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Sustainable Facility Management Practices in Public Institutions

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Abstract Original Research Article

This paper examines sustainable facility management practices in public institutions with a focus on preventive maintenance, eco-friendly strategies, governance, and organizational culture. Drawing on an integrative review of secondary literature and practice-based insights, the study demonstrates that preventive maintenance not only extends the lifespan of institutional assets but also reduces costs and supports long-term sustainability. Eco-friendly practices such as energy efficiency, waste management, and water conservation are highlighted as critical to minimizing environmental impacts and aligning institutions with global sustainability agendas. Findings reveal that governance structures and organizational culture are decisive in determining the success of sustainability initiatives, with leadership commitment and institutional accountability emerging as central drivers. Knowledge development and capacity-building also play crucial roles in overcoming barriers related to skills and resource constraints. The paper concludes that embedding sustainability into facility management enhances institutional efficiency, environmental stewardship, and societal leadership.

Keywords: Sustainable facility management; Preventive maintenance; Eco-friendly practices; Public institutions; Organizational culture.

INTRODUCTION

The built environment has been recognized as a major contributor to global environmental challenges due to its heavy reliance on natural resources and its significant role in energy consumption, material use, and greenhouse gas emissions. Buser, Støre-Valen, Olsen, Straub, and Lauridsen (2018) note that building operations account for nearly one-third of global energy use, about 40% of materials consumption, and approximately 40 to 50% of greenhouse gas emissions. This underscores the fact that the operational phase of buildings is the most critical stage where sustainability practices can make a measurable difference (Nielsen, Jensen, & Jensen, 2009). Public institutions, much like higher institutions of learning, are often regarded as "small cities" due to their extensive facilities, large populations, and numerous activities that place enormous demands on infrastructure and resources. Alshuwaikhat and Abubakar (2008) emphasize that such institutions manage multiple buildings, consume significant amounts of energy, and generate substantial waste, making them central actors in the pursuit of sustainability within the built environment. Hasim (2014) similarly argues that these institutions, because of their size and influence, are not only heavy consumers of resources but also potential leaders in championing sustainable development initiatives within society.

The significance of facility management within public institutions lies in its ability to integrate sustainability into daily operations and long-term planning. Facilities managers are increasingly viewed as critical actors who can influence campus planning, design, and environmental management processes, thereby shaping sustainable outcomes at organizational and societal levels (Tertiary Education Facilities Management Association, 2004; Nielsen *et al.,* 2009). Tucker (2013) defines sustainable facilities management as the management and delivery of non-core business services in ways that improve the economic, social, and physical environment of organizations, while simultaneously contributing to environmental sustainability. This perspective is particularly important for public institutions whose operational effectiveness depends on the durability and functionality of their infrastructure. Despite the clear benefits of adopting sustainable facility management, public institutions in many developing contexts face persistent barriers. According to Elmualim, Shockley, Valle, Ludlow, and Shah (2010), these barriers include inadequate knowledge, lack of senior management commitment,

insufficient financial resources, and weak institutional capability. Hasim (2014) further highlights that institutions in developing economies often lag in adopting sustainability principles due to entrenched organizational cultures and limited policy support. The absence of systematic and structured approaches to reducing environmental impacts exacerbates these challenges (Alshuwaikhat & Abubakar, 2008).

Given their role as agents of societal change, public institutions are under pressure to lead in advancing sustainable practices. Lozano, Lukman, Lozano, Huisingh, and Lambrechts (2013) argue that institutions that incorporate sustainability into their operations set an example for broader society, demonstrating that environmental responsibility can coexist with institutional efficiency. Nevertheless, the literature reveals that many institutions, particularly in Africa and other developing regions, continue to struggle with embedding sustainability in their facility management operations (Ugbaja, 2018; Ávila *et al.,* 2017). This raises questions about the extent to which public institutions can overcome structural and resource-related barriers to realize the potential benefits of sustainable facility management. Against this background, this paper examines the role of sustainable facility management in public institutions, identifies the salient challenges that hinder its practical implementation, and explores strategies that could bridge the gap between sustainability theory and practice. By focusing on preventive maintenance, eco-friendly practices, and governance structures, the paper aims to contribute to the ongoing discourse on how public institutions can enhance both efficiency and environmental stewardship.

Objectives

This paper aims to:

1. Examine the relevance of sustainable facility management in enhancing the efficiency of public institutions.
2. Identify common challenges associated with facility management in public organizations.
3. Explore practical strategies and models for sustainable property and facility administration.
4. Recommend policy and managerial interventions that can strengthen sustainability in estate management practices.

