



Feasibility Study for the Muhimbili National Hospital Redevelopment in Tanzania

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Korea University Medicine Research and Business Foundation

Junglim Architecture

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This Feasibility Study was conducted by a consortium of Korea University Medicine Research and Business Foundation, Junglim Architecture and Hyundai Asan, in collaboration with the relevant institutions of the Government of Tanzania (Muhimbili National Hospital (MNH)), with support from the Economic Development Cooperation Fund (EDCF) on behalf of the Government of Tanzania. The data, reviews, and conclusions presented in this publication are those of the authors and do not necessarily reflect the official position or policies of the EDCF. This report was prepared based on the information available at the time of writing. Any actions taken based on the information provided in this report must be performed at the user's own risk. EDCF shall not be held liable for any damages arising from the use of this report by the user.

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1. Project Description

1.1. Background

- ❑ Contribution to Achieving Tanzania's Development Vision 2025 through Improving the Health of Tanzanian Citizens
 - The Tanzanian government established Tanzania's Development Vision 2025 in 2001, which serves as a foundational document for its development strategy. It outlines the direction and philosophy of Tanzania's long-term development strategy.
 - Tanzania's Development Vision 2025 prioritizes "health" as a key area contributing to the enhancement of quality of life in Tanzania. Promoting the health of its citizens is a significant factor in contributing to economic growth by strengthening physical and mental capabilities, thereby fostering increased participation in economic activities and productivity. The reconstruction of MNH-Upanga is expected to accelerate the achievement of health sector goals, directly and indirectly contributing to Tanzania's government objectives outlined in its development vision, as well as future strategies to sustain and build upon these efforts.

- ❑ Contribution to Achieving Health Sector Goals in Tanzania's Third National Development Plan (2021/22-2025/26)
 - Tanzania's Third National Development Plan (2021/22-2025/26, FYDP-III) is a short-term development plan established to realize the objectives of Tanzania's Development Vision 2025.
 - The health sector-related specific targets within Tanzania's Third National Development Plan are structured into 13 intervention areas. This project is directly associated with the construction of healthcare facilities and the provision of advanced medical services. Although the Third National Development Plan is scheduled to conclude in 2025/26, this project is expected to contribute to subsequent strategies established thereafter. Upgrading facilities and providing advanced medical services at MNH-Upanga is anticipated to indirectly contribute to reducing the outflow of patients seeking medical treatment abroad. Additionally, it is expected to indirectly contribute to early detection of infectious and chronic diseases and strengthen community-based prevention education.

- ❑ Contribution to Strategic Prioritization and Outcomes of Tanzania's Fifth Health Sector Strategic Plan (2021-2026)
 - Vision and Mission
 - The vision of Tanzania's Health Sector Strategic Plan (HSSP V, 2021-2026) is to create a healthy and prosperous society that contributes to the development of both the nation and individuals. The mission is to provide sustainable healthcare services to all citizens without financial constraints, based on regional and gender equity.

- The strategic priorities of the Health Sector Strategic Plan incorporate health sector issues outlined in Tanzania's National Health Policy (2017), with detailed expected outcomes categorized by priority. Reconstruction of MNH-Upanga is expected to facilitate achievements such as improving maternal health, reducing mortality rates from infectious and non-communicable diseases, providing infrastructure for healthcare service accessibility, and conducting research to provide evidence for policy decisions.
- Contribution to Reducing Tanzania's Disease Burden through Redevelopment of MNH-Upanga
- Leading Causes of Death
 - Analysis of the top 20 causes of death in Tanzania revealed stroke as the highest, followed by heart disease, influenza and pneumonia, HIV/AIDS, and tuberculosis. Among these, road accidents, malaria, cervical cancer, maternal mortality, and esophageal cancer rank high globally.
 - Tanzania's leading causes of death include non-communicable diseases such as stroke, cancer, hypertension, diabetes, and trauma. The healthcare services provided by MNH-Upanga (including prevention, diagnosis, treatment, and rehabilitation) can help alleviate Tanzania's disease burden caused by acute conditions requiring complex medical services (such as myocardial infarction and stroke) and chronic illnesses.
 - Top 10 Cancer incidence and mortality
 - Analysis of Tanzania's top 10 cancer incidence and mortality reveals cervical cancer as the highest in both incidence and mortality, followed by prostate cancer, breast cancer, esophageal cancer, and colorectal cancer, in that order.
 - The similarity in rankings between incidence and mortality rates indicates delays in early diagnosis and intervention for these diseases. It is expected that MNH-Upanga can enhance early cancer detection through MRI and strengthen treatment outcomes through chemotherapy, thereby improving survival and recovery rates.

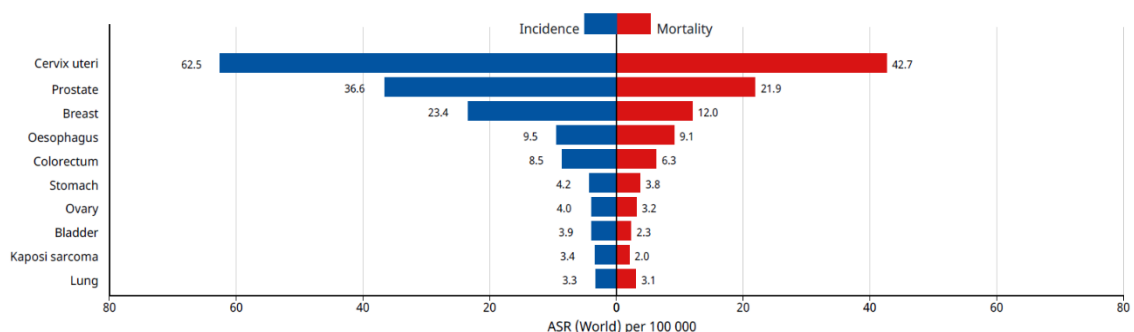


Figure 1. Top 10 Age-Standardized Cancer Incidence and Mortality Rates (per 100,000 population)

Source: Globocan 2020

- Contribution to Achieving Tanzania's SDG3 (Good Health and Well-being)
 - According to the Sustainable Development Goals (SDGs) progress report released in 2023, significant issues reported as major or important challenges include maternal mortality, neonatal mortality, tuberculosis incidence, road accidents, adolescent birth rate, and births attended by skilled health personnel. Maternal mortality, neonatal mortality, under-5 child mortality, and infectious disease indicators (TB, HIV) have shown improving trends towards achieving SDG targets from 2015 to 2022, but remain significant health issues.
 - Non-communicable disease-related SDG targets show stagnation or decline. Age-standardized mortality rates due to cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases show stagnating trends towards SDG achievement, while deaths due to road accidents are decreasing.
 - Redevelopment of MNH-Upanga to provide modern healthcare facilities and advanced medical services to high-risk maternal, neonatal, pediatric, infectious, and non-communicable disease patients visiting tertiary hospitals is expected to contribute to reducing disease burden and achieving SDG 3 goals.

- Contributing to Reducing Patient Outflow from Tanzania
 - Tanzanian patients seeking treatment abroad are often those with severe conditions, preferring the higher quality of medical services available abroad due to challenges in accessing adequate treatment within Tanzania. India, Singapore, and Kenya are commonly visited countries for medical care, with India accounting for the majority of cases.
 - Through this project, upgrading MNH-Upanga to a quaternary healthcare facility capable of providing advanced medical services aims to reduce economic losses due to patient outflow and mitigate safety concerns for patients during international travel.

- Modernization and Infrastructure Expansion Needs of MNH-Upanga as a Super-Specialised Healthcare Institution
 - Since its establishment in 1910, MNH-Upanga has undergone continuous construction and renovations across its buildings as Tanzania's population and healthcare demands have increased. Throughout this process, the hospital has faced challenges such as space constraints, aging buildings and equipment, and structural inefficiencies.
 - (Space Constraints) The hospital facilities, including beds, outpatient spaces, parking areas, and medical staff research labs, are inadequate to meet the current patient demand. As a National-level hospital, MNH-Upanga receives over 1,500 outpatient visits daily, highlighting the limitations of its current infrastructure.
 - (Aging Buildings and Equipment) Many buildings at the hospital have exceeded 30 years since their construction, leading to issues such as leaks, deteriorating roofs,

exterior damage, and wall cracks. Moreover, there are medical devices beyond their lifespan or outdated, necessitating the supply of new medical equipment to provide specialized medical services.

- (Structural Inefficiencies) Partial renovations and constructions over the hospital's operational history have resulted in structural inefficiencies. The hospital operates open-space ward layouts due to structural issues, raising concerns among medical staff about cross-infection and patient safety. Outpatient buildings are located north of the hospital site, separate from diagnostic, treatment, and inpatient facilities, causing inconvenience and inefficiencies in patient flow, particularly for severe cases navigating multiple buildings.
- Given the current dispersed layout, efficiency improvements through remodeling and partial constructions are limited. To meet Tanzania's unmet healthcare demands effectively and enhance hospital operations, there is a pressing need for the construction of a modern hospital and expansion of infrastructure through this project.

