

# Real-Time Monitoring and Performance of Environmental Conservation Projects in Nakuru County, Kenya

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**ABSTRACT:** *This study examines the influence of real-time monitoring in environmental conservation projects in Nakuru County, which has led to significant delays and cost overruns. Despite the recognized importance of monitoring, traditional methods have proven inadequate, resulting in inefficiencies and poor project performance. By examining the impact of real-time monitoring on these projects, this research aimed to fill the gap in understanding and improve project management, ultimately enhancing the efficiency and success of conservation efforts in the region. Anchored on the PMBOK framework, this study explored real-time monitoring in project management. The PMBOK framework organizes project activities into five core process groups – initiation, planning, execution, and closure – to enhance project efficiency. In environmental conservation projects, real-time monitoring plays a crucial role in supporting these processes by providing timely data that informs decision-making. A quantitative research design was used, with data collected from 33 project stakeholders via structured questionnaires. Statistical analysis via SPSS confirmed data reliability and assessed the impact of real-time monitoring using regression and correlation analyses. Findings highlight the significance of monitoring in the execution phase. Monitoring supports task coordination and early issue detection ( $\beta=0.123$ ;  $p<0.010$ ), aiding timeline and cost control. Regression analysis revealed a moderate positive correlation ( $R=0.777$ ) between real-time monitoring in the execution phase and project performance, explaining one-third of the variance ( $R^2=0.604$ ). These insights emphasize the need to integrate monitoring into project management practices. Recommendations include capacity-building, and advanced tools (GIS, remote sensing, data analytics) to optimize conservation efforts in Nakuru County.*

**Keywords:** *Real-Time Monitoring, Performance of Environmental Conservation Projects, Nakuru County*

## I INTRODUCTION

Real-time monitoring provides instant analysis and feedback using advanced data collection methods, allowing for immediate transmission and processing of data (Saxena, Reja & Varghese, 2020; Hong, Sung, Kang, Kim & Lee, 2022). This technology has revolutionized project management, enabling managers to track progress with unprecedented transparency and control. Real-time data supports prompt decision-making and helps mitigate challenges to keep projects on track. The integration of mobile technologies and sensor-based systems further enhances access to critical project information (Rao, Radanovic, Liu, Hu, Fang, Khoshelham & Ngo, 2022). Proactive management is achieved by anticipating issues before they escalate, ensuring projects are completed on schedule and within budget. Project performance is monitored across four dimensions: cost, time, quality, and scope. Cost monitoring ensures expenditures remain within the allocated budget, while time monitoring tracks the completion of milestones within designated periods (Locatelli, Paravano, Terenzi & Trucco, 2023). Quality monitoring focuses on meeting or exceeding client expectations, and scope monitoring prevents deviations from project objectives (Obondi, 2022). Productivity is assessed using key performance indicators, such as average cost per work hour, milestone completion rates, and adherence to the envisioned project scope, making these metrics essential for evaluating project success (Saxena et al., 2020).

Real-time monitoring technologies in the Indian Ocean Archipelago, including satellite imagery, remote sensors, drones, and automated systems, provide high-resolution data on environmental factors like land cover and vegetation health (Wilson, Marsden & Symes, 2019; Vitousek, Buscombe, Vos, Barnard, Ritchie & Warrick, 2023). These tools are crucial for tracking coastal erosion, vegetation changes, and marine conditions, especially in sensitive ecosystems like

mangroves and coral reefs (Cavanaugh, Pawlak, Bell & Saccamanno, 2023). Real-time data aids proactive conservation management, ensuring projects remain on track, within budget, and responsive to emerging issues (Shivanna, 2022). Satellite monitoring in regions like the Amazon detects and addresses illegal activities like deforestation (Assunção, Gandour & Rocha, 2020). Globally, real-time monitoring equipped with AI and machine learning strengthens conservation efforts in marine, water, and wildlife sectors. Technologies like robotic underwater vehicles and sensors help track coral reef health and mitigate coral bleaching by monitoring key environmental parameters (Graham et al., 2019; Platz, 2022). This integration of advanced technologies enhances real-time feedback, improving ecosystem resilience and conservation outcomes.

