Mediating Effect of Green Maintenance Funds on The Relationship Between Facilities Management Challenges and Performance of NITDA Nigeria

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ARTICLE INFO	ABSTRACT
	This study examines the relationship between facilities management challenges, green maintenance funds, and organizational performance, focusing on the mediating role of green maintenance funds. As sustainability becomes a key focus in facilities management, challenges such as resource constraints, inadequate training, and lack of strategic planning hinder the effective implementation of green initiatives. Using a quantitative approach, the study collected survey data from facilities managers across various sectors and applied structural equation modeling (SEM) to analyze the relationships between the key variables. Results indicate that facilities management challenges significantly impact the allocation of green maintenance funds ($\beta = 0.852$, $p = 0.000$), which in turn positively influences performance ($\beta = 0.190$, $p = 0.046$). Furthermore, green maintenance funds partially mediate the relationship between management challenges and performance ($\beta = 0.162$, $p = 0.000$). These findings suggest that addressing management challenges by allocating green maintenance funds can enhance organizational performance. The study highlights the importance of investing in green maintenance practices to improve both environmental outcomes and overall efficiency. It recommends that organizations prioritize sustainability, overcome facilities management challenges, and allocate sufficient resources to green maintenance to improve performance.

1. Introduction

The integration of green maintenance funds into facilities management has emerged as a strategic approach to addressing the increasing demand for sustainability in Nigeria's infrastructure. This aligns with global efforts to reduce environmental impact and enhance operational efficiency (Ikram et al., 2021; Dipeolu & Ibem, 2020). In Nigeria, challenges such as limited financing, inadequate technological integration, and aging infrastructure continue to hinder facilities management performance, particularly in public institutions like the National Information Technology Development Agency (NITDA) (Ebekozien et al., 2022; Chukwu et al., 2020). The role of green maintenance funds in mitigating these challenges remains underexplored, especially in the context of technology-driven organizations.

Facilities management is integral to ensuring the efficiency of organizational operations, encompassing the coordination of physical spaces, resources, and processes (Atkin & Brooks, 2021). However, in developing economies like Nigeria, systemic inefficiencies, poor resource allocation, and financial constraints have limited its impact (Amos et al., 2021; Nwachukwu & Unachukwu, 2023). For instance, green infrastructure, which has the potential to improve environmental sustainability, remains underutilized in institutional settings due to policy implementation gaps and inadequate funding mechanisms (Zuniga-Teran et al., 2020; Dipeolu & Ibem, 2020).

Green maintenance funds can address these challenges by promoting sustainable practices, reducing operational costs, and enhancing resource efficiency (Muslim, 2020; Ikram et al., 2021). For a technology-driven organization like NITDA, adopting such funds can support its mission to drive digital transformation while fostering environmental sustainability. The relevance of adopting sustainable practices in Nigeria is underscored by studies emphasizing the importance of enhancing digital literacy and technological adoption to drive socio-economic development (Kolawole & Akindoju, 2024; Kuppuswamy et al., 2023).

Despite these advancements, financial constraints remain a significant barrier to effective facilities management in Nigeria. Studies have highlighted the mediating role of financial mechanisms, such as maintenance funds, in overcoming these constraints (Amos et al., 2021; Ebekozien et al., 2022). Additionally, the adoption of blockchain and e-governance tools has shown potential for enhancing transparency and accountability in resource management, suggesting an innovative pathway for improving the efficiency of green maintenance funds (Kuppuswamy et al., 2023; Nwachukwu & Unachukwu, 2023).

Facilities management in Nigeria faces persistent challenges, including inadequate funding, aging infrastructure, and limited integration of sustainable practices (Ebekozien et al., 2022; Chukwu et al., 2020). These issues are particularly pronounced in public institutions like NITDA, where the efficiency of operations is critical to achieving the organization's objectives. Despite the potential of green maintenance funds to address these challenges, their application and impact on facilities management performance remain underexplored. Furthermore, existing financial mechanisms in facilities management have not sufficiently addressed the systemic inefficiencies that hinder sustainability and operational efficiency. While studies have explored green infrastructure and financial mechanisms in facilities management, there is limited research on the mediating role of green maintenance funds in addressing facilities management challenges in public institutions, particularly in the Nigerian context (Muslim, 2020; Ikram et al., 2021). Moreover, the intersection of green maintenance funds, technological adoption, and organizational performance has not been adequately investigated, leaving a critical gap in understanding how these elements interact to enhance facilities management outcomes in organizations like NITDA.