1.2. Project Objective

- ❑ Contributing to improved health standards of Tanzanian citizens through the redevelopment of MNH-Upanga with modern hospital infrastructure, advanced medical equipment and Hospital Information System (HIS) to provide super-specialized and patient-centered medical services
- ❑ Strengthening the role of MNH-Upanga as Tanzania's quaternary hospital, enhancing healthcare delivery systems and efficiency within the local community
- ❑ Contributing as a training hospital to foster high-quality medical professionals and enhance healthcare professionals' capacities as a center for medical education institutions

1.3. Project Scope

- ❑ The scope of EDCF support for MNH-Upanga in Tanzania can be categorized into procurement and consulting services.
- The procurement includes: 1) Redevelopment of MNH-Upanga with 1,301 beds, 2) Supply of medical equipment, 3) Hospital Information System (HIS) supply (software and hardware).
- The consulting services encompass: 1) Architectural design, Construction Supervision, 2) Medical planning, hospital operation consulting, and capacity building, 3) Medical equipment consulting, and 4) HIS consulting.

2. Project Area

2.1. Project Area

□ Project Site Location

- The project site is located within MNH-Upanga, and it is situated in the Dar es Salaam.
- MNH-Upanga's address is Malik Rd, Dar es Salaam; it is located in Upanga, Ilala which is at the center of Dar es Salaam.
- MNH-Upanga is located approximately 395 km (about 8 hours by car) from the administrative capital, Dodoma. It is about 23.7 km (about 55 minutes by car) from MNH-Mloganzila and about 11 km (about 35 minutes by car) from Julius Nyerere International Airport.
- The main access roads to MNH-Upanga are Ali Hassan Mwinyi Road to the east, Morogoro Rd to the west, and United Nations Road (UN Rd) to the south.

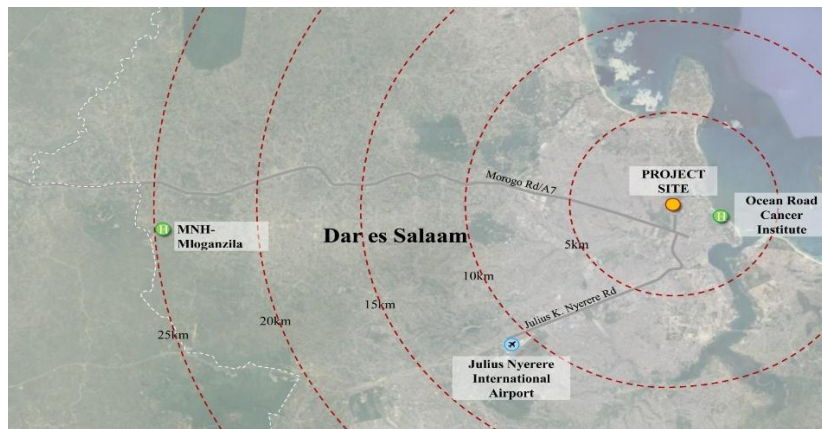


Figure 2. Project Site Location

Source: Prepared by the F/S team, based on data from Google.

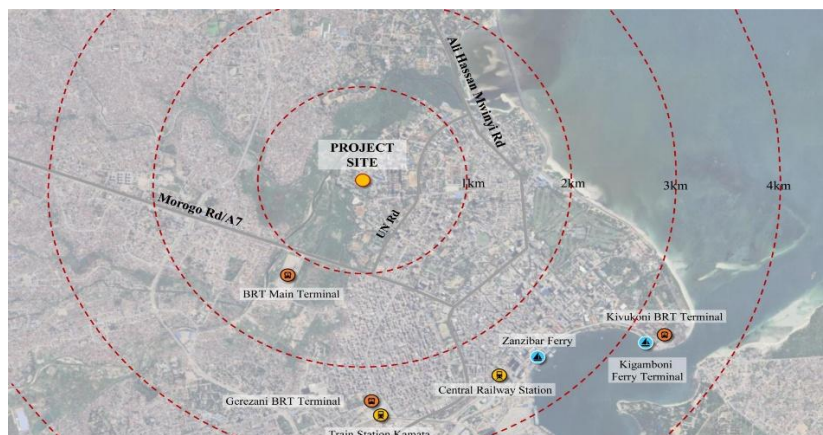


Figure 3. Main Access Routes to the Project Site

Source: Prepared by the F/S team, based on data from Google.

2.2. Analysis of Project Site

□ Analysis of the MNH-Upanga site

- Surrounding the main MNH-Upanga are the Muhimbili Orthopedic and Neurosurgery Institute (MOI), Jakaya Kikwete Cardiac Institute (JKCI), Muhimbili University of Health and Allied Sciences (MUHAS), and the School of Dentistry, each operated by different entities.
- The MNH-Upanga is bordered by the Msimbazi River on the northwest, and it is adjacent to Kalenga Street on the east, and Malik Road on the south.
- The site has easy accessibility to the main roads leading to the central business district of Dar es Salaam, facilitating convenient access to surrounding areas. Within about 1 km radius of MNH-Upanga, there are numerous educational facilities including MUHAS, as well as several diplomatic missions.
- There are a total of three entrances to the MNH-Upanga. The main entrance is next to the Malik Road and the secondary entrances located southwest and northeast of the main entrance.
- The main entrance is exclusively used for entry; the northeast entrance is exclusively used for exit only. While the southwest entrance is used for both entry and exit.
- Building of MNH-Upanga is divided by functions such as wards, emergency rooms, religious facilities, staff accommodations, and research facilities, most of which are deteriorating.

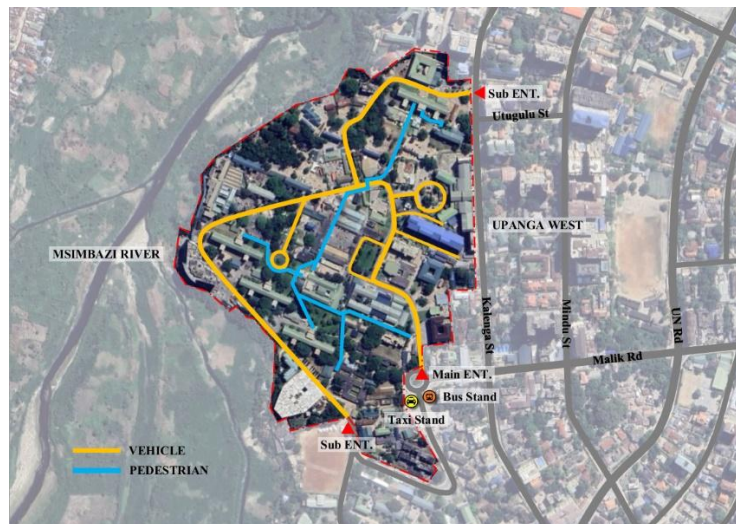


Figure 4. Location of MNH-Upanga and Access Roads
Source: Prepared by the F/S team, based on data from Google.

□ Land Use Strategy

- The existing project outline (PCP, Project Concept Paper)¹ divides the Muhimbili National Hospital redevelopment plan into eight zones. The plan includes the construction of major hospital facilities (A1, A2, C buildings) and support facilities (B building) in Zones 2 and 3.
 - Buildings A1 and A2: Emergency Department, Radiology, Laboratory, Rehabilitation Room, Mortuary, Surgical Department, etc.
 - Building B: Support facilities such as Laundry, Main Kitchen, Generator Room, Incinerator, Workshop, Boiler Room, etc.
 - Building C: Outpatient Clinic Building, Inpatient Wards, Administrative and Support Departments, etc.

□ Project site specifics

- (Topography) MNH-Upanga site is 19~25m above the sea level², it features a wide expansive land with level and flat elevation.
- (Geology) The project site is currently operational with buildings in use, which presents challenges for geological surveys and raises safety concerns due to heavy vehicle and visitor traffic. Therefore, the analysis is based on the geological survey report of the VIP wards currently under construction adjacent to the project site. According to the geological survey report, the hospital site consists of coarse sand mixed with clayey/silty sand reaching 11 meters underground. From a depth of 20 meters underground, weathered coral limestone gravel mixed with sand silt/clay is distributed. The soil bearing capacity for foundations ranges from 100 to 150 kN/m². The groundwater level is typically found at an average depth of 3.5 to 4.5 meters.
- (Water supply) The primary water supply is provided by the Lower Ruvu and Upper Ruvu pipelines managed by the Dar es Salaam Water and Sewerage Authority (DAWASA), with additional water sourced from groundwater drilling.³ The main water tank and pump room are located next to the under-construction VIP building. Water is supplied from the main water pump room to individual tanks of each facility.
- (Sewage system) MNH-Upanga is responsible for operation and maintenance and they have a central sewage system.⁴ Basically it is connected to the city's municipal sewage system, ultimately discharging to the Indian Ocean. It has been verified that

¹ LAND REDEVELOPMENT PROJECT CONCEPT NOTE, 2023.6

² THE MUHIMBILI NATIONAL HOSPITAL(MNH) 2020-2040 MASTERPLAN, 2021.2

³ THE MUHIMBILI NATIONAL HOSPITAL(MNH) 2020-2040 MASTERPLAN, 2021.2

⁴ Same as above

an EDCF project for a wastewater treatment facility is in progress in the Dar es Salaam region. If this project begins after the completion of the EDCF wastewater treatment facility, the wastewater treatment plan for this project may be subject to change. Therefore, it is imperative for the contractor to assess these potential impacts thoroughly prior to proceeding with the project.