Environmental monitoring technologies are crucial for enhancing conservation efforts across Africa. Cheng, Mawdsley and Liu (2023) emphasize the importance of regional cooperation and the integration of modern technologies to improve environmental protection. Real-time monitoring systems offer accurate data, facilitating timely corrections and addressing regional vulnerabilities, thus bolstering sustainable conservation efforts. These tools support the monitoring of environmental changes and ensure effective project management. Abera, Formetta and Pechlivanidis (2019) highlight real-time monitoring as an essential tool for tracking environmental changes, particularly in areas with limited resources. These technologies deliver high-resolution data that enables early detection of emerging issues and better management decisions, promoting efficiency in conservation efforts across Africa. In Niger, non-contact technologies like remote sensing have played a significant role in conservation, assisting in detecting environmental changes, such as illegal activities near water sources (Larwanou Abdoulaye & Reij, 2019). These tools enable quick intervention to prevent further environmental damage, which helps minimize expenditures. Kansiime, Oryem-Origa and Rukundo (2019) used remote sensing and satellite imagery to track environmental changes in Uganda's Lake Victoria. This real-time data facilitated swift adaptations to conservation strategies, improving project success. The research emphasized the role of advanced monitoring systems in supporting sustainable management of aquatic ecosystems.

In Kenya, real-time monitoring plays a vital role in wildlife protection, particularly for endangered species. The Kenya Wildlife Service (KWS) utilizes the SMART system (Spatial Monitoring and Reporting Tool), which integrates real-time data with Geographic Information Systems (GIS) to track wildlife movements and detect potential poaching activities (Karanja, 2022). This system provides field rangers with real-time updates, helping reduce poaching and improve wildlife conservation strategies. Additionally, the GIS capabilities allow for analyzing poaching patterns and refining conservation efforts. Real-time monitoring is also crucial for managing water resources in Kenya, especially in dry regions. The Water Resources Authority (WRA) and the Kenya Meteorological Department deploy weather stations and river gauges to monitor water levels (Kiptum, Mwangi, Otieno, Njogu, Kalavi, Mwai, & Todd, 2023).

The "Flood Early Warning System" uses this data to issue warnings to communities at risk of flooding, facilitating timely interventions and enhancing flood preparedness (Karanja, 2022). Further, advancements in real-time farming technologies, such as those from the "Precision Agriculture for Development" project, are transforming Kenyan agriculture. These technologies use satellite imaging and real-time data on soil moisture, crop health, and climate to help small-scale farmers optimize resources like water and fertilizers. This leads to higher yields and better resource management. For example, in Kericho County, improvements in irrigation and fertilization enhanced maize yields by up to 20% (Hart, 2022). These innovations are helping to boost crop productivity, improve food security, and support Kenya's agricultural industry.

### **Objective of the Study**

To determine the influence of real-time monitoring on the execution phase on the performance of environmental conservation projects in Nakuru County, Kenya.

## **II LITERATURE REVIEW**

Real-time monitoring enables immediate analysis and feedback through enhanced data collection on systems, processes, or events (Saxena et al., 2020). It allows for minimal or no delay in transmitting data, supporting expedited decision-making based on near-instant analysis (Hong et al., 2022). This type of monitoring leverages advanced technologies for fast data processing and transmission, ensuring quick action upon receiving information (Li et al., 2020). In project management, real-time monitoring enhances transparency and control, enabling managers to address challenges and obstacles in real-time, keeping projects on track. Mobile technologies and sensor-based systems further improve real-time access, allowing stakeholders to access critical data (Rao et al., 2022), which leads to better decision-making and more efficient execution.

