Int. j. adv. multidisc. res. stud. 2026; 6(2):541-552

Received: 28-01-2026
Accepted: 08-03-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Examining the Effectiveness of Green Project Management in Promoting Environmental Sustainability: A Case Study of the WASH Project at WaterforWater (WFW) Zambia

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Abstract
With rising environmental challenges and concerns over resource depletion, embedding sustainability in project management has become a global necessity. Green Project Management (GPM), which focuses on environmentally conscious planning, execution, and monitoring, offers a practical framework for fostering sustainability, particularly in development-driven projects. This study examines the WASH (Water, Sanitation, and Hygiene) project implemented by Water for Water Zambia, with the aim of evaluating how GPM practices support environmental sustainability within the project's activities. The study's main objective is to determine the extent to which applying GPM principles contributes to sustainable outcomes in the WASH project. More specifically, it aims to establish the strategies adopted, examine their impact on areas such as water resource protection, waste management, and energy efficiency, and ascertain limitations faced during implementation. A case study exploratory design was adopted, using a quantitative research methodology to gather and analyze primary data. Data was collected through structured questionnaires administered to project staff, environmental officers, and other stakeholders involved in the planning and implementation of the WASH project. Data analysis was conducted using STATA software, with descriptive statistics such as frequencies, percentages, and means used to summarize responses. Chi-square tests were applied to explore associations between GPM practices and perceived sustainability outcomes. The study findings indicate that Green Project Management (GPM) principles are integrated into the WASH project primarily through resource efficiency (40%), life cycle thinking (25%), and stakeholder engagement (20%), with lower emphasis on risk reduction (15%). GPM practices are most applied during implementation (45%), while planning, monitoring, and closure show less integration. Half of the respondents use comprehensive strategies combining waste reduction, energy-efficient equipment, and water-saving technologies. ISO 14001 and PRiSM methodologies guide implementation, with sustainability objectives embedded mostly in project goals. Solar energy (80%) and recycling (40%) are the dominant renewable energy and waste management practices, while donors and project staff are the main promoters of GPM adoption. The integration of GPM principles correlates significantly with the conduct of Environmental Impact Assessments (EIAs). Environmental outcomes show notable improvements in water quality (35%), energy efficiency (30%), and carbon footprint reduction (30%), with secondary benefits including access to safe water (40%) and cleaner environments (30%). Operational efficiency gains include reduced costs (40%) and improved time management (30%). Limitations to GPM adoption include limited funding, high initial costs, inadequate skills, weak policies, and logistical and institutional constraints, particularly during planning and renewable energy integration. Capacity building, resource mobilization, and improved monitoring systems are identified as critical strategies for addressing these challenges and strengthening the sustainability impact of GPM practices.

Keywords: WaterforWater (WFW), Green Project Management (GPM), WASH (Water, Sanitation, and Hygiene)

1. Introduction

1.1 Background

Environmental sustainability has become a pressing global priority, driven by the growing realization that current patterns of resource consumption and development are unsustainable (Harriram, 2023). Central to this concern is the need to integrate environmentally responsible practices into all aspects of development, including project management. Green Project Management (GPM) has emerged as a specialized discipline aimed at aligning project implementation with environmental sustainability principles (Carboni, 2024). GPM incorporates environmentally conscious planning, execution, and monitoring processes to minimize ecological impacts while enhancing the social and economic value of development projects (Malik, 2023).

Globally, environmental degradation, climate change, and water scarcity have catalyzed the adoption of green practices across sectors (Siddique, 2021) [40]. International frameworks such as the United Nations Sustainable Development Goals (SDGs) particularly Goal 6 (Clean Water and Sanitation) and Goal 13 (Climate Action) emphasize the importance of sustainable water resource management and environmentally sound development practices (Arora, 2022). Various international conventions and policy instruments, including the Paris Agreement and the UN Water Convention, reinforce the need for integrated, sustainable approaches to managing water, sanitation, and hygiene (WASH) programs (Mevono, 2024) [26].

In Zambia, environmental sustainability is increasingly being recognized as a national development priority, particularly in light of recurring droughts, inadequate access to clean water, and poor sanitation infrastructure (Habanyama, 2024) [11]. The Environmental Management Act (2011) and the National Policy on Environment (2007) provide the legal and policy frameworks guiding sustainable development in the country (Samba, 2021). However, despite these provisions, challenges persist in operationalizing environmental standards in project implementation, especially within the water and sanitation sector (Haque, 2021). Projects often overlook environmental impacts during planning and execution stages, resulting in unintended consequences such as water contamination, inefficient resource use, and ecosystem degradation (Farouk, 2024).

The WASH project implemented by Water for Water Zambia offers a compelling context to examine the application of green project management principles in a local setting (Vonk, 2021) [43]. As a critical intervention aimed at improving access to clean water and sanitation, the project intersects directly with environmental and public health concerns (Pouramin, 2020). Understanding how GPM is applied in the planning, implementation, and monitoring of this project can provide valuable insights into the practicalities of promoting environmental sustainability through project management (Nasr, 2025).

Given this evolving landscape, there is a growing need to assess how green project management is being implemented within Zambia's development initiatives and its effectiveness in achieving sustainable outcomes (Mukosha, 2023) [28]. This study, therefore, seeks to evaluate the role of GPM in promoting environmental sustainability within the WASH project undertaken by Water for Water Zambia. The findings will contribute to knowledge on sustainable project implementation and inform policy, practice, and capacity-building efforts aimed at integrating green principles into development projects at both local and national levels.

1.2 Statement of the Problem

Despite growing global and national emphasis on environmental sustainability, many development projects in Zambia, particularly in the water, sanitation, and hygiene (WASH) sector, still fall short in integrating green project management (GPM) principles into their implementation processes (Mwale, 2023) [30]. The persistent use of conventional project management approaches often neglects the environmental impacts of project activities, resulting in unsustainable outcomes such as depletion of water resources, poor waste management, and environmental degradation (Opku, 2019). Zambia continues to face significant environmental and public health challenges, largely linked to inadequate access to clean water and poor sanitation (Libanda, 2020). According to the Zambia Demographic and Health Survey (ZDHS, 2018), only 67% of the population has access to basic drinking water services, while just 44% have access to basic sanitation facilities (Hazyondo, 2020) [14]. In addition, a 2022 report by the Ministry of Water Development and Sanitation highlights that most WASH interventions lack environmental safeguards, leading to negative ecological impacts such as soil erosion and contamination of water sources (Shrestha, 2023). There is a lack of empirical research in Zambia on how GPM contributes to long-term sustainability within WASH projects. While studies in other countries have demonstrated that green project management improves environmental outcomes and resource efficiency, similar data is scarce locally (Nwaogbe, 2025). Therefore, the problem lies in the limited application and evaluation of green project management practices within Zambia's WASH projects. Without a deliberate and systematic approach to integrating environmental sustainability, such projects risk undermining their long-term impact and exacerbating environmental challenges (Vonk, 2021) [43]. This study seeks to address this gap by assessing the role of GPM in promoting environmental sustainability, using the WASH project at Water for Water Zambia as a case study.

