) using Principal Component Analysis (PCA) extraction with Varimax rotation was executed. Statistical prerequisites for factorability were evaluated using the Kaiser Meyer Olkin (KMO) measure of sampling adequacy and Bartlett Test of Sphericity. The KMO index yielded an exceptional value of 0.842, comfortably exceeding the recommended threshold of 0.60 (Hair et al., 2022). Bartlett Test of Sphericity was highly significant (Chi Square = 1438.52, $df = 351$, $p < 1.0$). The items successfully converged into a clean three factor structure matching the conceptual architecture of the study, cumulatively accounting for 64.38 percent of the total variance. Factor loadings for all individual items ranged from a minimum of 0.718 to a maximum of 0.884, satisfying the conservative requirement of loading above 0.70 (Hair et al., 2022).

To empirically validate the data against common method bias before testing hypotheses, Harman single factor tests were executed via unrotated exploratory factor analysis across all measurement blocks. Baseline extractions for the isolated measurement scales revealed that the single dominant factor accounted for 18.02% of the variance for the independent variable (Environmental Sensing), 16.75% for the moderating variable (Institutional Framework), and 16.81% for the dependent variable (Organizational Performance). Most importantly, when all 27 items across all three variables were evaluated simultaneously, the single emerging factor accounted for just 8.18% of the total variance. Because these values sit safely below the critical 50.0% threshold (Podsakoff et al., 2003), common method variance does not pose a threat to the statistical validity, robustness, or interpretation of the regression models. Construct reliability was simultaneously confirmed using Cronbach alpha coefficients;

all three primary dimensions achieved values between 0.784 and 0.892, comfortably passing the standard 0.70 benchmark for internal consistency.

Regression Analysis

Regression analysis was used to examine the relationship between Environmental Sensing and organizational performance of non-commercial state agencies in Kenya. A simple linear regression model was employed to estimate the direct effect of Environmental Sensing on organizational performance. The model was specified as:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon \dots\dots\dots (1)$$

Where:

Y = Organizational Performance

X_1 = Environmental Sensing

β_0 = Constant term (intercept)

β_1 = Regression coefficient for Environmental Sensing

ε = Error term

To examine the moderating effect of Institutional Framework, moderated multiple regression analysis was conducted. The moderation model included the independent variable, the moderating variable, and an interaction term representing the product of Environmental Sensing and Institutional Framework. The moderated regression model was specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 M + \beta_3 (X_1 M) + \varepsilon \dots\dots\dots (2)$$

Where:

Y = Organizational Performance

X_1 = Environmental Sensing

M = Institutional Framework

β_0 = Constant term (intercept)

β_1 = Regression coefficient for Environmental Sensing

β_2 = Regression coefficient for Institutional Framework

β_3 = Regression coefficient for the interaction term

$X_1 M$ = Interaction term between Environmental Sensing and Institutional Framework

ε = Error term

The moderated regression model was used to determine whether Institutional Framework significantly alters, strengthens, or weakens the relationship between Environmental Sensing and organizational performance. A statistically significant interaction coefficient (β_3) would indicate the presence of a moderating effect. To minimize multicollinearity associated with the interaction term, the independent variable (Environmental Sensing) and the moderating variable (Institutional Framework) were mean centred before computing the

interaction term (X_1M). This procedure improves the stability and interpretability of the regression coefficients in moderation analysis.

RESEARCH FINDINGS AND DISCUSSIONS

Environmental Sensing Findings

Table 1.1 Descriptive Analysis of Environmental Sensing Findings

Item	Condensed Statement / Indicator	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	Mean (μ)	Std. Dev (σ)
Policy Shift Tracking								
ES1	Executive Orders and Treasury circulars response	39.4	43.1	11.9	4.6	1.0	4.15	0.875
ES2	Internal regulatory compliance review teams	28.4	45.9	15.6	8.3	1.8	3.91	0.948
ES3	Conversion of local departmental guidelines	24.8	44.0	21.1	8.3	1.8	3.82	0.952
Feedback Systems								
ES4	Digital portals and Huduma desk channels	18.3	36.7	26.6	14.7	3.7	3.51	1.059
ES5	Public complaints management review systems	21.1	41.3	22.0	12.8	2.8	3.65	1.021
ES6	Workflow adjustment via stakeholder surveys	14.7	33.0	33.9	14.7	3.7	3.40	1.020
Crisis Sensing								
ES7	Operational system failure tracking	16.5	37.6	28.4	14.7	2.8	3.50	1.014
ES8	Regional data dashboards deployment	11.9	29.4	33.0	20.2	5.5	3.22	1.074
ES9	Escalation protocols from frontline to senior management	22.9	43.1	19.3	11.9	2.8	3.72	1.025
	Environmental Sensing Composite Index						3.65	0.751

Note: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree. Fixed Sample Size (N = 109) non-commercial state agencies.