This study is essential for several reasons. First, it addresses the pressing need for sustainable facilities management practices in Nigeria, a country grappling with environmental and economic challenges. Second, it provides insights into how green maintenance funds can enhance organizational performance by mediating the impact of facilities management challenges. Third, it contributes to the body of knowledge on the adoption of sustainable practices in public institutions, offering practical recommendations for policymakers and practitioners. By examining the role of green maintenance funds in NITDA, this study aims to bridge the gap between theory and practice, ultimately supporting the organization's mission to foster digital and environmental transformation.

The objectives of this study are threefold. First, it aims to identify and assess the key challenges facing facilities management at NITDA, Nigeria, including funding constraints, skill gaps, and maintenance culture. Second, the study seeks to examine the impact of these challenges on the performance of facilities management at NITDA, with a particular focus on operational efficiency, cost management, and sustainability outcomes. Finally, the study intends to explore the mediating effect of Green Maintenance Funds on the relationship between facilities management challenges and overall performance at NITDA. These objectives are designed to provide a comprehensive understanding of how challenges in facilities management influence performance, and how green maintenance funds may help mitigate these challenges to improve organizational outcomes.

2. Literature Review

Facilities Management Challenges and Performance

Facilities management (FM) encompasses a wide range of activities, including the maintenance of infrastructure, resource management, and ensuring operational efficiency (Atkin & Brooks, 2021).

However, in Nigeria, FM practices are hindered by challenges such as aging infrastructure, inadequate funding, and poor policy implementation (Ebekozien et al., 2022; Chukwu et al., 2020). Public institutions, including those in the technology sector, face significant difficulties in maintaining operational efficiency due to these constraints (Amos et al., 2021). Despite the recognized importance of effective FM, studies indicate that systemic inefficiencies, including outdated practices and lack of innovation, have negatively impacted organizational performance in the Nigerian public sector (Nwachukwu & Unachukwu, 2023; Ayodele et al., 2020).

Green Maintenance Funds as a Mediating Mechanism

Green maintenance funds have emerged as a sustainable solution to address the financial challenges associated with facilities management. These funds are designed to promote sustainable practices, reduce operational costs, and enhance resource efficiency (Muslim, 2020; Ikram et al., 2021). In the context of developing countries like Nigeria, where financial constraints are a significant barrier, the implementation of green maintenance funds offers a pathway to improve environmental sustainability and operational performance (Dipeolu & Ibem, 2020). Studies have highlighted the potential of financial mechanisms, such as dedicated maintenance funds, to mediate the relationship between FM challenges and organizational outcomes, suggesting their role in bridging performance gaps in resource-constrained environments (Amos et al., 2021).

Integration of Green Infrastructure and Technology in Facilities Management

The adoption of green infrastructure has been recognized as a critical component of sustainable facilities management. Green infrastructure enhances environmental sustainability while supporting long-term operational goals (Zuniga-Teran et al., 2020; Dipeolu & Ibem, 2020). However, the integration of green technology in FM remains limited in Nigeria due to financial and policy-related challenges (Ikram et al., 2021). Emerging technologies, including blockchain and digital twins, offer innovative solutions for enhancing transparency, accountability, and efficiency in resource management (Coupry et al., 2021; Kuppuswamy et al., 2023). These advancements align with global trends in digitalization, which have been shown to improve FM performance and sustainability (Lee et al., 2021).

Financial Mechanisms and Organizational Performance

Finance plays a crucial role in determining the efficiency of FM practices, particularly in resource-constrained environments. Studies have demonstrated the mediating effect of financial mechanisms, such as maintenance funds, on the performance of FM services in public institutions (Amos et al., 2021). In Nigeria, the lack of dedicated funding mechanisms for FM has been identified as a major barrier to achieving operational efficiency (Ebekozien et al., 2022). The integration of green maintenance funds can address these challenges by providing the necessary resources to implement sustainable practices, thereby improving organizational performance (Muslim, 2020).