1.3 General Objectives

The general objective for the study was to examine how Green Project Management practices contribute to environmental sustainability in the WASH project at Water for Water Zambia.

1.3.1 Specific Objectives

1. To establish Green Project Management strategies integrated into the WASH project at Water for Water Zambia.
2. To examine the effectiveness of Green Project Management strategies on environmental sustainability.
3. To ascertain limitations faced in implementing Green Project Management practices within the WASH project.

1.4 Conceptual Framework

The conceptual framework for this study is anchored on the relationship between Green Project Management (GPM) practices and environmental sustainability, particularly within the context of the WASH project at Water for Water Zambia (Katotobwe, 2024) [16]. The independent variable in this framework is the integration of Green Project Management principles, which includes environmentally conscious planning, implementation, and monitoring processes (Kivila, 2017). These principles are expected to guide how the WASH project minimizes its ecological footprint while delivering essential water and sanitation services.

The dependent variable is environmental sustainability, which in this study refers to outcomes such as resource conservation (especially water), reduction in pollution and waste, and the protection of local ecosystems. The framework assumes that the successful application of GPM practices leads to improved environmental outcomes in project implementation.

This relationship is influenced by several intervening variables, which play a mediating role in determining the extent to which GPM practices achieve their intended environmental impact. These include the institutional capacity of the implementing organization, the level of stakeholder engagement, the existence and enforcement of relevant policies, and community participation. These factors can enhance or hinder the effectiveness of GPM practices depending on how they are managed.

Furthermore, the framework identifies challenges and limitations as moderating variables that can weaken or obstruct the successful integration of GPM. These include financial constraints, lack of technical knowledge, resistance to change among stakeholders, and inadequate policy enforcement. These challenges, if not addressed, may reduce the potential benefits of green project management, limiting its contribution to sustainability.

2. Literature Review

2.1 The Green Project Management principles integrated into the WASH projects

Green Project Management (GPM) involves embedding environmental sustainability into every phase of a project's life cycle (Khater, 2021) [18]. When applied to WASH (Water, Sanitation, and Hygiene) projects especially those implemented by organizations like Water for Water (WfW) Zambia GPM ensures that development efforts not only improve public health and infrastructure but also preserve environmental integrity. Below are the key GPM principles integrated into WASH projects:

Life Cycle Thinking is another core principle of Green Project Management that emphasizes the consideration of environmental and resource impacts throughout all stages of a project's life from planning and design, through implementation and operation, to decommissioning or rehabilitation (Mazzi, 2020) [25]. Within WASH projects, life cycle thinking supports sustainable outcomes by promoting the selection of materials, technologies, and processes that minimize negative impacts over time (Mlisho, 2022) [27].

Stakeholder engagement and empowerment are fundamental principles in Green Project Management, ensuring that projects are not only environmentally sustainable but also socially inclusive and community-driven (Ahmad, 2024). In the context of Water, Sanitation, and Hygiene (WASH) projects, engaging stakeholders particularly local communities, government bodies, civil society organizations, and beneficiaries is essential for ensuring that interventions are contextually relevant, culturally appropriate, and ultimately effective (Calderon, 2021) [7]. This participatory approach enhances transparency, fosters ownership, and ensures that projects align with the actual needs and priorities of those they are meant to serve (Yahia, 2024).

Resource efficiency is a core principle of Green Project Management, emphasizing the prudent and optimal use of water, energy, and materials throughout the lifecycle of a project (Nwaogbe, 2025). In Water, Sanitation, and Hygiene (WASH) initiatives, resource efficiency is essential not only for reducing operational costs and environmental degradation but also for ensuring the long-term sustainability and resilience of systems in resource-constrained settings (Ali, 2024). As demand for basic services continues to grow, especially in developing regions, WASH projects must adopt resource-efficient strategies to deliver maximum benefits with minimal environmental impact (Abuzerr, 2025) [1].

Risk management with an environmental focus is a critical principle in Green Project Management, especially in the context of Water, Sanitation, and Hygiene (WASH) projects (Munyugi, 2024). The complexity and vulnerability of WASH systems make them particularly susceptible to environmental threats, including the growing impacts of climate change, pollution, and unsustainable resource use. Therefore, incorporating proactive and environmentally centered risk management strategies into project planning and execution is essential to ensure that WASH initiatives remain effective, resilient, and sustainable over time (Varma, 2022).

2.2 The Effects of Green Project Management principles on environmental sustainability

Green Project Management (GPM) ensures that environmental sustainability is embedded within the strategic objectives of a project from the very beginning, making it a central concern rather than an afterthought (Nasr, 2025). This principle signifies a shift from the traditional view of environmental issues as secondary elements of project management to a more integrated approach where sustainability is a fundamental goal alongside the financial and social objectives. By incorporating sustainability into the project's core purpose, GPM ensures that all stages of the project planning, execution, and monitoring are consistently aligned with the objective of reducing negative environmental impacts and promoting long-term ecological health (Calderon, 2021) [7].

From the outset, integrating sustainability into project goals requires a clear commitment to ensuring that the project contributes positively to environmental conservation and resilience (Orieno, 2024). The first step is setting specific, measurable sustainability objectives that guide every aspect of the project. This includes the efficient use of resources, minimizing waste, reducing carbon footprints, and conserving biodiversity. These sustainability goals must be as integral as the traditional project goals, such as time, cost, and quality, in order to influence decision-making throughout the project's life cycle (Ikudyisi, 2022).

The integration of sustainability also influences key decisions made during the project design phase (Secundo, 2022). For example, when selecting a site for a project, GPM advocates for choosing locations that minimize the environmental footprint. This could involve considering the site's proximity to critical natural resources, such as water sources or habitats that need to be preserved. Moreover, during the design process, GPM encourages the use of eco-friendly materials and technologies that reduce harm to the environment (Kerzner, 2025) [17]. In construction projects, this may mean opting for low-impact materials like recycled steel or eco-friendly concrete, or incorporating renewable energy systems, such as solar panels, to reduce reliance on fossil fuels (Nasr, 2025).