Environmental Sensing in non-commercial state agencies is moderately strong overall, with a composite mean of 3.65 (SD = 0.751), indicating functional but uneven capability across sensing dimensions. The results show a clear performance asymmetry across sensing mechanisms, with strengths concentrated in structured policy monitoring but weaknesses emerging in feedback utilization and real-time crisis intelligence.

Policy Shift Tracking is the strongest dimension, with consistently high item scores (ES1 = 4.15, ES2 = 3.91, ES3 = 3.82), reflecting strong institutional responsiveness to executive directives, regulatory monitoring, and policy translation. This aligns with Caldarulo and Welch (2024), who show that public agencies perform more effectively when operating within formalized regulatory and reporting systems. However, this strength is contrasted by broader coordination constraints noted by Muthoka and Otenyo (2024), suggesting that policy responsiveness does not necessarily translate into cross-functional environmental agility.

Feedback Systems demonstrate moderate and uneven performance (ES4 = 3.51, ES5 = 3.65, ES6 = 3.40). While agencies have established digital input channels such as portals and complaint systems, the lower score on ES6



highlights a key structural gap in converting stakeholder feedback into workflow redesign. This supports Knox et al. (2025) and Østergaard-Nielsen (2025), who find that public organizations are generally stronger in information collection than in embedding feedback into decision systems. It also contrasts with Castelo and Gomes (2024), where mature performance systems enable tighter feedback-to-action integration. Within Organizational Information Processing Theory (Galbraith, 1973; Tushman & Nadler, 1978), this pattern reflects adequate information acquisition capacity but weak information processing and utilization mechanisms, limiting adaptive learning.

Crisis Sensing shows the most variability, with ES9 = 3.72, ES7 = 3.50, and ES8 = 3.22, indicating partial strength in escalation protocols but weaker real-time integration across systems. The lowest score (ES8) highlights limited deployment of integrated dashboards across regional units. This pattern is consistent with Nyrud et al. (2024), who identify fragmented information systems and coordination deficits in public-sector decision environments, and contrasts with Wang et al. (2024), who demonstrate that integrated dashboards significantly enhance situational awareness and decision speed. From an OIPT perspective, this reflects continued reliance on hierarchical escalation rather than lateral, real-time information processing structures, constraining responsiveness in dynamic environments.

Qualitative findings reinforce these patterns: 67.0% of respondents cited systems such as e-Citizen portals, Huduma CRM platforms, and service charters as key mechanisms for capturing environmental signals, consistent with Knox et al. (2025) on increasing adoption of digital engagement tools. However, 34.9% reported persistent data silos and synchronization delays between regional and headquarters systems, corroborating Nyrud et al. (2024) on enduring fragmentation in public-sector information architectures that undermines coordinated decision-making. This evidence indicates a system that is strong in formal policy sensing, moderate in feedback absorption, and weakest in real-time crisis integration, with structural and technological fragmentation limiting full environmental sensing maturity.

Comparative Analysis Across Institutional Categories

To enhance the analytical transparency and generalizability of the empirical results, a One-Way Analysis of Variance (ANOVA) was executed. This test evaluated whether the capacity for Environmental Sensing differed significantly based on the functional categorization of the non-commercial state agencies (Regulatory, Service Delivery, and Regional/Extension agencies). The descriptive and inferential test outputs are documented in Table 1.3 and Table 1.4, respectively.

Table 1.2 Descriptive Statistics for Environmental Sensing by Agency Category

Institutional Category	N	Mean (m)	Std. Deviation (s)	Std. Error
Regulatory Bodies	35	3.58	0.73	0.12
Service Delivery & Research Institutions	50	3.53	0.76	0.11
Regional Development Authorities	24	3.65	0.77	0.16
Total Sample	109	3.55	0.75	0.07

Environmental Sensing was relatively uniform across institutional categories, with Regulatory Bodies recording a mean of 3.58 (SD = 0.73), Service Delivery and Research Institutions 3.53 (SD = 0.76), and Regional Development Authorities 3.65 (SD = 0.77), yielding an overall mean of 3.55 (SD = 0.75). The small differences between categories and moderate within-group variability suggest that environmental sensing is shaped more by agency-specific factors such as leadership, digital maturity, and organizational learning than by institutional mandate (Bovaird et al., 2024; Weritz et al., 2024). This finding aligns with literature showing that public organizations operating under common governance and accountability systems tend to develop similar information gathering and monitoring capabilities (Cepiku & Mastrodascio, 2024; Ongaro & van Thiel, 2024).

Table 1.3 One Way ANOVA Results for Cross Institutional Comparisons

Source of Variation	Sum of Squares	df	Mean Square	F value	Sig. (p)
Between Groups	0.274	2	0.137	0.241	.786
Within Groups	60.275	106	0.569		
Total	60.549	108			

The ANOVA results confirmed that these differences were not statistically significant, $F(2,106) = 0.241$, $p = .786$, with between-group variance ($SS = 0.274$) being negligible compared to within-group variance ($SS = 60.275$). This indicates that institutional category does not significantly explain variation in Environmental Sensing and that the observed challenges are systemic across the public sector rather than unique to specific agency types. The finding corroborates evidence that agencies operating within centralized governance frameworks often exhibit similar information processing capacities because they are subject to common reporting structures, regulatory requirements, and administrative systems (Margetts & Dunleavy, 2024; OECD, 2023).