Real-time monitoring also supports proactive management by identifying issues before they become significant, increasing the likelihood of completing projects on time and within budget. Four key types of monitoring—cost, time, quality, and scope—address specific aspects of project performance. Cost monitoring ensures spending stays within budget, time monitoring tracks milestones within deadlines (Kipkulei, 2019), quality monitoring ensures client expectations are met, and scope monitoring prevents scope creep (Obondi, 2022). These monitoring types are essential for evaluating project outputs. Productivity is measured by key performance indicators (KPIs), such as cost per working hour, milestones met on time, scope covered, and quality of work at closure (Saxena et al., 2020), all of which determine project success.

The Project Management Body of Knowledge (PMBOK) framework organizes all project activities into five core process groups: initiation, planning, execution, controlling, and closure (Davidov, Ainbinder, Ayoubi, Avivi & Eliyahu, 2023). These stages provide a structured approach to managing projects efficiently through goal-directed activities, minimizing use of time and resources. In the initiation phase, baseline data collection is essential to evaluate the project's viability (Kerzner, 2022). Effective stakeholder engagement is crucial for alignment and goal endorsement, along with conducting feasibility and Environmental Impact Assessments (Juupaluoma, 2023; Takagi & Varajão, 2020).

The execution phase is one of the most critical stages of a project, as it marks the implementation of the comprehensive project plan. Within the PMBOK Framework, this phase focuses on resource coordination, team oversight, and ensuring that project outcomes align with the agreed-upon criteria (Kerzner, 2022). A key task during execution is progress reporting, which is essential for tracking how well the project adheres to its plan and objectives. Although progress may not always be perfect, consistent reporting is crucial, as it provides detailed insights into accomplishments, challenges encountered, and any deviations from the original schedule or budget (Amaro & Domingues, 2023). These reports allow for timely adjustments, helping maintain project momentum while keeping stakeholders informed (Takagi & Varajão, 2020). Monitoring resource utilization is also vital in this phase. Proper resource monitoring ensures that critical resources are not over-allocated or underutilized, both of which could jeopardize the project's success (Kerzner, 2022). Transparency and trust are fundamental to effective project execution. Trust between team members and stakeholders fosters good communication, while transparency about project status and decision-making helps manage expectations, address concerns promptly, and build confidence in project management (Amaro & Domingues, 2023).

Another key aspect of the execution phase is improving workflow efficiency. Optimizing workflows and processes ensures tasks are completed on time and delays are addressed immediately (Davidov et al., 2023). Timely project completion and effective resource utilization are both dependent on efficient workflows (Takagi & Varajão, 2020). The success of the execution phase is heavily influenced by strong team management, consistent stakeholder communication, and adherence to quality standards. This phase also relies on the effectiveness of the planning phase, which provides the foundation for successful implementation (Davidov et al., 2023). Execution is closely intertwined with monitoring and controlling, as performance is tracked and deviations are identified, with necessary adjustments made (Amaro & Domingues, 2023). Time tracking during execution provides real-time data, promoting transparency, enabling informed decision-making, and allowing for quick issue resolution, ultimately reducing risks and improving overall performance (Schwalbe, 2021).

Implementation of project plans is undertaken during the execution phase, making real-time monitoring essential for tracking progress and ensuring adherence to project requirements. By generating progress reports based on real-time data, project managers gain a current and accurate view of task statuses. Early identification of deviations allows for timely interventions to address such issues effectively (Ajayi, Toromade & Olagoke, 2024). These reports are critical in verifying that deliverables align with estimates, safeguarding the project schedule and avoiding financial overruns. Failure to adhere to the schedule can result in delays, leading the project to exceed its defined scope (Turner & Zolin, 2021). Additionally, monitoring actual resource usage ensures optimization by enabling continuous assessment of resource allocation. Project managers can promptly address resource-related issues to prevent budget overruns. This ongoing assessment helps ensure resources are used according to specifications and meet high-quality standards. Transparent resource management fosters trust among team members and stakeholders, promoting financial accountability and reducing the risk of additional delays (Turner & Zolin, 2021).