2.3 Limitations faced in implementing Green Project Management practices within the WASH project

Financial constraints and budget limitations present one of the most significant challenges in adopting Green Project Management (GPM) practices within WASH (Water, Sanitation, and Hygiene) projects, particularly in low-resource settings (Adesina, 2021). The high initial investment required for implementing environmentally sustainable technologies and materials often acts as a major barrier. Green technologies, such as solar-powered water pumps, rainwater harvesting systems, eco-friendly sanitation systems, and sustainable water treatment methods, tend to have higher upfront costs compared to traditional, less sustainable alternatives (Geng, 2019). This cost disparity can discourage organizations or stakeholders from adopting these solutions, especially in resource-strapped areas where the need for WASH projects is most critical (Bungau, 2022). In addition to these financial challenges, there is a lack of awareness among some donors and government agencies about the long-term economic and environmental benefits of sustainable technologies. However, in many cases, the initial costs overshadow these long-term benefits in the decision-making process (Leskinne, 2020). The successful implementation of Green Project Management (GPM) practices in WASH (Water, Sanitation, and Hygiene) projects hinges on a deep understanding of both environmental sustainability and project management. However, in many regions, particularly in developing countries, there is often a significant gap in the technical knowledge required to integrate sustainable practices effectively into WASH initiatives (Lin, 2021) [22]. This lack of expertise can present a major barrier to the adoption of GPM principles, as local project managers and stakeholders may not have the necessary skills to implement or manage environmentally sustainable technologies. Consequently, this knowledge gap can lead to the improper application or underutilization of green technologies and strategies, undermining the potential for these projects to have a meaningful impact on environmental sustainability (Liu, 2022).

The technical aspects of GPM such as the design, installation, and maintenance of eco-friendly systems demand specialized knowledge. In many low-resource settings, where WASH projects are most needed, the lack of trained personnel with expertise in green technologies and sustainable infrastructure can prevent the effective implementation of these solutions (Manchisi, 2019) [24]. Even when green technologies are introduced, the lack of knowledge about how to operate, maintain, and repair these systems can lead to their failure or underperformance, wasting resources and diminishing the long-term benefits of the project. Moreover, local project managers and stakeholders may not fully understand the potential benefits of GPM principles (Omopariola, 2024).

3. Research Methodology

3.1 Research Design

The study adopted an exploratory case study, utilizing a mixed method approach.

3.2 Target Population

The target population for this study consisted of project managers, architects, engineers responsible for the WASH Project at Water for Water Zambia.

3.3 Sample Size

The study consisted of 50 participants.

3.4 Sampling

Convenience sampling approach was used to select the study sample.

3.5 Data Collection Methods

The main data collection method for this study was a structured questionnaire containing closed-ended questions.

4. Result Presentation

4.1 Presentation of results on background characteristics of the respondents

The majority of respondents (64%) fall within the 25-45 age range, indicating a relatively young and likely energetic workforce. The average age group is centered around young and middle-aged professionals, with only 12% being below 22-25 years and 24% being 45 or older.

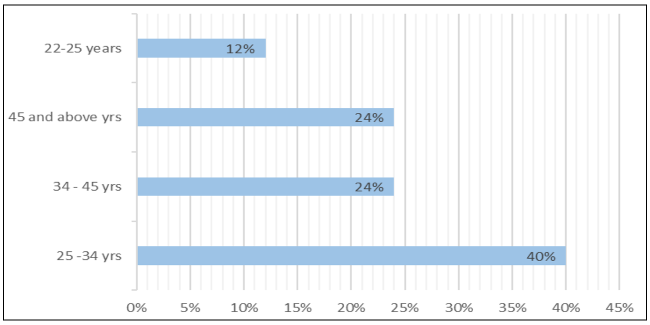


Fig 4.1.1: Age Distribution of Respondents

The gender distribution shows a significant majority of male respondents (70%) compared to female respondents (30%).

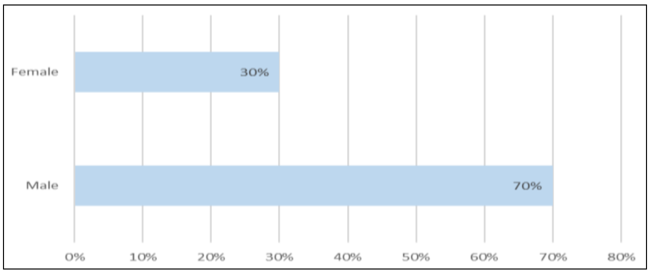


Fig 4.1.2: Gender Distribution of Respondents

The respondent pool is diverse in terms of project roles, with Technical Staff (32%) and Field Officers (30%) constituting the majority. This provides a well-rounded perspective from those directly involved in implementation, complemented by inputs from Project Management (18%) and Community Liaison (12%).

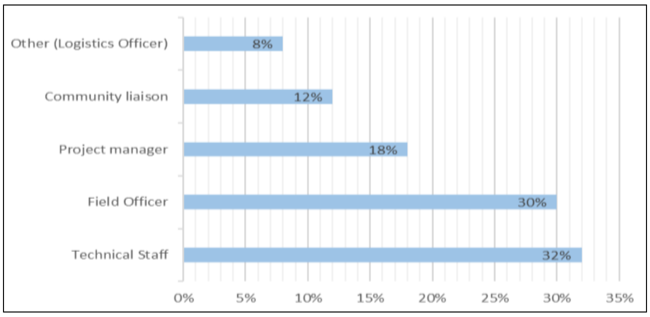


Fig 4.1.3: Roles of Respondents in Project Implementation

The project team is experienced, with a combined 76% having over 3 years of experience. Notably, 36% have more than 6 years of experience, suggesting a high level of expertise and familiarity with project challenges and contexts.

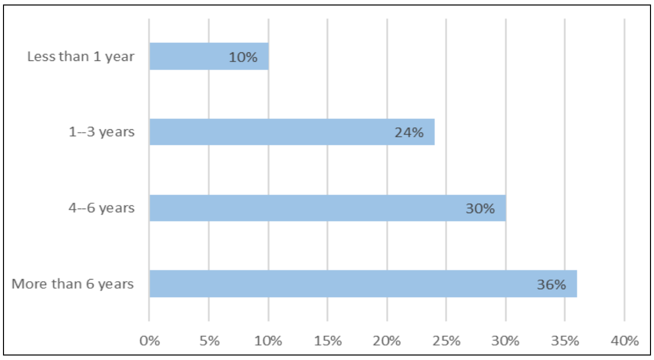


Fig 4.1.4: Work Experience of Respondents

The team is highly educated, with 88% holding a Diploma or higher. A Bachelor's Degree is the most common qualification (40%), followed by Diplomas (32%) and Master's degrees (16%).

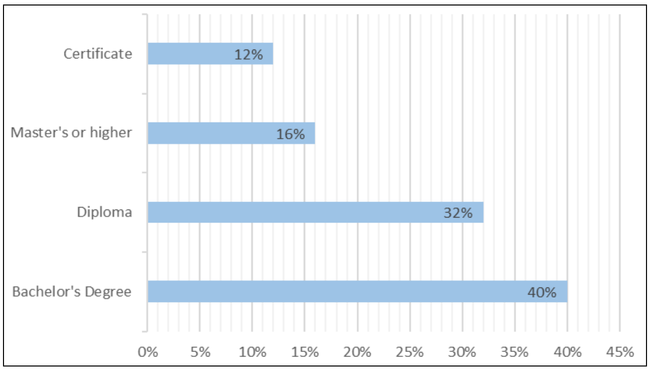


Fig 4.1.5: Educational Qualifications of Respondents

4.2 Objective I: Integration of Green Project Management strategies in the WASH Project

Resource efficiency is the most commonly applied principle, reported by 40% of respondents. Life cycle thinking, cited by 25%, shows consideration for the long-term environmental impact of project activities, while stakeholder engagement (20%) reflects efforts to involve communities and other relevant actors in decision-making. Risk reduction (15%) is less prioritized, suggesting that while environmental risks are considered, they are not the main focus.