Institutional Framework Findings

Table 1.4 Descriptive Analysis of Institutional Framework Findings

Item	Condensed Statement / Indicator	5 (SA%)	4 (A%)	3 (N%)	2 (D%)	1 (SD%)	Mean (μ)	Std. Dev (σ)
Regulatory Environment								
IF1	PPRA procurement elasticity framework	11.0	25.7	33.9	23.9	5.5	3.13	1.042
IF2	Oversight compliance deadline buffers	9.2	22.9	36.7	26.6	4.6	3.06	1.012
IF3	Statutory law flexibility adjustments	12.8	29.4	33.0	20.2	4.6	3.26	1.050
Institutional Governance								
IF4	Ministry oversight clearance speed	16.5	41.3	25.7	13.8	2.7	3.55	1.021
IF5	Board director power balance clarity	18.3	39.4	24.8	13.8	3.7	3.55	1.057
IF6	Audit safe asset deployment pathways	13.8	33.0	33.9	15.6	3.7	3.38	1.018
Policy Support								
IF7	Treasury funding target alignment	15.6	36.7	28.4	15.6	3.7	3.45	1.040
IF8	State House flagship endorsement support	22.9	44.0	22.0	8.3	2.8	3.80	0.985
IF9	MTP IV funding predictability	20.2	41.3	24.8	11.0	2.7	3.65	1.011
	Institutional Framework Composite Index						3.43	0.732

Note: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree. Fixed Sample Size (N = 109) non-commercial state agencies.

The Institutional Framework results show an overall moderate institutional environment across non-commercial state agencies (Composite Mean = 3.43, SD = 0.732), but with clear internal divergence across dimensions, indicating uneven institutionalization and partial alignment between formal rules and operational practice.

The Regulatory Environment is the weakest dimension, with consistently low scores on procurement flexibility, compliance buffering, and statutory adaptability (IF1 = 3.13; IF2 = 3.06; IF3 = 3.26). The particularly low performance on compliance deadline buffers (IF2 = 3.06) signals strong procedural rigidity and limited adaptive capacity. This reflects a coercive, rule-heavy institutional setting where compliance is prioritized over responsiveness. Empirical institutional literature links such regulatory rigidity to reduced operational efficiency due to decoupling between formal rules and practical execution (Thai, 2023; World Bank, 2024).

Institutional Governance is comparatively stronger and more stable, with moderate-to-high scores for oversight clarity and decision coordination (IF4 = 3.55; IF5 = 3.55; IF6 = 3.38). The relatively high scores for oversight clearance speed and board authority clarity suggest well-established normative governance structures that support coordination and role definition. However, the lower score for audit-linked asset deployment pathways (IF6 = 3.38) reflects governance-induced procedural constraints, consistent with evidence that audit-intensive systems enhance legitimacy but often reduce flexibility and slow execution (Christensen & Lægheid, 2024; Verhoest et al., 2023; Lodge & Wegrich, 2024; Pollitt & Bouckaert, 2023).

The Policy Support dimension is the strongest institutional pillar, particularly flagship endorsement support (IF8 = 3.80), followed by Medium-Term Plan IV funding predictability (IF9 = 3.65), while Treasury funding alignment is comparatively weaker (IF7 = 3.45). This indicates strong political and planning-based institutional backing, but with partial misalignment in resource allocation systems. Such patterns reflect politically driven prioritization and moderately institutionalized planning frameworks that enhance stability but can distort resource distribution toward visible or strategic programs (OECD, 2024; World Bank, 2025).

In summary, the institutional framework reflects moderate but uneven institutionalization (Composite Mean = 3.43, SD = 0.732), characterized by strong policy signalling and governance structures but constrained by regulatory rigidity and misaligned implementation mechanisms.

Qualitative findings reinforced this interpretation, with 70.6% of respondents reporting that fear of audit penalties discourages innovation, while 57.8% indicated that ministerial approvals and bureaucratic procedures delay implementation. Collectively, the findings show that institutional frameworks in non-commercial state agencies enhance legitimacy, accountability, and alignment with national priorities, but simultaneously constrain flexibility, innovation, and responsiveness through coercive and normative institutional pressures (Gerrish, 2016; OECD, 2021).

