Green Accounting in Healthcare: Strategic Framework for Sustainable Hospital Management

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ABSTRACT

The healthcare sector plays a vital role in improving human well-being, but also significantly contributes to environmental degradation through high energy consumption, resource use, and waste generation. In response to these environmental challenges, green accounting emerges as a strategic tool to integrate environmental costs into financial decision-making and promote sustainable hospital operations. This study examines the key components, implementation strategies, and real-world applications of green accounting in the healthcare industry, with a focus on environmental cost accounting, performance indicators, and green financial reporting. Using the qualitative method, drawing on global case studies including hospitals in the United States, the United Kingdom, Singapore, India, and South Africa, the research identifies effective practices and outcomes such as carbon footprint reduction, operational cost savings, and enhanced stakeholder engagement. While challenges persist, such as a lack of standardized metrics, limited technical infrastructure, and financial constraints, green accounting proves to be a transformative approach that aligns ecological responsibility with healthcare excellence. The study recommends policy support, digital infrastructure development, and staff engagement as critical enablers for mainstreaming sustainability in hospital management.

***Keywords**: Environmental Cost Accounting, Environmental Performance Indicators, Green Accounting, Green Financial Reporting, Healthcare Industry, Hospital Management, Sustainability Reporting.*

ABSTRAK

Sektor kesehatan memainkan peran penting dalam meningkatkan kesejahteraan manusia, namun juga memberikan kontribusi signifikan terhadap degradasi lingkungan melalui tingginya konsumsi energi, pemakaian sumber daya, dan produksi limbah. Menanggapi

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tantanganlingkungan tersebut, akuntansi hijau muncul sebagai alat strategis untuk mengintegrasikan biaya lingkungan ke dalam pengambilan keputusan keuangan dan mendorong operasi rumah sakit yang berkelanjutan. Penelitian ini bertujuan untuk menelaah komponen utama, strategi implementasi, dan penerapan nyata akuntansi hijau di sektor kesehatan, dengan fokus pada akuntansi biaya lingkungan, indikator kinerja, dan pelaporan keuangan hijau. Dengan menggunakan metode kualitatif dan merujuk pada studi kasus global, termasuk rumah sakit di Amerika Serikat, Inggris, Singapura, India, dan Afrika Selatan, penelitian ini mengidentifikasi praktik dan hasil yang efektif, seperti pengurangan jejak karbon, efisiensi biaya operasional, dan peningkatan keterlibatan pemangku kepentingan. Meskipun terdapat tantangan, seperti kurangnya metrik standar, keterbatasan infrastruktur teknis, dan kendala finansial, akuntansi hijau terbukti menjadi pendekatan transformasional yang menyelaraskan tanggung jawab ekologis dengan keunggulan layanan kesehatan. Penelitian ini merekomendasikan dukungan kebijakan, pengembangan infrastruktur digital, dan keterlibatan staf sebagai faktor penting untuk menegakkan keberlanjutan secara menyeluruh dalam manajemen rumah sakit.

***Kata kunci**: Akuntansi Biaya Lingkungan, Indikator Kinerja Lingkungan, Akuntansi Hijau, Pelaporan Keuangan Hijau, Industri Kesehatan, Manajemen Rumah Sakit, Pelaporan Keberlanjutan.*

INTRODUCTION

The global healthcare industry, though dedicated to human well-being, paradoxically contributes substantially to environmental degradation (Olawade et al., 2025). Hospitals and clinics consume large amounts of energy and water, produce significant hazardous and non-hazardous waste, and emit pollutants into the environment (Attrah et al., 2022). If considered a country, the global healthcare sector would rank as the fifth-largest emitter of greenhouse gases. This contradiction has prompted a re-evaluation of healthcare operations and their environmental footprint. In response, green accounting, which integrates environmental data into financial systems, has emerged as a strategic approach to align healthcare practices with sustainability goals (Putri, 2024).