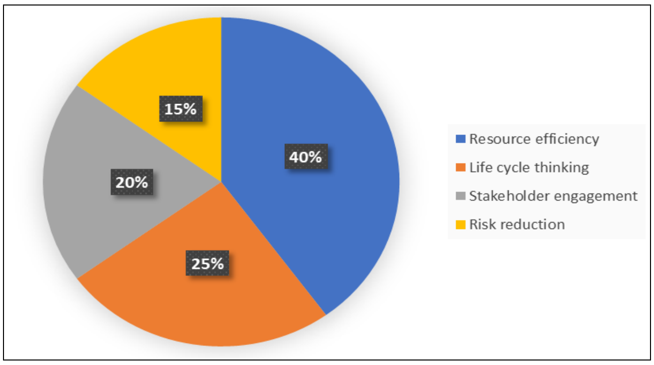


Fig 4.2.2: GPM principles applied

45% of respondents indicated that GPM principles are most actively applied during the implementation phase. Planning (30%) still incorporates sustainability considerations, but monitoring (15%) and closure (10%) show lower integration, indicating that evaluation and long-term assessment of environmental performance are not yet fully emphasized.

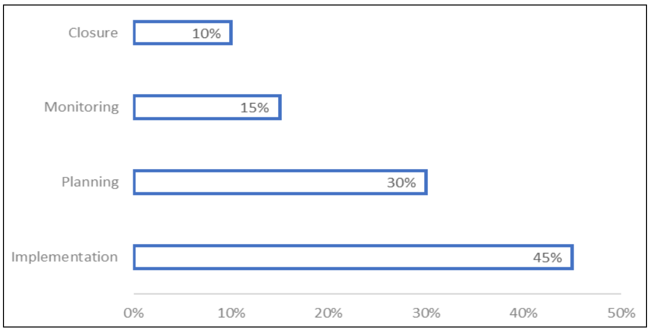


Fig 4.2.2: Project phase with highest GPM integration

Half of the respondents (50%) reported using all strategies waste reduction, energy-efficient equipment, and water-saving technologies reflecting a comprehensive approach to mitigating environmental impact. Energy-efficient equipment and individual strategies (20% and 15%) indicate some degree of selective adoption, but the preference for integrated approaches demonstrates a commitment to addressing multiple environmental factors simultaneously.

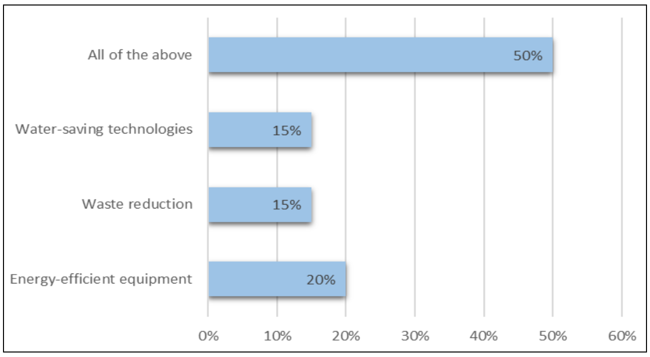


Fig 4.2.3: Approaches to minimize environmental impact

ISO 14001 was cited by 35%, highlighting adoption of a formalized environmental management system, which provides structured guidance for compliance and sustainability reporting. PRiSM methodology (25%) and internal policies (25%) are also applied. Only 15% refer to GRI, indicating that standardized reporting and global sustainability benchmarks are less emphasized.

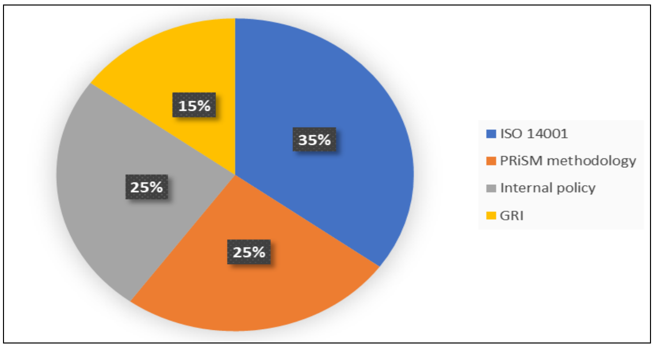


Fig 4.2.4: Sustainability standards guiding implementation

Respondents (40%) primarily integrate sustainability objectives through project goals, suggesting that environmental considerations are included from the outset. Policy compliance (30%) and donor requirements (20%) act as external motivators, while community consultations (10%) play a smaller role.

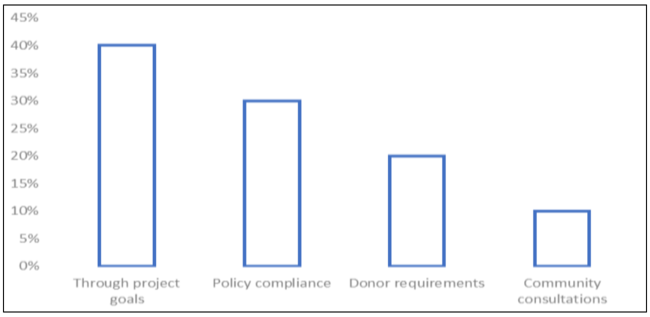


Fig 4.2.5: Integration of sustainability objectives in project design

Solar power dominates at 80%, showing a strong commitment to adopting clean energy technologies to reduce reliance on non-renewable sources. Biogas and hydropower are minimally applied (10% each), suggesting limited diversification of renewable sources.

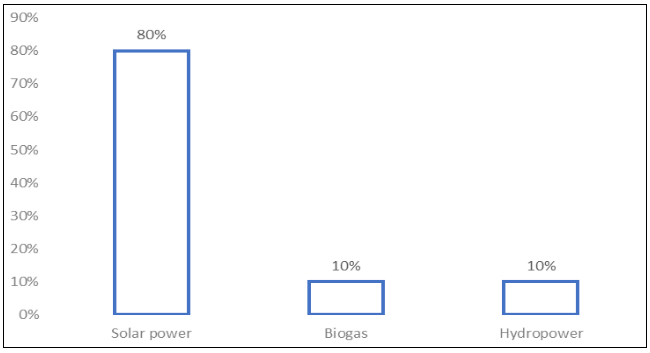


Fig 4.2.6: Renewable energy use

Recycling (40%) is the most common approach, with 30% using a combination of strategies including safe disposal and composting. The low reliance on composting alone (10%) may indicate that organic waste management is secondary compared to broader recycling initiatives.

