International Research Journal of Project Management

Vol 8, Issue 1, pp 66-76, Nov 18, 2026, © International Research Journal Publishers, ISSN 2710-2742 (online) www.irjp.org

Project Monitoring Planning, Monitoring Implementation and Performance of Water Pan Projects in Isiolo County, Kenya

Amina Osman[1*], Dr. Ezekiah Kimani, PhD[2]

[1*]Postgraduate student, MSc Project Management, Jomo Kenyatta University of Agriculture and Technology

[2]Lecturer, Department of Business Administration, Jomo Kenyatta University of Agriculture and Technology

Accepted: November 17, 2026

Abstract

Water pans are a major investment for water security in Kenya's Arid and Semi-Arid Lands, yet many lose functionality soon after construction. This study examined the relationship between project monitoring planning, monitoring implementation and the performance of water pan projects in Isiolo County, Kenya. It was guided by two specific objectives: to determine the relationship between project monitoring planning and the performance of water pan projects, and to assess the relationship between monitoring implementation and the performance of water pan projects. The study drew on Results-Based Management and Control Theory. A descriptive cross-sectional survey design was adopted. The target population comprised 320 stakeholders involved in the planning, implementation, monitoring, evaluation and management of water pan projects in Isiolo County. A sample of 178 respondents was selected through stratified, purposive and simple random sampling, and 158 usable questionnaires were analysed, representing a response rate of 88.8%. Data were analysed using frequencies, percentages, means, standard deviations, Cronbach's alpha and Pearson's product-moment correlation. Respondents agreed that both practices were applied. Monitoring implementation recorded a mean of 4.05 (SD = 0.71) and project monitoring planning a mean of 3.91 (SD = 0.76). The mean performance score was 3.94 (SD = 0.74). Both practices had strong, positive and statistically significant relationships with project performance: monitoring implementation ($r = 0.728$, $p < 0.001$) and project monitoring planning ($r = 0.641$, $p < 0.001$). Availability of baseline information, resources for monitoring and stakeholder participation in monitoring were the lowest-rated items. The study concluded that both practices are positively associated with the performance of water pan projects. It recommends documented monitoring frameworks with baselines and budgets, regular monitoring visits and formal inclusion of community committees in monitoring.

Keywords: *Monitoring and Evaluation, Monitoring Planning, Monitoring Implementation, Project Performance, Water Pans, Isiolo County*

INTRODUCTION

Water underpins health, food security, industrial growth and environmental sustainability. Progress towards safe and reliable water remains slow. In 2022, about 2.2 billion people still lacked safely managed drinking water and nearly 3.5 billion lacked safely managed sanitation

(World Health Organization & United Nations Children's Fund, 2023). Demand is expected to keep rising as populations grow, cities expand and the climate changes (UNESCO, 2023). Rising temperatures, shifting rainfall and prolonged droughts have also made freshwater supplies less reliable (Intergovernmental Panel on Climate Change, 2023). As a result, water harvesting structures such as water pans, sand dams and small reservoirs are widely promoted to help dryland communities build resilience.

Building these structures is only part of the challenge. Many completed projects lose functionality because of poor maintenance, weak institutional arrangements, limited stakeholder participation and monitoring that fails to flag problems early enough to act. Project success is therefore no longer judged on scope, budget and schedule alone. Performance is now judged on functionality, sustainability, service reliability and stakeholder satisfaction (Silvius & Schipper, 2022). Within this shift, monitoring and evaluation (M&E) has moved from a compliance exercise to a management tool that supports accountability, learning and adaptive decision-making (United Nations Development Programme (UNDP, 2022). Monitoring tracks progress against plans and indicators, while evaluation assesses relevance, efficiency, effectiveness, impact and sustainability (Organisation for Economic Co-operation and Development (OECD, 2021).