- (Electrical power supply) Main supply of power is Ilala substation, where 132kV is extended and transformed to medium voltage level.⁵ The JNHPP hydroelectric power plant with 2,115MW is scheduled to complete construction in 2024, currently in the process of connecting the electricity.
- (Roads) The traffic roads are within the hospital paved with a width of 6-8 meters, without the center lane dividing line. The roads, connected to the northeast side entrance, are often congested with vehicles waiting to exit. Therefore, the Contractor in consultation with MNH-Upanga should establish a dedicated traffic route plan for construction vehicles in order to minimize changes to the existing traffic system, considering pedestrian safety, and minimizing the increase in vehicle congestion.

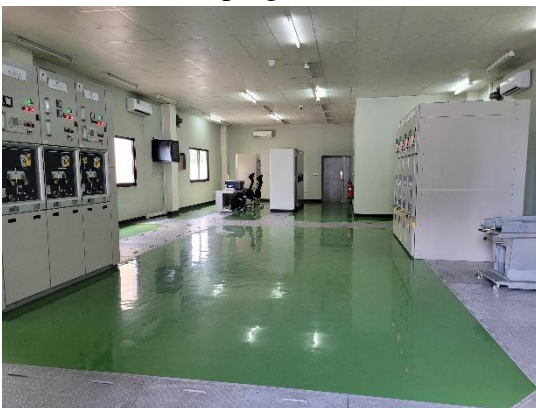
MNH-Upanga – Water tank



MNH-Upanga – Pump room



MNH-Upanga - Substation



MNH-Upanga – Main entrance



MNH-Upanga – Secondary entrance 1

MNH-Upanga – Secondary entrance 2

⁵ THE MUHIMBILI NATIONAL HOSPITAL(MNH) 2020-2040 MASTERPLAN, 2021.2



Figure 5. Current MNH-Upanga Infrastructure Picture.

Source: Summary prepared by the F/S Team based on on-site investigation.

□ Land Ownership and Area of MNH-Upanga

- The project site is located within Plot No. 1048/3, which is currently leased and owned by the MNH-Upanga from the government. The site area of Plot No. 1048/3 is estimated to be 17.1724 hectares (171,724 m²), as determined from the cadastral map provided by the MNH-Upanga.

2.3. Medical Catchment Area

□ Scope of medical catchment area

- The scope of medical catchment area for MNH-Upanga has been agreed upon as providing services nationwide in Tanzania, functioning as the quaternary national hospital.
 - Medical catchment area is categorized into primary catchment area, secondary catchment area, and tertiary catchment area depending on the type of medical service patients utilize.
 - The Lake zone, Western zone, South West Highlands zone, and Southern Highlands zone primarily lack hospitals at the tertiary level or have a situation where the hospitals are overwhelmed by the population it serves, indicating that the medical catchment area of MNH-Upanga should target the entire nation.

Table 1. Population status by region in Tanzania and distance to MNH-Upanga

S/N	Zone	Region	Population (2022)	Distance to MNH (Hours)
1	Central Zone	Dodoma	3,085,625	451km (7h 44m)
2		Singida	2,008,058	696km (11h 15m)

S/N	Zone	Region	Population (2022)	Distance to MNH (Hours)
3		Manyara	1,892,502	707km (11h 14m)
4	Eastern Zone	Dar es Salaam	5,383,728	5.2km (12m)
5		Morogoro	3,197,104	195km (3h 37m)
6		Pwani	2,024,947	36km (51m)
7	Lake Zone	Mwanza	3,699,872	1,134km (18h 9m)
8		Kagera	2,989,299	1,414km (21h 37m)
9		Geita	2,977,608	1,160km (19h 6m)
10		Mara	2,372,015	1,287km (20h 15m)
11		Shinyanga	2,241,299	986km (15h 43m)
12		Simiyu	2,140,497	1,122km (17h 43)
13	Northern Zone	Tanga	2,615,597	336km (5h 42m)
14		Arusha	2,356,255	626km (10h 29m)
15		Kilimanjaro	1,861,934	549km (8h 50m)
16	South West Highlands	Mbeya	2,343,754	825km (14h 46m)
17		Rukwa	1,540,519	1,145km (19h 55m)
18		Songwe	1,344,687	889km (16h 6m)
19		Katavi	1,152,958	1,188km (17h 37m)
20	Southern Highlands Zone	Ruvuma	1,848,794	1,056km (15h 21m)
21		Iringa	1,192,728	496km (8h 53m)

S/N	Zone	Region	Population (2022)	Distance to MNH (Hours)
22		Njombe	889,946	740km (13h 44m)
23	Southern Zone	Mtwara	1,634,947	561km (8h 19m)
24		Lindi	1,194,028	457km (6h 55m)
25	Western Zone	Tabora	3,391,679	831km (13h 27m)
26		Kigoma	2,470,967	1,247km (19h 58m)
27	Zanzibar zone	Mjini Magharibi	893,169	99km (2h 43m)
28		Pemba North	272,091	194km (4h)
29		Pemba South	271,350	176km (4h)
30		Unguja North	257,290	116km (3h 2m)
31		Unguja South	195,873	99km (2h 43m)

Source: Census Information Dissemination Platform of Tanzania National Bureau of Statistics webpage (<https://sensa.nbs.go.tz/>) (2024.01.11. accessed)

* F/S Team used Google Maps for distance and time measurements (from MNH-Upanga to each regional government office)

- To ensure comprehensive patient referral in line with Tanzania's healthcare system, monitoring of nearby tertiary and quaternary hospitals' status and establishment of a coordinated referral system with MNH-Upanga is essential.
- MNH-Upanga is approximately a 1-hour drive from Dar es Salaam, where 3 out of 5 specialized quaternary hospitals are located nearby. Within the MNH-Upanga, the Muhimbili Orthopaedic Institute (MOI) and Jakaya Kikwete Cardiac Institute (JKCI) are situated, while the Ocean Road Cancer Institute (ORCI) is within a 15-minute drive.

3. Project Executing Agency and Project Implementation Unit

3.1. Project Executing Agency (PEA)

□ Duties and responsibilities

- The Project Executing Agency (PEA) is responsible for monitoring during the planning and implementation stages of the project. It reviews and approves F/S reports and coordinates with the Tanzania Ministry of Finance and Ministry of Health.

□ Key stakeholder analysis

- The key stakeholders of this project in Tanzania include government ministries (Ministry of Finance, Ministry of Health, Ministry of Education), Muhimbili University of Health and Allied Sciences (MUHAS), and major hospitals (MNH-Mloganzila, quaternary-level specialized hospitals, and regional/zonal hospitals).

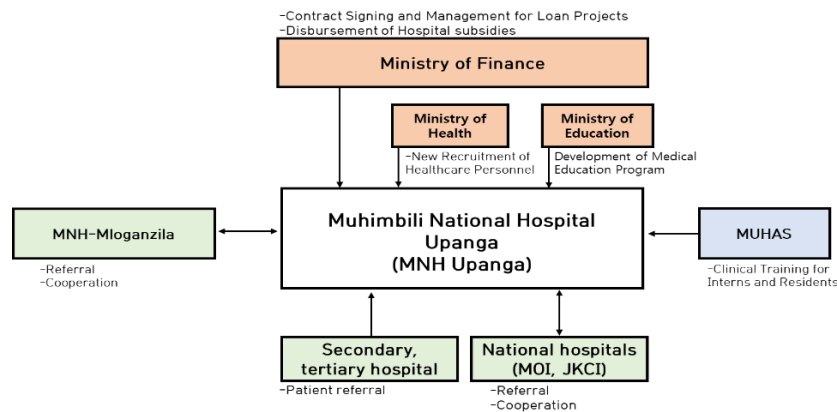


Figure 6. Key stakeholders

□ Project implementation capacity of the PEA

- Muhimbili National Hospital (MNH) has extensive experience in executing various hospital construction projects. Notable completed and ongoing projects include the New Outpatient Department (NOPD), the In Vitro Fertilization (IVF) Center, and the Private and VIP Wards. Additionally, the Transplantation Center at MNH-Mloganzila is currently under development.