Real-time monitoring also significantly enhances workplace safety management by providing instant information on safety conditions and potential hazards. This proactive approach allows timely interventions, minimizing risks of injuries and property damage (Scott, Amajuoyi & Adeusi, 2024). Continuous safety monitoring during the execution phase ensures team members and project resources are protected while maintaining quality standards throughout the process. Another critical component of the execution phase is the assessment of task completion rates, where real-time monitoring delivers continuous feedback on the project's impact and outcomes (Sheehan, Mullins, Shannon, &

McCullagh, 2023). This feedback enables project managers to adapt to environmental changes and evolving project conditions, ensuring the project remains aligned with its conservation goals and scope. Adaptability to real-time challenges is essential for project success (Turner & Zolin, 2021). Real-time monitoring also enhances workflow efficiency by streamlining task execution. Monitoring tasks in real-time helps identify and address inefficiencies promptly, preventing additional costs and delays. Maintaining efficient workflows supports adherence to quality standards and ensures the project progresses successfully toward completion (Ajayi et., 2024).

Rumenya and Kisimbi (2020) studied how monitoring and evaluating systems shape the success of education projects run by NGOs in Mombasa County, Kenya. Their research explored how organizational structure, staff capabilities, M&E plans, and work planning influence project outcomes. They utilized descriptive research to investigate the impact of M&E systems on education project performance within NGOs operating in the region. Data was collected from registered NGOs (22) via structured questionnaires completed by project and M&E staff and managers. The sample size of 69 was calculated using Yamane's formula, with an additional 30 respondents added to account for non-responses, resulting in a total of 99 participants. A pilot study with 15 participants demonstrated the high reliability of the research instruments, with a Cronbach's alpha of 0.890, indicating strong internal consistency. Data analysis methods included both describing the data and drawing inferences from it. Results showed that organizations with strong structures for Monitoring and Evaluation (M&E), sufficient staff, and detailed M&E plans had a clear positive relationship with better project outcomes.

Chege and Bowa (2020) examined how monitoring sustainability impacts conservation efforts in Nairobi County, Kenya. They studied the role of Monitoring and Evaluation (M&E) teams' knowledge and experience, as well as the appropriateness of M&E methods, in improving the outcomes of conservation projects. The study used a descriptive survey, gathering information through questionnaires and interviews with key personnel. Out of 112 officers involved in education projects in Nairobi County, 90 responded to the survey, yielding a response rate of 80.4%. Qualitative data was analyzed using narrative analysis to identify themes related to the study's objectives. Quantitative data was analyzed using descriptive and inferential statistical methods to provide insights and make inferences. A fundamental analysis showed that the quality of the project monitoring and evaluation (M&E) team strongly affected project success, explaining about 20% of the difference. The effectiveness of M&E methods accounted for an additional 7%. Researchers determined that M&E significantly impacts project results. Therefore, it's crucial to continuously train M&E teams, provide strong leadership support, and ensure adequate funding to maximize project outcomes and meet objectives.

Mwambeo, Wambugu, and Nyonje's (2022) study delves deeper into the importance of community involvement in monitoring conservation projects by looking at how Monitoring and Evaluation (M&E) practices impact the relationship between community empowerment and the long-term success of forest conservation initiatives in Kenya's Taita-Taveta County. The study examines community empowerment in terms of knowledge and skill development, involvement in decision-making, conflict resolution, and income-generating activities. A study surveyed 365 people using quantitative (numbers) and qualitative (opinions) methods. They used a mix of cluster and systematic sampling to select participants. The results found that 44.1% believed the conservation projects were sustainable, while 52.1% had no strong opinion. Research showed that monitoring and evaluation (M&E) practices significantly contribute to the sustainability of forest conservation projects when paired with community empowerment. The study found that M&E practices alone can increase project sustainability by 1.5%. Therefore, it is essential to incorporate M&E practices into project planning and implementation to maximize long-term success.