Hospitals operate continuously, relying on intensive energy, water, and material use for lighting, climate control, sterilization, laundry, and food services, resulting in high electricity and fossil fuel consumption. Anaesthetic gases such as nitrous oxide and desflurane further contribute to greenhouse emissions, while large, technology-driven hospital infrastructures generate significant waste and water usage through sterilisation and sanitation systems. The improper handling of medical, chemical, and infectious waste also poses environmental and public health risks. Traditionally focused on clinical, regulatory, and financial outcomes, hospitals have often overlooked ecological sustainability. Yet, as sustainability becomes central to global development, healthcare institutions are now urged to adopt environmentally responsible practices, driving growing interest in applying green accounting within the healthcare sector.

Green accounting, or environmental accounting, is a systematic method for identifying, measuring, and integrating environmental costs into an organizations financial system, allowing decision-makers to assess environmental impacts and their associated costs (Gray & Bebbington, 2001). In the healthcare sector, it facilitates monitoring of energy use, waste generation, water consumption, and eco-friendly procurement. Its significance lies in enhancing transparency by linking environmental and financial data, enabling hospital administrators to make informed, sustainable decisions, such as evaluating long-term savings from reusable materials or renewable energy investments. Moreover, incorporating environmental performance into financial reporting aligns healthcare institutions with global sustainability agendas, particularly the UN Sustainable Development Goals (SDG 3, SDG 12, and SDG 13).

Multiple factors are driving healthcare institutions toward sustainability. Environmental degradation is linked to public health issues such as climate change, air pollution, and toxic waste, creating a moral obligation for hospitals to reduce their

ecological impact (Fina et al., 2024). Regulatory frameworks now require reporting on carbon footprint, energy use, and waste management, with environmental performance influencing accreditation, funding, and accountability (Aboueid et al., 2023). Green certifications like LEED and BREEAM have become standard targets (Haroglu, 2013; Leite et al., 2025). Moreover, patients and staff increasingly value eco-conscious hospitals, reinforcing legitimacy and competitiveness in the sector (Ilmi & Juliana, 2023; Scholz et al., 2024; Cohen et al., 2025).

In this context, green accounting functions not merely as a technical tool but as a strategic management system that embeds sustainability into hospital operations. Internalizing environmental externalities provides a holistic view of healthcare costs and their ecological impacts (Nuraini & Andrew, 2023), enabling interventions that improve efficiency, reduce environmental harm, and enhance patient outcomes. It identifies high-resource departments, guides investments in energy-efficient technologies and waste management, supports lifecycle assessments for sustainable procurement, and helps anticipate compliance risks (Utami & Nuraini, 2020). Integrating environmental metrics into financial systems also promotes collaboration and embeds sustainability within the hospital's organisational culture.

Despite its advantages, adopting green accounting in healthcare faces key challenges, including the absence of standardized environmental cost frameworks, limited expertise among hospital finance staff, and high initial costs of green technologies, especially in low- and middle-income countries (Akinleye et al., 2019; Elhossade et al., 2022). Cultural barriers also persist, as hospitals often prioritize clinical and short-term financial outcomes over sustainability. Overcoming these obstacles requires leadership commitment, supportive policies, capacity building, and incentives. However, despite growing attention to sustainability, empirical research on how green accounting enhances organizational performance and environmental accountability in the healthcare sector, particularly in developing countries remains limited.

The adoption of green accounting in the healthcare sector remains limited, despite hospitals being major resource users and waste generators. The lack of integration between environmental cost accounting, performance indicators, and green financial reporting hinders transparency, resource efficiency, and environmental accountability, necessitating a comprehensive understanding of how green accounting can be effectively implemented to enhance hospital financial performance and sustainability. This study aims to identify the key components, analyze implementation strategies, and evaluate the impact of green accounting adoption on the environmental and financial performance of hospitals.

