SASBE 2025 aims to encourage the international exchange of innovative ideas between researchers from academia and industry. In addition to knowledge dissemination, the conference offers a valuable platform for professional networking, particularly benefiting university professors, graduate students, and postdoctoral researchers.

Research Article

Strategic Renovation and Healthcare Infrastructure: A Case Study of Facility Upgrades and Compliance at a Private Hospital in Kenya

Toseef Din[1], Nancy Njiraini[2], Edward Ochieng[3]

Strathmore University,Strathmore Business School
The British University in Dubai
Correspondence: toseef.din@strathmore.edu

Abstract

Legacy healthcare infrastructure in low- and middle-income countries (LMIC) increasingly faces pressure to modernise ageing buildings, enhance patient safety, and align with international accreditation standards. This study aims to examine how phased renovation and infrastructure upgrades can be strategically planned and implemented within an active hospital environment to meet clinical, safety, and compliance goals. Using a descriptive case study method, the paper analyses the renovation of critical hospital departments, including operating theatres, kitchen, laundry, and security systems, alongside the construction of a new multi-story medical tower. The process was guided by Evidence-Based Design (EBD), user input, and Joint Commission International (JCI) tracer assessments. Data was drawn from internal project records, audit findings, and architectural plans**.** The findings show that phased, compliance-driven upgrades, such as sterile zoning in operating theatres, workflow reconfiguration in kitchens, infection control enhancements in laundries, and integrated safety systems, significantly improved patient safety, operational efficiency, and environmental performance. The vertical expansion increased capacity and service range while embedding sustainability and safety features, demonstrating that legacy facilities can achieve accreditation readiness without disrupting care delivery.This study contributes practical insights into how healthcare facilities in resource-constrained urban settings can approach infrastructure renewal not merely as construction tasks, but as integrated, strategic opportunities to embed resilience, safety, and sustainability into the built environment.

Keywords: Healthcare renovation, Infrastructure modernisation, JCI compliance, Phased construction, Kenya.

Highlights

- Phased hospital renovation enabled Joint Commission International (JCI) compliance without disrupting clinical services.
- Smart upgrades improved safety, infection control, and energy efficiency in key departments.
- Renovation served as a strategic driver for quality, sustainability, and institutional growth.

Introduction

Healthcare infrastructure in many low- and middle-income countries (LMICs) faces growing pressure due to rising patient demand, complex clinical needs, and stricter international safety standards. Legacy hospital buildings often struggle to meet modern requirements for infection control, energy efficiency, and patient-centred care, hindering progress toward accreditation and quality improvement goals. Renovation and restoration are increasingly recognised as cost-effective strategies for upgrading existing facilities without full reconstruction. This study examines how strategic renovation can support institutional transformation, compliance, and sustainability in LMIC healthcare settings. It presents a case study of a 93-year-old private tertiary hospital in Nairobi, Kenya, which undertook a four-year phased renovation (2021–2024) across key departments, including theatres, laundry, kitchen, and security, while remaining fully operational. The research addresses three guiding questions: (1) How can phased renovation be implemented without disrupting hospital services? (2) Which infrastructure interventions enhance compliance with standards such as the Joint Commission International (JCI)? (3) How can renovation support long-term functionality and resilience? Existing literature underscores the benefits of evidence-based hospital design (Brambilla et al., 2019) and integrated infrastructure strategies (Thomé et al., 2016), yet few studies explore these processes in active LMIC hospitals. Additionally, non-clinical areas such as laundry remain underexamined despite their role in infection control (Lopes et al., 2019). This study provides one of the few empirical, real-world accounts of how a legacy hospital in a resource-constrained urban LMIC setting strategically renovated its infrastructure while ensuring continuous service delivery. By analysing project plans, tracer audits, and physical upgrades, this study highlights key insights and trade-offs in implementing hospital renovations under constraints. It contributes to global discussions on sustainable healthcare environments and demonstrates how restoration efforts can drive compliance, operational excellence, and system resilience.