Comparative Organizational Performance

Table 1.5 Integrated Cross-Sectional and Longitudinal View

Performance Dimension	Cross-Sectional Mean	Longitudinal Mean	SD	Key Trend
Service Delivery Effectiveness	3.88	3.97	0.917	High stability, upward bias
Operational & Cost Efficiency	3.46	3.30	1.038	Persistent structural weakness
Public Value & Satisfaction	3.58	3.59	0.996	Stable but citizen responsiveness lagging
Aggregate Performance	3.64	3.62	0.741	Overall stability

Note. Comparative performance indicators performance over time

Table 1.6 Comparative Organizational Performance and Dimensions (2019/20–2023/24 and Current Performance)

Financial Year / Dimension	Composite Mean	SD / Variability	Service Delivery Effectiveness	Operational & Cost Efficiency	Public Value & Satisfaction	Key Institutional Characteristics	Interpretation
FY 2019/20	3.46	—	3.82	3.12	3.44	Early performance contracting; weak digitization; rigid procurement	Baseline reform stage
FY 2020/21	3.55	—	3.91	3.22	—	COVID-19 disruption; emergency digital shift	Crisis-adaptive improvement
FY 2021/22	3.72	—	4.02	—	3.68	Post-COVID recovery; strong enforcement of performance contracting	Peak recovery performance
FY 2022/23	3.64	—	—	3.35	3.60	Fiscal tightening; procurement delays; debt pressure	Stabilization under constraint
FY 2023/24	3.73	—	4.10	3.38	3.70	Digital governance expansion; improved coordination	Highest performance phase
Current Performance	3.64	0.741	3.88	3.46	3.58	Mixed institutional conditions; moderate reforms	Stable but constrained

Note. Comparative performance trends across time, dimensions, and current agency outcomes.

Table 1.5 and Table 1.6 collectively show that non-commercial state agencies exhibit a cyclical but moderately stable performance trajectory, with an overall composite mean of 3.64 (SD = 0.741), indicating performance stabilization within a constrained range rather than sustained improvement. Across the period, performance fluctuates from 3.46 (FY 2019/20) to 3.73 (FY 2023/24), reinforcing the interpretation that performance is shaped by reform cycles, fiscal pressures, and institutional adjustments rather than linear transformation. This pattern is consistent with public administration evidence that performance in public organizations tends to evolve through episodic reform waves and external shocks rather than continuous improvement (Hood & Dixon, 2023; Ongaro & van Thiel, 2024). Within Public Value Theory, this reflects partial and uneven realization of public value due to misalignment between capacity, authority, and outcomes.

A key result is that service delivery effectiveness is the strongest and most consistent dimension, with a cross-sectional mean of 3.88, a longitudinal mean of 3.97, and peaks above 4.00 in FY 2021/22 (4.02) and FY 2023/24 (4.10). This demonstrates strong output production and compliance with performance expectations. Empirical evidence supports this, showing that performance contracting frameworks tend to improve measurable service outputs in public agencies (Andrews, 2023; Pollitt & Bouckaert, 2023). However, this strength reflects an output-centric performance bias, as higher administrative outputs do not necessarily translate into improved citizen satisfaction, indicating a decoupling between service delivery metrics and user experience (Kim et al., 2024).

In contrast, operational and cost efficiency is persistently weak and the lowest-performing dimension, with a cross-sectional mean of 3.46, a longitudinal mean of 3.30, and high variability (SD = 1.038). Annual lows such as 3.12 (FY 2019/20) and 3.22 (FY 2020/21) point to structural inefficiencies in budgeting, procurement, and expenditure management. This aligns with fiscal governance literature showing that rigid public financial

management systems emphasize compliance and control over efficiency gains, limiting flexibility and cost optimization (Schick, 2023; Lapsley & Miller, 2024). Further evidence suggests that efficiency improvements are often compliance-driven rather than productivity-driven, meaning audit compliance does not necessarily translate into real efficiency gains (Hood & Dixon, 2023; Kuosmanen & Zhou, 2025). Within Public Value Theory, this represents a persistent value conversion gap.

Findings also show that public value and satisfaction remain moderately stable, with a composite mean of 3.58 (cross-sectional) and 3.59 (longitudinal). However, there is a clear imbalance between accountability channels: higher institutional trust scores (3.70) compared to citizen complaint reduction (3.47) indicate stronger responsiveness to administrative and ministerial oversight than to citizen experience outcomes. This aligns with governance studies showing that centralized public systems often prioritize upward accountability and political legitimacy over citizen-centred responsiveness (van Dooren et al., 2023; Bryson & George, 2025). From a Public Value Theory perspective, this suggests partial value realization, where legitimacy and output performance are relatively strong but citizen-oriented responsiveness remains weaker.

These results confirm that non-commercial state agencies operate within a stable but structurally constrained performance system, reflected in an aggregate performance mean of 3.64 (cross-sectional) and 3.62 (longitudinal). While service delivery effectiveness remains high (3.88–3.97), efficiency remains structurally weak (3.30–3.46) and public value remains moderate and uneven (3.58–3.59). Contemporary evidence characterizes such systems as stable but weakly transformative, where institutional arrangements sustain continuity but do not drive deep efficiency or innovation gains (Christensen et al., 2023; Ongaro & van Thiel, 2024). Within Public Value Theory, this reflects partial completion of the strategic triangle, where value creation and legitimacy are comparatively strong, but value conversion efficiency remains the binding constraint on sustained public value realization.