LITERATURE REVIEW

Green Accounting and Sustainability Theory

Green accounting, or environmental accounting, involves incorporating environmental costs into traditional financial accounting systems. This theory posits that environmental impacts such as resource consumption, waste generation, and pollution should be measured, reported, and managed just like any other cost (Gray & Bebbington, 2001). In the healthcare context, green accounting is used to track the environmental costs of hospital operations, such as the energy consumption of medical equipment, the disposal of biohazardous waste, and the use of single-use plastics. By quantifying these costs, healthcare institutions can make informed decisions that align with both economic and ecological goals. A study by Chang and Deegan (2008) emphasized the importance of environmental accounting in industries with high resource consumption and waste production, identifying healthcare as a prime candidate due to its complex operations. Similarly, Batara et al. found that integrating green accounting into hospital management systems improved environmental performance and supported more accurate cost control in public hospitals (Batara et al., 2024).

Sustainability theory, rooted in the Brundtland Report, defines sustainable development as meeting the needs of the present without compromising the ability of

future generations to meet their own needs (Choy, 2015). In healthcare, this translates to delivering high-quality care while preserving natural resources and minimizing environmental harm. Sustainability in hospitals involves optimizing energy and water use, reducing waste, and ensuring that procurement and infrastructure decisions consider environmental impact. Healthcare organizations embracing this theory recognize that planetary health and human health are inextricably linked, a view increasingly supported by public health literature (Whitmee et al., 2015). Research by Berwick et al. (2008) underlines the need for sustainable transformation in healthcare systems, urging hospitals to adopt resource-efficient models to prevent long-term environmental damage. Furthermore, the application of sustainability principles in hospital design, such as green buildings, has been shown to reduce both costs and carbon emissions (Sagha et al., 2016).

Legitimacy and Stakeholder Theory

Legitimacy theory proposes that organizations must act in ways that are congruent with the norms, values, and expectations of the society in which they operate to maintain legitimacy (Suchman, 1995). For hospitals, legitimacy is particularly important given their social mission and reliance on public trust and funding. The theory suggests that by publicly disclosing environmental initiatives through sustainability reports or integrated financial-environmental disclosures, hospitals can maintain or regain societal legitimacy. This is especially relevant in an era where environmental degradation is recognized as a determinant of health. A study by Deegan and Rankin (1997) found that companies increased environmental disclosures in response to negative media coverage, illustrating the strategic nature of legitimacy management. For healthcare institutions, this implies that green accounting can serve as both a risk mitigation and image enhancement strategy.

Stakeholder theory, introduced by Freeman (2010), posits that organizations must consider the interests of all parties affected by their operations, not just shareholders. In healthcare, this includes patients, employees, regulatory bodies, insurers, and the surrounding community. Hospitals that engage in green accounting demonstrate accountability to these stakeholders by acknowledging the environmental impact of their operations and outlining their efforts to reduce harm. This transparency can lead to improved trust, loyalty, and cooperation. Benn et al. (2014) emphasized that stakeholder engagement in sustainability initiatives is critical to achieving environmental and organizational goals. In hospitals, engaging patients and staff in energy-saving and waste-reduction programs fosters a shared sense of purpose and supports long-term cultural change.

Environmental Economics and Corporate Social Responsibility (CSR) Theory

Environmental economics focuses on the concept of externalities, the costs or benefits of economic activity not reflected in market prices. Hospitals often generate negative externalities such as air and water pollution, greenhouse gas emissions, and medical waste. Environmental economics argues that these costs should be internalized through proper accounting mechanisms (Pigou, 2017). Green accounting applies this principle by quantifying environmental externalities and including them in financial decision-making. This promotes more efficient resource allocation and reduces long-term environmental liabilities. Studies by Nordhaus (2010) and Sundarasen et al. (2024) support the application of environmental economics in public sector accounting, advocating for the integration of environmental values into national and organizational accounts.

CSR theory posits that corporations have obligations beyond profit maximization, including social and environmental responsibilities (Huwaida et al., 2025). In the healthcare sector, this involves promoting public health through responsible environmental practices. CSR-driven hospitals often publish sustainability reports, invest in green buildings, and participate in community environmental programs. These actions contribute to brand reputation, staff retention, and patient satisfaction. Carrolls (1999) The pyramid of CSR, comprising economic, legal, ethical, and philanthropic responsibilities, has been widely used to assess CSR performance. Healthcare

organizations that adopt green accounting fulfill both their ethical and legal responsibilities by disclosing their environmental impacts and efforts.

