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Research Article

Bridging the Sustainability Gap in Urban Water Utilities Through Performance Monitoring: A Case Study of Selected Urban Water Utilities in Nigeria

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Abstract

Water utilities are vital for urban health and economic growth, but face sustainability challenges, especially in low- and middle-income countries. In Nigeria, despite long-term investment, urban water utilities struggle with operational inefficiencies, frequent service interruptions, high non-revenue water, and low customer satisfaction. This study examined how performance monitoring can improve the operational sustainability of State Water Utilities in Nigeria. The objectives were to assess institutional performance monitoring practices and to evaluate the use of key performance indicators in tracking operations. A mixed-methods, cross-sectional case study was conducted in six urban utilities across six states. The data was collected in September 2022 through document re-views, structured questionnaires, and in-depth interviews. Descriptive statistics was used to analyze quantitative data; NVivo facilitated qualitative thematic analysis. Findings show all utilities have functional M&E departments responsible for performance monitoring activities, but M&E plan implementation varies (50%), with notable capacity gaps, inconsistent data management (only one utility has a Data Management Plan), and 7–22 indicators per utility. Baseline and target-setting are weak (pre-sent in 50% of utilities), and dissemination beyond internal reporting is limited. Recommendations include institutional reforms, capacity development, allocating 10% of budgets to performance monitoring, and embedding adaptive learning to enhance sustainability, effectiveness, and public trust.

Keywords

Performance Monitoring, Urban Water Utilities, Sustainability, Monitoring and Evaluation (M&E)

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1. Introduction

Water supply and sanitation are fundamental human rights and essential services contributing to health, dignity, and economic productivity. Globally, significant progress has been made towards improving access to safe water; however, the sustainability of water services remains an important concern, particularly in developing countries [3]. In Nigeria, despite heavy investments over decades, urban water utilities continue to grapple with operational inefficiencies, service interruptions, high non-revenue water (NRW) rates exceeding 50%, and poor customer satisfaction [4, 13]. These inefficiencies undermine public trust and compromise the financial viability of utilities, creating a vicious cycle of underperformance [12, 15]. Achieving Sustainable Development Goal 6 (ensure availability and sustainable management of water and sanitation for all) requires infrastructural expansion and the institutional strengthening of utilities to monitor, evaluate, and improve their performance systematically [5]. Performance monitoring serves as a critical tool in this context, entailing data collection, analysis, and use to track progress towards pre-determined objectives, inform management decisions, and foster accountability [1, 2].

The effectiveness of performance monitoring hinges on a well-structured, functional Monitoring and Evaluation (M&E) system, which includes organization-wide components such as dedicated structures, trained personnel, strategic partnerships, and clear national frameworks, as outlined in international guidelines [9, 16]. A systematic data collection, analysis, and feedback approach is vital for utilities to foster continuous improvement, ensure accountability, and adapt to evolving service demands [6, 14]. However, in Nigeria, performance monitoring practices within State Water Utilities (SWUs) are often ad hoc, donor-driven, or focused more on reporting compliance than organizational learning and service improvement. The absence of robust monitoring and evaluation (M&E) systems limits opportunities for education, accountability, and continuous service [8, 7]. Utilities cannot efficiently plan, allocate resources, and respond to evolving customer demands and infrastructure needs without credible data and learning systems.

This study assesses how performance monitoring practices contribute to operational sustainability in six Nigerian SWUs, providing detailed empirical evidence from diverse regional contexts [19]. It seeks to generate evidence to inform policy and practice improvements necessary for strengthening the urban water sector in Nigeria and similar contexts. It addresses a significant knowledge gap in the Nigerian WASH sector by examining the link between M&E system functionality and utility performance, an aspect often overlooked in traditional infrastructure-centred reforms. The study's objectives include (1) to assess institutional performance monitoring practices for sustainable water service delivery, and (2) to evaluate the utilization of key performance indicators (KPIs) in tracking water utility operations [20].

2. Method

2.1. Study Design

This research employed a mixed-methods, cross-sectional case study design, integrating quantitative performance indicator tracking with qualitative assessments of organizational structures and practices. The study utilized a convergent parallel design where quantitative and qualitative data were collected simultaneously and analyzed separately before integration during interpretation [11].