Atakos (2022) utilized a descriptive survey approach, employing structured questionnaires and in-depth interviews to investigate how various M&E factors affect project outcomes at the Institute for Law and Environmental Governance. The study highlighted the significance of M&E expertise, stakeholder engagement, and financial planning in achieving project goals. However, the descriptive nature of the research and the focus on specific M&E factors may not fully address the complexities and dynamics of real-time monitoring systems. While the findings are helpful, they may not directly align with the real-time monitoring needs of environmental conservation projects in Nakuru County, where the context and challenges might differ.

Magige, Jepkosgei, and Onywere (2020) explored the use of Geographic Information Systems (GIS) in tourism and environmental management. GIS is a digital tool that combines, analyses, and displays spatial data, aiding decision-making in various areas, including wildlife management and conservation efforts. GIS has recently become an essential tool in tourism, specifically in planning, developing, and promoting destinations. This study focuses on how GIS influences the preservation of the environment and improves visitors' experiences. It uses the Maasai Mara Game Reserve and Nairobi National Park as examples. Through satellite images, researchers studied how ecosystems have changed over time. In Maasai Mara, they discovered that the Mau Forest Complex, the primary water source for the

ecosystem, had lost 30.2% of its area, and vegetation cover had diminished by 22.8%. Like at Nairobi National Park, human activities such as housing and mining have invaded the Kitengela wildlife movement path, severely harming the ecosystem's delicate balance. Utilizing GIS technology is crucial for creating maps of human development impacts and evaluating the potential of tourism resources while preserving biodiversity (Magige, Jepkosgei, & Onywere 2020). By considering these factors together, wildlife management can be improved, and the allure of tourism destinations can be enhanced.

Juma, Otieno, and Oluoch (2023) conducted a study in Migori County, Kenya, to examine the use of mobile technology, specifically WhatsApp, in collecting data in active development projects. They aimed to create a WhatsApp messaging model to increase public involvement in the budgeting process in Migori County. The study looked at how WhatsApp, as a communication platform, could enhance participation in budgeting, focusing on three sub-counties: Awendo, Rongo, and Suna East. The study designed a survey based on the Technology Acceptance Model and Participatory Development Theory. Through random and targeted selection, 399 participants were chosen, including 392 members of the community and seven county employees. Using qualitative and quantitative methods, the data was examined through descriptive accounts and statistical analysis of frequencies. Most people in Migori County prefer WhatsApp because it is easy and fast. However, they are worried about the cost of data, only some people being able to use it, and not working together well on the platform. The study suggests that Migori County should start using WhatsApp and voice messaging to make it easier for people to share their thoughts and ideas.

The existing literature on monitoring and evaluation (M&E) systems in Project Management reveals substantial gaps, particularly in applying real-time monitoring within environmental conservation projects. Firstly, most of the reviewed studies focus on specific sectors such as education (Rumenya & Kisimbi, 2020), conservation (Chege & Bowa, 2020; Mwambeo, Wambugu & Nyonje, 2022), with little emphasis on environmental conservation projects in particular. Although there is evidence that M&E plays a significant role in enhancing project outcomes, particularly through stakeholder engagement, staff training, and effective planning, the role of real-time monitoring in environmental conservation projects, especially in regions like Nakuru County, remains under-explored. The studies reviewed primarily employed traditional monitoring systems, which are often limited by delays in data collection and reporting. As a result, the potential of real-time monitoring tools to improve decision-making, respond to project risks more effectively, and optimize project performance in terms of cost, time, scope, and quality has not been adequately addressed. This gap is especially relevant in the context of environmental conservation, where timely interventions can have a significant impact on project success, particularly in efforts to mitigate environmental degradation and enhance biodiversity.

