



Waterfall and Agile Project Management: Cost-Efficient and Collaborative Approach for Renovating Operating Theater in District General Hospital Negombo

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Abstract

The Main operating theatre (OT) at the District General Hospital (DGH) in Negombo, Sri Lanka, a crucial healthcare facility near the Bandaranaike International Airport (BIA) and export processing zone (KEPZ), was non-functional for over five years due to structural safety issues.

An initial proposal for a new OT at Sri Lankan Rupees (LKR) 1,500 million was deemed financially unfeasible due to economic constraints [1], which necessitated a cost-efficient solution. Focus group discussions (FDGs) were held with the stakeholders, and Key Informant Interviews (KII) were conducted. SWOT analysis was conducted to propose alternative solutions. The most cost-efficient intervention was implemented through public-private collaboration with pro bono expertise [5]. The cost estimate was LKR 70 million.

Employing a hybrid project management approach (Waterfall and Agile) [5], this project included civil engineering improvements, electrical and air conditioning (AC) upgrades, and an advanced medical gas supply. A Work Breakdown Structure (WBS) and Gantt Chart supported phased execution and timely resource allocation [7].

The project was physically started on 05.01.2025. Major risks such as contractor coordination, economic constraints, end user perspectives, and material preference were addressed through daily meetings, change control, Radio Frequency Identification Device (RFID) tracking, [1], and pre-approved payments. Close stakeholder engagement was vital, particularly with the Ministry of Health (MoH) and hospital staff. As a result, 90% of physical progress was achieved at the end of March 2025.

Successful renovation demonstrates the significance of adaptive and agile project management, [5] fiscal responsibility, and stakeholder collaboration in public healthcare infrastructure projects. It provides an example of cost-efficient hospital renovation in resource-limited settings [3]. Recommendations include deploying a dedicated project manager and a wider stakeholder consultation to manage the triple constraints of the project [5].

Introduction

The DGH in Negombo is a pivotal government healthcare provider in Sri Lanka, serving as the main curative care center for Katunayake and the broader Negombo region since its establishment in 1909.

Strategically located near BIA Katunayake, DGH Negombo is the preferred medical facility for international delegates, tourists, and the aviation community, reflecting its increasing importance in meeting the healthcare demands of a growing population as a dynamic economic hub.

It caters to the health needs of the Board of Investment (BOI—KEPZ), one of the

country's largest industrial hubs, government and private sector institutions, and local communities in the catchment area. It operates with 940 beds and a workforce of approximately 1,000 health care personnel. In 2024, approximately 265,000 Outpatient Department (OPD) visits and nearly 90,000 in-ward admissions were recorded. Moreover, the hospital has performed nearly 13000 surgeries per annum.

Problem Statement

Despite its extensive medical services, DGH Negombo has faced significant challenges in surgical operations due to a lack of infrastructure. The main OT, located on the top floor of a seven-story building, has not been

utilized for the last five years due to water seepage and unsafe conditions, hindering the hospital's ability to meet the increasing demand for surgical care [8]. The hospital authorities decided to rectify the main OT, addressing the safety issues. The initial estimated cost was LKR 1,500 million, but the MoH was unable to provide funds due to economic constraints [3]. In this context, the Consultant surgeons and the Consultant anesthetists of the hospital were demotivated and expressed their dissatisfaction to the hospital management, leading to a conflict situation.

This issue was discussed with the Secretary of Health and the Director General of Health Services (DGHS). They advised generating alternative options. The hospital management committee was convened, and it was decided to find a cost-effective solution to renovate the OT using a collaborative approach. A team was assigned to explore this area further, and the following objectives have been formulated.

Objectives

General Objective: To provide a cost-efficient solution to renovate the Operating Theater in DGH Negombo.

Specific Objectives

1. To conduct a SWOT analysis with the stakeholders to find out the appropriate strategies to renovate the main OT
2. To propose a cost-efficient solution to the MoH to renovate the main OT at DGH, Negombo
3. To implement the proposed solution to renovate the main OT, addressing the safety concerns.

Design

The key stakeholders of the Project included the Project Sponsor (GOSL, MoH), a core team comprising MoH, hospital administration, surgeons, anaesthetists, and end users (patients, public, and medical staff). The primary stakeholders were the MoH, hospital administration, surgeons, and anaesthetists, which were considered a high-power and interest group. The secondary stakeholders included the Health Secretary, DGHS, MoH Engineering and Logistics Departments, the Chief Financial Officer of the MoH, and the building contractors, who possessed high power but low interest. It

necessitated strategies to keep them satisfied. Beneficiaries were the patients, public, medical, and surgical staff.

SWOT analysis was designed to be conducted with the following stakeholders: Consultants, MO/Planning, Hospital management committee, and the hospital development committee, including a religious priest and well-wishers.

They assessed the internal and external environment to find out strengths, weaknesses, opportunities, and threats.

FGDs were held with the surgical and anaesthetist teams. KII was conducted with the Central Engineering Consultancy Bureau (CECB) [2] and the Additional Secretary, Engineering, MoH.

The qualitative data were analyzed to decide the layout and other structural compliance with International Healthcare Standards [1]. The quantitative data were analyzed based on the Bill of Quantities (BOQs), and the cost estimates were prepared and further scrutinized to calculate the minimum possible cost which is required to renovate the OT using a collaborative approach.