The Role of Policy and Digital Literacy

Policy frameworks and digital literacy are pivotal in the successful implementation of sustainable FM practices. In Nigeria, the adoption of e-government and blockchain technologies has shown potential for improving resource management, but their application in FM remains limited (Nwachukwu & Unachukwu, 2023; Kuppuswamy et al., 2023). Enhanced digital literacy can empower FM professionals to leverage these technologies, thereby overcoming operational challenges and improving sustainability outcomes (Kolawole & Akindoju, 2024). Policymakers are encouraged to prioritize the development of regulatory frameworks and capacity-building While existing studies have explored various aspects of FM, including challenges, financial mechanisms, and sustainability practices, the mediating role of green maintenance funds in the Nigerian context remains underexamined (Amos et al., 2021; Muslim, 2020). Additionally, there is limited research on the integration of digital technologies in FM to address systemic inefficiencies and enhance organizational performance (Lee et al., 2021; Coupry et al., 2021). This study aims to fill these gaps by investigating

the role of green maintenance funds in mediating the relationship between FM challenges and performance in NITDA, Nigeria.

Table 1. Challenges of Facilities Management in NITDA, Nigeria

Challenges	Impact of the Challenges	Effect on Aspects of Performance	Relation with Facilities Management	Source	Remark
Inadequate Funding	Limited resources for regular maintenance and upgrades	Reduced efficiency and quality of service delivery	Directly affects the ability to maintain facilities	Ebekozien et al. (2022); Amos et al. (2021)	Highlights the need for green maintenance funds as a sustainable financial mechanism
Aging Infrastructure	Increased maintenance costs and frequent breakdowns	Reduced operational efficiency and safety	Necessitates frequent repairs, leading to resource strain	Chukwu et al. (2020); Zuniga-Teran et al. (2020)	Calls for modernization and integration of sustainable infrastructure solutions
Poor Policy Implementation	Lack of clear frameworks for FM practices	Inconsistent operational practices	Weakens compliance with FM standards	Nwachukwu & Unachukwu (2023)	Advocates for the development of effective FM policies and monitoring systems
Limited Adoption of Green Practices	Missed opportunities for cost savings and sustainability	Poor environmental and resource efficiency	Directly impacts sustainability goals and resource management	Muslim (2020); Ikram et al. (2021)	Suggests increased focus on green infrastructure and technology in FM strategies
Low Digital Literacy Among FM Staff	Difficulty in adopting modern tools and technologies	Slow response to maintenance and service issues	Limits the adoption of smart FM solutions	Kolawole & Akindoju (2024); Lee et al. (2021)	Indicates the need for capacity building and training for FM staff
Inadequate Data Management	Inefficient tracking of maintenance schedules and resource usage	Poor decision-making and planning	Reduces effectiveness in maintenance operations	Bayero (2023); Coupry et al. (2021)	Calls for adoption of digital tools like blockchain and BIM for efficient data management
Shortage of Skilled Personnel	Delays in service delivery and reduced maintenance quality	Poor client satisfaction and performance outcomes	Directly affects maintenance service delivery	Ayodele et al. (2020); Amos et al. (2021)	Emphasizes the need for training programs to bridge the skill gap
High Energy Costs	Increased operational expenses	Reduced financial sustainability	Strains budgets allocated for facility maintenance	Ikram et al. (2021); Shah et al. (2021)	Advocates for energy-efficient technologies and practices to mitigate costs
Lack of Stakeholder Collaboration	Fragmented approach to FM decision-making and execution	Ineffective resource allocation and project success	Limits integration of sustainable FM practices	Ebekozien et al. (2022); Dipeolu & Ibem (2020)	Suggests the need for inclusive stakeholder engagement in

Inconsistent Maintenance Practices	Reactive rather than preventive maintenance approach	Increased downtime and repair costs	Weakens overall operational readiness and reliability	Amos et al. (2021); Chukwu et al. (2020)	FM planning and implementation Highlights the importance of adopting proactive and standardized maintenance practices