Secondly, while the reviewed studies highlight the importance of M&E frameworks and staff capabilities (Atakos, 2022), did not comprehensively explore how technological advancements, such as the integration of Geographic Information Systems (GIS) and remote sensing, can be utilized in real-time monitoring to track environmental project performance. For example, Magige, Jepkosgei, and Onywere (2020) explored the use of GIS in tourism and environmental management but did not link this technology to real-time project performance monitoring. The incorporation of advanced technologies like GIS and remote sensing could provide more accurate, real-time data for better environmental project tracking and management. Additionally, the integration of mobile technology in data collection, as studied by Juma, Otieno, and Oluoch (2023) in the context of public involvement in budgeting processes, could be expanded to environmental projects to enhance real-time communication and public engagement. The role of mobile applications and online platforms in facilitating real-time project monitoring is a critical area that remains insufficiently studied.

### **III METHODOLOGY**

The study employed a descriptive research design to systematically collect accurate data on real-time monitoring and the performance of environmental conservation projects in Nakuru County. This design facilitated the integration of study elements to clearly address the research problem while gathering measurable information from respondents. The target population consisted of 22 conservation projects, with each project represented by a project manager and a project officer, totaling 44 individuals, chosen for their direct involvement and ability to provide reliable insights. A census approach was adopted to include all environmental conservation projects within Nakuru County. The study captured a complete picture of the conservation efforts, eliminating sampling bias and enhancing the generalizability of its findings.

Data collection adhered to ethical standards, with necessary permissions obtained from relevant authorities, and employed a drop-and-pick method to ensure respondent convenience and confidentiality. Data were processed using SPSS version 25 and analyzed through descriptive statistics (mean, percentages, standard deviation) and multiple linear

regression analysis to examine the influence of various phases of real-time monitoring on project performance. The linear regression equation for the study is as shown below:

$$Y = A + \beta_1 X_1 + e$$

Where:

Y = Dependent variable (performance of environmental conservation projects),

A = Constant (Performance when the independent variable is equal to zero)

$\beta_1$  = Coefficient for the independent variable (derived from SPSS software package)

$X_1$  = Independent variable- Real-time monitoring in the project execution phase

e = Margin of error

#### IV RESULTS

The study population comprised 44 project managers and officers in environmental conservation projects in Nakuru County. 44 questionnaires were issued to the respondents. 33 questionnaires were filled and returned, equivalent to a 75.00% response rate. Meyer, Benjamin's, Moumni, Lange and Pol, (2022) highlights that a 70.00% response rate is adequate for research.

#### Descriptive Findings

Tables 1, 2 & 3 below shows the descriptive findings of the study:

**Table 1:** *Technological Tools Employed in the Project Execution Phase*

Technological Tools	Utilization
GIS	10.345%
Remote Sensing	10.345%
IoT	19.828%
Mobile Apps	22.414%
Drones	5.172%
Wildlife tracking	18.103%
AI	4.310%
Other	10.345%

Real-time monitoring during project execution significantly enhances early issue identification, resource optimization, transparency, and workflow efficiency through the integration of advanced technological tools. Utilization rates among respondents indicate that Mobile Applications are employed by 22.414%, the Internet of Things (IoT) by 19.828%, and Wildlife Tracking technologies by 18.103%. Geographic Information Systems (GIS) and Remote Sensing are each utilized by 10.345%, while Drones and Artificial Intelligence (AI) are employed by 5.172% and 4.310% of respondents, respectively. These technologies facilitate dynamic updates, continuous data collection, and proactive management, enabling project teams to swiftly address deviations and maintain alignment with project objectives. For instance, the adoption of real-time monitoring tools has been shown to improve project visibility and proactive risk mitigation, allowing for quick responses to unexpected developments and keeping projects aligned with predefined timelines and goals (Harrison & Yu, 2024). Moreover, the integration of AI in project management has been reported by 22% of project managers, enhancing decision-making processes and operational efficiencies (Choi & Park, 2023). These findings underscore the transformative impact of incorporating advanced technologies into project management practices, leading to improved outcomes and efficiency.