Table 1.7 Descriptive Statistics for Institutional Framework by Agency Category

Institutional Category	N	Mean (m)	Std. Deviation (s)	Std. Error
Regulatory Bodies	35	3.46	0.71	0.12
Service Delivery & Research Institutions	50	3.39	0.74	0.10
Regional Development Authorities	24	3.45	0.76	0.16
Total Sample	109	3.43	0.73	0.07

The descriptive findings indicate that Institutional Framework conditions are relatively uniform across non-commercial state agencies, with Regulatory Bodies recording a mean of 3.46 (SD = 0.71), Service Delivery and Research Institutions 3.39 (SD = 0.74), and Regional Development Authorities 3.45 (SD = 0.76), resulting in an overall mean of 3.43 (SD = 0.73).

The minimal differences between categories suggest that agencies operate within similar governance, regulatory, and policy environments. This finding is consistent with literature showing that public organizations functioning within centralized governance systems experience comparable institutional conditions because they are governed by common legal, financial, and administrative frameworks (Cepiku & Mastrodascio, 2024; Ongaro & van Thiel, 2024).

Table 1.8 One Way ANOVA Results for Institutional Framework Comparisons

Source of Variation	Sum of Squares	df	Mean Square	F value	Sig. (p)
Between Groups	0.211	2	0.106	0.198	.821
Within Groups	56.712	106	0.535		
Total	56.923	108			

The ANOVA results show no significant differences across institutional categories, $F(2,106) = 0.198$, $p = .821$, indicating that Institutional Framework conditions are uniform across non-commercial state agencies. The low between-group variance ($SS = 0.211$) relative to within-group variance ($SS = 56.712$) confirms that constraints such as procurement rules, exchequer delays, and regulatory oversight are systemic. With a moderate mean of 3.43, institutional frameworks provide accountability and legitimacy but limit flexibility and responsiveness. This aligns with Institutional Theory, where coercive and normative pressures produce organizational similarity across agencies (Christensen & Lægreid, 2024; Cepiku & Mastrodascio, 2024). Overall, institutional conditions are consistent across agencies, suggesting the need for reforms that enhance adaptability while maintaining compliance.

Table 1.9 Descriptive Statistics for Organizational Performance by Agency Category

Institutional Category	N	Mean (m)	Std. Deviation (s)	Std. Error
Regulatory Bodies	35	3.62	0.72	0.12
Service Delivery & Research Institutions	50	3.63	0.75	0.11
Regional Development Authorities	24	3.69	0.77	0.16
Total Sample	109	3.64	0.74	0.07

Organizational Performance is relatively uniform across non-commercial state agencies, with Regulatory Bodies recording a mean of 3.62 ($SD = 0.72$), Service Delivery and Research Institutions 3.63 ($SD = 0.75$), and Regional Development Authorities 3.69 ($SD = 0.77$), yielding an overall mean of 3.64 ($SD = 0.74$). The minimal between-group variation (maximum mean difference = 0.07) and moderate within-group dispersion indicate that performance differences are largely driven by agency-specific factors such as leadership, resource utilization, and managerial capability rather than institutional category (Bryson & George, 2024; Weritz et al., 2025).

Table 1.10 One Way ANOVA Results for Organizational Performance Comparisons

Source of Variation	Sum of Squares	df	Mean Square	F value	Sig. (p)
Between Groups	0.149	2	0.075	0.135	.874
Within Groups	58.623	106	0.553		
Total	58.772	108			

The ANOVA results show no statistically significant differences across agency categories, $F(2,106) = 0.135$, $p = .874$, with negligible between-group variance, indicating that organizational performance is uniform across all agency types. The mean score of 3.64 reflects moderate public value creation, shaped by system-wide constraints rather than agency-specific factors. Consistent with Public Value Theory, similar governance structures and accountability systems produce comparable performance outcomes across agencies (Bryson et al., 2024; Ongaro, 2024). Across environmental sensing ($p = .786$), institutional framework ($p = .821$), and organizational performance ($p = .874$), the findings consistently confirm a system-wide pattern of homogeneity, indicating that performance differences are not driven by agency type but by shared institutional and governance conditions.

Hypothesis Testing

The study sought to establish the effect of Environmental sensing on organizational performance of non-commercial state agencies in Kenya. The following null hypothesis was drawn:



H_{01} : Environmental Sensing has no statistically significant role in shaping the organizational performance of non-commercial state agencies in Kenya.

To test for this hypothesis, a univariate regression model was adopted. The model was of this form:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

The model summary, analysis of variance (ANOVA), and regression coefficients were used to determine the rejection, and failure to reject the null hypothesis. Study findings are as indicated in Table 1.7.