3.2. Project Implementation Unit (PIU)

□ Composition of the PIU

- MNH-Upanga has constituted a task force team responsible for the Redevelopment Plan as the PIU for this project. The PIU currently consists of medical staff working at the hospital, experts in each field including environmental and social impact assessment specialists, and procurement officers.

4. Project Implementation Plan

4.1. Medical Plan

4.1.1. Functions and Roles of the Hospital

- Functions and roles of the MNH-Upanga
 - As the highest-level referral hospital, it provides advanced medical services for complex and severe diseases that primary, secondary, and tertiary hospitals are unable to treat.
 - In addition to existing departments, new specialties will be established to meet unmet medical needs in Tanzania, including Transplant and Vascular Surgery, Endocrinology Surgery, a Burn Center, Geriatrics, and Palliative Care. These additions aim to strengthen essential advanced medical services in the country.
 - MNH-Upanga is the largest training hospital in Tanzania, providing internships and residency programs to train interns and residents. Through Continuous Professional Development (CPD), it aims to cultivate specialized medical personnel with advanced knowledge and skills.
 - As the highest-level medical institution in Tanzania's healthcare delivery system, MNH-Upanga provides sophisticated medical services for severe diseases. Its role focuses on reducing the burden of disease from a perspective of fatality and mortality rates, rather than just prevalence and incidence, fulfilling its function as the top national referral hospital.

4.1.2. Bed Capacity

- Bed capacity estimation
 - Assuming a bed utilization rate of 90%, the estimated bed demand and supply for MNH-Upanga indicate that the hospital will require 1,298 beds in 15 years.

Table 2. Estimated hospital bed scale

Year	Actual hospitalized Patients per year	Calculation of Hospital Bed Demand			Remark
		Estimated no. of beds required (A)	No. of beds to be supplied (B)	Additional number of beds required (C)=(A)-(B)	
2023/24	41,192	815	0	815	
2024/25	42,491	841	0	841	
2025/26	43,831	867	0	867	
2026/27	45,213	895	0	895	

Year	Actual hospitalized Patients per year	Calculation of Hospital Bed Demand			Remark
		Estimated no. of beds required (A)	No. of beds to be supplied (B)	Additional number of beds required (C)=(A)-(B)	
2027/28	46,638	923	0	923	
2028/29	48,108	952	0	952	
2029/30	49,625	982	0	982	
2030/31	51,190	1,013	0	1,013	
2031/32	52,804	1,045	0	1,045	
2032/33	54,469	1,078	0	1,078	
2033/34	56,186	1,112	0	1,112	10 years later
2034/35	57,957	1,147	0	1,147	
2035/36	59,785	1,183	0	1,183	
2036/37	61,669	1,220	0	1,220	
2037/38	63,614	1,259	0	1,259	
2038/39	65,619	1,298	0	1,298	15 years later
2039/40	67,688	1,339	0	1,339	
2040/41	69,822	1,382	0	1,382	
2041/42	72,024	1,425	0	1,425	
2042/43	74,294	1,470	0	1,470	

Source: Analyzed by F/S team

❑ Total bed capacity of MNH-Upanga after redevelopment

- Through this project, the new building will include 1,301 beds and 100 baby cots in the general neonatal ward. The 356 beds in the pediatrics department are not included in the project scope, so the New Pediatric Complex (NPC) will remain and continue to be used as is. Therefore, the total bed capacity of MNH-Upanga after reconstruction will be 1,757 beds, an increase of 322 beds compared to the current 1,435 beds in use.

Table 3. Total number of beds after the redevelopment of MNH-Upanga

Department		No. of beds per ward		No. of ward	Sub total	Total	Remark
Standardized	General ward (5 beds)	30	40	26	1,040	1,301	

Department		No. of beds per ward	No. of ward	Sub total	Total	Remark
General ward	IPPM (2 beds)	4				Included in the scope of the Redevelopment Project
	IPPM (private)	2				
	HDU (4 beds)	4				
Hematology	General ward (5 beds)	15	26	1	26	
	IPPM (private)	2				
	Clean room for BMT	5				
	HDU (4 beds)	4				
Isolation ward (infectious disease)	General ward (5 beds)	10	23	2	46	
	IPPM (private)	4				
	Negative Pressure	5				
	HDU (4 beds)	4				
Psychiatry ward	General ward (5 beds)	30	36	2	72	
	IPPM (private)	2				
	HDU (4 beds)	4				
VIP	VIP	6	7	1	7	
	Presidential	1				
ICU	MICU	20	110	1	110	
	SICU	25				
	OTICU	10				
	MAICU	15				
	NICU	30				
	Burn unit ICU	10				
Baby cot		-	-	100		
NPC (New Pediatric Complex)		-	-	356	NPC is not included in the scope of the project. The existing building will not be demolished and will continue to be used.	
Total		-	-	1,757	There will be an increase of 322 beds compared to the existing 1,435 beds.	

4.1.3. Composition of Clinical Departments

- Medical departments of MNH-Upanga after the redevelopment
 - After the redevelopment, the departments of the MNH-Upanga are as follows.

Table 4. Medical department of MNH-Upanga after the redevelopment

Medical department	Details of department
Internal Medicine (19 Medical Dept.)	Internal Medicine, Neurology, Pulmonology, Hematology, Rheumatology, Endocrinology, Nephrology, Infectious diseases, Dermatology, Cardiology, Oncology, Gastroenterology, Geriatric, Palliative, Pediatrics & child health, Psychiatry & mental health, Emergency medicine, Critical care, Rehabilitation medicine
Surgery (16 Medical Dept.)	General Surgery, Plastic and Reconstructive Surgery, Thoracic, Gastroenterology, Endocrine Surgery, Pediatric Surgery, Transplant and vascular, Burn Centre, Orthopedics, Neurosurgery, Urology, Obstetrics and gynecology, Ophthalmology, Dental, Otorhinolaryngology, Anesthesia
Clinical Support Services	Pharmacy, Radiology, Anatomical pathology, Diagnostic laboratories

- Key Changes in Medical Departments
 - The composition of medical departments⁶ has become more diverse with the addition of new departments or units that did not previously exist. Some units previously under departments have been upgraded to departments, enhancing the authority and autonomy of these specialties compared to the previous structure.
- Newly established medical departments
 - A total of seven medical department and centers will be added through Redevelopment of MNH-Upanga: Geriatric Medicine, Palliative Care, Endocrine Surgery, Transplant and Vascular Surgery, a Burn Center, Orthopedic Surgery, and Neurosurgery.
 - While medical services for Endocrine Surgery, Geriatric Medicine, Palliative Care, and the Burn Center are currently being provided, there is high medical demand leading to unmet needs. The MNH-Upanga has requested the establishment of new

⁶ A department is a higher-level organizational concept than a unit. According to the Muhimbili National Hospital Act (2000), heads of departments are responsible for the functions and roles of their departments, supporting and supervising internal operations. Department heads are appointed by the board and have a duty to report to the hospital director.

departments or units to secure personnel (especially specialized doctors) and to enhance the functions and roles of these departments.

- Burn Center, Orthopedics, and Neurosurgery correspond to tertiary and higher levels of care as mentioned in the Tanzanian guidelines for tertiary and quaternary health facilities (HOSPITAL AT LEVEL III & IV AND SPECIALISED CLINICS AT LEVEL III, 2017).

□ Composition of medical departments

- The medical departments provide direct medical services to patients, including prevention, diagnosis, treatment, and rehabilitation. Following the redevelopment, the detailed composition and major functions of the internal medicine and surgery departments at MNH-Upanga are as follows.

Table 5. Composition and major functions of departments at MNH-Upanga

Dep.	No.	Department	After redevelopment	Functions
Internal Medicine	1	Internal Medicine	Department	General Outpatient Services
	2	Neurology	Department	Stroke Treatment and Rehabilitation
	3	Pulmonology	Department	Bronchoscopy and Pulmonary Function Tests (Including Plethysmography)
	4	Hematology	Department	Sickle Cell Disease (SCD) Treatment and Hematopoietic Stem Cell Transplantation
	5	Rheumatology	Department	Autoimmune Diseases Treatment and Joint Injections, Rheumatic Fever Care
	6	Endocrinology	Department	Diabetology and Treatment of Diabetic Foot Diseases
	7	Nephrology	Department	Dialysis and Kidney Transplantation (Internal Medicine)
	8	Infectious diseases	Department	Treatment of HIV, Tuberculosis, and Tropical Diseases, Infection Control, Isolation(negative pressure) ward
	9	Dermatology	Department	Surgical Procedures Including Laser Treatments and Dermatopathology, Phototherapy