In Sub-Saharan Africa, rural households that depend on rain-fed farming and livestock are the most exposed to water insecurity (United Nations Children's Fund (UNICEF, 2024). Kenya is a water-scarce country, with about 500 to 600 m^3 of renewable freshwater per person each year, well below the 1,000 m^3 sufficiency threshold (Ministry of Water, Sanitation and Irrigation (MWSI, 2024). The pressure is greatest in the Arid and Semi-Arid Lands (ASALs), which cover about 89% of the country (National Drought Management Authority (NDMA, 2024). Substantial government and donor funding has gone into water pans, dams, boreholes and rural supply systems. Yet national assessments point to inadequate maintenance, weak funding for operation and maintenance, poor coordination, limited technical capacity and low community participation as causes of declining functionality (MWSI, 2024).

Isiolo County lies in Kenya's ASALs and is marked by low, erratic rainfall, high evaporation and recurrent drought (NDMA, 2024). Many residents depend on pastoralism, agro-pastoralism and small-scale farming, so water shapes household welfare, livestock productivity and food security (County Government of Isiolo, 2023). In long dry spells, water pans are often the main water source for both people and livestock. The national government, the county government and development partners have invested in water pans to improve domestic supply and build resilience to drought (County Government of Isiolo, 2023). Still, many water pans struggle with rapid siltation, poor maintenance, damaged embankments, reduced storage capacity and weak community management (NDMA, 2024).

Statement of the Problem

Despite sustained public and donor funding, many water pans in Isiolo County perform poorly. County implementation reports show reduced storage capacity caused by siltation, inadequate maintenance, delayed rehabilitation and weak post-construction monitoring (County Government of Isiolo, 2023). M&E is widely recognised as the means of detecting such problems early and correcting them, Project Management Institute (PMI, 2021). In many public infrastructure projects in Kenya, however, M&E is treated as an administrative reporting requirement rather than a management tool. Problems are therefore detected late, and corrective action is delayed (MWSI, 2024).

Kenyan studies report positive links between M&E or project management practices and the performance of water projects (Kimatu & Musembi, 2024; Maina & Ngugi, 2026; Nduta & Mungai, 2024). Most of them, however, concern urban or community water projects in other counties, and many treat M&E as a single composite variable. Few studies have examined the separate relationship of project monitoring planning and monitoring implementation with water pan performance. Little empirical evidence exists for Isiolo County, where climatic vulnerability and water insecurity are severe. This study therefore examined how these two monitoring practices relate to the performance of water pan projects in Isiolo County, Kenya.

Objectives of the Study

The general objective was to examine the relationship between project monitoring planning, monitoring implementation and the performance of water pan projects in Isiolo County, Kenya. The specific objectives were:

i. To determine the relationship between project monitoring planning and the performance of water pan projects in Isiolo County, Kenya.
ii. To assess the relationship between monitoring implementation and the performance of water pan projects in Isiolo County, Kenya.

LITERATURE REVIEW

This section critically examines existing theoretical and empirical studies relevant to the study. It first discusses Results-Based Management and Control Theory, which explain how monitoring planning and monitoring implementation relate to project performance. It then reviews empirical studies on each of the two practices and identifies the conceptual, contextual and geographical gaps that the present study addresses.

Theoretical Review

Results-Based Management (RBM)

RBM is a management approach that shifts attention from activities alone to measurable outputs, outcomes and impacts. It evolved through public-sector management reforms and international development practice during the 1990s. Under RBM, monitoring provides routine information on progress against planned activities, indicators and resource use. The information generated is useful only when managers review it and apply the findings to improve implementation and accountability. UNDP (2022) emphasizes that planning, monitoring and evaluation should operate as an integrated cycle that supports learning, accountability and management decisions. RBM is relevant to this study because monitoring planning establishes the indicators, baselines and responsibilities against which results are measured, while monitoring implementation generates the routine performance information that RBM depends on.

Control Theory

Control Theory is grounded in feedback and regulation principles from engineering and cybernetics. Wiener (1948) provided a foundational formulation of cybernetics, emphasizing feedback as a mechanism for comparing actual system conditions with desired states. Applied to project management, the control process depends on reliable performance information and the capacity to respond to deviations. PMI (2021) identifies monitoring and controlling as core project management activities. Project managers compare actual implementation progress, expenditure and quality of outputs against approved plans, budgets and technical specifications. The theory is relevant because monitoring implementation is the stage at which this comparison takes place. It also assumes that standards are clearly set in advance, which links it to monitoring planning. Where monitoring information is inadequate, identified deviations may persist.