2.2. Study Population and Period

The study was conducted across six states with functional urban water utilities representing diverse geographical and socio-economic contexts in Nigeria. The states included Plateau, Kaduna, Taraba, Niger, Delta, and Imo. The study was conducted in September 2022.

2.3. Sample Size and Sampling Strategy

Six State Water Utilities were purposively selected based on diversity in geography, operational maturity, accessibility, and regional representation covering Nigeria's five out of six geo-political zones. This sampling strategy ensured the inclusion of utilities with varying institutional histories and M&E system development stages. The selected utilities represent different operational contexts and developmental stages:

Plateau: Jos Water Services Corporation (JOWASCO)

Kaduna: Kaduna State Water Corporation (KADSWAC)

Taraba: Taraba State Water and Sewerage Corporation (TAWASCO)

Niger: Niger State Water and Sewage Corporation (NISWASEC)

Delta: Delta State Urban Water Corporation (DESUWACO)

Imo: Imo State Water and Sewerage Corporation (ISWSC).

The selection based on operational maturity was critical: Well-established utilities like NISWASEC (Niger) and DESUWACO (Delta) have long-standing operational histories and established Monitoring and Evaluation (M&E) units as early as 2016–2017, representing mature systems [6]. Conversely, emerging utilities such as ISWSC (Imo) and TAWASCO (Taraba) were relatively new, having operationalized their M&E structures post-2018, providing insight into early stages of institutional development [7]. Additional considerations included accessibility and willingness to cooperate with the study, ensuring that data could be reliably obtained. Specifically, the diverse geographical contexts provided the following operational contrasts: JOWASCO (Plateau) serves a moderately populated urban center; KADSWAC (Kaduna) operates in a major northern city with high demand; TAWASCO (Taraba) is a newer utility with

limited historical data; NISWASEC (Niger) and DESU-WACO (Delta) are well-established utilities serving large urban populations; and ISWSC (Imo) is a utility with developing operational systems.

For this study, purposive sampling targeted key informants, including M&E focal persons, Planning Research and Statistics (PRS) department heads, utility managers, and technical staff directly involved in monitoring and evaluation activities were utilized. A total of 6 participants who were substantive Leads of the PIRS or M&E Units across the six SWUs were interviewed between September 12 to 27, 2022. A key rationale for choosing only six participants for the key informant interviews is the purposive nature of the study design and the specific roles of the interviewees. Each participant was a substantive lead of the Planning, Research, and Statistics (PIRS) or Monitoring and Evaluation (M&E) unit, which makes them the definitive experts on performance monitoring within their respective utilities.

2.4. Data Collection Methods

Data was collected during September 2022 across the six water utilities. Specifically, quantitative data were collected using a structured questionnaire. The content of the questionnaire used for collection data was adapted from the 12 Components Monitoring and Evaluation System Strengthening [10, 17], which includes Organizational Structures, Human Capacity, Partnerships, M&E Plan, M&E Work Plan, Communication and Culture, Routine Monitoring, Surveys and Surveillance, Database, Evaluation and Research, Data Management and Data Quality, Data Dissemination and Use. Qualitative data were collected through interviews with state water utility focal personnel.

Overall, the data collection employed a triangulation approach incorporating multiple sources, which include:

Structured questionnaire surveys capturing organizational M&E practices, human capacity, and institutional arrangements.

In-depth key informant interviews with M&E managers, department heads, and technical staff.

Document reviews of strategic plans, M&E plans, monitoring reports, and organizational policies.

Performance data extraction from utility databases covering operational indicators for 2020-2021.

Observational assessments of M&E infrastructure and data management systems and methods to ensure validity and reliability.

Quantitative performance data covering 2020 and 2021 were extracted from utility databases. The data sources included.

2.5. Data Analysis

Quantitative data were analyzed using Microsoft Excel for descriptive statistics (means, percent-ages, trends). Qualitative data were coded and thematically analyzed using NVivo. Indicator performance (e.g., water production, revenue collection, and non-revenue water) was compared across states.