Dep.	No.	Department	After redevelopment	Functions
	10	Cardiology	Department	ECG, Heart Failure Treatment, Pacemaker Implantation
	11	Oncology	Department	Chemotherapy
	12	Gastroenterology	Department	Endoscopic Procedures
	13	Geriatric	Department	Comprehensive Geriatric Assessment and Frailty Management, Geriatric Rehabilitation
	14	Palliative	Department	Pain Management, End-of-life Care, Symptom Relief for Terminal Patients
	15	Pediatrics & child health	Department	Pediatric Outpatient Services, Immunizations, Pediatric Intensive Care Unit
	16	Psychiatry & mental health	Department	Child and Adolescent Psychiatry, Addiction Medicine, Geriatric Psychiatry, Occupational Therapy, and Neuropsychiatry
	17	Emergency medicine	Department	Adult and Pediatric Emergency Care, Emergency Response Units
	18	Critical care	Department	Internal Medicine ICU, Surgical ICU, Neonatal ICU, Maternal ICU, Transplant ICU, Burn ICU
	19	Rehabilitation medicine	Department	Physical Therapy, Occupational Therapy, Women's Rehabilitation, Burn Rehabilitation, Sports Medicine, Cancer Rehabilitation
Surgery	1	General Surgery	OPD only	General surgeries, Outpatient Services
	2	Plastic and Reconstructive Surgery	Department	Cosmetic Surgery and Cancer Reconstruction Surgery
	3	Thoracic	Department	Thoracic Surgery, Lung Cancer Treatment, Chest Wall Reconstruction
	4	Gastroenterology	Department	Gastrointestinal Surgery, Hepatobiliary Surgery
	5	Endocrine Surgery	Department	Thyroidectomy, Parathyroid Surgery, Adrenalectomy, Pancreatic Surgery

Dep.	No.	Department	After redevelopment	Functions
	6	Pediatric Surgery	Department	Pediatric Congenital Anomalies, Pediatric Trauma Surgery, Pediatric Urological Surgery
	7	Transplant and vascular	Department	Organ Transplantation (Liver, Kidney), Vascular Bypass Surgery, Aneurysm Repair
	8	Burn Centre	Department	Comprehensive Burn Care, Skin Grafting, Burn Rehabilitation, Scar Management
	9	Orthopedics	Department	Joint Replacement, Fracture Management, Spinal Surgery,
	10	Neurosurgery	Department	Brain Tumor Surgery, Spinal Surgery
	11	Urology	Department	Kidney Transplantation, Laparoscopic Surgery, Treatment of Sexual Dysfunction/Infertility, Urological Reconstruction Surgery
	12	Obstetrics and gynecology	Department	Endoscopic Surgery (Minimally Invasive Surgery), Gynecological Oncology, Pelvic Reconstruction, Infertility Clinic (Including IVF), Adolescent Care, Menopause Care
	13	Ophthalmology	Department	Pediatric Ophthalmology, Amblyopia, Strabismus, Retinal Surgery, Glaucoma, Cataracts, Ocular Oncology, External Eye Diseases, Ophthalmic Examinations, Neuro-Ophthalmology
	14	Dental	Department	Oral and Maxillofacial Surgery, Periodontics, Prosthodontics, Endodontics, Orthodontics
	15	Otorhinolaryngology	Department	Otolaryngology (ENT), Rhinology, Laryngology, Allergy Clinic, Cochlear Implants
	16	Anesthesia	Department	General Anesthesia, Local Anesthesia, Pediatric Anesthesia, Epidural Anesthesia (for Labor), Thoracic Surgery Anesthesia, Transplant Surgery Anesthesia

- Outpatient consultation rooms
 - The current NOPD (New OPD) building contains 67 outpatient rooms. The building will continue to be used even after the new building is constructed and does not need to be demolished.
 - The new building, which is planned as part of this project, will include 100 outpatient rooms.

- Clinical support departments
 - Clinical Support Departments are responsible for providing diagnostic and treatment services.
 - Clinical Support Departments include Pharmacy, Radiology, Pathology (tissue examinations, cytology, immunological tests, molecular tests, and autopsies), and Laboratory Medicine.
 - Pathology is responsible for diagnosing pathological changes in the morphology of organs and tissues due to disease and provides medical information necessary for treatment and prevention. For its role as a teaching hospital, the pathology department includes an autopsy room.
 - Laboratory Medicine performs tests using substances from the human body, such as blood, urine, stool, body fluids, and amniotic fluid, to facilitate early disease detection, diagnosis, monitoring of disease progression, assessing treatment effectiveness, and determining prognosis.

Table 6. Composition and major functions of clinical support services at MNH-Upanga

No.	Department	After redevelopment	Functions
1	Pharmacy	Department	Medication Management, Supply Chain Management, Quality Control
	IPD pharmacy	Unit	Prescription Filling and Medication Administration for Inpatient
	OPD pharmacy	Unit	Prescription Filling and Medication Administration for Outpatient
	Central drug store	Unit	Drug Receiving, Inspection, and Classification; Distribution of Medications for OPD and IPD, Quality Control
	Central surgical	Unit	Prescription Filling and Medication Administration for Operating Rooms and Recovery Rooms
	Clinical pharmacy	Unit	Medication Information Management and Treatment Monitoring

No.	Department	After redevelopment	Functions
	Advanced compounding production	Unit	Aseptic Preparation of Chemotherapy and Nutritional Infusions; Production, Management, and Dispensing of Pharmacy Preparations
2	Radiology	Department	Imaging Services and Interventional Procedures
	Diagnostic radiology	Unit	Diagnostic Imaging (X-rays, CT scans, MRI, Ultrasound)
	Intervention radiology	Unit	Minimally Invasive Procedures Including Diagnostic Angiography
3	Anatomical pathology	Department	Pathological Diagnosis and Analysis
	Cytopathology	Unit	Diagnosis of Diseases at the Cellular Level (Pap Smear, FNAC)
	Histopathology	Unit	Tissue Examination for Disease Diagnosis, Biopsy Analysis
	Immunopathology	Unit	Immune System Disorders Diagnosis, Immunohistochemistry
	Molecular Pathology	Unit	Genetic and Molecular Testing for Disease Diagnosis
4	Diagnostic laboratories	Department	Laboratory Testing and Diagnostics
	Clinical Chemistry	Unit	Blood and Urine Analysis, Biochemical Testing
	Blood bank	Unit	Blood Collection, Storage, and Transfusion Services
	Hematology	Unit	Blood Disorders Testing, Complete Blood Count (CBC), Coagulation Tests
	Bacteriology	Unit	Microbiological Testing, Bacterial Infection Detection
	Serology	Unit	Antibody Testing, Infectious Disease Diagnosis
	Parasitology	Unit	Detection and Diagnosis of Parasitic Infections
	Histology	Unit	Microscopic Examination of Tissues for Disease Diagnosis
	Molecular biology	Unit	DNA/RNA Testing for Genetic Disorders and Infectious Diseases
	Immunology	Unit	Immune System Function Testing, Autoimmune Disease Diagnosis

❑ Nursing department

- The Nursing Department operates with the goal of standardizing nursing practices and improving the quality of care within the hospital. It is comprised of Nursing and Housekeeping, Social Welfare, Central Sterilization, and Midwifery and Productive services.

❑ Other departments

- The Other Departments include various facilities such as the Mortuary, Cafeteria, Laundry, Tailor, Incinerator, Medical Engineering, and Printing Room.

4.1.4. Hospital Operational Plan

❑ Hospital organizational chart

- The draft organizational chart reflects additions and changes to the departments based on the existing organizational structure of MNH-Upanga.