Related Work

The relationship between facility management and sustainability has been widely examined across different contexts, with scholars highlighting both opportunities and barriers. The built environment is increasingly recognized as a key driver of environmental degradation, but also as an area with significant potential for sustainability interventions. Brundtland (1987) provided the foundational definition of sustainable development as meeting present needs without compromising the ability of future generations to meet theirs, which remains central to contemporary discussions. Bartlett and Chase (2004) further argue that sustainability within institutions must be an ongoing process that balances environmental protection with the improvement of human well-being. Within the context of higher institutions and public organizations, facilities management has been conceptualized as an integrated process that aligns infrastructure with organizational goals. Barrett and Baldry (2003) describe facilities management as the practice of maintaining and adapting organizational buildings to support primary objectives, while Tucker (2013) emphasizes its sustainability dimension in terms of reducing waste, conserving resources, and improving environmental performance. Elmualim, Czwakiel, Valle, Ludlow, and Shah (2009) identify a knowledge gap in sustainable facility management, highlighting that while sustainability is often recognized as a strategic priority, facility managers may lack the skills and frameworks to implement it effectively.

Several studies have emphasized the role of facility managers in embedding sustainability into institutional operations. Cortese (2003) stresses that higher education and public institutions are positioned as leaders in sustainability, given their capacity to influence societal norms. Price, Matzdorf, Smith, and Agahi (2003) also demonstrate that facilities directly affect institutional reputation and stakeholder decision-making, which reinforces the importance of sustainable practices. Similarly, Lozano, Lukman, Huisingh, and Lambrechts (2013) argue that sustainability declarations in higher education can act as commitments that align facilities management with broader organizational missions. Barriers to effective implementation, however, remain significant. Hasim (2014) highlights that financial limitations, poor organizational culture, and weak policy enforcement mainly constrain institutions in developing economies. Elmualim, Shockley, Valle, Ludlow, and Shah (2010) reinforce this view by noting that the lack of senior management commitment undermines facility managers' ability to implement sustainability measures. Supporting this, Hodges (2005) argues that while sustainability may be recognized as a long-term priority, operational practices often prioritize short-term cost savings. Lai and Yik (2006) also observe that practitioners frequently lack adequate knowledge about sustainable building operations, leading to inefficiencies in implementation.

Studies across various regions have attempted to identify and classify these barriers. Ávila et al. (2017) examined universities worldwide and found that senior management commitment and policy frameworks were among the most significant obstacles. Støre-Valen and Buser (2017, 2019) investigated Scandinavian contexts and revealed that even in developed countries, facility managers encounter challenges such as organizational inertia and resistance to change. Sarpin and Yang (2012) similarly emphasize that building knowledge capacity

among facility management professionals is crucial to promoting sustainability. Later, Sarpin (2015) developed a people capability framework to support sustainability initiatives in facility management, underlining the importance of professional training. Shah (2007) notes that the high costs associated with adopting green technologies discourage many organizations from pursuing sustainability initiatives. Shafii, Ali, and Othman (2006) show that in Southeast Asian developing countries, financial barriers combined with weak policy environments have slowed progress in sustainable construction. Ugbaja (2018), studying African universities, affirms that limited resources and a lack of institutional commitment have hindered the mainstreaming of sustainability practices. Adewunmi, Omirin, and Koleoso (2012) further contextualize this within Nigeria, suggesting that a strategic corporate approach is necessary to overcome structural financial limitations.

Beyond resource and knowledge barriers, organizational culture plays a critical role. Elmualim *et al.,* (2009) stress that facility managers often struggle against cultural resistance within institutions, which hampers their ability to implement new practices. Vidler (2011) adds that sustainability in facility management must be reframed as a necessity rather than a luxury, requiring cultural shifts at both managerial and operational levels. Ogbeifun (2011), in a study of multi-campus universities, observed that fragmented institutional cultures made sustainability practices difficult to coordinate effectively across different campuses. From a broader perspective, the role of sustainability in facilities management is also tied to global environmental imperatives. Cheng, Pouffary, Svenningsen, and Callaway (2008) highlight how the building and construction sector is critical to meeting international climate targets under frameworks such as the Kyoto Protocol. Nielsen and Galamba (2010) and Nielsen, Sarasoja, and Galamba (2016) argue that facilities management must be understood as a core business area that directly contributes to sustainable development, rather than a support function. Taken together, the literature demonstrates a convergence of perspectives: while the importance of sustainable facility management is widely acknowledged, significant gaps persist in implementation due to barriers of knowledge, resources, culture, and leadership. This reinforces the need for further research that contextualizes these barriers within developing public institutions, where structural limitations are more acute.

METHODOLOGY

This study adopts a qualitative, practice-based methodology supported by an integrative literature review to explore sustainable facility management in public institutions. The choice of methodology aligns with Russell's (2005) assertion that an integrative review allows researchers to objectively critique, summarize, and synthesize findings from existing studies in order to generate new insights. By relying on secondary data and experiential reflections, the paper emphasizes depth of understanding rather than statistical generalization. The integrative review was carried out by identifying, categorizing, and thematically analyzing relevant literature on facility management, sustainability, and barriers to their integration. According to Lee and Kang (2013), this approach is appropriate when a research problem requires consolidation of knowledge from diverse contexts in order to create a conceptual basis for practice. For this paper, sources were selected based on their relevance to public institutions, sustainability initiatives, and the role of facilities management in both developed and developing country contexts. Key databases and prior scholarly works provided the foundation for the review, consistent with the procedures outlined by LoBiondo-Wood and Haber (2010).