Literature Review

This section establishes the intellectual and theoretical basis for the study, providing a structured analysis of key concepts, relevant theories, and existing frameworks that inform the research. It critically reviews literature to position the study within the broader academic discourse, identifying gaps that the research seeks to address. Additionally, it introduces a conceptual model that guides the study's approach, offering a lens through which the research problem is examined.

2.1 Defining Key Concepts

This study is centred on three key constructs below. Understanding these terms is essential to appreciating the scope, significance, and outcomes of the renovation initiatives examined in this study.

Healthcare infrastructure renovation: refers to upgrading physical facilities to improve safety, efficiency, and service delivery. In architectural literature, renovation is commonly associated with structural repairs, retrofitting, or aesthetic enhancement of ageing buildings (Mishra *et al.*, 2025). In healthcare, however, the term takes on broader significance, encompassing infection control, patient flow, ventilation, waste management, and compliance with clinical safety standards (Brambilla *et al.*, 2019).

Strategic renovation: distinguishes itself from routine maintenance by aligning physical upgrades with institutional goals such as international accreditation, sustainability, or service expansion (Thomé, Scavarda, & Scavarda, 2016). This study adopts an operational definition that emphasises phased, audit-informed upgrades that are multidisciplinary and outcome-focused. For example, redesigning a sterile zone to meet JCI standards reflects strategic intent.

Compliance-driven upgrades: this term captures modifications that respond specifically to regulatory or accreditation requirements. These may include installing fire-rated doors, adjusting airflow systems, or ensuring sterile zoning, measures that directly affect patient safety and institutional readiness (Joint Commission International, 2023).

These concepts manifest in real-world hospital settings through projects that are often executed under live operational conditions, requiring the integration of technical planning with clinical service continuity. For instance, at the case study hospital, renovations in operating theatres were phased to prevent surgical service disruptions, while the laundry redesign introduced workflow zoning to minimise cross-contamination. Each intervention was not merely architectural but strategic, serving broader organisational objectives such as JCI accreditation, infection prevention, and staff safety. By operationalising these key terms in the study, we provide a framework that captures the technical, strategic, and compliance dimensions of healthcare infrastructure modernisation in LMIC settings.

2.2 Existing Theories and Frameworks

This study draws on two complementary perspectives, the Resource-Based View (RBV) and Institutional Theory (IT), to analyse hospital renovation as both a strategic and legitimacy-driven process. The RBV emphasises the role of internal resources, such as skilled staff, infrastructure, and processes, in providing competitive advantage (Barney, 1991). In this study, renovation was shaped by in-house capabilities: interdisciplinary planning teams, phased upgrades, and adaptive engineering solutions that improved zoning, safety, and efficiency. In contrast, IT explains organisational change as a response to external pressures like accreditation, norms, and policy (Scott, 2008). The hospital's renovations were influenced by institutional forces such as JCI standards, which demanded structural compliance in fire safety, sterile zoning, and infection control. While RBV highlights capability mobilisation, IT focuses on external conformity. Their integration offers a holistic view: RBV explains how renovations are implemented, while IT explains why they are pursued, especially in highly regulated healthcare settings. Both frameworks have been applied in healthcare studies.Lopes *et al*. (2019) used the RBV lens to assess efficiency in hospital laundries, while Corvalán *et al*. (2020) applied IT to explore climate adaptation in African hospitals. However, few studies combine them to examine infrastructure renovation, especially in LMIC contexts. This dual-theory approach enables a nuanced understanding of hospital renovation as both an internally resourced and externally legitimised transformation process.

2.3 Knowledge Gaps and Research Opportunities

Although sustainable healthcare infrastructure is widely acknowledged as critical, current literature primarily focuses on new builds or isolated upgrades like energy systems, with limited attention to renovation in live clinical settings, particularly in LMICs (Ying *et al*., 2022; Lopes *et al*., 2019). Studies by Addy *et al*. (2021) and Agyekum *et al*. (2020) cite institutional and regulatory barriers, but rarely within the healthcare context. A significant gap lies in the disconnect between theory and implementation. IT explains external pressures, but little is known about how these translate into