2.6. Ethical Approval

Ethical approval was obtained and endorsed by participating state water utilities. Informed consent was secured from all participants before data collection. Confidentiality and anonymity were maintained throughout the study, with findings presented in aggregate form to protect participant identities.

3. Results and Discussion

This analysis investigates the extent and effectiveness of performance monitoring and indicators use among six urban State Water Utilities (SWUs) in Nigeria: Plateau, Kaduna, Taraba, Niger, Delta, and Imo. It is guided by two primary objectives: (1) to assess institutional performance monitoring practices for sustainable water service delivery, and (2) to evaluate the utilization of key performance indicators in tracking water utility operations. The analysis combines descriptive statistics with thematic interpretations and insights, offering a nuanced understanding of institutional performance dynamics in the WASH sector.

Table 1. *Summary of Key Findings.*

Area	Observation
M&E Human Capacity	Adequate gender parity, but weak skill assessments and no training plans
Strategic Plan and M&E Plan	The presence of strategic plans contrasts with the 67% availability of M&E plans
Indicator Tracking	Broad variation; 7–22 indicators per SWU
Baseline and Target Use	Lacking in at least 50% of the states
DQA Mechanisms	Present but informal and undocumented in most cases
Dissemination Practices	Underutilized—limited to internal meetings

Area	Observation
Learning and Evaluation	Weak; no formal learning plans or research inventories

3.1. Performance Monitoring Practices

This objective assesses the extent to which M&E systems are institutionalized and functional in ensuring sustainable WASH operations [20].

3.1.1. Institutionalization of M&E Systems

The presence of functional PRS and M&E departments across all six SWUs signals that a performance monitoring structure is formally recognized. However, while five SWUs had standalone M&E units, one had integrated them within broader administrative departments. This latter configuration risks diluting focus, reducing visibility of M&E to senior management, and compromising timely oversight of performance indicators.

Institutional commitment was further assessed through the age of M&E units. For example, NISWASEC and DESWACO established M&E structures as early as 2016–2017, while some, like ISWSC and TAWASCO, only began operationalizing M&E post-2018, indicating varying stages of maturity. The implication is that the presence of units without adequate tools, trained personnel, or defined responsibilities may result in tokenism rather than meaningful performance tracking [16]. The gender balance is a strength, but must be leveraged through upskilling and role clarity.

3.1.2. Human Capacity and Gender Balance

Across the SWUs, analysis of results revealed that staffing strength ranged from 3 to 7 per unit, averaging around three staff per M&E/PRS unit. Gender parity was observed, balancing the number of male and female staff. However, qualitative responses revealed inconsistencies in job descriptions to staff, with two of the water utilities lacking clearly defined roles for staff members, which may hinder accountability and performance expectations. Additionally, human capacity assessments and structured training plans were largely absent. Only two states had ever conducted a formal M&E capacity assessment, and none had a documented capacity building plan for their M&E personnel. This gap could weaken M&E performance and learning.

3.1.3. Planning and Strategic Orientation

Five of the six SWUs had documented strategic plans, but only three had an M&E plan developed within the past three years. The M&E frameworks used were logic-based or results-oriented, though their implementation was uneven. Evidence on implementing the M&E Plan was limited to data collection processes, albeit not for all indicators stated in the plans. While M&E work plans were present in four states, only two water utilities had annual costed plans linked to institutional budgets. The remaining states either lacked budget allocations for M&E or operated under unpredictable funding, reducing their ability to sustain monitoring routines or field visits.

3.1.4. Monitoring Routines and Evaluation Systems

Available data revealed routine monitoring activities across all the SWUs, using checklists and standard tools. However, monitoring frequency varied from quarterly to ad hoc visits. The composition of monitoring teams ranged from M&E unit staff to zonal officers, but in most states, monitoring reports were not developed, and even when done, the findings from the reports were not shared across departments and with key decision makers, which could hinder adaptive management practices. When it came to evaluation and research, only one SWU had an inventory of assessments and studies. Others lacked basic records of learning activities, evaluations, or operational research [18]. Only two utilities had ever hosted a learning workshop in the past 24 months before the study.