The thematic framework guiding this methodology was informed by prior studies that have categorized barriers and drivers of sustainable facilities management. For instance, Elmualim, Shockley, Valle, Ludlow, and Shah (2010) identified knowledge gaps and leadership commitment as recurring themes, while Hasim (2014) emphasized financial constraints and organizational culture as significant barriers. Drawing from such sources, themes including preventive maintenance, eco-friendly practices, governance structures, resource allocation, and institutional culture were employed to structure the analysis. To strengthen reliability, the review also integrated findings from diverse geographical contexts. Shafii, Ali, and Othman (2006) examined sustainable construction practices in Southeast Asia, providing insight into the challenges faced by developing countries. Similarly, Ávila et al. (2017) offered a comparative view of barriers across multiple continents, while Ugbaja (2018) focused specifically on African universities, highlighting the contextual difficulties that resonate strongly with public institutions in Nigeria and similar settings. By triangulating across these sources, the methodology ensured a balanced understanding that captures both global and local perspectives. The qualitative orientation of this study allows for a practice-based interpretation of sustainability issues. As Cortese (2003) and Lozano, Lukman, Lozano, Huisingh, and Lambrechts (2013) argue, institutions are not only service providers but also agents of societal change, and methodological approaches must therefore engage with institutional practices and values as much as with structural barriers. Consequently, this study emphasizes experiential insights and professional practices drawn from estate and facility management contexts. This methodological stance is consistent with the argument of Sarpin and Yang (2012) that capacity development and knowledge frameworks are central to embedding sustainability in facility management practice. The methodology is qualitative, integrative, and practice-oriented. It synthesizes secondary literature from multiple contexts, organizes insights into thematic categories, and

interprets them against the backdrop of public institutional practices. This approach provides both theoretical grounding and practical relevance, ensuring that the study contributes meaningfully to ongoing debates on sustainable facility management.

Sustainable Facility Management in Public Institutions

Preventive and Eco-Friendly Maintenance Practices

Sustainable facility management within public institutions increasingly relies on preventive and eco-friendly maintenance practices. These practices are essential because they extend the lifespan of infrastructure, reduce operational costs, and mitigate the environmental impact of institutional activities. Preventive maintenance involves systematic inspection, repair, and servicing of assets to prevent breakdowns and ensure optimal functionality. In contrast, eco-friendly maintenance practices incorporate environmentally responsible approaches such as energy efficiency, waste minimization, water conservation, and sustainable procurement. Together, they constitute a crucial foundation for achieving long-term sustainability in facility management. The built environment has been shown to consume significant levels of energy and natural resources, with operations accounting for nearly one-third of global energy use, 40% of material consumption, and up to half of greenhouse gas emissions (Buser, Støre-Valen, Olsen, Straub, & Lauridsen, 2018). Public institutions, often comparable to small cities due to their extensive infrastructure and diverse operations, contribute substantially to these statistics (Alshuwaikhat & Abubakar, 2008). As a result, their facility management practices hold considerable potential for driving environmental sustainability, especially when preventive and eco-friendly approaches are prioritized.

Preventive maintenance is considered one of the cornerstones of effective facility management. According to Hodges (2005), preventive measures allow institutions to avoid costly breakdowns, maintain service continuity, and minimize disruptions to core organizational functions. In the context of public institutions, this can include routine servicing of electrical systems, regular inspection of water supply facilities, and proactive repairs of structural components. Barrett and Baldry (2003) argue that preventive maintenance not only prolongs the life of assets but also supports organizational performance by ensuring that facilities remain aligned with institutional objectives. By embedding sustainability principles into such preventive practices, public institutions can simultaneously pursue cost efficiency and environmental responsibility.

Eco-friendly maintenance extends these benefits by incorporating sustainability into operational routines. Tucker (2013) defines sustainable facilities management as the process of delivering non-core services in ways that improve environmental, social, and economic outcomes. Eco-friendly practices include switching to energy-efficient lighting, adopting renewable energy sources where feasible, and reducing reliance on non-biodegradable cleaning agents. Elmualim, Shockley, Valle, Ludlow, and Shah (2010) emphasize that facilities managers are critical in embedding such practices into daily operations, given their influence on decisions regarding energy use, procurement, and waste management. Evidence from global studies highlights the transformative role of eco-friendly maintenance. Cheng, Pouffary, Svenningsen, and Callaway (2008) note that sustainable building practices, particularly in relation to the Kyoto Protocol and the Clean Development Mechanism, are essential to mitigating the environmental footprint of construction and facility operations. In higher institutions, where energy demand is continuous and often high, integrating green technologies such as solar panels, energy-efficient heating systems, and smart meters can drastically reduce emissions while also lowering costs. Nielsen, Jensen, and Jensen (2009) further argue that sustainable facilities management in housing estates demonstrates how eco-friendly measures in existing building stock can contribute to national sustainability targets. This principle is equally relevant to public institutional settings.