renovation design decisions under resource constraints. Similarly, the RBV highlights internal capabilities but lacks empirical insights into how multidisciplinary teams and phased upgrades are operationalised to align infrastructure with strategic goals. Much of the existing work also isolates drivers like sustainability or compliance, overlooking the interplay of trade-offs hospitals face, such as infection control versus continuity of care, or retrofitting legacy systems with modern standards (Sherman & Hopf, 2018). Emerging themes like user-centred design, building management systems (BMS), and accreditation-aligned planning remain underexplored in LMICs. Documented case studies that bridge theory and real-world complexity are scarce. This study fills these gaps through a case analysis of a Nairobi-based tertiary hospital's strategic, phased renovation. It offers practical insights into how hospitals in constrained settings adapt infrastructure under dual pressures of internal capability and external compliance, advancing both theory and application.

2.4 Proposed Conceptual Model

This study presents a conceptual model combining IT and the RBV to explain how hospitals in LMICs navigate strategic renovation amid resource and regulatory constraints. The model illustrates how internal capabilities and external compliance pressures jointly influence renovation planning, execution, and outcomes.

External Institutional Pressures (IT): these include regulatory mandates, accreditation requirements (e.g., JCI), patient expectations, and national policies. IT suggests such pressures drive hospitals to undertake renovations to gain legitimacy and meet evolving standards (Scott, 2008).

Internal Strategic Capabilities (RBV): this involves the hospital's internal assets, project teams, leadership, clinical input, and insights from tracer audits. RBV argues that these resources enable effective, phased renovation without service disruption (Barney, 1991).

Strategic Renovation Outcomes: the synergy between institutional pressures and internal resources leads to outcomes like improved infection control, safety compliance, workflow efficiency, and accreditation readiness, which enhance institutional legitimacy and competitive advantage.

Two core processes link these domains:

Compliance Alignment – translating external standards into practical design features.

Capability Mobilisation – leveraging internal strengths to deliver phased, low-disruption renovations.

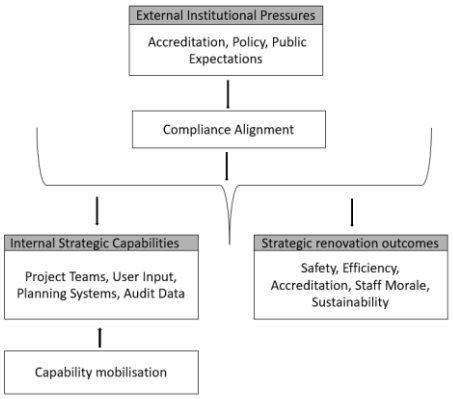

Figure 1: Conceptual model

Source: Authors (2025)

The proposed model (*see Figure 1*) justifies the selection of both RBV and IT as core frameworks. RBV explains how hospitals execute renovation (through internal capabilities), while IT explains why they do so (to conform to legitimising forces). Together, they provide a comprehensive view of renovation as both a strategic and institutional phenomenon. The model also directly informs the study's research questions by identifying the mechanisms through which renovation is triggered, executed, and evaluated. It provides an analytical lens for interpreting how infrastructure renewal unfolds in an active healthcare setting and what factors contribute to its effectiveness.

Methodology

This study employs a qualitative descriptive case study to investigate the phased infrastructure renovation process of a private tertiary hospital in Nairobi, Kenya, while it remained operational. The case study approach enables an in-depth understanding of complex, real-world processes where context and phenomenon are intertwined (Yin, 2014). It is ideal for exploring how and why strategic renovation occurs under institutional and operational constraints in LMICs. The research is guided by an integrated theoretical framework combining IT and the RBV. IT helps analyse external pressures like JCI accreditation and regulatory demands, while RBV highlights internal capabilities such as project leadership, clinical collaboration, and phased planning.

Case Context

The focal hospital is a 93-year-old, 217-bed tertiary facility that embarked on a four-year renovation program (2021–2024) targeting five key areas: operating theatres, laundry, kitchen, security office, and the construction of a new multi-storey medical tower. These infrastructure upgrades were part of the hospital's broader institutional strategy to align with JCI standards and enhance patient safety, service efficiency, and environmental performance.