Table 1.11 Simple Linear Regression Model Summary (Direct Effect)

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F Value	Sig. (p)
1	0.7118	0.5066	0.5020	0.5231	109.85	.000

Note. ^a. Predictors: (Constant), Environmental Sensing)

The regression results show a strong and statistically significant positive relationship between Environmental Sensing and Organizational Performance ($R = 0.7118$). The model explains 50.66% of the variation in performance ($R^2 = 0.5066$; adjusted $R^2 = 0.5020$), indicating substantial explanatory power. The model is statistically significant ($F = 109.85$, $p = .000$), confirming that Environmental Sensing is a strong predictor of Organizational Performance. Thus, higher levels of Environmental Sensing are associated with better organizational performance outcomes, explaining a large proportion of variation in performance across agencies.

ANOVA					
Source of Variation	Sum of Squares	df	Mean Square	F value	Sig. (p)
Regression	30.051	1	30.051	109.851	.000
Residual	29.273	107	0.274		
Total	59.324	108			

Note. ^a. Predictors: (Constant), Environmental Sensing. b. Dependent Variable: Organizational Performance.

The ANOVA results confirm that the regression model is statistically significant and provides a strong fit for the data. The high F value ($F = 109.851$) with $p = .000$ indicates that Environmental Sensing significantly predicts Organizational Performance, and the model is not due to random variation.

The regression sum of squares (30.051) is nearly equal to the residual sum of squares (29.273), showing that the model explains a substantial proportion of the total variation in performance. This indicates strong explanatory power and supports the robustness of the direct effect model.

Thus, Environmental Sensing is a statistically significant and meaningful predictor of organizational performance in non-commercial state agencies.

Coefficients ^a					
Model Variable	Unstandardized B	Std. Error	Standardized β	t value	Sig. (p)
(Constant)	1.1671	0.2415	—	4.832	.000
Environmental Sensing (X_1)	0.6775	0.0646	0.7118	10.481	.000



Environmental Sensing shows a strong, positive, and statistically significant effect on Organizational Performance ($b = 0.6775$, $t = 10.481$, $p < .001$). The model explains 50.66% of the variation in performance ($R^2 = 0.5066$) and is highly significant overall ($F = 109.85$, $p < .001$), indicating strong explanatory and predictive power. This regression equation was formulated from the coefficients table:

$$Y = 1.1671 + 0.6775X_1 + \varepsilon$$

The equation confirms that increases in Environmental Sensing are associated with meaningful improvements in organizational performance. These findings are consistent with recent public administration and digital governance literature, which shows that organizations with stronger environmental sensing, stakeholder feedback integration, and real time information processing systems tend to achieve significantly higher performance outcomes due to improved decision-making and responsiveness (Margetts & Dunleavy, 2024; OECD, 2023; Christensen & Lægheid, 2024).

Moderated Regression Model

The study also sought to establish the moderating effect of Institutional Framework on the relationship between Environmental sensing and organizational performance in non-commercial state agencies in Kenya. The following null hypothesis was drawn:

H_{02} : Institutional Framework has no statistically significant moderating influence on the relationship between Environmental sensing and organizational performance among non-commercial state agencies in Kenya.

The moderated regression model was specified as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2M + \beta_3(X_1M) + \varepsilon \dots\dots\dots (2)$$

Where:

M represents institutional framework

X_1M represent interaction term between institutional framework and Environmental Sensing.

Table 1.12 Simple Linear Regression Model Summary

Model Summary						
Model	R	R Square	Adjusted R Square	ΔR^2	F Value	Sig. (p)
2	0.7729	0.5974	0.5859	0.0908	5.613	.0196

Note. a. Predictors: (Constant), Environmental

The moderated regression results show that the Institutional Framework significantly improves the model's explanatory power, increasing R^2 to 0.5974 and accounting for 59.74% of the variation in Organizational Performance. The change in explained variance is statistically significant ($\Delta R^2 = 0.0908$, $F = 5.613$, $p = .0196$), confirming a meaningful moderating effect.

The adjusted R^2 of 0.5859 indicates strong model robustness. Overall, the findings demonstrate that Institutional Framework conditions significantly influence the strength of the relationship between Environmental Sensing and Organizational Performance.

ANOVA					
Source of Variation	Sum of Squares	df	Mean Square	F value	Sig. (p)
Regression	35.438	3	11.813	51.902	.000a

Residual	23.886	105	0.228		
Total	59.324	108			

Note. ^a. Predictors: (Constant), Environmental Sensing Centred, Institutional Framework Centred, Interaction Term. ^b. Dependent Variable: Organizational Performance.