3. Research Methods

The study adopts a quantitative research approach using a descriptive exploratory strategy to investigate the mediating effect of green maintenance funds on the relationship between facilities management challenges and performance at NITDA, Nigeria. This design allows for the systematic collection, analysis, and interpretation of data to understand the complex dynamics of facilities management in the context of NITDA. The population for the study comprises all 290 staff members of the National Information Technology Development Agency (NITDA), Nigeria, who are directly or indirectly involved in facilities management. A sample size of 165 staff members was determined using appropriate sampling techniques to ensure representativeness and generalizability of the findings. Primary data was collected through a structured questionnaire designed to capture challenges of facilities management at NITDA, the role of green maintenance funds in addressing these challenges, and the impact on the overall performance of facilities management at NITDA. The questionnaire employed a Likert scale to measure respondents' perceptions and attitudes toward key variables. The questionnaire was subjected to a pilot test with a subset of participants to ensure reliability and validity. Cronbach's Alpha was used to measure internal consistency, ensuring the instrument's reliability. Content validity was ensured by consulting domain experts and reviewing existing literature. The study utilized both descriptive and inferential statistical tools for data analysis. Descriptive analysis, including measures such as mean, standard deviation, and frequency distribution, was used to summarize the data and provide insights into the facilities management challenges and their impacts. Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied to analyze the relationships between facilities management challenges, green maintenance funds, and performance. PLS-SEM was chosen for its robustness in handling complex models and small sample sizes. Ethical considerations were carefully observed in this study. Informed consent was obtained from all participants, and confidentiality and anonymity were maintained throughout the study. Ethical approval was secured from relevant authorities before data collection. The research framework was developed to illustrate the relationships between facilities management challenges, the mediating role of green maintenance funds, and performance at NITDA. The framework hypothesizes that green maintenance funds mediate the relationship between challenges and performance, influencing sustainability outcomes.

4. Results and Discussions

Data Normality Assessments

Table 2 presents the data normality statistics for the variables measured in the study. The mean values for the variables, such as GMF1, GMF2, and GMF3, range from approximately 3.76 to 4.46, indicating generally positive responses from participants. The median values for most variables are at or near 4 or 5, suggesting a slight skew toward higher ratings for the items.

The standard deviations for the variables range from 0.924 to 1.477, with the lowest variability observed in items related to performance (e.g., PERFM5 with SD = 0.924) and the highest in Green Maintenance Fund items such as GMF1 (SD = 1.477). This variation in standard deviation indicates a somewhat diverse range of responses among participants, with some items reflecting a higher level of agreement than others.

Excess kurtosis and skewness values indicate the shape and symmetry of the distributions. The excess kurtosis values for many items are negative, suggesting that most distributions are relatively flat, with few extreme outliers. However, items like PERFM3, PERFM4, and PERFM5 show a positive excess kurtosis, indicating a leptokurtic distribution with a higher peak and more extreme values. The skewness values are

predominantly negative, but none exceed the threshold of -3 or +3, suggesting that the data distributions fall within an acceptable range for normality.

The data indicates generally normal distributions with some items displaying slight skewness and flatness, especially for performance-related variables. This suggests that respondents tended to provide similar assessments regarding the Green Maintenance Funds, Facilities Management Challenges, and Performance of NITDA, with minor variations. However, the distribution shape of some performance-related items indicates significant variations in responses for these aspects.

Table 2. Data Normality

Name	Type	Mean	Median	Standard deviation	Excess kurtosis	Skewness
GMF1	MET	3.764	4.000	1.477	-0.844	-0.805
GMF2	MET	3.794	4.000	1.421	-0.846	-0.782
GMF3	MET	4.073	5.000	1.184	0.113	-1.094
GMF4	MET	3.927	4.000	1.287	-0.133	-0.983
GMF5	MET	4.121	5.000	1.154	0.649	-1.244
FMC1	MET	4.085	5.000	1.162	0.407	-1.149
FMC2	MET	4.067	5.000	1.197	0.439	-1.179
FMC3	MET	4.073	5.000	1.189	0.473	-1.212
FMC4	MET	3.994	5.000	1.258	-0.414	-0.929
FMC5	MET	3.891	4.000	1.255	-0.706	-0.719
PERFM1	MET	3.788	4.000	1.334	-0.927	-0.641
PERFM2	MET	4.000	5.000	1.279	0.011	-1.104
PERFM3	MET	4.436	5.000	1.080	3.704	-2.133
PERFM4	MET	4.418	5.000	1.009	3.974	-2.093
PERFM5	MET	4.461	5.000	0.924	5.143	-2.206