Preventive and eco-friendly practices also extend to sanitation and waste management, which are critical areas in public institutions. Hasim (2014) stresses that unsustainable waste disposal practices contribute significantly to environmental degradation, while eco-friendly alternatives such as recycling, composting, and waste segregation foster cleaner and healthier environments. Elmualim, Czwakiel, Valle, Ludlow, and Shah (2009) add that facilities managers face a “knowledge chasm” in implementing such practices, often due to insufficient training or lack of institutional support. Nevertheless, proactive maintenance of sanitation facilities and the adoption of environmentally safe cleaning agents not only enhance institutional hygiene but also reduce harmful chemical runoff into the environment.

Several scholars highlight the need for preventive strategies that address energy efficiency. Shafii, Ali, and Othman (2006) demonstrate that in Southeast Asia, energy-efficient retrofitting and the use of renewable energy technologies are among the most effective eco-friendly practices. Similarly, Shah (2007) notes that sustainable practices for facility managers should prioritize interventions such as energy audits, retrofitting of old buildings, and adoption of environmentally friendly equipment. These measures are particularly relevant in public institutions, where outdated infrastructure often leads to high energy wastage and unsustainable operating costs. Another critical dimension of eco-friendly maintenance involves water management. According to Jaunzens, Warriner, Garner, and Waterman (2001), integrating facilities expertise into building design ensures that water systems

are more efficient and easier to maintain. In existing buildings, preventive maintenance of plumbing systems, installation of water-saving fixtures, and monitoring of water consumption are practical measures to promote sustainability. This aligns with findings by Hodges (2005), who identifies water conservation as a vital component of sustainable facility management in institutional settings.

Organizational culture and leadership commitment also play a significant role in sustaining preventive and eco-friendly maintenance. Elmualim *et al.,* (2010) observe that the lack of senior management commitment is one of the key barriers to sustainability, as facility managers cannot implement preventive or eco-friendly practices without institutional support. Ávila *et al.,* (2017) similarly identify leadership and policy frameworks as critical in determining whether institutions adopt environmentally responsible practices. Where leadership prioritizes sustainability, preventive maintenance programs are better funded, eco-friendly initiatives are encouraged, and long-term institutional gains are realized. Case studies from African universities illustrate both the challenges and potential of preventive and eco-friendly facility management. Ugbaja (2018) found that despite widespread recognition of the importance of sustainability, many African universities struggle to embed eco-friendly practices due to resource constraints and weak policy enforcement. Adewunmi, Omirin, and Koleoso (2012) argue that a strategic approach is necessary, particularly in contexts like Nigeria, to overcome financial limitations and integrate sustainability into corporate estate management. These studies suggest that preventive maintenance, when combined with eco-friendly strategies, provides a practical pathway for institutions to achieve sustainability even in resource-constrained environments.

Training and capacity development are also necessary to support preventive and eco-friendly maintenance. Sarpin and Yang (2012) advocate for the development of knowledge capabilities to promote sustainability in facility management, while Sarpin (2015) emphasizes the role of people capability frameworks in embedding eco-friendly practices. Lai and Yik (2006) similarly note that knowledge gaps among practitioners often hinder effective implementation, suggesting that professional education and capacity building must be prioritized to equip facility managers with the necessary expertise. Incorporating preventive and eco-friendly practices ultimately aligns facility management with the broader goals of sustainable development. Lozano *et al.,* (2013) stress that institutions play a leading role in advancing sustainability agendas, and their practices set important precedents for wider societal adoption. Vidler (2011) further reinforces the idea that sustainability must be viewed as a necessity rather than an optional initiative in facilities management. Preventive and eco-friendly maintenance practices, therefore, provide a practical means of demonstrating institutional commitment to environmental stewardship while simultaneously improving efficiency and reducing costs.

In summary, preventive and eco-friendly maintenance practices are central to sustainable facility management in public institutions. Preventive maintenance ensures the longevity and reliability of infrastructure, while eco-friendly approaches reduce environmental footprints through energy efficiency, water conservation, sustainable sanitation, and waste management. The literature consistently shows that while financial, knowledge, and cultural barriers persist, institutions that prioritize these practices realize significant benefits in both operational performance and environmental responsibility. By embedding sustainability into everyday maintenance routines, public institutions can fulfill their role as agents of societal change, bridging the gap between sustainability theory and practical implementation.