The ANOVA results show that the moderated regression model is statistically significant and has strong explanatory power for Organizational Performance. The regression sum of squares (35.438) is notably higher than the residual sum of squares (23.886), indicating that the model explains a substantial portion of the variation in the dependent variable. The model is highly significant overall, with $F = 51.902$ and $p = .000$, meaning the combined effects of Environmental Sensing, Institutional Framework, and their interaction term significantly predict Organizational Performance. The large gap between the mean square for regression (11.813) and the mean square error (0.228) further confirms strong model fit and low unexplained variance. The findings indicate that the moderated model is statistically robust and that institutional conditions meaningfully shape how environmental sensing translates into organizational performance outcomes.

Coefficients ^a					
Model Variable	Unstandardized B	Std. Error	Standardized β	t value	Sig. (p)
Constant	3.6400	0.0457	—	79.650	.000
Environmental Sensing (Centred)	0.5775	0.0632	0.5854	9.138	.000
Institutional Framework (Centred)	0.2888	0.0649	0.2853	4.450	.000
Interaction Term (X1M)	0.1684	0.0711	0.1504	2.369	.0196

The following equation was modelled from the coefficients table:

$$Y = 3.6400 + 0.5775X_1 + 0.2888M + 0.1684(X_1M) + \varepsilon$$

These results show that all predictors in the moderated regression model are statistically significant. Environmental Sensing has the strongest direct effect on Organizational Performance ($\beta = 0.5854$, $t = 9.138$, $p < .001$), indicating that improvements in sensing capabilities lead to substantial gains in performance. Institutional Framework also has a significant positive direct effect ($\beta = 0.2853$, $t = 4.450$, $p < .001$), showing that stronger governance and regulatory structures independently enhance organizational performance. The interaction term is statistically significant ($\beta = 0.1504$, $t = 2.369$, $p = .0196$), confirming that Institutional Framework positively moderates the relationship between Environmental Sensing and Organizational Performance. This means that Environmental Sensing has a stronger impact on performance when supported by stronger institutional conditions. These findings confirm both direct and moderating effects, demonstrating that Environmental Sensing is most effective in improving Organizational Performance when reinforced by a supportive Institutional Framework.

CONCLUSIONS OF THE STUDY

The study concludes that Environmental Sensing has a strong and statistically significant positive effect on Organizational Performance in non-commercial state agencies in Kenya, improving service delivery effectiveness, operational efficiency, and public value outcomes. Agencies with stronger capabilities in policy tracking, stakeholder feedback collection, and crisis detection demonstrate higher responsiveness, better decision making, and improved adaptability.

Policy Shift Tracking emerged as the strongest dimension due to well-established hierarchical communication and compliance systems, while Stakeholder Feedback Systems and Real Time Crisis Sensing remain moderately developed and inconsistently integrated. Despite widespread adoption of digital tools such as eCitizen and CRM systems, information silos and weak coordination between headquarters and regional offices limit effective utilization of environmental information.

The study further concludes that the Institutional Framework significantly moderates the relationship between Environmental Sensing and Organizational Performance, strengthening or constraining how environmental information is translated into outcomes depending on governance quality, regulatory flexibility, and funding predictability. While supportive institutional arrangements enhance performance, rigid procedures and bureaucratic controls reduce responsiveness and innovation.

These findings confirm that Environmental Sensing leads to stronger performance when supported by effective institutional structures, consistent with Organizational Information Processing Theory. The study concludes that improving organizational performance requires integrated sensing systems, improved digital coordination, and institutional reforms that balance accountability with flexibility and adaptive capacity.

Contribution To Theory and Knowledge

This study contributes to theory by extending the application of Organizational Information Processing Theory within the context of non-commercial state agencies in Kenya. While the theory has traditionally been applied in private sector and technologically intensive environments, this study demonstrates its relevance in explaining how public sector institutions process environmental information to improve organizational performance. The findings show that agencies with stronger information acquisition, integration, and coordination mechanisms are better positioned to respond to policy changes, stakeholder demands, and crisis situations. The study therefore reinforces the argument of Organizational Information Processing Theory that organizational effectiveness depends on the capacity to process environmental uncertainty through appropriate information systems and coordination structures (Galbraith, 1973; Tushman & Nadler, 1978).

The study also contributes to theoretical knowledge by operationalizing Environmental Sensing through Policy Shift Tracking, Stakeholder Feedback Systems, and Real Time Crisis Sensing within the public sector context. Existing studies have largely examined environmental sensing broadly or within private sector organizations, with limited attention to how specific sensing dimensions function in non commercial state agencies. By empirically testing these dimensions, the study provides a more contextualized understanding of how public institutions monitor, interpret, and respond to environmental changes in highly regulated governance environments.

Further, the study advances knowledge on the moderating role of Institutional Framework in the relationship between Environmental Sensing and Organizational Performance. The findings establish that governance systems, policy support, accountability structures, and regulatory conditions significantly influence the extent to which environmental information is translated into organizational outcomes. This contributes to existing institutional literature by demonstrating that institutional frameworks do not merely provide an operational backdrop but actively shape organizational responsiveness, adaptability, and performance within public institutions.