Taken together, the two theories treat monitoring planning and monitoring implementation as connected stages of one management process. Planning sets the standards and indicators, and implementation supplies the evidence used to compare actual performance with those standards.

Empirical Review

Project Monitoring Planning and Project Performance

Project monitoring planning is the process of deciding in advance how implementation will be monitored and assessed. It identifies monitoring objectives, indicators, responsibilities, resources, data-collection procedures and reporting schedules. Nduta and Mungai (2024) reported a positive and significant relationship between project planning and the performance of water projects in Nairobi City County. Kimatu and Musembi (2024) examined M&E management practices in community water projects in Machakos County. They reported positive and significant relationships for M&E stakeholder involvement and M&E planning review. In Tanzania, Karia and Chanzi (2026) identified the allocation of financial, human and material resources in monitoring and planning as relevant to the performance of water supply projects in Songea. Maina and Ngugi (2026) also identified M&E planning and stakeholder engagement as relevant practices for water projects in Nyeri County. These studies show that planning matters for water project performance. However, they focused on urban, community or piped water projects rather than water pans in an ASAL county.

Monitoring Implementation and Project Performance

Monitoring implementation is the execution of the monitoring activities set out in the monitoring plan. It includes collecting and checking information, conducting field supervision, tracking work against schedules and budgets, and reporting progress to decision-makers. Wachira and Mutuku (2024) identified monitoring approaches, evaluation methods and performance indicators as relevant to project implementation in Kenya. Nzamwita and Sikubwabo (2023) examined the relationship between M&E and the performance of water supply projects in Gakenke District, Rwanda. Mutiso et al. (2026) emphasized the role of monitoring project activities and resolving implementation issues in the performance of mega dam projects in Kenya. On participation, Ouma and Odhiambo-Abuya (2025) linked participatory M&E practices with the performance of community-based irrigation projects in Western Kenya. Muhatia and Wainaina (2024) associated stakeholder engagement in M&E with the sustainability of water projects in Makueni County. Yahaya et al. (2025) highlighted continuous stakeholder engagement in planning and monitoring of water supply projects in Tanzania. Iaa and Gisayi (2026) likewise linked M&E practices with the performance of water projects in Iringa District, Tanzania. These studies support the relevance of monitoring during implementation. However, they do not establish how data collection, progress tracking and stakeholder participation, taken together as implementation monitoring, relate to the performance of water pans.

Research Gaps

The reviewed studies leave three gaps. Conceptually, most examine M&E as a composite or examine selected dimensions such as planning review and stakeholder involvement, rather than monitoring planning and monitoring implementation as separate practices. Contextually, they focus on urban, community and piped water projects. Water pans have distinct characteristics, including seasonal storage, siltation, embankment maintenance and dependence on local management arrangements. Geographically, the studies were conducted in Nairobi, Machakos, Makueni, Nyeri, Rwanda and Tanzania, and none directly assesses water pan projects in Isiolo County. The present study addresses these gaps.

Conceptual Framework

The study conceptualized project monitoring planning and monitoring implementation as the independent variables and performance of water pan projects as the dependent variable. Figure 1 shows the indicators used to measure each variable.