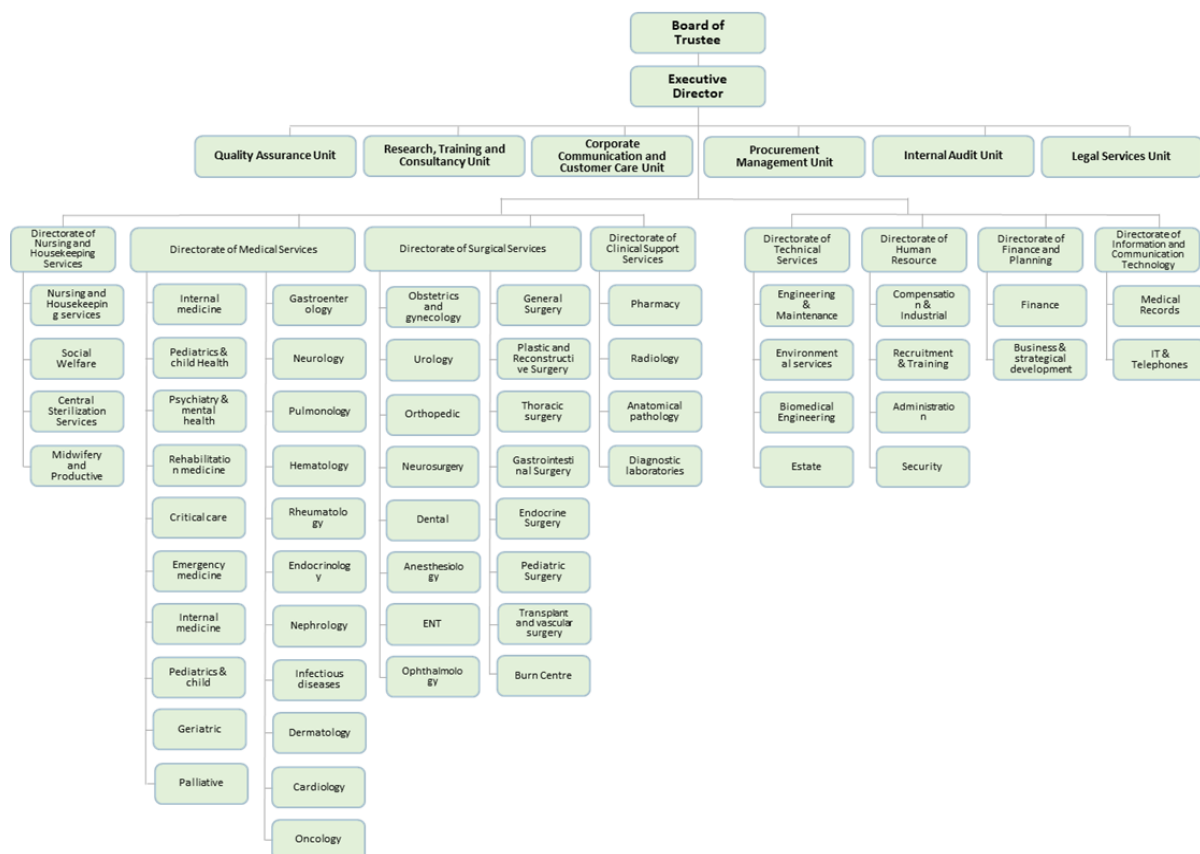


Figure 7. Organizational chart of MNH-Upanga after redevelopment

□ Hospital staffing plan

- Staffing Status of MNH-Upanga and 2024/25 New Recruitment Plan
 - The current number of staff members is 2,929. Following the new recruitment for 2024/25, approved by the Ministry of Health, the total will rise to 3,249 with an addition of 320 staff members.

Table 7. Staffing Status of MNH-Upanga and 2024/25 New Recruitment Plan

Classification	Current Staffing (As of May 2024)	New Recruitment Planned for 2024/25 (Approved by the Ministry of Health)	Total After Recruitment
Medical officers ⁷	131	40	171
Specialists	414	10	424
Nurses	1,643	142	1,785
Pharmacists	43	8	51
Physical Therapists	44	6	50
Medical Engineers	18	5	23
Medical Technologists	150	33	183
Hospital Management	6	-	6
Training and Education Staff	8	-	8
Administrative Department	362	50	412
Support Departments	110	26	136
Total	2,929	320	3,249

Source: MNH-Upanga Human Resources Team (Received May 3, 2024; Document Title: SCHEDULE OF PERSONAL EMOLUMENTS (ESTABLISHMENT AND STRENGTH))

⁷ Including Assistant Medical Officer (AMO)

- Overview of staffing plan
 - The numbers of additional staffmembers due to the establishment of new departments and the increase in bed capacity are 18 and 295 respectively.

Table 8. Overview of staffing plan of MNH-Upanga

Classification	Medical personnel	No. of staffs required	
Additional staffing for new departments	Specialist	13	18
	Nursing Officer	5	
Additional staffing due to increase in bed capacity	Enrolled Nurse (EN)	19	295
	Assistant Nursing Officer (ANO)	110	
	Nursing Officer (NO)	44	
	Health Assistant	69	
	Medical officer	22	
	Pathology technologist	13	
	Pharmacist	13	
	Admin. Staff (Health records)	3	
	Admin. Staff (Receptionists)	2	
Total		313	

- Key consideration for staffing of MNH-Upanga
 - In Tanzania, the lack of statistical data on the number of doctors has resulted in ineffective planning for physician placement in both the public and private sectors. Additionally, the lengthy hiring process for doctors in the public sector is identified as a significant barrier compared to the private sector.
 - Given that the Ministry of Health is responsible for the deployment and management of medical personnel in Tanzania, for newly established and strengthened departments such as Orthopedics, Neurosurgery, Geriatrics, and Palliative Care, recruitment should be completed before the trial operation begins, which is one year prior (Preparation for invitation training (2 months), Training in South Korea (6 months), Return to Tanzania and preparation for duties (1 month), Relocation preparation (1 month), Relocation and installation (2 months).

- Estimation of annual patient volume after redevelopment
 - Upon the completion of the redevelopment at MNH-Upanga, the hospital will accommodate approximately 947,160 patients annually (78,930 inpatients and 868,230 outpatients) in the first year of operation.

Table 9. Estimation of annual patient of MNH-Upanga

Year	Average Length of Stay	Bed Occupancy Rate	Inpatient Numbers	Outpatient Numbers	Total Patient Numbers
1st year	6.5	80%	78,930	868,230	947,160
2nd year	6.5	80%	78,930	868,230	947,160
3rd year	6.5	85%	83,863	922,493	1,006,356
4th year	6.5	85%	83,863	922,493	1,006,356
5th year	6.5	90%	88,797	976,767	1,065,564
6th year	6.5	90%	88,797	976,767	1,065,564
7th year	6.5	90%	88,797	976,767	1,065,564
8th year	6.5	90%	88,797	976,767	1,065,564
9th year	6.5	90%	88,797	976,767	1,065,564
10th year	6.5	90%	88,797	976,767	1,065,564

4.2. Construction Plan

- Project Brief of MNH-Upanga Reconstruction Project
 - Number of beds: 1,301 beds
 - Gross Floor area: 113,000 m² (Hospital: 105,000 m², Nurse Hostel: 4,000 m², Mortuary building: 4,000 m² (Mortuary: 2,200 m², Mortuary parking lot: 1,800 m²))
 - Project Site Area⁸: 46,400 m² (Site A (Admin. & Supporting Facilities): 23,000 m², Site B (Main hospital): 22,000 m², Site C (Mortuary): 1,400 m²)
 - Operating room: 24 ORs
 - Intensive Care Unit: MICU 20 Beds, SICU 25 Beds, OTICU 10 Beds, MAICU 15 Beds, Burn unit ICU 10 Beds, NICU 30 Beds
 - Specialized Facilities: Hemodialysis 100 Chairs, 100 bassinets in Nursery

⁸ The project site area is an estimated area.

□ Site plan (Proposal)

- Propose the site plan for an efficient land use of a 1,301 bed, 4th-level hospital to be built on the premises of MNH-Upanga.



Figure 8. Proposed Site Plan of New MNH-Upanga

□ Architectural plan

- As representing Tanzania's state-of-the-art national hospital, the project aims to contribute to the growth and development of the country's healthcare facilities and environment, positioning itself as a pioneering model for Tanzanian healthcare through improved medical quality and patient services.
- The hospital is designed with a patient-centered approach, ensuring convenience and safety for patients while providing a medical environment conducive to healing and recovery.
- The plan incorporates an eco-friendly hospital design, taking into account Tanzania's climate and cultural characteristics.
- A sustainable hospital is envisioned, considering connectivity with the existing MNH-Upanga facilities and potential for future expansion.



Figure 9. Proposed Perspective View of the New MNH-Upanga

□ Space Program

Table 10. Space program

Department Category	Department	Gross Room Area(m ²)	Note	
INPATIENT WARD	General PCU	20,280	1,040 Beds	
	Isolation PCU	1,560	46 Beds	
	Psychiatric PCU	1,560	72 Beds	
	Private PCU	780	7 Beds	
	Special PCU	780	26 Beds	
	ICU	MICU	2,070	20 Beds
		SICU		25 Beds
		OTICU		10 Beds
		MAICU		15 Beds
		Burn unit ICU		10 Beds
Department Total Area		27,030		
OPD	General OPD	3,830		
	Emergency Department	1,780	50 Beds	
	Department Total Area		5,610	
DIAGNOSTIC & TREATMENT	Clinical Laboratories	1,540		
	Pathological Laboratories	610		
	Functional Test	1,420		
	Diagnostic Radiology	1,980		
	Surgery	3,380	24 ORs	
	Delivery Suite	1,060	8 Delivery rooms, 1 OR	
	Nursery & NICU	830	100 bassinets in Nursery & 30 Beds in NICU	
	Physiotherapy	790		
	Hemodialysis	1,290	100 Chairs	
	Department Total Area		12,900	

Department Category	Department	Gross Room Area(m ²)	Note
SUPPORT FACILITY	Pharmacy	1,170	
	Kitchen	840	
	CSSD	730	
	Laundry Service	1,060	
	Central Storage	810	
	Tailoring Service	220	
	Waste Management	400	
	Department Total Area	5,230	
ADMINISTRATIVE MANAGEMENT	Administration Dept.	1,990	
	Staff Restaurant	650	
	Transport Dept.	150	Driver's Office
	Department Total Area	2,790	
RETAILS	Retails & Convenience	280	
	Department Total Area	280	
EDUCATION & RESEARCH	Auditoriums & Seminar Rooms	940	
	Department Total Area	940	
MEP	Mechanical Room	3,940	Including Oxygen Plant
	Electrical Room	2,780	
	AHU	1,500	
	Department Total Area	8,220	
TOTAL DEPARTMENT AREA		66,000	