RESEARCH METHODS

This study employed an integrative research methodology designed to explore the strategic application of green accounting in the healthcare industry. The approach combined a comprehensive literature review with case-based analysis to assess the practical implementation, performance outcomes, and systemic implications of green accounting within hospital settings. This methodological framework was selected to align with the interdisciplinary nature of the topic, encompassing environmental science, accounting, healthcare management, and public policy. A descriptive-analytical design was employed to examine the application of green accounting principles across healthcare settings, integrating theoretical foundations with practical implementation to develop a conceptual framework for sustainable hospital management. The study identified key components of environmental cost accounting, performance indicators, green reporting, infrastructure design, and stakeholder engagement, along with their environmental and financial outcomes.

A structured literature review was conducted to establish the theoretical foundation of green accounting in healthcare. Relevant scholarly articles, institutional reports, and policy documents were reviewed across databases such as Scopus, ScienceDirect, JSTOR, and PubMed, focusing on six key theories: Green Accounting, Sustainability, Legitimacy, Stakeholder, Environmental Economics, and Corporate Social Responsibility (CSR). Using keywords related to environmental costs and hospital sustainability, 55 peer-reviewed and grey literature sources were analyzed to identify best practices and research gaps. A comparative case study approach was applied to assess the implementation and outcomes of green accounting across diverse healthcare settings. Five hospitals, Kaiser Permanente (USA), NHS Trusts (UK), Changi General Hospital (Singapore), Apollo Hospitals (India), and Groote Schuur Hospital (South Africa), were selected for their sustainability achievements, geographic diversity, and accessible environmental data. Using secondary sources such as environmental reports, sustainability disclosures, and peer-reviewed studies, the analysis examined key indicators including carbon reduction, energy efficiency, waste management performance, and financial returns.

Descriptive and comparative content analysis was used to evaluate each hospital's implementation of green accounting practices. Quantitative data on reductions in GHG emissions, energy consumption, waste diversion, and cost savings were compiled to illustrate measurable impacts, while qualitative information on institutional policies and cultural initiatives was thematically coded using NVivo to identify key patterns, barriers, and success factors. To ensure validity, the study included only peer-reviewed literature and verified institutional reports. Case selection was based on transparent reporting and independent certification from bodies such as LEED, BREEAM, and national sustainability councils. Reliability was strengthened through triangulation by cross-referencing environmental outcomes with multiple data sources, including hospital reports, academic studies, and policy documents, thereby enhancing the consistency and credibility of the findings.

RESULTS

Key Components of Green Accounting in Healthcare

Green accounting in healthcare is a multifaceted approach that integrates environmental considerations into hospital financial and operational systems. This integration supports strategic decision-making, resource efficiency, regulatory compliance, and public transparency. The key components of green accounting in healthcare include: (1) Environmental Cost Accounting, (2) Environmental Performance Indicators, and (3) Green Financial Reporting. Each plays a distinct role in translating environmental impacts into measurable and actionable data.

Environmental Cost Accounting (ECA) refers to the process of identifying, classifying, and allocating costs associated with environmental activities and impacts. In healthcare, it encompasses expenditures on energy and water use, waste disposal, emissions management, environmental compliance, and sustainable procurement. These costs can be categorized as direct (e.g., energy bills, waste treatment, eco-friendly materials), indirect (e.g., depreciation of energy-efficient equipment, staff training), and hidden or contingent (e.g., liabilities from hazardous waste, regulatory fines, reputational risks). Through ECA, hospitals can evaluate the true costs of their clinical and non-clinical operations, enabling cost-benefit analyses of sustainability measures such as assessing long-term savings from adopting reusable surgical instruments despite higher initial costs. Jasch (2003) highlighted that ECA enhances organizational transparency and reveals cost-saving opportunities by exposing inefficiencies in resource utilization. Similarly, Burritt and Schaltegger (2010) argued that integrating environmental accounting with conventional cost control systems strengthens ecological decision-making within healthcare institutions.