Data Collection

The study draws on retrospective qualitative data collected from multiple internal sources, including:

- Architectural and engineering renovation plans.
- Project implementation schedules and Gantt charts.
- JCI tracer audit findings and internal compliance checklists.
- Procurement and installation records (e.g., fire doors, scavenging systems).
- Facility walkthrough observations by clinical, engineering, and quality teams.
- Departmental feedback memos and interdepartmental meeting summaries.

No interviews or patient/staff surveys were conducted. Following institutional approval, the data were collected over 3 months. This structure enabled the study to map how both external forces and internal resources interact to shape hospital renovation trajectories.

Data Analysis

A narrative analysis approach was used to reconstruct the renovation journey of each department. Key qualitative steps included:

- Chronological ordering of renovation activities across departments.
- Thematic coding of operational drivers (e.g., infection control, fire safety).
- Comparative analysis of intervention types and compliance outcomes.

- Cross-validation with internal tracer audits and visual documentation.
- Mapping renovations to strategic goals using the RBV and IT lens.

No software was used for coding; analysis was done manually using structured data extraction matrices.

Methodological Framework

The study's methodological framework is summarised in Figure 2, which illustrates the research process, starting from the theoretical foundation of the RBV and IT. Data was collected from multiple hospital sources, including architectural plans, audits, and departmental feedback, and then analysed through chronological mapping, thematic coding, and cross-validation. The outcomes of this analysis informed the development of a conceptual model capturing the drivers, processes, and impacts of strategic hospital renovation.

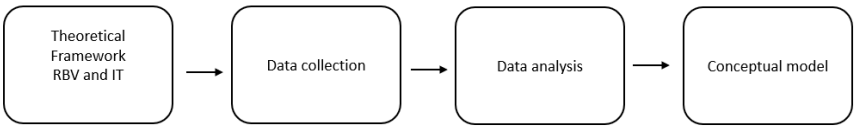

Figure 2: Methodological framework

Source: Authors (2025)

Ethical Considerations

As the study relied solely on institutional documents and did not involve human subjects, ethical clearance was granted by the hospital's internal quality and ethics committee. All data were anonymised and stored securely, with no identifiable patient or staff information included in the analysis.

Methodological Limitations

The primary limitation is the single-site focus, which may affect generalisability. Additionally, the study did not include financial cost-benefit analysis or post-renovation patient satisfaction data, which could enhance the assessment of renovation outcomes. Future research may expand this scope by incorporating longitudinal assessments across multiple hospitals or integrating mixed-methods approaches.

Results- Key Findings

This section presents the primary outcomes from the phased renovation. Findings are organised by renovation area, aligned with the study's central objectives.

Operating Theatres

The renovation of the operating theatres created fully compliant, high-performance surgical environments that met JCI standards. Advanced ventilation, gas scavenging, and infection control upgrades also improved workflow efficiency, staff safety, and operational resilience. Key interventions included:

- Sterile and semi-sterile zones were delineated, eliminating cross-contamination risks between clean and dirty corridors.
- A centralised scavenging system for anaesthetic gases was installed, aligning with international safety requirements.
- Ventilation was enhanced through pressure-controlled airflow systems with real-time digital monitoring.
- Fire-rated doors, automated scrub sinks, and staff-specific workflow paths improved infection control and safety.
- Post-renovation tracer audits showed full compliance with JCI standards for surgical environments.

Medical Tower Expansion

The vertical expansion increased the hospital's capacity and service range while embedding sustainability and safety features. Specialised clinical spaces, improved patient–staff flow, and energy-efficient systems enhanced care coordination and operational efficiency. Key interventions included:

- The vertical expansion added seven floors, housing specialty clinics, inpatient wards, minor operating theatres, a rehabilitation unit, and a warehouse.
- Smart elevator zoning was introduced to separate patient and staff flows.
- Energy-efficient systems for lighting, water, and HVAC were installed to reduce operational costs.
- Structural fire safety was enhanced with emergency egress systems.
- Spatial adjacencies were optimised, e.g., Maternity units connected directly to neonatal and paediatric ICU floors, improving care coordination.