PUBLIC SPACE		39,000	Core, Corridor, Lobby, etc.
G/N Ratio (Net gross area to Building gross area)		1.59	
HOSPITAL BUILDING GROSS AREA		105,000	
* Mortuary Building			
Department		Gross Room Area(m²)	Note
Mortuary	Mortuary	770	
	Funeral Service	430	
	Public Space	1,000	
	Department Total Area	2,200	
Parking	Parking Lot	1,800	Parking capacity for 50cars
Mortuary Building Gross Area		4,000	
* Nurse Hostel			
Department		Gross Room Area(m²)	Note
Nurse Hostel	Room (8Beds)	1,575	75 rooms
	Etc.	1,092	Laundry, Kitchen, etc.
	Public Space	1,333	Core, Corridor, Lobby, etc.
	Department Total Area	4,000	
Nurse Hostel Building Gross Area		4,000	

4.3. Medical Equipment Plan

- ❑ A list and specifications of medical equipment best suited for the quaternary hospital should be prepared based on the medical and architectural plan, considering the Tanzanian medical market condition and the demand from physicians
- ❑ The medical equipment layout plan must be continuously updated by verifying power, water supply/drainage, exhaust, etc. within the construction plan

- ❑ To ensure the continuous operation of the medical equipment supplied to MNH-Upanga, a medical equipment supply plan has been prepared with products that guarantee the stability of maintenance through the smooth supply of consumables, reagents and repair parts, etc.
- ❑ The list of major medical equipment to be supplied by department is proposed as follows.

Table 11. A list of medical equipment by hospital departments (proposed)

Department	Major medical equipment
OPD+NOPD	Stethoscope(381), Sphygmomanometer, portable(381), Thermometer(381), Examining table(127), etc.
Neurology	EEG, 31 channel(3), Examining table, motor type(3), Trans cranial doppler(1), etc.
Pulmonology	Bronchoscopy system, 3 flexible videoscopes(2), Bronchoscopy system, rigidscope(1), X-ray, C-arm(1), Lung function machine (1), etc.
Rheumatology	ESWT(1), Examining table, motor type(1), etc
Hematology	Vein Detectors(2)
Nephrology	Hemodialysis machine with R/O(100), Dialysis chair(100), Ultrasound machine, 2 probes(Curved, Linear)(1) etc.
Dermatology	Laser, fractional CO2/CO2 (2), Laser, CO2/CO2 (2), UV examing light/UV (1), Dermato videoscope system(2), etc.
Cardiology	Stress ECG(1), Holter monitor, 24HR(2), ECG, 12channel(2), etc.
Gastroenterology (Endoscopy Room)	Gastroscopy system(Audult & pediatric)(5), Colonoscopy system (Adult & pediatric)(2), X-ray, C-arm(1), Anesthesia machine(2), etc.
Emergency medicine	Ventilator, portable(15), Ventilator, portable(10), X-ray, digital, 2 detector(1), Ultrasound machine, portable(2), Defibrillator(9), etc.
Critical care	Patient monitor for Intensive care(113), Infant incubator(30), Pump, infusion(200), Pump, syringe(150), etc.
Rehabilitation medicine	Electronic Stimulator(2), Traction System(2), Pedal exercise(4), Walking analysis Treadmill(2), Manual Function Test (MFT)(4), etc.
Orthopedic	Cast & cutter system(2), etc.
Neurosurgery	EMG (2), Evoked potential(1), Examining table, motor type(2), etc.
Urology	ESWL (1), Lithotropsy(1), Lithotropsy laser(1), Ultrasound machine, urology(1), Video urodynamic machine(1), etc.
Obstetrics and gynecology	Ultrasound machine for OBGY, portable type(1), Infant bassinet(20), Pump, infusion(20), Pump, syringe(20), Colposcope(5), etc.
Ophthalmology	Non-Mydriatic Auto Fundus Camera(1), Ophthalmic unit & chair(4), A-B Echo scan(1), etc.

Department	Major medical equipment
Dental	CB CT (1), Unit & Chair, Dental, Mount Type(9), Intraoral Camera, Dental w/ PC (2), etc.
Otorhinolaryngology (ENT)	E.N.T unit grand type(3), E.N.T microscope(2), Auditory brainstem response equipment(3), etc.
Pharmacy	Automatic tablet packing machine(10), Tablet counting machine(10), Medicine refrigerator, 700L(10), Drug cabinet(20), etc.
Radiology	MRI, 3.0 tesla(1), MRI, 1.5 tesla(2), CT, 512 channel(1), CT, 256 channel(4), Angiography, Bi-plane(1), Mammography, Digital 4D (1), etc.
Anatomical pathology	Automatic Slide Staniner(2), Tissue Processor(2), Upright microscope(4), Autopsy table(1), Lift, mortuary(1), Cart, mortuary(1), etc.
Diagnostic laboratories	Auto chemistry analyzer(2), Auto immunoassay analyzer(2), Hematology analyzer(2), Coagulation analyzer(3), Identification and Antimicrobial analyzer(1), Blood refrigerator, 1000L(3), Real Time- PCR(4), etc.
Mortuary	Refrigerator, mortuary, 2 body(50), Autopsy table(2), Lift, mortuary(2), Cart, mortuary(2) etc.
Operating Room	Anesthesia machine(24), Operating light(24), X-ray, C-arm(2), Operating microscope, general(1), Arthroscopy system(1),etc.
Recovery	Patient monitor, 5 parameter(36), IV pole(36), Bed, recovery(36), Patient Warmer(Water type)(20), etc.
CSSD	Autoclave, 1000L, Double door (3), Plasma Sterilizer, 120L, Double door(2), EO Gas Sterilizer, 350L, Double door(1), etc.
Laundry	Washing machine, 100kg(4), Drying machine, 50kg(3), Stainless cabinet(15), etc.
General Ward	Patient bed, 2 motor(1,191), IV pole(1,191), Bedside cabinet(1,191), Electric Suction Pump(214), etc.

4.4. Hospital Information Systems (HIS) Plan

4.4.1. Introduction to HIS Supply

- (Guidelines) Companies supplying HIS software should adhere to the following guidelines:
 - (Provision of Program Source) Companies supplying HIS software should provide program source for future work scope changes.
 - (Program Utilization) The ownership of the provided HIS software belongs to the Tanzanian Ministry of Health, and the business rights are owned jointly by the company that provides the software and the Tanzanian Ministry of Health.

- The suppliers should engage the ICT team during HIS software coding and requirements gathering, while also providing advanced technical capacity-building training to the ICT team on the functionality of their HIS code and how to make minor adjustments to the system. This will enable MNH to make additional changes or add new functionalities to the HIS without relying on the vendor.
 - For the new HIS, all ICT hardware and software, system code, user manuals, system documentation, and user interfaces must be written in English.
 - HIS suppliers should provide an environment and practice to identify a demo of a similar system in a live environment when ICT team visits. This hands-on experience will ensure confidence and clarity on the new HIS software before moving forward.
 - Technical support developers for HIS should be able to speak English to avoid confusion during system support and for easier communication with MNH ICT team.
- (Location of Computer Room) Considering the current HIS operation status of MNH-Upanga and MNH-Mloganzila, the main HIS center will be established and operated within the MNH-Upanga, and the Disaster Recovery center will be established at MNH-Mloganzila to ensure the stability of system operation.
- (User Manual) To ensure smooth operation and maintenance after HIS construction, it is necessary to provide HIS software and hardware user manuals and various technical documents related to HIS.

4.4.2. HIS Software Basic Plan

- (HIS Software Configuration) The Muhimbili National Hospital is building the basic functions of HIS, including treatment (including nursing), medical support, hospital affairs, general affairs, mobile PACS, patient waiting guidance, and internal/external linkage functions, etc.
- (Medical Treatment) It includes functions, such as CPOE⁹, EMR¹⁰, ENR¹¹, nursing management, and operation theater, etc.
 - (Medical Support) It includes functions, such as LIS¹², pathology, image information, pharmacy information management, medical record management, nutrition information management, blood-bank, and dietary, etc.