Table 3. Descriptive Statistics Table of Challenges of Facilities Management in NITDA

Challenges	Mean (M)	Standard Deviation (SD)	Ranking
Inadequate funding	4.35	0.78	1
Lack of skilled personnel	4.21	0.82	2
Poor maintenance culture	4.1	0.85	3
Limited adoption of green technologies	3.95	0.8	4
Insufficient government policy enforcement	3.88	0.9	5
Dependence on outdated equipment	3.76	0.85	6
High cost of maintenance	3.62	0.92	7
Lack of stakeholder engagement	3.55	0.94	8
Inefficient energy management	3.5	0.89	9
Environmental sustainability challenges	3.42	0.88	10

The analysis of the challenges associated with facilities management at NITDA reveals significant insights, as illustrated by the descriptive statistics. The mean scores and standard deviations highlight the respondents' perceptions of the severity of these challenges and their relative importance. The challenge of inadequate funding emerges as the most critical, with the highest mean score of 4.35 and a standard deviation of 0.78, ranking first. This indicates a widespread consensus among respondents that insufficient financial resources are a primary obstacle in achieving effective facilities management. This finding aligns with previous studies emphasizing the pivotal role of adequate funding in ensuring operational efficiency in facilities management.   Following closely is the lack of skilled personnel, with a mean score of 4.21 and a standard deviation of 0.82, ranked second. The shortage of trained and competent staff highlights a significant skills gap that impedes the adoption of modern practices and technologies in facilities management. This issue underscores the need for targeted capacity-building initiatives to enhance workforce competencies. The poor maintenance culture ranks third, with a mean of 4.10 and a standard deviation of 0.85. This reflects a systemic issue where maintenance activities are often reactive rather than proactive, leading to the

rapid deterioration of infrastructure and equipment. Such a culture not only compromises the performance of facilities but also incurs higher long-term costs. The limited adoption of green technologies ranks fourth, with a mean score of 3.95 and a standard deviation of 0.80. This finding indicates a moderate level of concern about the integration of sustainable and energy-efficient technologies, which are vital for reducing environmental impacts and enhancing sustainability in facilities management. Insufficient government policy enforcement is ranked fifth, with a mean of 3.88 and a standard deviation of 0.90. This challenge highlights regulatory gaps and the lack of stringent policy implementation, which undermine the effectiveness of facilities management practices.

Other notable challenges include dependence on outdated equipment (mean = 3.76, SD = 0.85), high cost of maintenance (mean = 3.62, SD = 0.92), and lack of stakeholder engagement (mean = 3.55, SD = 0.94), ranking sixth, seventh, and eighth, respectively. These issues point to inefficiencies in resource utilization and the absence of collaborative approaches, which are crucial for achieving optimal outcomes in facilities management. Finally, inefficient energy management (mean = 3.50, SD = 0.89) and environmental sustainability challenges (mean = 3.42, SD = 0.88) rank ninth and tenth, respectively. Although these challenges are perceived as relatively less critical, they remain important considerations, especially in the context of global sustainability goals and the need for environmentally responsible facilities management practices. In summary, the findings reveal a spectrum of challenges affecting facilities management performance at NITDA, with inadequate funding, lack of skilled personnel, and poor maintenance culture being the most pressing. These insights underscore the importance of addressing these challenges through strategic interventions, including increased funding, workforce development, policy enforcement, and the integration of green technologies. Addressing these issues will significantly enhance the effectiveness, efficiency, and sustainability of facilities management at NITDA.

Quality criteria
R-Square

The quality criteria for the study were evaluated using various statistical measures, including R-squared, f-square, and construct reliability and validity. These measures provide insights into the strength and validity of the relationships among the study variables.