3.1.5. Data Management and Use

Evidence presented showed that data management capabilities varied. Two utilities used structured databases managed by designated staff, while others stored data manually or via Excel sheets. Only one SWU had a documented Data Management Plan (DMP). Practices like data cleaning, validation, and triangulation were mentioned, but were neither consistent nor formalized.

Regarding data use, most SWUs produced reports, but dissemination was limited. Consistent dissemination in common dissemination events and tools like learning sessions with stakeholders, social media, websites, or newsletters was absent in all utilities. The implication is that poor data storage, validation, and limited dissemination reduce transparency and hinder evidence-based decision-making. In addition, a weak data culture limits feedback loops between data producers and users.

The institutional gaps identified in this section (3, 1) are directly linked to the three pillars of utility sustainability. For instance, the inconsistent data management and DQA mechanisms (Section 3.1.5) directly compromise the financial viability of utilities by undermining the reliability of key metrics like Non-Revenue Water (NRW) [13]. Furthermore, the lack of external dissemination hinders social sustainability, eroding public trust and accountability, as noted in the broader

literature on water sector reforms [15]. Ultimately, the M&E weaknesses translate directly into a failure to achieve operational and institutional permanence [12].

3.2. Utilization of Key Performance Indicators (KPIs)

This objective assessed the utilization of key performance indicators in tracking water utility operations:

3.2.1. Tracking and Classification of Indicators

All six water utilities acknowledged tracking performance indicators, though tracking intensity varied across the utilities. The average number of indicators tracked was approximately 14.7, with a standard deviation of 5.54, indicating a high level of disparity. More mature utilities, such as NISWASEC and DESWACO, had broader indicator sets, while others focused narrowly on core metrics like water production, customer complaints, billing, etc.

Applying the convergent parallel design methodology [11], the qualitative responses provided critical context to the quantitative findings on indicator tracking. Specifically, the observed wide disparity in the number of indicators tracked (Avg. 14.7, SD 5.54) is strongly corroborated by key informant interviews, which revealed the absence of documented M&E plans and weak baseline setting in 50% of the utilities. This integration of data underscores that the problem is not merely a lack of M&E presence, but a systemic gap in performance-oriented organizational culture and strategic planning [14].

3.2.2. Baselines and Target Setting

Three utilities had clear baseline values for tracked indicators. These were typically derived from historical records, donor-funded assessments, or initial post-establishment performance audits. For example, NISWASEC used historical data, while DESWACO relied on donor performance bench-marks. However, across all the utilities, target-setting practices were weak. Only JOWASCO and KADSWAC consistently set annual targets for each indicator tracked by the situation. Most water utilities either lacked targets or used external benchmarks without contextual adjustments.

3.2.3. Data Quality and Analytical Use

Five utilities reported informal Data Quality Assurance (DQA) mechanisms such as triangulation, sign-offs, and monthly reviews. However, only one SWU had conducted a structured DQA exercise with documented findings. Indicator literacy among staff was generally high, but formal training had only been reported in KADSWAC and NISWASEC.

Despite ongoing data collection efforts, electronic tools for data collection, analysis, and visualization remained minimal and were not embedded as a routine practice across the utilities. Data management processes were predominantly paper-based, and staff generally lacked the skills to operate electronic systems effectively. Few SWUs had automated dashboards or even basic trend charts. As a result, indicator data were not consistently used to guide decision-making, except in isolated cases like ISWSC responding to reduced water production following M&E findings.

3.2.4. Reporting and Use of Findings

Reporting frequencies ranged from monthly to quarterly. However, the use of data for adaptive management was rare. When data were used, it was usually to react to operational challenges such as pipeline repairs or customer communication complaints. Formal evidence-to-policy mechanisms were largely absent, such as learning briefs or review meetings.

4. Conclusion

This study demonstrates that while performance monitoring structures are increasingly present across Nigerian State Water Utilities, these structures have not yet translated into consistent improvements in operational sustainability [12, 14, 15]. Although all six utilities have established M&E units and show encouraging gender balance within their teams, the overall functionality of these systems remains weak. Capacity gaps, outdated or poorly implemented M&E plans, and limited routine monitoring continue to undermine the strategic use of data.