Environmental Performance Indicators (EPIs) serve as quantitative tools for measuring and monitoring a hospital's environmental footprint. They enable healthcare institutions to assess efficiency trends, compare performance over time, and benchmark against industry standards. Typical indicators include energy consumption per bed-day, water use per procedure, waste generation per inpatient, recycling or composting rates, Greenhouse Gas (GHG) emissions, environmentally responsible procurement, and compliance with standards such as ISO 14001. By systematically applying EPIs, hospitals can establish baselines, set measurable sustainability targets, and monitor progress toward achieving them, while also supporting external audits and certifications. Research by Berkhout et al. (2002) and Berkhout and Hertin (2002) found that hospitals integrating EPIs into their management systems achieved notable improvements in energy efficiency and waste reduction, underscoring the importance of quantification in implementing green strategies. Likewise, Panagiotopoulos et al. (2024) emphasized that EPIs are crucial for aligning environmental objectives with operational policies within healthcare organizations.

Green financial reporting involves incorporating environmental information into an organization's financial disclosures, often through sustainability reports, environmental statements, or integrated reporting frameworks. Within the healthcare sector, such transparency is vital for maintaining accountability and legitimacy among stakeholders, including regulators, patients, staff, and donors. This practice enables hospitals to communicate their environmental impacts and mitigation strategies, demonstrate compliance with regulations, justify investments in sustainable technologies, and strengthen stakeholder trust. Reports typically include data on environmental costs, performance metrics, goals, and progress, guided by international frameworks such as the Global Reporting Initiative (GRI) and the Integrated Reporting (IR) Framework (Bais et al., 2024). Burritt and Schaltegger (2010) emphasized that environmental reporting enhances corporate sustainability and stakeholder engagement, while Kaiser Permanente exemplifies this approach through detailed disclosures on emissions, waste, and energy initiatives (Aquino, 2021; Lee et al., 2023; Sambare et al., 2025). Furthermore, Elijido-Ten (2009) and Elijido-Ten et al. (2010) found that voluntary environmental disclosures in public healthcare foster greater transparency and institutional legitimacy among stakeholders.

Implementation Strategies for Green Accounting in Hospitals

Implementing green accounting in hospitals requires a multi-dimensional strategy encompassing operational practices, institutional policies, cultural change, and technological upgrades (Batara et al., 2024). Unlike traditional accounting, green accounting integrates environmental metrics that are often decentralized and context-dependent, necessitating an integrated approach to ensure environmental data collection, analysis, and reporting are embedded in daily operations and long-term planning. Six

primary strategies guide its effective implementation: operational optimization, sustainable procurement, waste management systems, green infrastructure, staff engagement, and integration of environmental information systems.

Operational optimization reduces environmental costs by improving energy and water efficiency. Interventions include LED lighting, motion-sensor systems, energy-efficient HVAC, solar panels, real-time energy monitoring, and low-flow or greywater systems. Studies show that optimizing energy use in Indian hospitals reduced costs by up to 25%, highlighting the role of green accounting in identifying inefficiencies (Reddy et al., 2019; Silva et al., 2024). Facilities monitoring consumption systematically are more likely to invest in energy-saving technologies, institutionalizing sustainability practices (Boza-Kiss et al., 2013; Roletto et al., 2024).

Sustainable procurement addresses the environmental impact of single-use medical devices, packaging, and non-renewable materials (Olawade et al., 2025). Key strategies include sourcing eco-labeled or LCA-verified products, prioritizing local suppliers, switching to reusable surgical kits and linens, and adopting biodegradable or recyclable packaging. Sustainable supply chain management enhances environmental performance and cost efficiency (Seuring & Müller, 2008). In healthcare, sustainable procurement can reduce life-cycle emissions by over 30%, particularly in high-resource areas like operating rooms (Eckelman et al., 2020).