Policy, Governance, and Organizational Culture

The integration of sustainability into facility management in public institutions cannot be achieved through technical measures alone. Policy frameworks, governance structures, and organizational culture collectively play decisive roles in shaping whether preventive and eco-friendly practices are institutionalized or abandoned. Scholars consistently emphasize that the absence of supportive governance and cultural alignment often undermines sustainability initiatives, regardless of the availability of resources or knowledge (Elmualim, Shockley, Valle, Ludlow, & Shah, 2010). For public institutions that manage extensive facilities and serve vast populations, sustainability is ultimately contingent on leadership commitment, organizational priorities, and a culture that fosters accountability and innovation. Policies provide the formal structure within which facility managers operate. Barrett and Baldry (2003) argue that facility management itself is an integrated process tied to organizational goals, which cannot be divorced from institutional policy frameworks. In many cases, policies determine how funds are allocated, how priorities are set, and which sustainability practices are legitimized as essential. Shah (2007) notes that one of the most significant challenges for sustainable facility management is that policies often remain aspirational without being translated into enforceable operational frameworks. For example, policies may endorse sustainability rhetorically while budgets continue to favor short-term, reactive maintenance approaches.

Governance adds a further dimension by influencing decision-making and oversight. Cortese (2003) highlights that institutions, particularly in higher education and public administration, act as agents of societal change. This means governance structures must actively facilitate the adoption of sustainability rather

than act as barriers. Elmualim *et al.,* (2010) identify a lack of senior management commitment as a central obstacle, as leaders determine whether sustainability receives institutional priority. Ávila *et al.,* (2017) similarly demonstrate that universities across multiple continents face challenges where leadership hesitancy and weak governance systems limit the implementation of sustainability principles. Without governance mechanisms that embed accountability, facilities managers are often unable to move beyond short-term or reactive responses to infrastructure challenges. Organizational culture further reinforces or obstructs sustainability practices. Vidler (2011) argues that sustainability must be understood as a necessity in facility management rather than a luxury, which requires a cultural shift at every level of the institution. Hasim (2014) identifies organizational culture as one of the most persistent barriers to sustainable facility management in developing countries, noting that entrenched attitudes toward resource consumption and maintenance often prioritize convenience over long-term planning. Elmualim, Czwakiel, Valle, Ludlow, and Shah (2009) echo this observation, pointing out that cultural inertia and resistance to change frequently prevent the adoption of new sustainability practices, even when knowledge and resources are available.

The relationship between governance and culture is particularly evident in the way institutions allocate resources. Hodges (2005) underscores that senior management commitment is crucial because it directly affects whether time and finances are made available for sustainability initiatives. If leadership recognizes the value of sustainability, then preventive and eco-friendly maintenance receives the necessary support. Conversely, when governance structures deprioritize sustainability, the organizational culture tends to normalize reactive maintenance, high operational costs, and wasteful practices. Lai and Yik (2006) also suggest that gaps in practitioners' knowledge are compounded by institutional cultures that undervalue professional training in sustainability, perpetuating a cycle of inefficiency. International perspectives reinforce these challenges. Støre-Valen and Buser (2017, 2019), studying the Nordic context, found that even in developed countries with established policies, facility managers face resistance from institutional cultures reluctant to depart from traditional practices. Ugbaja (2018) adds that in African universities, governance frameworks often fail to enforce sustainability mandates, leaving facilities managers to work within inconsistent or weakly defined policies. Adewunmi, Omirin, and Koleoso (2012) emphasize that a strategic corporate approach is needed in Nigeria, where fragmented governance structures often undermine sustainability goals despite rhetorical commitments. These studies highlight that governance and culture are not only barriers in developing contexts but are universal challenges that manifest differently across regions.

Policies must also be adaptive and forward-looking. Cheng, Pouffary, Svenningsen, and Callaway (2008) link sustainable building and facilities management to global frameworks such as the Kyoto Protocol, stressing that governance systems must align with international sustainability commitments. Lozano, Lukman, Lozano, Huisingh, and Lambrechts (2013) further argue that institutions that adopt declarations or charters on sustainability, such as the Talloires Declaration, demonstrate the importance of aligning internal governance with external global commitments. However, the mere signing of declarations is insufficient without internal cultural transformation and operational follow-through. Another important aspect of governance is the incorporation of facilities managers into decision-making processes. Jaunzens, Warriner, Garner, and Waterman (2001) argue that including facilities expertise during the design and planning phases of buildings ensures that sustainability is embedded from the outset. When governance structures exclude facility managers from strategic planning, the result is often buildings that are difficult to maintain sustainably. Nielsen, Jensen, and Jensen (2009) add that facilities management must be understood as central to organizational sustainability, not as a peripheral support service. This governance recognition is essential for embedding eco-friendly practices into long-term institutional planning.