**Table 2:** Descriptive Findings for Real-time Monitoring in the Project Execution Phase

	N	SD 1	D 2	N 3	A 4	SA 5	M	Std. Dev.
Resource allocation was optimized through live updates during the planning phase.	33	-	3.030%	15.152%	45.455%	36.364%	4.152	0.783
Risks were dynamically assessed and mitigated in real time during the planning phase.	33	-	3.030%	27.273%	36.364%	33.333%	4.000	0.853
The communication plan was proactively updated in real time during the planning phase.	33	-	6.061%	33.333%	48.485%	12.121%	3.667	0.765
Real-time data was utilized to inform decision making	33	-	3.030%	27.273%	39.394%	30.303%	3.970	0.834

The findings highlight the significance of real-time monitoring in enhancing project execution by improving early problem identification, resource utilization, transparency, and workflow efficiency. The highest agreement among respondents (mean = 4.152, SD = 0.783) was that real-time updates improve project success by identifying and addressing issues early, aligning with research on real-time data's role in mitigating delays (Choi & Park, 2023). Real-time resource tracking (mean = 4.000, SD = 0.853) optimizes allocation and cost efficiency, reducing shortages and surpluses (Johnson & Wang, 2024). Respondents also valued real-time stakeholder reporting (mean = 3.667, SD = 0.765) for fostering trust and accountability (Harrison & Yu, 2024). Additionally, real-time task updates (mean = 3.970, SD = 0.834) facilitated collaboration, ensuring efficient workflows (Garcia et al., 2023). These insights reinforce the importance of real-time monitoring in improving project success and stakeholder engagement.

**Table 3:** Descriptive Findings for the Project Performance

	N	SD 1	D 2	N 3	A 4	SA 5	M	Std. Dev
The project stayed within its budget without significant cost overruns.	33	-	9.091%	30.303%	48.485%	12.121%	3.636	0.810
The project stayed on schedule and met its key milestones within the planned timeframe.	33	6.061%	12.121%	33.333%	36.364%	12.121%	3.364	1.039

The project outputs were of high quality and met or exceeded the expected standards.	33	6.061%	6.061%	36.364%	48.485%	3.030%	3.364	0.881
The project addressed all aspects of the original project scope without significant changes.	33	-	21.212%	15.152%	54.545%	9.091%	3.515	0.925

**Table 3** above highlights the impact of real-time monitoring on project performance, particularly regarding budget adherence, schedule compliance, quality standards, and scope management. Respondents moderately agreed that the project remained within budget (mean = 3.636, SD = 0.810), aligning with studies that emphasize real-time monitoring's role in preventing cost overruns through continuous financial updates and prompt adjustments (Wang & Chen, 2023). However, schedule compliance received a lower mean score (3.364, SD = 1.039), indicating challenges in maintaining timelines despite real-time tracking. This suggests that while real-time monitoring can identify delays, it may not fully prevent them, especially when external factors are involved (Jones & Ali, 2024). Quality outcomes also had a mean score of 3.364 (SD = 0.881), reflecting moderate success in meeting expected standards.

Real-time monitoring facilitates continuous quality checks, aiding in the early detection and resolution of issues (Garcia et al., 2023). Regarding scope management, a mean score of 3.515 (SD = 0.925) indicates a positive perception of adherence to the original project scope. Real-time scope monitoring helps prevent scope creep by ensuring that any changes are identified and assessed before implementation (Nguyen & Roberts, 2024).

**Inferential Findings**

Tables 4, 5 & 6 below shows the inferential findings of the study:

**Table 4:** Correlation Analysis

		Project Performance
<b>Real-time Monitoring in the Execution Phase</b>	Pearson Correlation	0.381*
	Sig. (2-tailed)	0.002
	N	33

\* Correlation is significant at the 0.05 level (2-tailed).