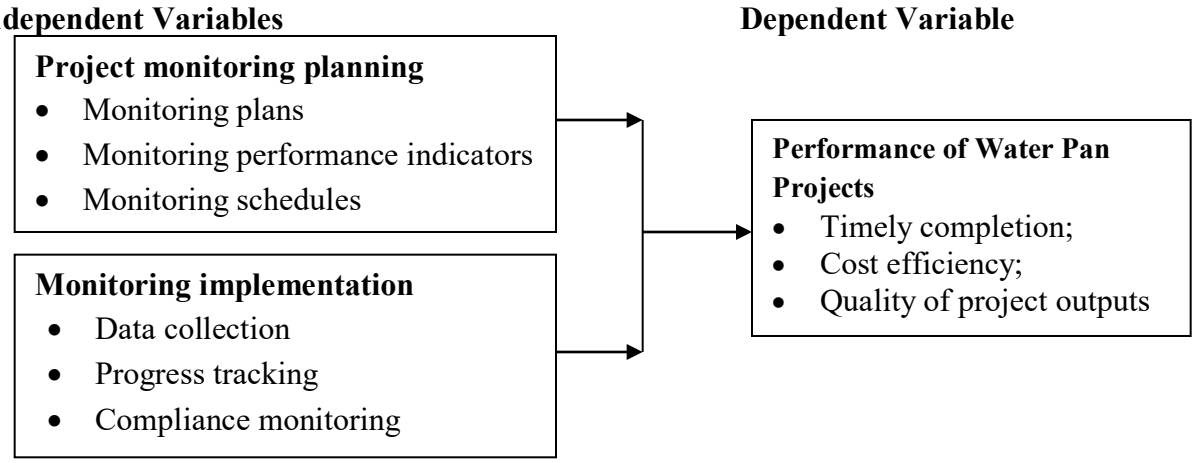


Figure 1: Conceptual Framework

METHODOLOGY

Research Design

The study adopted a quantitative descriptive cross-sectional survey design. Data were collected from respondents at one point in time to describe monitoring practices and examine their statistical relationships with project performance. The design was appropriate because the study did not manipulate the research environment and sought to assess naturally occurring relationships among the study variables (Creswell & Creswell, 2023).

Target Population and Sampling

The study targeted 320 respondents from stakeholder institutions involved in the planning, implementation, monitoring, evaluation, operation and management of water pan projects in Isiolo County (County Government of Isiolo, 2023). The sample size was calculated using the formula $n = N/[1 + N(e^2)]$, where N = 320 and e = 0.05. This yielded 177.8, rounded to 178 respondents (Saunders et al., 2023). The sample was allocated proportionately across eight strata, as shown in Table 1.

Table 1: Target population and sample

Category of respondents	Population (N)	Sample (n)
County Department of Water, Environment and Natural Resources officers	28	16
National water agencies	22	12
Water pan project managers	34	19
Monitoring and evaluation officers	18	10
Water Users Association officials	48	27
Water Management Committee members	76	42
NGO/development partner project officers	24	13
Community leaders/project committee officials	70	39
Total	**320**	**178**

Stratified sampling was first used to group respondents by their institutional responsibilities. Purposive sampling was then applied to select respondents in specialized technical and managerial positions, including county officers, project managers, M&E officers and officials of national water agencies. Simple random sampling was used to select respondents from the larger strata, namely Water Users Associations, Water Management Committees and community leadership structures.

Research Instrument, Validity and Reliability

A structured questionnaire was used to collect primary data. Each construct was measured using five items on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. Content validity was established through expert review by university supervisors and specialists in project management, M&E and water resources management. The instrument was then pilot-tested on 20 respondents from institutions with characteristics similar to the study population, who were excluded from the main survey. Minor revisions to wording and sequencing were made after the pilot.

Internal consistency was tested using Cronbach's alpha on the main-study data. All three constructs exceeded the 0.70 threshold (Table 2). Because all variables were measured using a single questionnaire, Harman's single-factor test was applied to the full instrument. The first unrotated factor accounted for about 31.8% of the total variance, below the 50% threshold, so common method bias was not considered a serious threat.

Table 2: Reliability results

Variable	Number of items	Cronbach's alpha	Interpretation
Project monitoring planning	5	0.901	Excellent
Monitoring implementation	5	0.914	Excellent
Performance of water pan projects	5	0.934	Excellent

Data Collection and Analysis

Authorization was obtained from the university, the National Commission for Science, Technology and Innovation (NACOSTI) and the County Government of Isiolo. Questionnaires were administered using the drop-and-pick-later technique, supplemented by researcher-assisted administration where necessary. Completed questionnaires were checked, coded and analysed using SPSS Version 30. Frequencies, percentages, means and standard deviations were used to describe the data. Mean scores were interpreted as follows: 1.00–1.49 strongly disagree, 1.50–2.49 disagree, 2.50–3.49 neutral, 3.50–4.49 agree and 4.50–5.00 strongly agree. Pearson's product-moment correlation was used to establish the direction, strength and significance of the relationship between each monitoring practice and project performance. Coefficients of 0.10–0.29 were interpreted as weak, 0.30–0.49 as moderate and 0.50 and above as strong, at $p < 0.05$ (Field, 2024).