The R-squared values for Green Maintenance Funds and Performance are both 0.726, with the adjusted R-squared values being 0.724 and 0.723, respectively. These values indicate a strong explanatory power, as approximately 72% of the variance in both Green Maintenance Funds and Performance is explained by the model. The adjusted R-squared values, slightly lower than the regular R-squared, account for the number of predictors in the model, but still indicate a high degree of fit and robustness.

Table 4. R-square

	R-square	R-square adjusted
Green Maintenance Funds	0.726	0.724
PERFORMANCE	0.726	0.723

F-Square

Regarding the f-square values, the results show that Facilities Management Challenges have a large effect size on Green Maintenance Funds, with an f-square value of 2.644. This indicates a substantial impact, meaning that the challenges in facilities management significantly influence the Green Maintenance Funds. The f-square value for Green Maintenance Funds on Performance is 0.036, which is very small, suggesting that while Green Maintenance Funds may have some effect on Performance, the relationship is not substantial. Furthermore, the f-square values for Performance and Facilities Management Challenges indicate that these factors have a moderate impact on the overall model.

Table 5. f-square

	Facilities Management Challenges	Green Maintenance Funds	PERFORMANCE
Facilities Management Challenges		2.644	0.469
Green Maintenance Funds			0.036
PERFORMANCE			

Construct reliability and validity

In terms of construct reliability and validity, the study demonstrates high reliability and validity across all key constructs. For Facilities Management Challenges, the Cronbach's alpha is 0.943, indicating excellent internal consistency. The composite reliability (rho_a) is 0.945, and the rho_c value is 0.957, both of which exceed the commonly accepted threshold of 0.70, confirming strong reliability. The average variance extracted (AVE) for Facilities Management Challenges is 0.815, indicating that the construct explains a significant portion of the variance in the measured indicators. Similarly, Green Maintenance Funds have a Cronbach's alpha of 0.919, a rho_a of 0.922, and a rho_c of 0.939, all indicating high internal consistency and reliability. The AVE for this construct is 0.754, suggesting that Green Maintenance Funds account for a substantial proportion of variance in the indicators. For Performance, the Cronbach's alpha is 0.897, rho_a is 0.918, and rho_c is 0.922, which also demonstrate strong reliability. The AVE for Performance is 0.703, which, while slightly lower than the other constructs, still meets the acceptable threshold, confirming the construct's validity. The quality criteria show that the study's constructs and measures are reliable and valid, with the model explaining a significant proportion of the variance in the dependent variables, and the relationships among the constructs being well-supported by the data.

Table 5. Construct reliability and validity

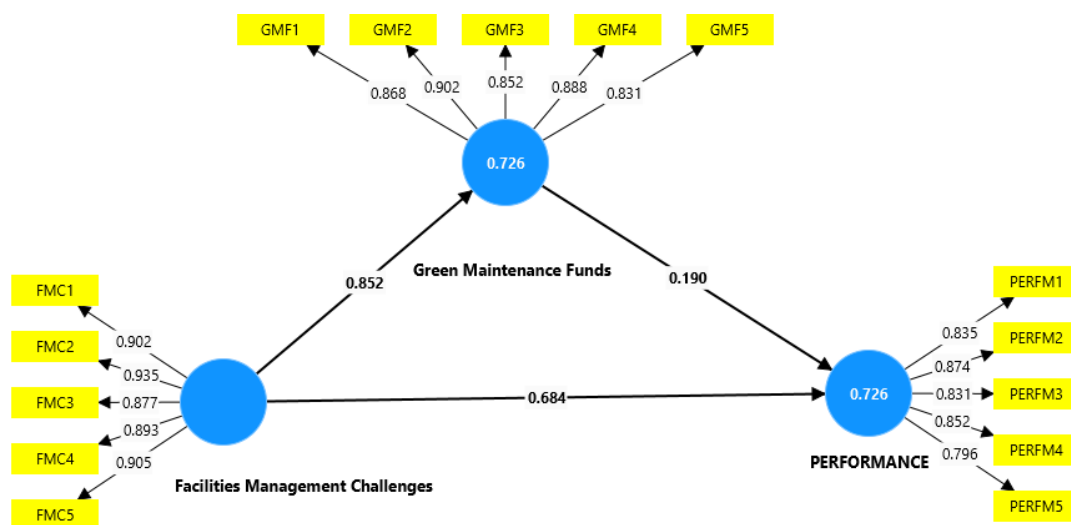|	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Facilities Management Challenges	0.943	0.945	0.957	0.815
Green Maintenance Funds	0.919	0.922	0.939	0.754
PERFORMANCE	0.897	0.918	0.922	0.703