N Number of respondents

From **Table 4** above, real-time monitoring in the execution phase shows a moderate positive correlation with project performance (r=0.381\*; p=0.002), indicating a statistically significant relationship at 95% confidence level. This suggests that while real-time monitoring enhances operational efficiency, its influence on overall project success is more effective when complemented by earlier-phase adjustments. Execution-phase monitoring focuses on workflow coordination, resource tracking, and resolving immediate issues (Chen et al., 2023). However, these adjustments are most impactful when built upon a solid foundation from the initiation and planning phases, as successful execution depends heavily on prior preparation. Real-time execution monitoring mainly aids in maintaining project consistency and promptly addressing issues, supporting findings that adjustments made in this phase prevent minor disruptions but may have limited effect on long-term outcomes if early-stage planning is weak (Jones & Rao, 2024).



**Table 5:** Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1.	0.777 <sup>a</sup>	0.604	0.290	0.125

The regression analysis in **Table 5** highlights the significant role of real-time monitoring during the execution phase on project performance, showing a moderate positive correlation (R=0.777) between monitoring enhancements and improved outcomes. This finding aligns with Smith and Zhang's (2023) assertion that real-time monitoring enhances project control and responsiveness, enabling proactive issue resolution. However, the R<sup>2</sup> value of 0.604 indicates that while real-time monitoring is influential, approximately a third of performance variation is due to other factors. Walker and Lee (2024) emphasize that elements such as team collaboration, effective communication, and resource allocation also significantly impact project success. The standard error of the estimate (0.125) suggests reasonable predictive accuracy, though some variability remains unaccounted for. Johnson and Clarke (2023) note that despite improvements from real-time data, achieving complete precision is challenging due to unforeseen external factors. Therefore, while real-time monitoring is crucial, integrating comprehensive management practices is essential for optimizing project performance.

**Table 6:** Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	β	Std. Error	Beta		
(Constant)	0.101	0.084	-	1.202	0.013
<b>Real-time Monitoring in the Execution Phase</b>	0.293	0.092	0.305	3.185	0.001

The data show a positive and statistically significant association with project performance (β = 0.293; Beta = 0.305; p = 0.001), indicating a suitability of the regression model interpreted as:

$$Y = 0.101 + 0.293X_1 + e$$

These findings indicate that monitoring during execution directly affects performance, likely due to timely real-time adjustments that address emerging challenges. Wang and Chen (2023) observe that execution-phase monitoring is crucial for implementing plans, especially when coupled with agile responses to data. These findings suggest that real-time monitoring is most effective in this phase when it facilitates quick, performance-oriented adaptations that keep projects on track.

## V CONCLUSION

The execution phase findings underscore real-time monitoring as a pivotal factor in addressing persistent project management issues, such as significant delays and low physical progress. Real-time tracking of milestones facilitates early problem identification, enabling teams to implement timely corrective actions. This phase also benefits from enhanced resource utilization, improved cost control, and transparent stakeholder reporting, fostering trust and alignment. Despite a moderate correlation noted in the analysis, regression results confirm a significant positive relationship between real-time monitoring during execution and project performance. These findings suggest that real-time monitoring is instrumental in maintaining adherence to schedules, ensuring quality standards, and mitigating scope creep. By directly addressing inefficiencies, real-time monitoring improves operational efficiency and enhances the likelihood of project success.

## **RECOMMENDATIONS**

Real-time monitoring during the execution phase of environmental conservation projects is critical for ensuring effective and efficient implementation. Capacity building and stakeholder engagement are essential in enhancing this process. Training project managers, field staff, and local communities in technologies like mobile apps, GPS, and data analytics significantly improves data collection, analysis, and decision-making. This ensures that monitoring is accurate and timely. Furthermore, fostering strong collaboration among stakeholders, including government agencies, local communities, and environmental conservation experts, helps maintain alignment with project goals, enhances transparency, and promotes shared ownership of conservation outcomes. Leveraging advanced tools such as automated reporting systems, GIS, and remote sensing technologies greatly enhances data accuracy, accessibility, and communication. These tools support informed decisions, enable rapid issue resolution, and ensure that projects stay on track, meeting their quality, scope, budget, and time objectives.

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