Ethical Considerations

Participation was voluntary, and informed consent was obtained from every respondent. Respondents were informed of the purpose of the study and their right to withdraw at any stage. They were not required to disclose personal identifiers, and completed questionnaires and datasets were stored securely and accessed only by the researcher.

RESULTS AND DISCUSSION

Response Rate and Respondent Profile

Of the 178 questionnaires distributed, 158 were completed and usable, a response rate of 88.8%. Male respondents made up 65.8% and female respondents 34.2%. Most respondents (89.3%) were aged 26 to 55 years, and 95.0% held at least a certificate or diploma. About 60% were

community-based actors, namely Water Management Committee members (24.1%), community leaders and project committee officials (20.9%) and Water Users Association officials (15.2%). The remaining 40% were technical and institutional officers. In addition, 88.6% had at least two years of experience. The respondents were therefore able to give informed views on monitoring practices and project performance.

Project Monitoring Planning

Table 3: Descriptive statistics for project monitoring planning

Indicator	Mean	SD	Interpretation
Monitoring objectives and indicators were clearly established	3.96	0.91	Agree
Performance indicators were defined before implementation	4.08	0.86	Agree
Monitoring schedules were established	3.89	0.94	Agree
Baseline information was available for monitoring progress	3.78	1.00	Agree
Adequate resources were allocated for monitoring activities	3.83	0.97	Agree
Overall mean	**3.91**	**0.76**	**Agree**

The overall mean of 3.91 (SD = 0.76) indicates that respondents agreed that monitoring planning was undertaken. The highest-rated item was the definition of performance indicators before implementation (M = 4.08). The lowest-rated item was the availability of baseline information (M = 3.78), which also recorded the widest spread of opinion (SD = 1.00), followed by resources for monitoring (M = 3.83). Projects were therefore good at setting indicators but less consistent in establishing the reference values and resources needed to apply them. Without baseline data, progress and outcomes cannot be objectively measured. Without adequate resources, even well-designed monitoring plans may not be implemented, which is a particular concern for water pans in dispersed and remote ASAL settings.

Monitoring Implementation

Table 4: Descriptive statistics for monitoring implementation

Indicator	Mean	SD	Interpretation
Regular monitoring visits were undertaken	4.12	0.82	Agree
Project progress was regularly documented	4.07	0.84	Agree
Project performance was tracked against targets	4.10	0.81	Agree
Stakeholders participated in monitoring activities	3.94	0.91	Agree
Implementation data were systematically collected	4.02	0.86	Agree
Overall mean	**4.05**	**0.71**	**Agree**

Monitoring implementation recorded an overall mean of 4.05 (SD = 0.71), higher than monitoring planning. Regular monitoring visits (M = 4.12) and tracking of performance against targets (M = 4.10) were the highest-rated items. Stakeholder participation in monitoring recorded the lowest mean (M = 3.94) and a comparatively wide spread of opinion (SD = 0.91). Monitoring was therefore well established as a technical and supervisory routine, but participatory monitoring involving communities and committees was less consistently practised. This is notable because about 60% of respondents were community-based actors, and water pans depend on local operation and maintenance after construction.

Performance of Water Pan Projects

Table 5: Descriptive statistics for performance of water pan projects

Indicator	Mean	SD	Interpretation
Water pans remained functional after completion	3.96	0.86	Agree
Water services were reliable	3.91	0.88	Agree
Maintenance was undertaken effectively	3.87	0.91	Agree

Beneficiaries were satisfied with water services	4.00	0.83	Agree
Water pan projects demonstrated sustainability	3.96	0.87	Agree
Overall mean	**3.94**	**0.74**	**Agree**

The overall mean of 3.94 (SD = 0.74) shows that respondents agreed that the water pans performed favourably. Beneficiary satisfaction recorded the highest mean (M = 4.00), while maintenance effectiveness recorded the lowest (M = 3.87). The pans were generally functional and valued by users, but maintenance was the weakest link and the most likely point at which functionality could be eroded.