Waste management systems are critical due to substantial hazardous and general waste. Practices include segregating hazardous, infectious, pharmaceutical, and recyclable waste; establishing on-site recycling and composting; safe sharps disposal; and reducing single-use plastics. Poor waste management poses ecological and health risks, while integrating waste reduction with environmental accounting yields environmental and financial gains (McGain et al., 2015; Windfeld & Brooks, 2015).

Green infrastructure supports sustainable operations through new construction or retrofitting to meet environmental standards. Key elements include certifications (LEED, BREEAM, Green Globe), low-emission materials, natural ventilation, daylighting, green roofs, rainwater harvesting, and permeable surfaces. Environmentally designed hospitals reduce ecological impact and improve patient outcomes via better air quality and lighting, and facilitate effective monitoring through environmental cost accounting (Ulrich et al., 2008).

Staff engagement is essential for sustaining environmentally responsible practices. Effective strategies include sustainability training, green teams or committees, employee recognition programs, and real-time dashboards of resource use. Organizational transformation is faster when staff perceive personal and collective value in initiatives, with higher engagement linked to better environmental performance (Bond et al., 2002).

Integration of digital systems involves linking ERP with environmental modules or adopting EMIS for comprehensive data management. This enables automated tracking of energy, water, and waste; real-time dashboards; integration with financial ledgers; and audit-ready sustainability reports. IT-enabled accounting enhances data accuracy, transparency, and decision-making efficiency (Burritt et al., 2002) while supporting timely interventions aligned with key environmental performance indicators.

Case Studies and Results from Leading Hospitals

To understand the real-world application of green accounting in healthcare, it is valuable to examine hospitals that have pioneered environmental sustainability efforts. These institutions demonstrate how green accounting translates from theory into practice and offer evidence of its operational, financial, and environmental benefits. This section in Table 1 highlights prominent case studies from both high-income and developing country contexts, focusing on how hospitals have integrated green accounting through energy management, waste reduction, procurement policies, and reporting.

Table 1. Summary of Case Study

Hospital	Key Focus	Environmental Impact	Financial Impact
Kaiser Permanente (USA)	Integrated sustainability	Carbon neutrality, waste reduction	> $10M/year in savings
NHS Trusts (UK)	Public sector accountability	18.5% CO_2e reduction, net-zero plan	£90M/year in savings by 2019
Changi General (Singapore)	Green building, procurement	40% energy savings, 35% waste diversion	Reduced operational costs
Apollo Hospitals (India)	Waste and energy audits	Biodegradable material use, energy savings	Lowered utility expenses
GSH Hospital (South Africa)	Waste segregation, water use	65% recycling rate, reduced water consumption	ZAR 2 million in annual savings

Kaiser Permanente, one of the largest not-for-profit healthcare organizations in the United States, serves more than 12 million members nationwide and is widely recognized for its pioneering role in environmental sustainability and the implementation of integrated green accounting systems. The organization tracks and publicly discloses its environmental performance through annual Environmental Stewardship Reports, incorporating environmental cost data directly into its enterprise financial systems. Kaiser Permanente has also made substantial investments in renewable energy, achieving carbon neutrality in 2020. Its monitoring framework includes metrics such as energy and water use, GreenHouse Gas (GHG) emissions, waste diversion rates, and environmentally preferable purchasing. These initiatives have produced measurable outcomes, including a reduction of over 800,000 metric tons of CO_2e emissions since 2008, LEED or equivalent certification for more than 90% of its facilities, and a significant decrease in landfill waste through closed-loop material systems and reusable instruments. Collectively, these efforts have yielded financial savings exceeding $10 million annually through improved energy and waste efficiencies.

The National Health Service (NHS) in the United Kingdom has institutionalized green accounting through the establishment of the Sustainable Development Unit (SDU), a centralized body responsible for monitoring and guiding the environmental performance of more than 200 NHS Trusts. The SDU promotes transparency and standardized sustainability reporting across the healthcare system. Green accounting measures implemented by the NHS include the adoption of carbon foot printing tools to assess hospital impacts across scopes 1–3, the integration of environmental key performance indicators (KPIs) into Trust-level performance evaluations, and the publication of the "Delivering a Net Zero NHS" roadmap in 2020. These initiatives have produced significant outcomes: NHS England achieved an 18.5% reduction in its carbon footprint between 2007 and 2017 despite increased clinical activity, hospitals recorded major reductions in energy consumption, and green initiatives generated approximately £90 million in cost savings by 2019. Furthermore, environmental reporting has been aligned with the Public Sector Sustainability Reporting Guidance to ensure consistency and comparability across institutions.