Cultural change requires not only leadership commitment but also capacity-building efforts. Sarpin and Yang (2012) stress that developing knowledge capabilities among facility management professionals is vital for shifting organizational culture toward sustainability. Sarpin (2015) builds on this argument by proposing a people capability framework, which integrates sustainability competencies into institutional training and professional development. This cultural investment ensures that preventive and eco-friendly maintenance practices are not isolated initiatives but become embedded in the organizational identity. Empirical studies further illustrate how governance and culture interact in shaping sustainability outcomes. Shafii, Ali, and Othman (2006) highlight that in Southeast Asia, cultural attitudes toward construction and maintenance, combined with governance weaknesses, slow the adoption of sustainability practices. Ávila *et al.,* (2017) note that across multiple continents, senior management support was consistently identified as the most critical factor in overcoming cultural and institutional resistance. Elmualim *et al.,* (2009) add that facility managers themselves often face tensions between personal commitment to sustainability and institutional cultures that prioritize short-term goals. These findings underscore that sustainability in facility management cannot succeed without a supportive culture anchored by robust governance frameworks.

In the context of public institutions, governance and culture are particularly critical because these organizations are accountable to the public and expected

to model responsible practices. Cortese (2003) emphasizes that institutions of learning and governance play symbolic roles in promoting societal sustainability agendas, making their governance and culture especially influential. Lozano *et al.,* (2013) further note that declarations of commitment to sustainability are meaningful only when internal governance and culture align with these external promises. Thus, preventive and eco-friendly practices can only be sustained when governance systems establish accountability mechanisms and organizational cultures embrace sustainability as part of institutional identity. Policy, governance, and organizational culture are decisive factors in determining whether sustainable facility management practices succeed in public institutions. Policies provide the formal frameworks, governance ensures accountability and leadership commitment, and culture determines whether sustainability becomes embedded in institutional practices. The literature consistently reveals that without strong governance and supportive cultures, preventive and eco-friendly maintenance practices are unlikely to be implemented effectively. Conversely, institutions that align policy, governance, and culture not only enhance operational efficiency but also fulfill their societal role as leaders in sustainability.

FINDINGS AND DISCUSSION

The review of literature and practice-based insights reveals that a dynamic interplay of preventive maintenance practices, eco-friendly strategies, governance structures, and organizational culture shapes sustainable facility management in public institutions. The findings underscore that while sustainability has been widely acknowledged as critical, its implementation remains fraught with challenges that vary across institutional, cultural, and geographical contexts.

A first key finding is that preventive maintenance provides a practical foundation for sustainability. Barrett and Baldry (2003) highlight that maintaining and adapting institutional infrastructure in line with organizational objectives improves efficiency and reduces long-term costs. In the context of public institutions, preventive approaches such as scheduled inspections, proactive repairs, and systematic servicing of utilities are essential for ensuring continuity of operations and avoiding resource-intensive breakdowns. Hodges (2005) reinforces this perspective, noting that preventive maintenance fosters resilience and supports long-term sustainability by reducing reliance on costly emergency interventions. These findings suggest that preventive measures serve as a low-cost, high-impact entry point for embedding sustainability within facility management.

A second finding relates to the growing importance of eco-friendly practices in enhancing the environmental performance of public institutions. Tucker (2013) defines sustainable facilities management as a process that not only supports organizational goals but also promotes environmental and social outcomes. Specific practices such as energy efficiency, water conservation, and sustainable sanitation have been shown to yield measurable benefits. Cheng, Pouffary, Svenningsen, and Callaway (2008) stress that alignment with international frameworks such as the Kyoto Protocol places pressure on institutions to adopt environmentally responsible measures. Shafii, Ali, and Othman (2006) similarly demonstrate that integrating renewable technologies and sustainable construction practices can significantly reduce the ecological footprint of institutional operations. These findings indicate that eco-friendly practices not only enhance environmental stewardship but also align institutions with global sustainability agendas.

However, barriers persist, and the findings consistently emphasize that governance and organizational culture remain decisive. Elmualim, Shockley, Valle, Ludlow, and Shah (2010) identify a lack of senior management commitment as a recurring barrier across institutions, regardless of geographical location. Without leadership prioritization, sustainability initiatives are frequently underfunded, inconsistently implemented, or treated as peripheral rather than central to institutional operations. Ávila *et al.,* (2017) expand on this point by noting that in universities worldwide, leadership support and clear governance structures are the single most important determinants of whether sustainability principles are embedded into facility management. These findings illustrate that governance is not merely a supportive factor but the bedrock upon which sustainable practices depend.

The discussion also highlights the importance of organizational culture as either an enabler or a barrier to sustainability. Hasim (2014) identifies entrenched maintenance cultures in developing country institutions that prioritize reactive responses over proactive, long-term strategies. This cultural inertia often undermines preventive and eco-friendly initiatives. Elmualim, Czwakiel, Valle, Ludlow, and Shah (2009) reinforce this by noting that cultural resistance to change creates a "knowledge chasm" where facility managers may be aware of sustainability practices but are unable to operationalize them due to institutional reluctance. Vidler (2011) goes further by arguing that unless sustainability is reframed as a necessity rather than a luxury, cultural resistance will continue to impede progress. Together, these findings suggest that cultural transformation is as essential as technical interventions in embedding sustainable facility management.