Correlation Analysis

Table 6: Correlation between monitoring practices and performance of water pan projects (n = 158)

Predictor	Pearson r	r^2	p-value	Interpretation
Project monitoring planning	0.641	0.411	< 0.001	Strong positive
Monitoring implementation	0.728	0.530	< 0.001	Strong positive

Both practices had strong, positive and statistically significant relationships with the performance of water pan projects. Monitoring implementation shared about 53% of its variance with project performance, compared with about 41% for monitoring planning. Since the study adopted a cross-sectional design, these correlations are interpreted as associations rather than evidence of causality.

Discussion

The first objective sought to determine the relationship between project monitoring planning and the performance of water pan projects. The strong positive association ($r = 0.641$, $p < 0.001$) indicates that projects with clearer indicators, schedules, baselines and monitoring resources tended to perform better. This agrees with Nduta and Mungai (2024), who found a positive and significant relationship between project planning and water project performance in Nairobi City County. It is also consistent with Kimatu and Musembi (2024), who reported a positive relationship for M&E planning review in Machakos County, and with Karia and Chanzi (2026), who linked resource allocation in monitoring and planning with water supply performance in Tanzania. The finding supports RBM, which treats indicators, baselines and targets as the foundation of results measurement (UNDP, 2022). The low ratings for baseline information and monitoring resources, however, suggest that the planning component of RBM was only partially institutionalized in Isiolo County.

The second objective sought to assess the relationship between monitoring implementation and the performance of water pan projects. Monitoring implementation had the stronger association of the two practices ($r = 0.728$, $p < 0.001$). Projects where monitoring visits were regular, progress was documented and performance was tracked against targets tended to perform better. This is consistent with Mutiso et al. (2026), who emphasized the role of monitoring project activities in the performance of dam projects in Kenya, and with Nzamwita and Sikubwabo (2023) in Rwanda. The finding supports Control Theory, under which performance improves when actual progress is compared regularly with approved plans and deviations are detected early (PMI, 2021; Wiener, 1948). The lower rating for stakeholder participation is significant. Ouma and Odhiambo-Abuya (2025), Muhatia and Wainaina (2024) and Yahaya et al. (2025) all link stakeholder participation in monitoring with better performance or sustainability of water and irrigation projects. Strengthening community participation may therefore further improve the performance of water pans.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The study concludes that project monitoring planning is positively and significantly associated with the performance of water pan projects in Isiolo County ($r = 0.641$, $p < 0.001$). Monitoring objectives, indicators and schedules were generally established, but baseline information and resources for monitoring were weaker.

The study further concludes that monitoring implementation is positively and significantly associated with project performance ($r = 0.728$, $p < 0.001$), and more strongly than monitoring planning. Regular monitoring visits, progress documentation and tracking against targets were generally practised, while stakeholder participation in monitoring lagged behind.

Overall, the findings support treating monitoring as a continuous management process in which planning sets the standards and implementation supplies the evidence used to manage performance.

Recommendations

The County Government of Isiolo and implementing agencies should require a documented monitoring framework for every water pan project before implementation begins. It should contain measurable indicators, baseline values, targets, schedules, responsible persons and budget allocations. Baseline assessments should be completed at the design stage, and monitoring costs should be built into project budgets so that monitoring is not treated as an unfunded requirement.

The County Government and implementing organizations should institutionalize regular monitoring visits and standardized progress reports covering physical progress, expenditure, technical quality, timelines and emerging risks.

Water Management Committees and community representatives should be formally included in monitoring visits and trained to collect basic monitoring data, because stakeholder participation recorded the lowest rating under monitoring implementation.

Because maintenance effectiveness was the weakest performance indicator, routine monitoring should continue after construction and cover desilting, embankment condition and the functioning of maintenance arrangements.

Limitations and Suggestions for Further Research

The study used a cross-sectional design and perception-based data from a single questionnaire, so the results show associations rather than causal effects. It was also limited to one county. Future studies could estimate the unique contribution of each practice using regression or structural equation modelling, and compare water pan projects across other ASAL counties. A longitudinal design tracking projects from planning through post-completion operation would give stronger evidence. Mixed-methods studies combining surveys with interviews and project document reviews could explain why particular monitoring practices succeed or fail.

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