Laundry Department

The laundry renovation delivered major operational and compliance gains, achieving a 98% hygiene audit score and increasing processing capacity by 50%. These targeted upgrades in a non-clinical area enhanced patient safety, staff well-being, and sustainability outcomes. Key Interventions included:

- A new layout enabled full separation of clean and soiled linen pathways.
- A sluicing area and barrier washers were introduced, minimising staff biohazard exposure.
- Energy- and water-efficient washer-extractors and an industrial ironer improved hygiene and productivity.
- Staff safety improved through lint collectors, ergonomic layouts, and mechanical ventilation.
- Linen processing volume increased by 1.5× with a 98% score in environmental hygiene audits.

Kitchen Renovation

The kitchen renovation improved dietary safety, operational efficiency, and sustainability performance through purpose-built zones and reconfigured workflows. Modern equipment enhanced hygiene and speed, while reducing energy use and emissions, advanced patient safety, staff productivity, and environmental stewardship. Key interventions included:

- A new non-vegetarian kitchen was built adjacent to the main kitchen to support dietary separation.
- Cooking areas were re-zoned to separate raw and cooked food workflows, minimising contamination risk.
- Rational ovens and high-temperature dishwashers improved food safety and reduced reheating time.

- Seamless flooring and fire suppression systems were installed to meet safety standards.
- Gas consumption and kitchen-related Scope 1 emissions were reduced.

Security and Fire Safety Upgrades

Security and fire safety enhancements improved the hospital's resilience, compliance, and operational oversight. Centralised monitoring, access control, and upgraded fire protection strengthened patient and asset protection while preparing the facility for future BMS integration. A centralised security command centre was established, integrating surveillance across hospital zones. Key interventions included:

- Digital access control systems were deployed for restricted areas such as the pharmacy and paediatric wards
- Fire safety compliance was improved through fire-rated doors, smoke detectors, and illuminated emergency signage.
- All systems were designed to integrate into a future Building Management System (BMS).

As shown in Figure 3**,** the hospital adopted a phased renovation strategy from 2021 to 2024, prioritising critical areas such as the operating theatres and laundry. Services such as laundry were temporarily outsourced, and staff relocation plans and communication protocols were put in place to ensure continuity of care and stakeholder awareness. This approach allowed infrastructure upgrades without disrupting clinical operations, aligning with safety and accreditation goals.

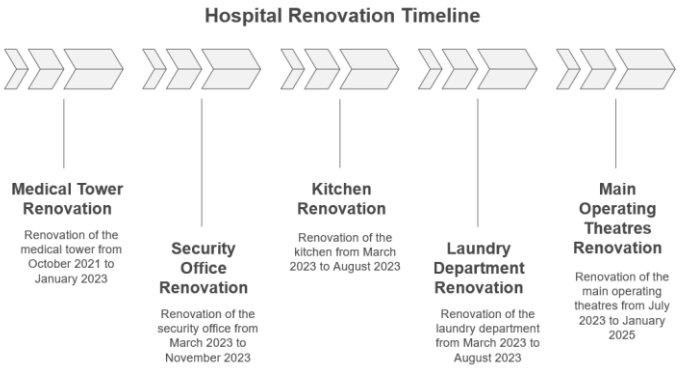

Figure 3: Hospital renovation timeline

Source: Authors (2025)

Discussion

This study aimed to explore how phased renovation and infrastructure upgrades can be strategically planned and implemented within an active hospital in an LMIC to achieve clinical, safety, and compliance objectives without service disruption. The findings confirm that compliance-driven upgrades can be successfully executed in operational LMIC settings, offering a replicable model for sustainable hospital design and urban health planning. This was achieved through targeted interventions in both clinical and non-clinical departments, each directly contributing to improved safety, efficiency, and accreditation readiness. These outcomes align closely with the study's purpose, demonstrating that even in resource-constrained environments, strategic renovation can serve as a catalyst for institutional transformation. The results strongly support the initial predictions of the study. It was anticipated that aligning renovations with JCI standards, guided by evidence-based