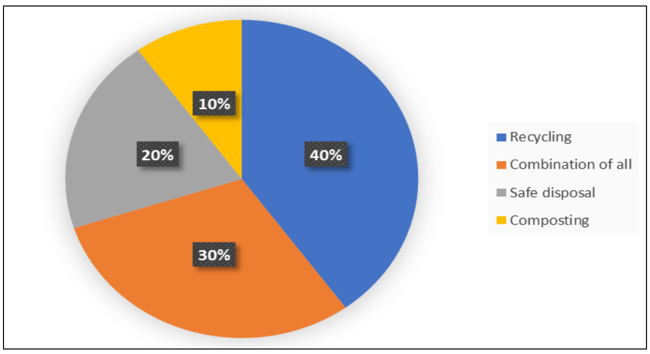


Fig 4.2.7: Waste management strategies

Donors (35%) and project staff (30%) are the primary promoters of GPM principles, showing that external funding agencies and internal team members play critical roles in ensuring sustainability compliance. Government agencies (20%) and community members (15%) are less influential.

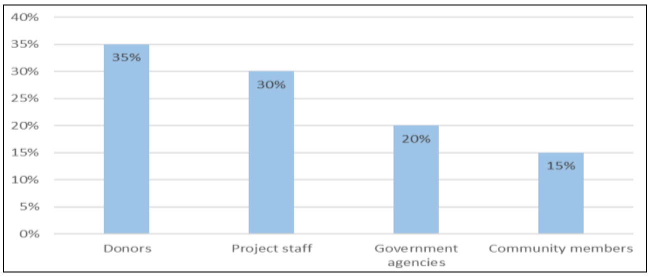


Fig 4.2.8: Stakeholder contribution to GPM practices

Environmental management plans (40%) and sustainability reports (30%) are primary sources of documented evidence of GPM adoption, highlighting formalized recording and accountability processes. Project charters (20%) and procurement policies (10%) are less commonly used, suggesting that sustainability is not fully embedded in all procedural documents.

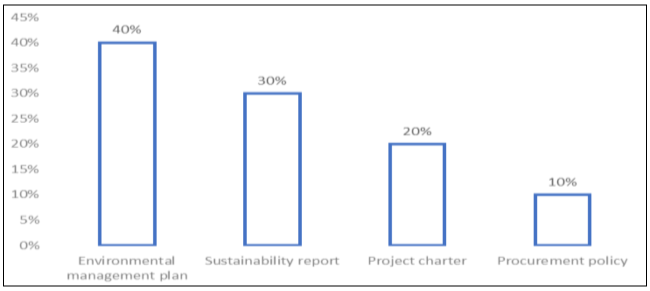


Fig 4.2.9: Documentation reflecting GPM integration

The Chi-square test results show a statistically significant association between the perception of GPM integration in planning and the conduct of Environmental Impact Assessments (EIAs) ($\chi^2 = 133.333$, df = 6, $p < 0.001$). The significant linear-by-linear association ($\chi^2 = 7.419$, $p = 0.006$) indicates a positive trend, suggesting that projects with higher perceived integration of green project management principles are more likely to have conducted EIAs prior to project initiation. This implies that strong integration of GPM principles in planning aligns with better adherence to environmental assessment requirements, reinforcing responsible project management practices.

Table 4.2.1: Association Between Perception of Green Project Management Integration and Conduct of Environmental Impact Assessments: A Chi-Square Analysis

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	133.333[a]	6	.000
Likelihood Ratio	134.602	6	.000
Linear-by-Linear Association	7.419	1	.006
N of Valid Cases	100		

4.3 Objective II: Effectiveness of Green Project Management Principles on Environmental Sustainability

Water quality (35%) and energy consumption (30%) have shown the most improvement, demonstrating that GPM practices directly enhance critical environmental outcomes in the WASH project. Improvements in waste generation (20%) and air quality (15%) are less pronounced, suggesting that while operational efficiency and resource management are strong, some broader environmental factors require more targeted interventions.

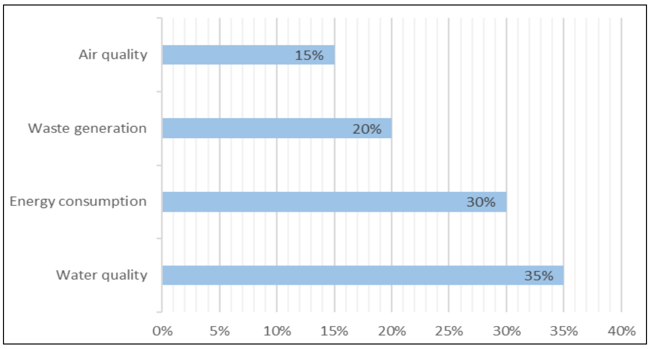


Fig 4.3.1: Environmental aspects improved

Reduction in carbon footprint (30%) and improved sanitation (30%) reflect the dual benefits of GPM both environmental and social. Increased resource reuse (25%) indicates efforts toward circular economy practices, while reduced water losses (15%) highlight operational efficiency.

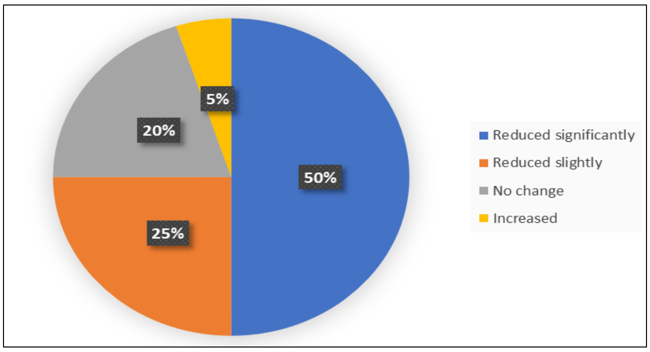


Fig 4.3.2: Indicators of sustainability contribution

Access to safe water (40%) is the most cited benefit, showing that GPM implementation has a direct positive impact on communities. Cleaner environments (30%) and employment creation (20%) suggest secondary social and environmental benefits, while better health outcomes (10%) are less immediately visible, possibly requiring longer-term monitoring.

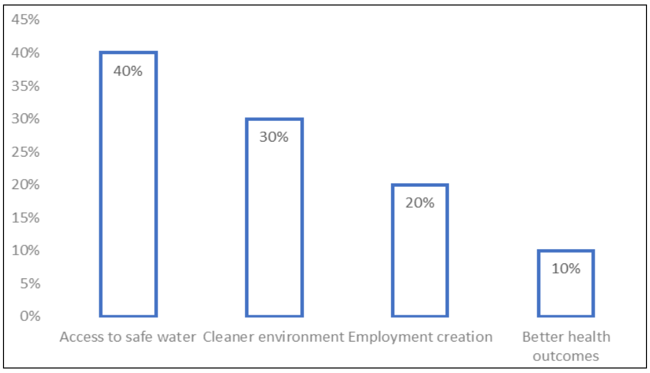


Fig 4.3.3: Community-level benefits

Reduced costs (40%) and improved time management (30%) indicate that integrating sustainability into project activities enhances efficiency. Enhanced coordination (20%) shows some organizational benefit, while 10% report no significant effect, suggesting that operational gains are not universal across all activities.