Results

SWOT analysis revealed the following.

Internal strengths: Regular management committee meeting for which all section heads are participating.

Internal Weaknesses: Conflict among supportive staff

External opportunities: Expert architects and engineers who were willing to offer voluntary expert service to redesign and plan solutions for free of charge (pro bono expertise).

External threats: The prevailing unstable economic situation, with constraints on fiscal space.

It was found that quantity surveyors in the community were willing to prepare the BOQ free of charge with the guidance of the architects and engineers. These designs and BOQs were prepared with no cost involvement.

Yet, the estimate could be brought down to LKR 450 million, and the MoH was unable to provide these funds during the given year. Repeated discussions were held to identify ways of mitigating the cost further.

As the CECB estimate was high [2], it was advised to get a third-party contractor following procurement guidelines.

As a result, a renovation estimate of LKR 70 million was prepared, excluding the consultancy fees of the CECB [2] and including only the essential civil works and other requirements. The stakeholder consensus was obtained through regular consultations with surgeons, engineers, and MoH officials, ensuring scope clarity. A WBS was divided into civil, electrical, AC, and medical gas work. Risk management was proactive, using a risk matrix to identify high-probability issues like contractor delays and assigning mitigation strategies [5]. This cost-efficient proposal was submitted to the MoH, and approval was obtained to proceed.

The most cost-effective alternative solution has been implemented through the collaborative efforts of hospital well-wishers, including engineers, architects, and medical professionals from the private sector [1]. The MoH supervised the project through its Engineering Department, ensuring adherence to quality and safety regulations. The meticulous preparation of bidding documents, facilitated by professional well-wishers, highlighted the collaborative spirit of this transformative initiative. Safety certifications from the MoH and CECB [2], staff training programs, comprehensive project documents, maintenance manuals for the upgraded systems, and a transition plan for staff handover and operational continuity were provided to the DGH Negombo.

As of March 2025, the physical progress was 90% with no variation to the cost.

Discussion

The project utilized a hybrid methodology, combining structured waterfall phases with iterative agile feedback [7]. Waterfall is a linear, sequential approach where each phase of a project must be completed before the next begins. Conversely, Agile is iterative and flexible, emphasizing collaboration and continuous feedback to adapt to changing requirements.

The project employed a Stakeholder Power-Interest Grid to prioritize communication with influential stakeholders like surgeons and MoH. Earned Value Management (EVM) was used to monitor budget adherence amidst change requests [5]. SWOT analysis evaluated the project's strengths, weaknesses, opportunities, and threats.

The strengths included pro bono expertise, ensuring cost efficiency, and strong stakeholder collaboration, which helped mitigate risks [6]. Weaknesses included the lack of a dedicated project manager, which led to coordination issues; inexperienced contracts, which increased rework risks; and weak supervision by the MoH Engineering Department, causing oversight lapses. These weaknesses correlated with risks like delays, cost overruns, and quality problems [10]. Opportunities involved public-private partnerships, potential economic recovery for additional funding, and technology adoption like Radio Frequency Identification (RFID) tracking (a possible precedent for other public projects), which could reduce risks and create advantages [7]. Threats consisted of the economic crisis, causing limited funding and straining contractor relations, pilferage/theft due to an open site, and scope creep from surgeons' ad-hoc demands, all requiring proactive mitigation.

A SWOT-Based Risk Matrix links SWOT elements to specific risks and mitigation strategies. For example, inexperienced contractors (weakness) were associated with rework delays and safety non-compliance, addressed through pre-project workshops and third-party inspections. The economic crisis (threat) posed payment delays and contractor disputes, mitigated by pre-approved payment milestones and MoH guarantees [8]. Stakeholder collaboration (strength) reduced scope conflicts through daily stand-up meetings. RFID tracking adoption (opportunity) aimed to reduce pilferage by partnering with tech firms [3]. The SWOT analysis enhanced risk management through proactive planning (early risk identification and linking to mitigation), resource allocation (prioritizing high-impact weaknesses), and improved stakeholder confidence by demonstrating structured risk evaluation and project governance [7].

Conclusions & Recommendations

The DGH Negombo OT project underscores the importance of adaptive planning, robust stakeholder communication, [6] and proactive risk management. While fiscal constraints necessitated innovative solutions, gaps in governance highlight the need for structured PM frameworks in public-sector projects [1].

The successful renovation of DGH Negombo's Operating Theatre demonstrates the critical role of adaptive project management in overcoming financial,

logistical, and operational challenges. By leveraging hybrid methodologies—combining Gantt charts for timeline precision, Stakeholder Power-Interest Grids for prioritized engagement, [10] and Earned Value Management for fiscal control, the project is almost completed within a streamlined budget of 70 million LKR

Protective risk management, interim governance adjustments, and stakeholder collaboration mitigated challenges such as contractor coordination gaps, scope creep, and material pilferage [3]. This initiative not only restored vital healthcare infrastructure but also underscored the value of integrating professional expertise with structured frameworks, offering a model for resource-constrained public-sector projects prioritizing efficiency, safety, and stakeholder alignment [6].

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