The findings further reveal that capacity and knowledge development are critical factors influencing outcomes. Lai and Yik (2006) show that many facility management practitioners lack sufficient knowledge about sustainable building operations, which hampers

effective implementation. Sarpin and Yang (2012) propose that targeted knowledge capability development is necessary to bridge this gap, while Sarpin (2015) argues for people capability frameworks that embed sustainability competencies into training and professional practice. Elmualim *et al.,* (2009) also stress that knowledge deficits are particularly acute in developing contexts, where access to training and professional development opportunities is often limited. These findings suggest that building human capacity is central to the success of preventive and eco-friendly maintenance practices. Another finding relates to the financial and resource constraints that pervade sustainability initiatives in public institutions. Shah (2007) points out that the perceived high costs of green technologies discourage adoption, even when long-term savings are evident. Ugbaja (2018) highlights that African universities frequently struggle to implement sustainability practices due to limited budgets and competing priorities. Adewunmi, Omirin, and Koleoso (2012) similarly emphasize the need for strategic approaches to overcome financial barriers in Nigerian institutions. These findings illustrate the paradox that while sustainability promises long-term cost savings, the upfront investment required often deters public institutions from pursuing eco-friendly maintenance.

The findings also demonstrate that contextual factors shape implementation outcomes. Støre-Valen and Buser (2017, 2019) show that even in Scandinavian contexts with robust policies, institutional resistance and inertia remain significant barriers. Ogbeifun (2011) notes that in multi-campus institutions, fragmentation of governance structures exacerbates these challenges, making coordination of sustainability practices more difficult. In contrast, Lozano, Lukman, Huisingh, and Lambrechts (2013) emphasize that global declarations and frameworks such as the Talloires Declaration provide a strong normative push, encouraging institutions to align with sustainability agendas. These comparative findings suggest that while challenges are universal, their manifestations vary by context, and solutions must be adapted accordingly.

A final significant finding is that sustainability in facility management is not solely a technical matter but also a symbolic one. Cortese (2003) underscores that institutions, particularly public and educational ones, act as exemplars in promoting sustainability for broader society. This symbolic role means that preventive and eco-friendly maintenance practices carry implications beyond institutional efficiency; they signal an institutional commitment to environmental responsibility and societal leadership. Lozano *et al.,* (2013) similarly argue that institutions that adopt sustainability commitments influence cultural and societal expectations, reinforcing the broader sustainability agenda. These findings highlight the dual role of facility management: operational efficiency within institutions and normative leadership in society. Taken together, the findings demonstrate a convergence across the literature: preventive and eco-friendly maintenance practices are practical and necessary for sustainable facility management, but their success is heavily mediated by governance, culture, knowledge, and resources. The discussion reveals that while technical measures can be readily identified, their implementation depends on supportive policies, leadership commitment, and cultural transformation. Institutions that align these factors not only achieve operational efficiencies but also fulfill their societal role as sustainability leaders. Conversely, institutions that neglect governance and culture risk undermining even the best-designed preventive and eco-friendly strategies.

Contribution to Research

This study contributes to the field of estate and facility management research by situating sustainability practices within the specific operational realities of public institutions. While a substantial body of literature has examined sustainable facility management in general terms, there has been less emphasis on the intersection of preventive maintenance, eco-friendly practices, governance, and organizational culture in the context of public institutions, particularly in developing economies. By integrating insights from existing studies, this paper addresses that gap and offers a nuanced understanding of how sustainability can be both conceptualized and operationalized in institutional settings. One important contribution is the emphasis on preventive maintenance as a practical foundation for sustainability. Barrett and Baldry (2003) and Hodges (2005) provide theoretical and practical evidence that preventive maintenance reduces costs and ensures infrastructure longevity. Yet, these perspectives have not been fully contextualized within the broader sustainability discourse. By linking preventive strategies to eco-friendly outcomes such as reduced energy consumption and improved sanitation (Tucker, 2013; Hasim, 2014), this research enriches the theoretical conversation by showing how day-to-day operational practices connect with sustainability goals. This strengthens the literature by demonstrating that preventive maintenance is not merely a cost-saving measure but also a sustainability strategy in its own right.

Another significant contribution lies in the integration of eco-friendly practices into institutional operations. Scholars such as Cheng, Pouffary, Svenningsen, and Callaway (2008) and Shafii, Ali, and Othman (2006) have explored the importance of aligning institutional practices with international sustainability frameworks. However, their focus has been mainly on the construction and design phase of buildings. This study extends their insights into the operational phase of facility management, emphasizing how existing institutions can retrofit their practices to align with sustainability agendas. By highlighting practices such as water conservation, waste management, and energy efficiency, the paper demonstrates how public institutions can contribute to sustainability even in the

absence of new construction or large-scale infrastructural investments.