Fig. 1. Structural Model

Path Coefficients Evaluations

Table 6. Path coefficients

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Facilities Management Challenges -> Green Maintenance Funds	0.852	0.854	0.028	30.586	0.000
Facilities Management Challenges -> PERFORMANCE	0.684	0.679	0.091	7.497	0.000
Green Maintenance Funds -> PERFORMANCE	0.190	0.198	0.095	1.993	0.046
Facilities Management Challenges -> Green Maintenance Funds -> PERFORMANCE	0.162	0.170	0.084	1.920	0.000

The path coefficient evaluation provides a detailed understanding of the relationships between the constructs in the study. The path from Facilities Management Challenges to Green Maintenance Funds has a strong positive coefficient of 0.852, with a sample mean of 0.854. The standard deviation is 0.028, resulting in a T-statistic of 30.586, which is well above the threshold of 1.96, indicating a statistically significant relationship. The p-value for this path is 0.000, further confirming the significance of the path. This suggests that Facilities Management Challenges have a substantial and positive influence on Green Maintenance Funds.

The path from Facilities Management Challenges to Performance has a coefficient of 0.684, with a sample mean of 0.679. The standard deviation for this path is 0.091, yielding a T-statistic of 7.497, which is also significant. The p-value for this path is 0.000, indicating a significant impact of Facilities Management Challenges on Performance. This shows that the challenges faced in facilities management have a moderate but significant effect on the overall performance.

The path from Green Maintenance Funds to Performance shows a positive coefficient of 0.190, with a sample mean of 0.198. The standard deviation is 0.095, and the T-statistic is 1.993, which is just above the critical value of 1.96, making it statistically significant. The p-value is 0.046, indicating that Green Maintenance Funds have a small but significant effect on Performance. In the mediation analysis, the indirect effect of Facilities Management Challenges on Performance through Green Maintenance Funds has an original sample coefficient of 0.162, with a sample mean of 0.170. The standard deviation for this indirect path is 0.084, resulting in a T-statistic of 1.920, which is close to the critical value of 1.96, and the p-value is 0.000, indicating a statistically significant mediation effect. This suggests that Green Maintenance Funds partially mediate the relationship between Facilities Management Challenges and Performance. Overall, the path coefficient and mediation analyses reveal significant relationships between the constructs, with Facilities Management Challenges having a direct impact on both Green Maintenance Funds and Performance. Additionally, Green Maintenance Funds mediate the effect of Facilities Management Challenges on Performance, highlighting the importance of addressing challenges in facilities management to improve overall performance.

The path coefficient analysis in this study offers important insights into the dynamics between Facilities Management Challenges, Green Maintenance Funds, and Performance. A substantial positive coefficient of 0.852 for the path from Facilities Management Challenges to Green Maintenance Funds suggests that the challenges experienced in managing facilities are a strong determinant of the allocation of resources towards green maintenance initiatives. This is further supported by the extremely high T-statistic of 30.586, well above the threshold of 1.96, indicating a statistically significant relationship. The p-value of 0.000 solidifies this finding, confirming that addressing facilities management challenges directly influences the allocation of green maintenance funds.

The significant impact of facilities management challenges on green maintenance funds can be seen in previous studies as well. For instance, in the context of Nigeria, Ebekozien et al. (2022) discuss the pressing need to overcome challenges in facilities management for effective maintenance practices in public hospitals, highlighting how such obstacles hinder the efficient allocation of resources for green initiatives. This underscores the broader finding in the present study that addressing management challenges is crucial for

enhancing the funds directed toward green maintenance, which is integral for achieving sustainability goals in facilities management.