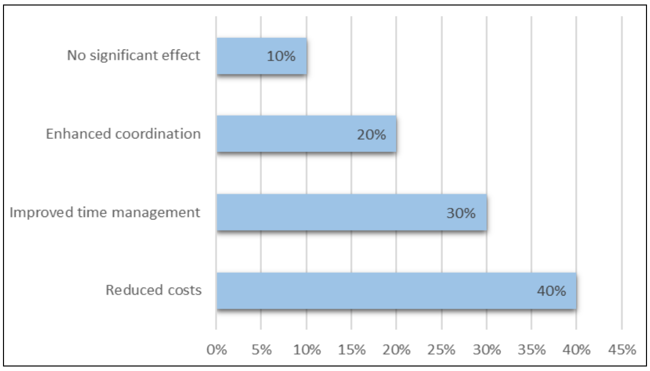


Fig 4.3.4: Influence on operational efficiency

45% of respondents report improvements across all environmental measures (emissions, recycling, waste reduction), showing the broad positive impact of GPM. Individual outcomes such as reduced waste disposal (25%), increased recycling (20%), and lower emissions (10%) highlight targeted improvements, though certain metrics remain underdeveloped.

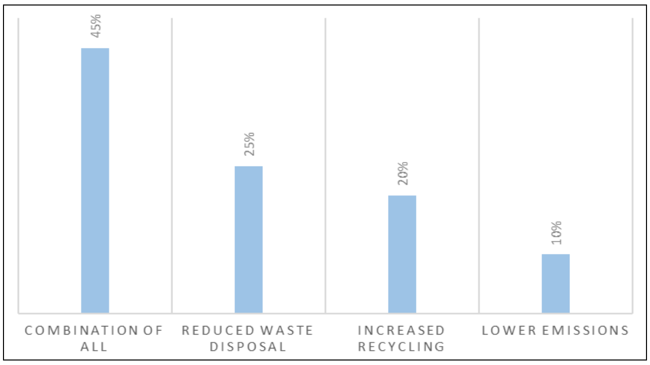


Fig 4.3.5: Measurable environmental outcomes

Renewable energy use (40%) contributes most to sustainability, followed by efficient waste disposal (30%). Eco-friendly materials (20%) and sustainable sourcing (10%) indicate that material choice is secondary but still relevant. The findings suggest that energy-focused interventions provide the greatest sustainability returns.

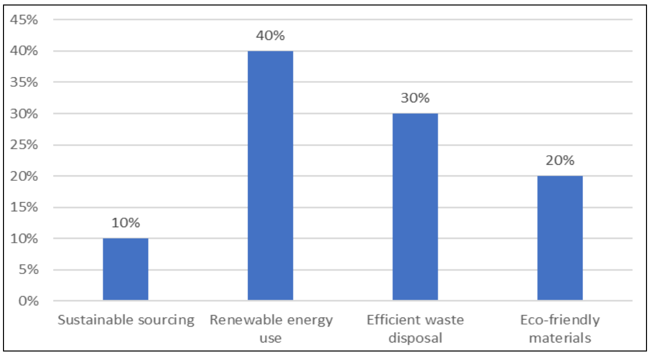


Fig 4.3.6: Long-term sustainability practices

Beneficiaries (35%) report the highest satisfaction with environmental outcomes, suggesting that GPM adoption delivers visible improvements in service quality. Donors (30%) and staff (25%) are also satisfied, reflecting positive perception among key project stakeholders. Local authorities (10%) report the least satisfaction, possibly due to differing priorities or expectations.

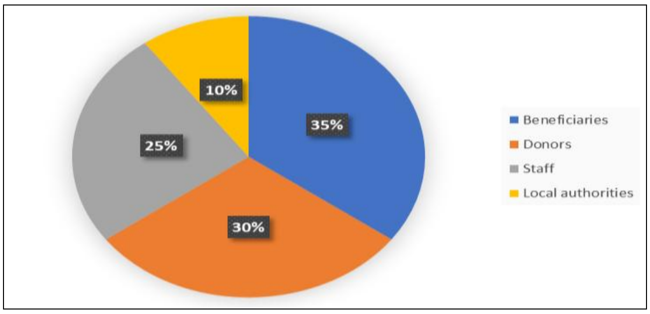


Fig 4.3.7: Stakeholder satisfaction

Increased lifespan (45%) indicates that GPM practices contribute to durability and reliability of infrastructure, reducing maintenance costs and improving service continuity. Improved functionality (25%) and reduced maintenance costs (20%) further demonstrate operational benefits, while 10% report no change, indicating uneven impact.

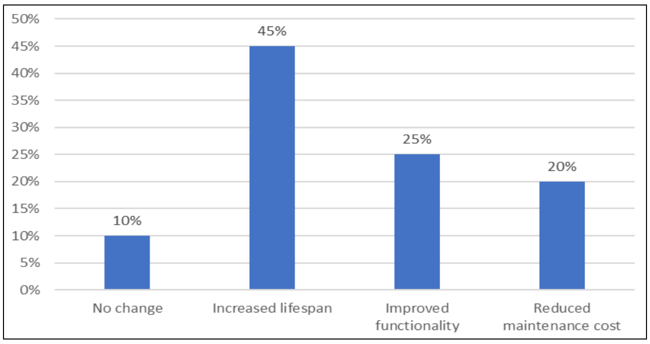


Fig 4.3.8: Longevity of water infrastructure

Emission reduction (40%) is the area least impacted, suggesting that while the project improves water and energy outcomes, climate-related impacts are less effectively addressed. Energy efficiency (25%), waste management (20%), and water conservation (15%) are relatively better, showing selective progress in sustainability.