design and internal capability mobilisation, would yield measurable improvements in safety, infection control, and workflow efficiency. This was validated across multiple domains. For example, sterile zoning in the operating theatres eliminated cross-contamination pathways, the laundry redesign improved infection control performance to a 98% audit score, and kitchen reconfiguration reduced both contamination risks and Scope 1 emissions. The incorporation of energy- and water-efficient systems, alongside modern safety infrastructure, further confirmed that environmental performance can be enhanced alongside patient safety and service delivery goals. In interpreting these findings, it becomes evident that the success of this phased renovation model lies in its dual emphasis on meeting compliance requirements and leveraging internal resources to ensure minimal operational disruption. Rather than treating infrastructure upgrades as isolated technical tasks, the hospital approached them as interconnected strategic projects with direct links to organisational objectives. This integration ensured that improvements in one department reinforced gains in others, for instance, infection control measures in the laundry complemented sterile zoning in surgical areas, and enhanced kitchen workflows supported patient nutrition safety. Overall, the study's findings demonstrate that strategically executed, compliance-oriented renovations can yield high-impact results in LMIC healthcare facilities while maintaining uninterrupted care delivery. The outcomes not only affirm the feasibility of such approaches under operational constraints but also highlight their potential as a blueprint for other legacy hospitals aiming to balance safety, efficiency, and sustainability in future infrastructure renewal efforts.

Conclusions

This study explored how a private tertiary hospital implemented phased infrastructure renovations to enhance safety, compliance, and sustainability while maintaining continuous clinical operations. Using a descriptive case study, it addressed how live renovations can be executed, which interventions support JCI compliance, and how to optimise renovations for long-term functionality. Findings show that compliance-driven, user-informed renovations, guided by tracer audits and internal capabilities, can significantly improve infection control, workflow, and safety. The study adds to architectural and healthcare literature by offering a real-world model of strategic retrofitting in LMIC urban settings.

Comparison with Existing Literature-The results align with prior research on integrated hospital design in enhancing infection control and operational efficiency (Brambilla et al., 2019), but extend this body of work by providing rare empirical evidence from a live LMIC hospital renovation. The study reinforces Lopes et al. (2019) in recognising the critical role of support services like laundries in infection prevention, while also highlighting kitchens, security systems, and fire safety infrastructure as equally important to accreditation and resilience. The findings address gaps identified by Sherman and Hopf (2018) on balancing infection control with environmental sustainability, demonstrating that both can be advanced through targeted design interventions.

Theoretical Contributions-By applying both Institutional Theory (IT) and the Resource-Based View (RBV), the study explains the hospital's renovation process as the result of an interplay between external compliance pressures and internal capability mobilisation. IT clarified why specific interventions were undertaken to meet legitimising forces like JCI standards, while RBV explained how these were successfully implemented through multidisciplinary teams, phased execution, and adaptive engineering solutions. This dual-lens approach offers a holistic and transferable framework

for understanding renovation as both a legitimacy-seeking and capability-driven process in LMIC contexts.

Practical Implications-For hospital leaders and policymakers, the study demonstrates the practicality of modular, phased renovation strategies that avoid decanting patients, optimise infection control, and integrate sustainability measures. Using tracer audit findings as a design tool proved effective in ensuring compliance alignment, while prioritising non-clinical departments in renovation planning delivered significant operational and accreditation benefits often overlooked in capital projects. These insights provide a blueprint for other legacy hospitals aiming to balance patient safety, operational efficiency, and environmental performance within resource constraints.

Limitations include its single-site scope and retrospective design; future studies could use comparative or longitudinal methods to assess broader impacts and integrate digital tools such as BMS to enhance operational oversight. Overall, the study demonstrates that strategic renovation, when guided by compliance requirements and internal capabilities, can transform healthcare delivery in resource-limited environments, offering both a practical guide and a theoretical framework for building sustainable, resilient care facilities.