Furthermore, the path from Facilities Management Challenges to Performance (coefficient of 0.684) emphasizes that the nature of these challenges significantly impacts overall organizational performance. This relationship is strong and statistically significant, with a T-statistic of 7.497 and a p-value of 0.000. This aligns with previous research by Ayodele et al. (2020), who examined the impact of skill gaps in facilities management on the performance of real estate graduates in Nigeria, indicating that inefficiencies in managing facilities directly influence organizational performance. Therefore, improving facilities management practices not only facilitates a more sustainable allocation of resources, such as green maintenance funds but also enhances overall operational performance.

The path from Green Maintenance Funds to Performance, while still significant, shows a smaller effect (coefficient of 0.190). This suggests that while funding directed towards green maintenance is beneficial, its effect on performance is somewhat less pronounced compared to the direct impact of facilities management challenges. However, with a T-statistic of 1.993 and a p-value of 0.046, this relationship is statistically significant, indicating that green maintenance investments do contribute to performance improvements. This finding is in line with the work of Ikuabe et al. (2022), who discussed how the quality of maintenance interventions, including green initiatives, can positively affect performance in facilities management, particularly when such funds are utilized effectively.

The mediation analysis further reveals that Green Maintenance Funds partially mediate the relationship between Facilities Management Challenges and Performance, with a coefficient of 0.162 and a p-value of 0.000. This suggests that the allocation of green maintenance funds plays a critical role in improving performance, even when facilities management challenges are present. This finding supports the concept of mediated pathways in organizational performance, as noted by Amos et al. (2021), who identified that financial resources, such as those allocated to green maintenance, act as significant mediators in performance outcomes within facilities management. The significant mediation effect observed here further emphasizes the importance of green maintenance investments in overcoming management challenges and driving performance improvements. In practical terms, these results have significant implications for facilities management professionals and policymakers. The positive influence of Facilities Management Challenges on Green Maintenance Funds highlights the need for addressing these challenges effectively to secure adequate funding for sustainable initiatives. Moreover, the direct and indirect effects of Facilities Management Challenges on Performance demonstrate the critical role that effective management practices play in ensuring optimal performance. This can inform strategies aimed at improving the efficiency of maintenance practices, particularly through the integration of green technologies and sustainable practices. In conclusion, the findings of this study underscore the interconnectedness of facilities management challenges, green maintenance funds, and performance. Addressing challenges in facilities management not only facilitates better resource allocation for green maintenance but also enhances overall performance. The mediation effect of green maintenance funds further underscores their importance in achieving sustainable outcomes. These results align with prior research in the field and provide practical insights for enhancing facilities management practices to support sustainability and performance improvements.

5. Conclusion

The findings of this study demonstrate significant relationships between the challenges faced in facilities management, green maintenance funds, and performance. The path analysis reveals that facilities management challenges strongly and positively influence the allocation of green maintenance funds, which in turn affects overall performance. Notably, green maintenance funds partially mediate the relationship between facilities management challenges and performance, highlighting the critical role of financial resources dedicated to sustainability efforts. These results underscore the importance of addressing the challenges in facilities management, particularly in terms of adopting green initiatives, in order to enhance operational performance. Facilities management challenges, such as resource constraints, insufficient training, and lack of strategic planning, are obstacles that, if not properly addressed, can limit the potential of green maintenance initiatives and hinder overall organizational performance. However, with a structured approach to allocating green maintenance funds, organizations can improve their performance and contribute to environmental sustainability goals. The mediation effect of green maintenance funds indicates that these financial resources not only provide a direct impact on performance but also play a crucial role in mitigating the negative effects of facilities management challenges. Based on these findings, several

recommendations can be made to improve facilities management and promote the adoption of green maintenance practices. First, organizations should increase investment in green maintenance funds, prioritizing sustainable practices to reduce environmental impact and improve overall performance. Second, it is essential to address facilities management challenges by providing targeted interventions, such as enhanced training, upgrading technology, and fostering collaboration. Third, efforts should be made to enhance awareness and education on green practices by offering training programs and workshops for facilities managers. Additionally, leveraging financial incentives from governments and policymakers can further encourage the allocation of funds toward green maintenance. Finally, organizations should embed sustainability as a core operational goal, aligning it with performance metrics to ensure long-term success and competitiveness. These strategies will help organizations navigate challenges, optimize green initiatives, and achieve both environmental and operational excellence.

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