Changi General Hospital (CGH), part of Singapore's Eastern Health Alliance, has distinguished itself for embedding environmental sustainability into both its infrastructure and daily operations. It became the first hospital in Singapore to receive the Green Mark Platinum Award for outstanding environmental building performance. Through its comprehensive Green Hospital Framework, CGH employs a Building Management System (BMS) to monitor energy and waste, while also implementing sustainable procurement practices that prioritize local sourcing and recyclable packaging for food and medical supplies. These initiatives have yielded measurable results, including a 40% reduction in energy consumption within non-critical areas through automation and efficient lighting, and the diversion of more than 35% of solid waste from incineration via recycling and reuse programs. Additionally, environmental Key Performance Indicators (KPIs) are reviewed quarterly and integrated into the hospital's overall operational performance reporting, ensuring sustainability remains a core component of institutional accountability.

Apollo Hospitals, a leading private healthcare network with over 70 facilities across India, has integrated green hospital principles into its Corporate Environmental Responsibility framework. The institution has implemented waste stream audits and digital tracking systems for biomedical waste management in collaboration with local authorities. Additionally, Apollo has transitioned from single-use medical plastics to biodegradable alternatives where possible and installed energy-efficient sterilization and HVAC systems in its major hospitals. These initiatives have produced tangible results, including a reduction of more than 1.5 million kWh in annual electricity consumption across five flagship hospitals and the adoption of solar water heating systems that significantly lowered fossil fuel dependence. The hospital group also publishes environmental performance highlights within its Corporate Social Responsibility (CSR) reports, reinforcing transparency and stakeholder accountability in its sustainability efforts.

Groote Schuur Hospital (GSH), one of South Africa's largest public hospitals located in Cape Town, has made significant progress in integrating green accounting principles, with a strong focus on waste and water management. As part of the Department of Environmental Affairs Green Hospital Project, GSH established an on-site recycling facility for plastic, paper, and glass, and implemented greywater systems for irrigation and other non-potable uses. These initiatives have led to a marked improvement in waste segregation rates from 30% to 65% within three years and generated annual savings of approximately ZAR 2 million through reduced waste disposal costs and enhanced water conservation. Moreover, environmental cost data derived from green accounting have been instrumental in supporting funding proposals for further infrastructure improvements, demonstrating the hospital's commitment to both ecological and financial sustainability.

DISCUSSION

The integration of green accounting into healthcare operations represents a transformative shift in how hospitals measure value, expanding the focus beyond financial performance to include environmental stewardship and long-term sustainability. This aligns with sustainability theory, which emphasizes balancing economic performance with ecological preservation to ensure long-term organizational viability (Choy, 2015; Whitmee et al., 2015). As explored in the framework of this paper, green accounting rests on three core components: environmental cost accounting, performance measurement, and green financial reporting. These components enable healthcare institutions to quantify their environmental impacts, identify inefficiencies, and justify strategic investments in sustainability. When embedded within operational structures, these practices do more than track resource use; they inform hospital leadership on how environmental decisions influence economic efficiency, regulatory compliance, and institutional reputation.