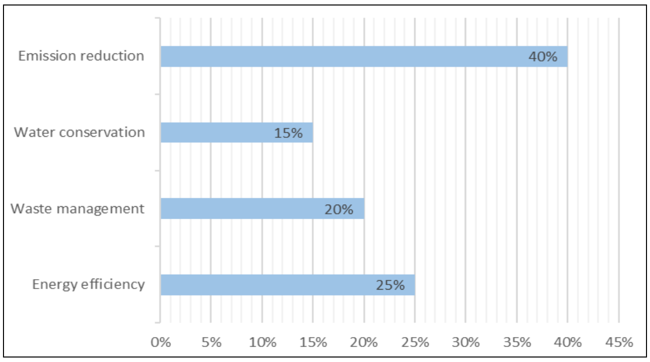
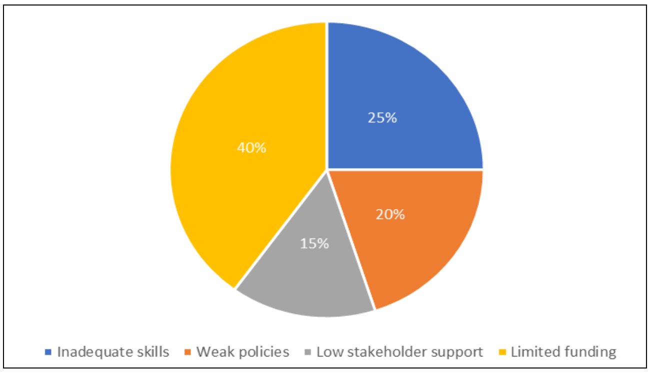


Fig 4.3.9: Sustainability areas least affected

4.4 Objective III: Limitations in Applying Green Project Management Principles

Limited funding (40%) is the primary barrier, demonstrating that financial constraints restrict the scope and intensity of sustainable practices. Inadequate skills (25%) and weak policies (20%) indicate human resource and institutional limitations, while low stakeholder support (15%) shows that engagement challenges exist.

Major challenge affecting GPM application



High initial costs (45%) are the main barrier, reflecting financial limitations that prevent full adoption of clean energy technologies. Lack of expertise (25%), maintenance challenges (20%), and technical limitations (10%) further constrain renewable energy integration.

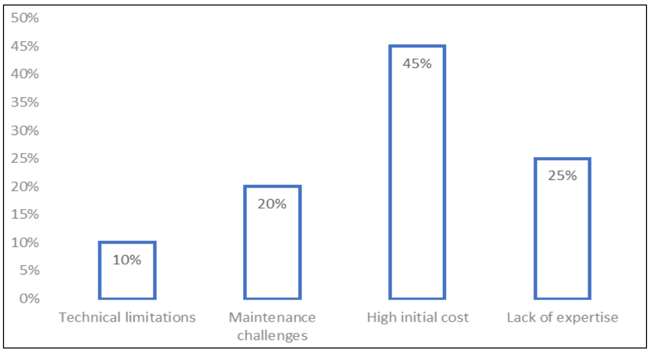


Fig 4.4.1: Constraint to renewable energy adoption

Planning (35%) is the most challenging phase for implementing GPM, highlighting difficulties in integrating sustainability principles early in project development. Monitoring (30%) and implementation (25%) also face challenges, indicating that both assessment and execution phases require more structured support.

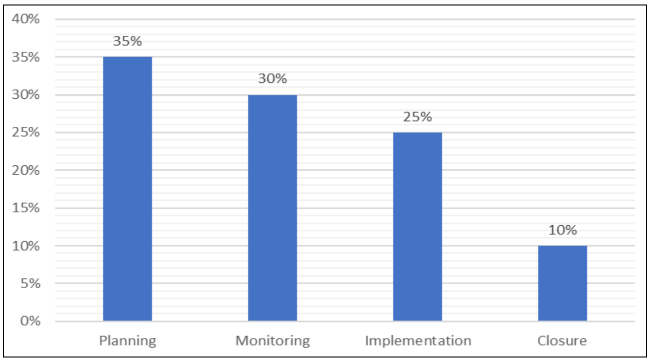


Fig 4.4.2: Project phase with greatest difficulty

Regulatory constraints (30%) and market availability of green materials (30%) are key limitations, suggesting systemic and supply chain factors restrict GPM adoption.

Donor conditions (25%) and community attitudes (15%) also play roles but are secondary.

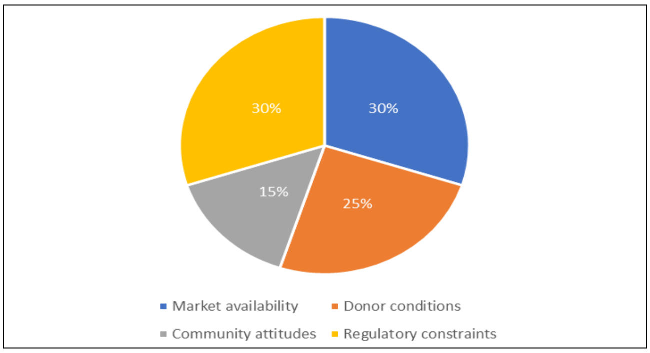


Fig 4.4.3: External factors limiting implementation

Lack of data (35%) is the most significant factor, reflecting gaps in monitoring systems and record-keeping. Limited awareness (25%) and absence of reporting frameworks (25%) further restrict consistent documentation, while time constraints (15%) affect reporting capacity.

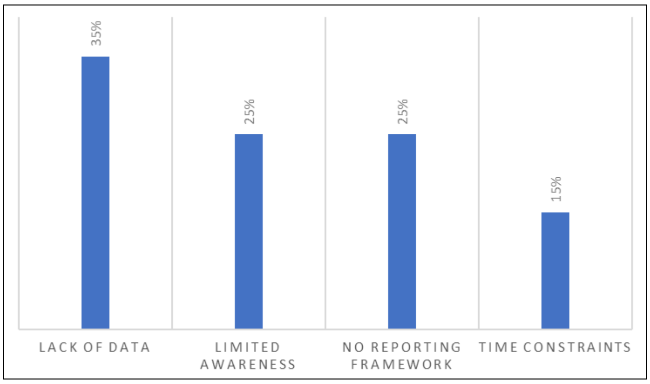


Fig 4.4.4: Primary reason for poor sustainability reporting

Insufficient training (40%) is the largest challenge, showing that capacity building is essential to ensure staff can implement GPM effectively. Lack of environmental officers (25%), poor leadership (20%), and staff turnover (15%) also contribute to human resource constraints.

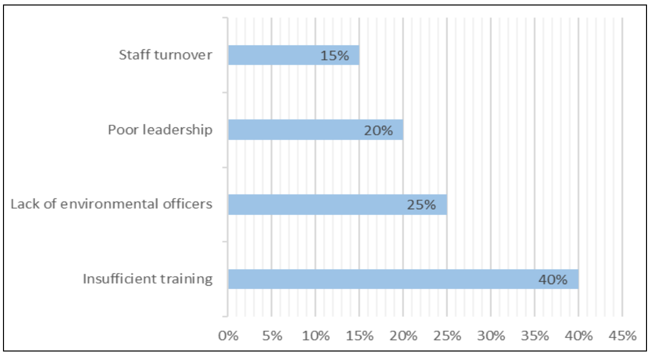


Fig 4.4.5: Human resource limitations

High costs (40%) are the main logistical barrier, limiting the procurement of sustainable materials and technologies. Limited supplier options (30%), long lead times (20%), and quality inconsistencies (10%) are secondary challenges affecting project execution.