Performance indicator tracking is particularly underdeveloped. Utilities monitor varying numbers of indicators, often without baselines, targets, or standardized approaches. Weak data quality assurance further limits the reliability of available information. As a result, although data is generated, it is rarely analyzed or applied in ways that meaningfully influence management decisions or drive operational improvements.

These systemic issues constrain service reliability, hinder timely responses to operational problems, and slow progress toward financial and institutional sustainability. For performance monitoring to deliver its intended benefits, SWUs must shift from compliance-oriented reporting to a culture that values learning, accountability, and evidence-informed decision-making. Strengthening institutional capacity, formalizing indicator systems, and integrating structured learning platforms are essential steps toward this transition.

Future research should build on these findings through longitudinal studies that track performance indicators over time, particularly before and after M&E system strengthening reforms. Such evidence will be vital for guiding sector-wide reform efforts and demonstrating the tangible impact of adaptive learning on utility performance and operational efficiency [14].

5. Recommendations

To strengthen the sustainability and operational effective-

ness of urban water utilities in Nigeria, a strategic shift is urgently needed regarding how monitoring and evaluation (M&E) systems and performance indicators are integrated into daily operations. This study provides the following recommendations to achieve this goal:

1) First, there is a need to reinforce the institutionalization of performance monitoring systems across all State Water Utilities (SWUs). This requires standardizing the structure and function of M&E units, ensuring each utility has a dedicated department with a clear mandate, adequate staffing, and gender-sensitive roles supported by formal job descriptions. Institutional frameworks must include regular performance appraisals for M&E personnel to enhance accountability and improve service delivery outcomes.
2) Capacity building is central to effective performance monitoring. Each SWU should develop and implement a training plan beyond basic data collection. These plans should cover critical skills like data management, performance indicator tracking, evidence synthesis, and data visualization techniques that support real-time operational decisions. Tailored coaching and mentoring will enhance staff capacity to contribute meaningfully to planning and review processes.
3) Strategic planning must be strengthened by ensuring that M&E plans are developed, actively implemented, and funded. All M&E work plans should be costed and integrated into the utilities' annual operational budgets. Doing so will enhance the alignment of M&E activities with broader utility goals and ensure that performance monitoring becomes a routine part of program management rather than an ad hoc or donor-driven process. As a standard, 10% of the utility budget should be allocated to performance monitoring.
4) Improved data management is also critical. SWUs must invest in robust data systems that include digital databases managed by trained personnel. These systems should enable real-time data entry, validation, analysis, and visualization. Alongside these systems, adopting standardized data quality assurance (DQA) protocols will ensure that the data feeding into decision-making processes is credible and reliable.
5) Utilities should adopt a harmonized set of WASH performance indicators when tracking key performance indicators, guided by a national framework. These indicators should be practical, relevant, and capable of driving operational improvements. Based on contextual realities and available resources, baseline values must be established through structured studies, and targets should be developed collaboratively with Utility staff and stakeholders.
6) Finally, data must be used, not just collected. SWUs should institutionalize quarterly performance review meetings where data trends, operational bottlenecks, and service delivery gaps are discussed and acted upon. Evidence informs decision-making, with utilities demonstrating how performance insights translate into corrective actions, resource reallocations, or policy adjustments. To build public trust, utilities should move beyond internal reporting by sharing performance insights through public dashboards, newsletters, and social media platforms.

Abbreviations

SWU	State Water Utility
M&E	Monitoring and Evaluation
PIRS	Planning, Research, and Statistics
NRW	Non-Revenue Water
DQA	Data Quality Assurance
JOWASCO	Jos Water Services Corporation
KADSWAC	Kaduna State Water Corporation
DESUWACO	Delta State Urban Water Corporation
NISWASEC	Niger State Water and Sewage Corporation
ISWSC	Imo State Water and Sewerage Corporation
WASH	Water, Sanitation, and Hygiene
USAID	United States Agency for International Development in This Study
DMP	Data Management Plan
KPIs	Key Performance Indicators

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Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

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