Successful implementation, however, hinges on hospitals adopting a systems-based approach. A systems-based approach also resonates with stakeholder theory, as it requires collaboration among internal and external actors, including staff, patients, suppliers, and regulators, to achieve sustainable outcomes (Freeman, 2010). Strategies such as operational optimization, sustainable procurement, waste segregation, infrastructure greening, and staff engagement are not isolated interventions but interconnected processes that reinforce one another. For example, the adoption of environmental performance indicators requires hospitals to first establish a reliable data infrastructure often tied to energy and waste audits (Reddy et al., 2019; Nuraini & Andrew, 2023). These, in turn, inform procurement decisions and building design. The implementation of such practices, as seen in Kaiser Permanente's carbon neutrality initiative or the NHS's net-zero strategy, demonstrates how environmental accounting tools can shape major institutional policy (Sambare et al., 2025). From a legitimacy theory perspective, these initiatives also enhance institutional legitimacy by demonstrating accountability to societal expectations for environmental responsibility (Suchman, 1995). Furthermore, green accounting

strengthens the case for retrofitting hospital infrastructure, as demonstrated by Changi General Hospital's energy-saving initiatives, and supports responsible supply chain decisions, as practiced by Apollo Hospitals in its waste audits and local sourcing efforts (Lan et al., 2017; Apollo Hospitals Group, 2025).

These case studies demonstrate that the value of green accounting extends well beyond compliance and cost reduction, underscoring its role in linking environmental performance with health outcomes and organizational resilience. Kaiser Permanentes integration of environmental metrics into its enterprise systems led to over 800.000 metric tons of CO_2 emission reductions, exemplifying how transparency drives systemic change (Hensher et al., 2020). Likewise, the NHS's centralized sustainability framework standardized reporting across a complex public network, showing how governance can enable large-scale environmental accountability (England, 2020). Collectively, these examples highlight that effective green accounting reframes sustainability as a core component of healthcare's ethical and operational mission, aligning financial discipline with ecological responsibility.

However, its broader implementation remains constrained by key challenges. The absence of standardized, healthcare-specific metrics limits comparability, as general frameworks like ISO 14001 and Global Reporting Initiative (GRI) fail to address sector-specific factors such as emissions from medical gases, sterilization processes, or waste per bed-day. Additionally, fragmented information systems and a shortage of trained environmental accounting personnel hinder accurate data collection and reporting. These structural and technical barriers continue to impede the institutionalization of green accounting within the global healthcare sector.

Financial and cultural barriers continue to limit the adoption of green accounting in healthcare. Public and nonprofit hospitals face budget constraints that hinder investments in sustainability despite long-term benefits. Implementing green accounting involves significant initial costs for technologies, information systems, and staff training, which are often deprioritized amid immediate clinical demands (Batara et al., 2024; Sundarasen et al., 2024). Moreover, the dominance of patient-centered culture and lack of leadership or regulatory support reduce commitment to sustainability. To advance adoption, healthcare systems should develop sector-specific policies, reporting mandates, and fiscal incentives, while hospitals integrate environmental modules, assess Environmental Return on Investment (eROI), and cultivate sustainability-oriented cultures through education and recognition.

CONCLUSION

Green accounting in healthcare is not merely a financial management tool but a strategic framework that integrates environmental responsibility into hospital operations, governance, and service delivery. Its implementation can enhance operational efficiency, fiscal accountability, and institutional credibility while promoting sustainable and ethical healthcare practices. The findings highlight that integrating green accounting within healthcare systems has significant managerial and policy implications. Hospitals can improve cost efficiency, regulatory compliance, and environmental performance by embedding sustainability indicators into financial and operational systems. Policymakers should consider green accounting as a governance mechanism to institutionalize sustainability, linking environmental performance to healthcare quality standards and funding incentives.

Despite its potential, implementation remains constrained by several limitations. The lack of standardized, healthcare-specific environmental metrics and the absence of unified reporting frameworks create inconsistencies in data collection and benchmarking. Financial constraints, limited staff expertise, and outdated information systems also hinder integration. Furthermore, there is insufficient empirical evidence directly connecting environmental performance improvements with patient health outcomes, which reduces stakeholder motivation. Future studies should develop and validate standardized green accounting frameworks tailored to healthcare contexts, incorporating

metrics for energy, waste, water, and emissions specific to hospital operations. Comparative cross-country analyses are needed to identify scalable best practices and contextual differences between high- and low-income settings. Moreover, interdisciplinary research linking environmental sustainability with clinical outcomes will be crucial to demonstrating the broader value of green accounting in healthcare.

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