Empirically, the study contributes to knowledge by providing current evidence from 131 non commercial state agencies in Kenya, a context that remains underrepresented in environmental sensing and public sector performance literature. Most previous studies have focused on commercial organizations or broader public administration systems without isolating non commercial state agencies. The study therefore fills an important contextual and empirical gap by generating evidence from agencies responsible for regulatory, administrative, and public service functions within Kenya's governance system.

Methodologically, the study contributes to knowledge through the application of a mixed methods explanatory design combining quantitative and qualitative data. The integration of moderated regression analysis with qualitative insights provides a deeper understanding of how institutional conditions influence the effectiveness of environmental sensing practices. The study also contributes locally relevant measurement indicators for Environmental Sensing, Institutional Framework, and Organizational Performance that may support future public sector research in Kenya and similar developing country contexts.

Finally, the study contributes practical knowledge by demonstrating that improving organizational performance in non commercial state agencies requires not only stronger environmental sensing systems but also integrated

digital infrastructure, coordinated information sharing mechanisms, and institutional arrangements that balance accountability with flexibility and responsiveness.

RECOMMENDATIONS FOR PRACTICE, POLICY, & FUTURE STUDIES

Recommendations for Practice

The study recommends that non commercial state agencies in Kenya strengthen integrated environmental sensing systems to improve organizational responsiveness and performance. Agencies should institutionalize structured mechanisms for Policy Shift Tracking through dedicated policy analysis units, automated regulatory monitoring systems, and continuous communication channels with oversight institutions such as the National Treasury, Parliament, and sector ministries. This would enable agencies to detect policy changes early, reduce implementation delays, and improve strategic alignment with government priorities.

The study further recommends the strengthening of Stakeholder Feedback Systems through integrated digital platforms capable of collecting, analysing, and disseminating stakeholder information in real time. Non commercial state agencies should move beyond feedback collection toward embedding analytics and feedback interpretation into operational decision-making processes. Strengthening coordination between headquarters and regional offices through centralized information systems would reduce information silos and improve organizational responsiveness to citizen needs and service delivery challenges.

The study also recommends investment in Real Time Crisis Sensing infrastructure through integrated dashboards, predictive analytics systems, and interagency communication platforms. Agencies should strengthen digital information sharing capabilities and establish rapid response coordination structures to improve preparedness for crises such as floods, cyber threats, pandemics, and operational disruptions. Training programs should also be introduced to strengthen managerial capacity in environmental analysis, crisis interpretation, and evidence-based decision-making.

In addition, public institutions should balance accountability requirements with operational flexibility. While regulatory compliance and audit systems are necessary for transparency and legitimacy, excessive bureaucratic controls and approval procedures should be reviewed to reduce delays in implementation and decision making. Agencies should therefore adopt governance systems that maintain accountability while supporting innovation, adaptability, and timely responsiveness.

Recommendations for Policy

The study recommends that the Government of Kenya strengthen policy and institutional support for integrated public sector information systems. National policies should encourage interoperability between government digital platforms to improve information sharing, coordination, and real time environmental monitoring across agencies. This would enhance the capacity of non-commercial state agencies to process complex and rapidly changing environmental information.

The study further recommends reforms aimed at simplifying rigid regulatory procedures that constrain organizational responsiveness. Policymakers should review procurement systems, compliance timelines, and approval procedures to create greater operational flexibility while maintaining accountability and transparency. This is particularly important in crisis situations where delays in approvals and decision making may negatively affect service delivery outcomes.

The government should also strengthen investment in digital governance infrastructure and data analytics capacity within non commercial state agencies. Policies supporting integrated digital transformation, institutional data management standards, and cyber resilience would enhance organizational information processing capacity and improve evidence based public sector decision-making.

Further, national governance frameworks should promote collaborative institutional arrangements that support coordination among ministries, regulators, oversight bodies, and state agencies. Stronger coordination

mechanisms would reduce duplication, improve information integration, and strengthen collective responsiveness to environmental changes affecting public institutions.

Methodological Limitations and Future Research Directions

While this study provides important insights into the relationship between Environmental Sensing, Institutional Framework, and Organizational Performance in non-commercial state agencies, several limitations should be acknowledged. First, the study relied primarily on cross-sectional data collected from senior managers, which limits the ability to establish long-term causal relationships among the variables. Although procedural remedies were applied and Harman's single-factor test confirmed that common method variance was not a significant concern, future studies should adopt longitudinal research designs to examine how changes in environmental conditions and sensing capabilities influence organizational performance over time. Second, while the study complemented survey data with secondary sources, key constructs were measured largely through perceptual assessments, which may be subject to social desirability and respondent bias. Future research should incorporate more objective performance measures, such as audited budget absorption rates, service charter compliance indicators, citizen satisfaction records, and cost-efficiency metrics, to strengthen the validity of findings. Such approaches would provide a more rigorous assessment of the long-term effectiveness of environmental sensing and institutional frameworks in enhancing public sector performance.

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