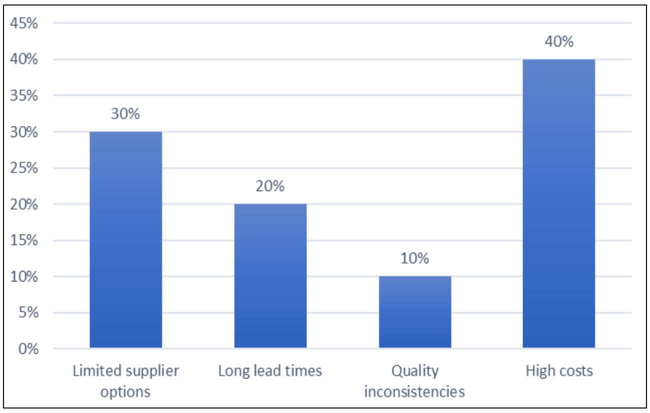


Fig 4.4.6: Logistical challenge in green procurement

Weak enforcement (35%) and lack of management support (30%) highlight organizational barriers that prevent consistent application of sustainability principles. Poor coordination (20%) and absence of clear policies (15%) exacerbate these challenges.

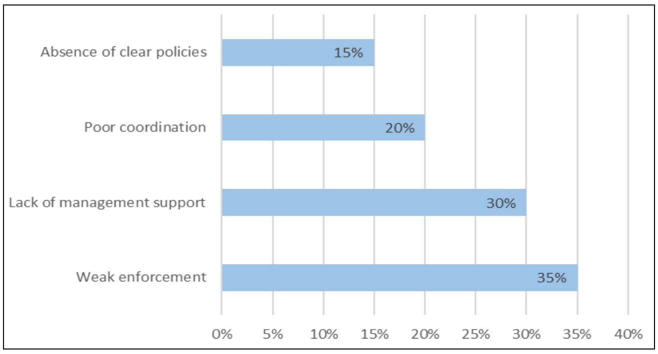


Fig 4.4.7: Institutional factors affecting GPM adoption

Capacity building (40%) is the primary approach to addressing knowledge and skill gaps, indicating emphasis on training. Outsourcing experts (30%) and peer learning (20%) supplement internal capacity development, while 10% report no structured approach, suggesting uneven knowledge management practices.

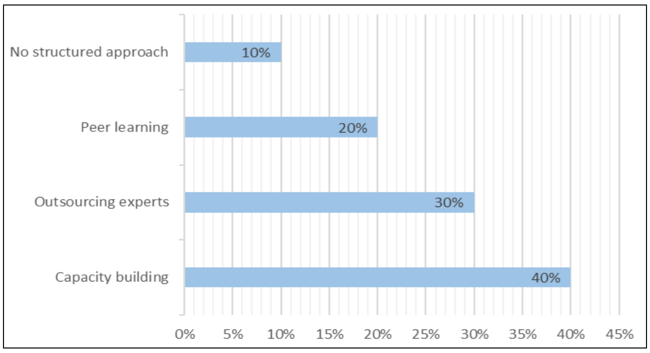


Fig 4.4.8: Addressing knowledge gaps

Resource mobilization (35%) is critical for scaling GPM practices, reflecting the need for additional financial and material support. Monitoring systems (30%) and policy alignment (20%) require improvement to ensure consistent application, while training (15%) highlights ongoing human resource needs.

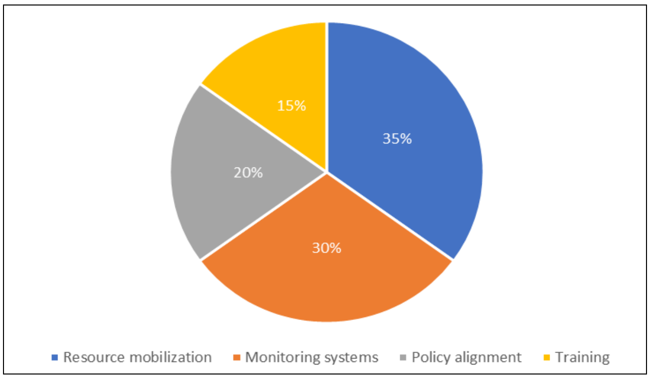


Fig 4.4.9: Area requiring most improvement

5. Discussion

The study examined how Green Project Management (GPM) principles are applied, their impact on environmental sustainability, and the challenges faced in WASH projects. It found that sustainability is integrated unevenly, with resource efficiency being the most practiced principle and risk reduction the least. Sustainability is mostly applied during project implementation, while planning and monitoring receive less attention. Common strategies include waste reduction, energy-efficient systems, and solar energy use, though global reporting and community participation remain limited. Donors and project staff are the main drivers of sustainability, with weak involvement from government and communities. GPM adoption has improved environmental outcomes, including better water quality, energy efficiency, and reduced carbon footprints, while also yielding social benefits such as access to clean water and job creation. Operational efficiency gains include cost and time savings, and improved infrastructure reliability. However, emission reduction, waste management, and water conservation remain weak areas. Key barriers to GPM implementation include limited funding, high upfront costs, inadequate technical expertise, weak institutional support, and low community awareness. Bureaucratic processes, poor policy enforcement, and insufficient monitoring also hinder progress. Addressing these challenges requires stronger capacity building, resource mobilization, policy alignment, and community engagement to ensure comprehensive and sustained adoption of GPM principles in WASH projects.

6. Conclusion

The study established that Green Project Management (GPM) principles were integrated to a moderate to large extent in the WASH project, with 70% of respondents confirming their application in planning. Environmental Impact Assessments were widely conducted prior to project initiation, reflecting a strong commitment to environmental responsibility. However, integration of green initiatives into budgeting and the use of renewable energy and eco-friendly materials showed moderate adoption, highlighting areas for financial and technical improvement. Resource efficiency emerged as the most commonly applied principle, while life cycle assessment was least utilized. Sustainability indicators were inconsistently included in project monitoring, and significant training gaps were noted, with only 22% of respondents receiving high-level GPM training. Environmental stewardship informed decision-making frequently, but not universally. Emphasis on waste management and innovation was moderate, though community and stakeholder engagement in environmental conservation was perceived as active and effective. GPM practices contributed positively to environmental sustainability, notably improving water conservation, reducing waste, enhancing energy efficiency, and reducing the overall environmental footprint. Adaptation to climate resilience and the use of moderately sustainable materials further reinforced the project's long-term viability. Eco-friendly sanitation systems were found effective in reducing pollution, and GPM practices contributed to the protection of local ecosystems. Financial constraints, technological barriers, lack of training, bureaucratic hurdles, and cultural resistance were identified as significant challenges affecting GPM implementation. Community perceptions were generally supportive, though a lack of awareness highlighted the need for better communication and education.

7. Acknowledgement

I am deeply grateful to God, the ultimate source of life, knowledge and wisdom for guiding and blessing me on this research journey. I also wish to express my sincere appreciation to my supervisor, **Dr Kelvin Chibomba**, for their exceptional guidance, constructive criticism and unwavering support throughout the course of this study, their expertise and valuable insights were instrumental in shaping the direction and quality of this research.

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