Acknowledgements

The authors would like to thank the staff and leadership of the hospital for their commitment to sustainability and their contributions to the renovations. Special appreciation is extended to the project committee, clinical and non-clinical departments, and the Chief Operations Officer, whose insights and actions significantly contributed to the success of this initiative. Gratitude is also owed to the JCIA, which provided valuable tools and guidance that informed the hospital's diagnostic and planning processes.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The study was self-supported by the lead author as part of ongoing doctoral research in healthcare infrastructure and sustainability.

Data Availability Statement

The data supporting the findings of this study are not publicly available due to institutional confidentiality and privacy agreements with the participating hospital. However, de-identified excerpts or design documents may be made available by the corresponding author upon reasonable request and subject to ethical clearance.

Conflicts of Interest

The authors declare no conflict of interest. The funders, if any, had no role in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

Addy, M., Adinyira, E., Danku, J. C., & Dadzoe, F. (2021). Impediments to the development of the green building market in sub-Saharan Africa: The case of Ghana. Smart and Sustainable Built Environment, 10(2), 193–207. https://doi.org/10.1108/SASBE-12-2019-0170

Agyekum, K., Adinyira, E., & Ampratwum, G. (2020). *Factors driving the adoption of green certification of buildings in Ghana*. *Smart and Sustainable Built Environment, 9*(3), 274–295.https://doi.org/10.1108/SASBE-02-2019-0017

Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99–120. https://doi.org/10.1177/014920639101700108

Brambilla, A., & Capolongo, S. (2019). Evidence-based hospital design: A literature review of the recent publications about the built environment's effects on health and healthcare. Annali di Igiene: Medicina Preventiva e di Comunità, *31*(2), 165–180. https://doi.org/10.7416/ai.2019.2269

Corvalán, C., Villalobos Prats, E., Sena, A., Campbell-Lendrum, D., Karliner, J., Risso, A., Wilburn, S., Slotterback, S., Rathi, M., Stringer, R., Berry, P., Edwards, S., Enright, P., Hayter, A., Howard, G., Lapitan, J., Montgomery, M., Prüss-Ustün, A., Varangu, L., & Vinci, S. (2020). Towards climate-resilient and environmentally sustainable health care facilities. International Journal of Environmental Research and Public Health, 17(23), 8849. https://doi.org/10.3390/ijerph17238849

Joint Commission International. (2023*).* Joint Commission International accreditation standards for hospitals (8th ed.). Oak Brook, IL: Joint Commission Resources.
Lopes, C., Scavarda, A., De Carvalho, M., Vaccaro, G., & Korzenowski, A. (2019). Analysis of sustainability in hospital laundry: The social, environmental, and economic (cost) risks. Resources, 8(1), 37. https://doi.org/10.3390/resources8010037
Mishra, S., Verma, P., Patidar, N., Katira, J. M., Gaonkar, N., Solanki, J., Tadvi, R., Yasobant, S., & Saxena, D. B. (2025). Building climate-resilient healthcare systems through interventions in Gujarat, India. Discover Public Health, 22(1), 273. https://doi.org/10.1186/s12982-025-00659-7
Scott, W. R. (2008). *Approaching adulthood: The maturing of institutional theory. Theory and Society, 37*(5), 427–442. https://doi.org/10.1007/s11186-008-9067-z
Sherman, J. D., & Hopf, H. W. (2018). Balancing infection control and environmental protection as a matter of patient safety: The case of laryngoscope handles. Anesthesia & Analgesia, 127(2), 576–579. https://doi.org/10.1213/ane.0000000000002759
Thomé, A. M. T., Ceryno, P. S., Scavarda, A., & Remmen, A. (2016). Sustainable infrastructure: A review and a research agenda. Journal of Environmental Management*, 184*, 143–156. https://doi.org/10.1016/j.jenvman.2016.09.080
Yin, R. K. (2017). Case study research and applications (6th ed.). Thousand Oaks, CA: SAGE Publications.
Ying, J., Zhang, X., Zhang, Y., & Bilan, S. (2022). *Green infrastructure: Systematic literature review. Economic Research-Ekonomska Istraživanja, 35*(1), 343–366. https://doi.org/10.1080/1331677X.2021.1893202