The research also advances the discourse on governance and organizational culture in sustainability implementation. Elmualim, Shockley, Valle, Ludlow, and Shah (2010) and Ávila *et al.,* (2017) have documented barriers related to leadership and institutional commitment. However, this paper consolidates these findings to argue that governance and culture are not peripheral but central determinants of sustainability outcomes. The study contributes to research by framing governance and culture as the mediating variables that determine whether preventive and eco-friendly practices succeed or fail. This perspective enriches the literature by encouraging researchers to move beyond technical and financial considerations to examine the institutional and cultural dynamics of sustainability. Additionally, this paper contributes to the body of research on knowledge and capacity development in facility management. Lai and Yik (2006) and Sarpin and Yang (2012) highlight knowledge deficits among practitioners, while Sarpin (2015) proposes frameworks for building sustainability competencies. By integrating these perspectives, the current study underscores the need for capacity-building as a critical research area, suggesting that future studies should focus more explicitly on training programs, professional development, and knowledge transfer mechanisms that support sustainable facility management.

The study also adds value by contextualizing sustainability research within developing economies, where challenges such as resource scarcity, weak governance, and entrenched cultural practices are more pronounced (Ugbaja, 2018; Adewunmi, Omirin, & Koleoso, 2012). Much of the existing literature has been generated in developed contexts, particularly Europe and North America, where resources and policy frameworks are comparatively robust (Støre-Valen & Buser, 2017, 2019). By addressing the specific realities of public institutions in resource-constrained environments, this research contributes to the diversification of sustainability literature. It encourages a more globalized understanding of facility management practices. This research strengthens the symbolic dimension of sustainability in facility management. Cortese (2003) and Lozano, Lukman, Lozano, Huisingh, and Lambrechts (2013) emphasize that public institutions serve as exemplars in society. By positioning preventive and eco-friendly practices as both operational necessities and symbolic commitments, this paper extends the theoretical discussion to include the reputational and societal roles of public institutions. This contribution encourages researchers to frame facility management not only as a technical or financial process but also as a practice with normative implications for society at large.

This study contributes to research in five key ways: (1) framing preventive maintenance as a sustainability practice, (2) extending eco-friendly strategies into the operational phase of facility management, (3) emphasizing governance and culture as mediating factors, (4) highlighting the role of capacity-building in sustaining institutional change, and (5) contextualizing sustainability within developing economies while recognizing the symbolic role of institutions. These contributions collectively enrich the academic discourse on sustainable facility management and provide a basis for future research that bridges theory, practice, and policy.

CONCLUSION

The review and analysis undertaken in this study establish that sustainable facility management is central to the effectiveness and longevity of public institutions. The findings confirm that preventive and eco-friendly maintenance practices provide both immediate and long-term benefits by reducing operational costs, enhancing efficiency, and minimizing environmental impacts (Barrett & Baldry, 2003; Hodges, 2005). These practices, when systematically embedded, ensure that institutional infrastructure remains functional, resilient, and aligned with broader sustainability goals. Equally significant is the recognition that technical solutions alone are insufficient. Governance and organizational culture emerged as critical determinants of success. Without strong policy frameworks, leadership commitment, and a culture that prioritizes sustainability, even the most advanced preventive and eco-friendly measures struggle to gain traction (Elmualim, Shockley, Valle, Ludlow, & Shah, 2010; Ávila *et al.,* 2017). As Vidler (2011) suggests, sustainability must be framed as a necessity rather than an optional initiative, requiring deliberate cultural transformation supported by governance structures. This underscores the importance of leadership and institutional accountability in driving meaningful change.

The study also emphasizes that knowledge and capacity-building are integral to advancing sustainability in facility management. The knowledge deficits identified by Lai and Yik (2006) and addressed through frameworks such as those proposed by Sarpin and Yang (2012) illustrate that without professional training and institutional learning, sustainability initiatives risk stagnation. Developing the skills and competencies of facility managers is therefore essential to ensuring that preventive and eco-friendly practices move from theory to practice. Resource constraints, particularly in developing economies, remain a challenge, but the evidence suggests that strategic planning and incremental implementation can overcome these limitations (Shafii, Ali, & Othman, 2006; Ugbaja, 2018). Aligning facility management practices with global sustainability frameworks, as Cheng, Pouffary, Svenningsen, and Callaway (2008) propose, also

positions public institutions as leaders in societal transformation. Cortese (2003) and Lozano, Lukman, Lozano, Huisingh, and Lambrechts (2013) remind us that institutions have symbolic roles in promoting sustainability, and by modeling responsible facility management, they influence broader cultural and societal expectations.

Sustainable facility management is both a practical necessity and a strategic opportunity for public institutions. By embedding preventive and eco-friendly practices within supportive governance frameworks and organizational cultures, institutions can improve their operational performance while simultaneously advancing environmental stewardship and societal leadership. This dual role not only strengthens institutional resilience but also reinforces their contribution to sustainable development.

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