⁹ Computerized Physician's Order Entry

¹⁰ Electronic Medical Record

¹¹ Electronic Nursing Record

¹² Laboratory Information System

- (Hospital Affairs) It includes functions, such as outpatient management, inpatient management, bill management, and mortuary, etc.
- (General Affairs) It includes the functions, such as human resource management, payroll management, accounting management, inventory management, contract management, maintenance, and business intelligence etc.
- (Parking Management) The functions such as CCTV and monitoring parking status used in the parking management system are configured in the electrical/communications sector of the building. From the perspective of HIS, the existing system is used (in need of consultation with the Construction Sector and the Muhimbili National Hospital).
- (Mobile PACS) Mobile PACS is built separately and linked to mobile medical treatment. It is mainly useful at night or on holidays, especially when there is a shortage of doctors for reading, and the functions provided by mobile PACS are not much different from those provided by PACS.
- (Patient Waiting Guidance System) In order to improve the hospital environment and strengthen hospital patient services, it considers additional services such as guidance services for waiting in medical treatment and examination rooms, issuing patient reception number tags, and a broadcasting system at the hospital affairs window.
- (Internal and External Linkage) Internally, it includes linkage with various medical equipment that can be linked to HIS, and externally, it includes linkage with the Tanzanian Ministry of Health and cooperative hospitals/clinics for medical treatment.

4.4.3. HIS Hardware Basic Plan

- (HIS Hardware Configuration) HIS hardware consists of servers, networks, storage and backup devices, data security equipment, and system software, with MNH-Upanga as the main center and MNH-Mloganzila as the DR center.
- (HIS IT Network Configuration) The network of the MNH-Upanga should establish wired and wireless environments for providing HIS and mobile service, and a

dedicated line¹³ for connection to the MNH-Mloganzila. The construction sector is responsible for establishing an environment for wired and wireless networks in the building, and the HIS IT network configuration includes the construction of a network environment within the HIS computer room of the MNH-Upanga.

- ❑ (Availability) The main server, network, and data security equipment hardware for HIS operation are configured in duplicate to ensure system availability. In addition, it configures an L4 load balancing switch to distribute the system load and ensure availability.
- ❑ (Expansion) It configures a virtual server for flexible expansion and stable operation of server resources.
- ❑ (Stability) In order to provide a stable data storage and services, it separates storage network areas and configures them for each use. It establishes a remote backup system in the DR Center of the MNH-Mloganzila to ensure data stability through remote backup.

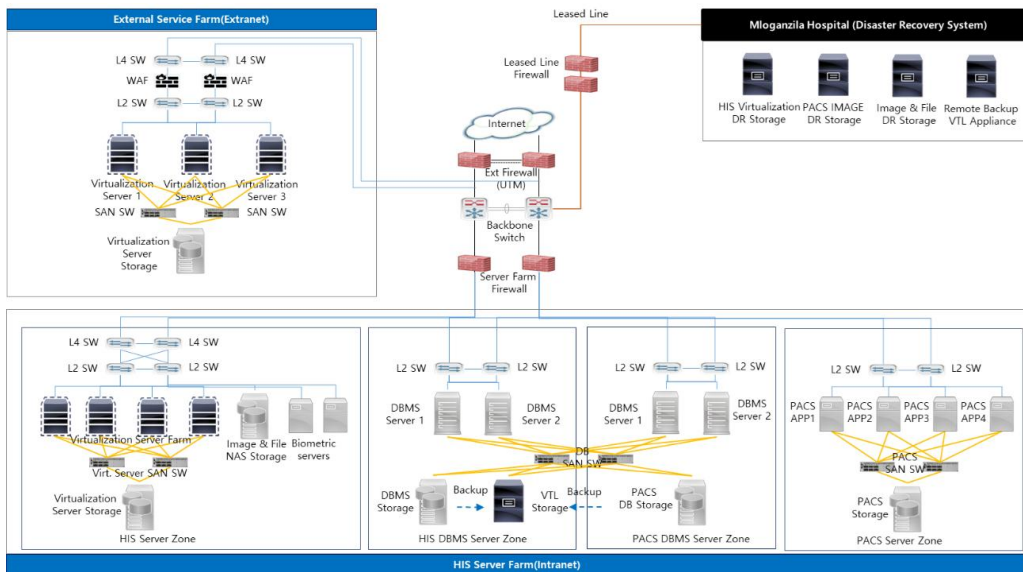


Figure 10. Diagram of HIS hardware

Source: Written by F/S team

¹³ The construction sector's electrical/communication field is responsible for developing the hospital's wired/wireless environment and dedicated lines for inter-hospital connections. Therefore, this report remarks, "The construction sector is responsible for establishing an environment for wired and wireless networks in the building, and the HIS IT network configuration includes the construction of a network environment within the HIS computer room of the MNH-Upanga."

5. Risk Management and Maintenance Support

5.1. Risk Management Plan

5.1.1. Hospital operation

- ❑ Medical service interruption due to demolition and relocation
 - (Risk Factor) During the project period, there is a risk that medical services provided by the hospital may be disrupted or their quality compromised due to demolition and relocation.
 - (Response Strategy) MNH-Upanga must develop hospital operation and relocation plans to minimize medical service interruption. Expert review should be conducted and suggest alternatives to maintain the quality of medical services.

- ❑ Shortage of personnel necessary for hospital operations
 - (Risk Factor) In Africa, including Tanzania, there are various constraints in recruiting and securing healthcare professionals. Difficulty in securing additional specialized personnel for MNH-Upanga could potentially hinder hospital operations and medical service delivery.
 - (Response Strategy) It is essential to review and strategize the recruitment and supply plans for healthcare professionals by the Ministry of Health from the initial phases of consulting. Preemptive recruitment should commence 1-2 years before the deployment of required healthcare professionals.

- ❑ Lack of sufficient budget for hospital operations
 - (Risk Factor) MNH-Upanga as a public hospital may experience operational disruptions if the funds from the Tanzanian government are not adequately provided.
 - (Response Strategy) It is crucial from the early phases of consulting to ensure financial stability through collaboration with the Tanzanian Ministry of Health and Ministry of Finance. Additionally, diversifying the revenue structure to generate income beyond government support funds is necessary to sufficiently cover the costs required for hospital operations.

5.1.2. Construction

- ❑ Construction delays due to demolition
 - (Risk factor) Possibility of delay in main construction due to delay in relocation and demolition of existing facilities before construction begins.
 - (Countermeasure) Ensure comprehensive pre-construction coordination with the Government of Tanzania to facilitate the completion of relocation and demolition of

existing facilities before the construction starts. Monitor the progress to prevent construction delay.

- ❑ Safety issues for patients and hospital staff due to demolition and construction
 - (Risk Factor) Inpatients will need to be moved as a result of the demolition and construction. Also, there may be safety concerns for medical staff and employees working at the hospital during these phases.
 - (Countermeasure) Safety regulations must be established to maximize the safety of patients and hospital staff during the entire period from demolition to construction and relocation stages.

- ❑ Increased risks due to the construction vehicle traffic
 - (Risk factor) Hazards associated with pedestrian accidents and debris falling from trucks while moving construction vehicles
 - (Countermeasure) Secure a dedicated route for construction vehicles and separate it from the pedestrian paths. Mandatory use of construction vehicle cargo covers and safety inspections.

- ❑ Unstable power supply
 - (Risk factor) Risk of unstable power supply
 - (Countermeasure) Secure adequate electrical supply and sufficient power from the substation. Establish emergency generators and uninterrupted power supply systems, to enable seamless distribution of electricity.

- ❑ Construction noise and dust
 - (Risk factor) Noise and dust generated during demolition and construction.
 - (Countermeasure) Select appropriate construction methods to minimize noise and dust generation, and install necessary safety equipment.

- ❑ Potential water damage due to flooding and other factors
 - (Risk factor) Possibility of water damage in the hospital during the wet season
 - (Countermeasure) During the construction period of the new hospital, the existing covered-walk way will be utilized as much as possible so that visitors, patients, and staff could move around without being exposed to rain. During construction, the constructor must establish a plan to prevent flooding at the construction site, including installing water barriers, controlling the site, and stopping construction.

5.1.3. Medical Equipment

- ❑ Increased equipment budgets and potential delays in supply schedules. Due to construction delays
 - (Risk factor) In case of delays in the supply of medical equipment due to construction delays, there is a risk that the price of medical equipment may increase because of the rise in raw material prices. In addition, there is a risk of discontinuance of contracted items as new products are introduced,
 - (Countermeasure) The medical equipment budget must be set to account for inflation. If a product is discontinued, it may be necessary to consider approving a contract change to another product that meets the core specifications of the original product.

- ❑ Medical equipment relocation and reinstallation
 - (Risk factor) Due to demolition and reconstruction loss or failure of medical equipment may occur during relocation and reinstallation.
(Countermeasures) It is essential to develop a relocation plan in consultation with the architect and the government of Tanzania.

5.1.4. HIS

- ❑ Lack of HIS Infrastructure
 - (Risk Factor) There is inadequate HIS scope and level distributed in the local area
 - (Countermeasure) It is necessary to identify the distributed level of HIS in the local area and build a system that reflects this level.

- ❑ Lack of HIS operation capacity
 - (Risk Factor) There is a lack of capacity to operate the HIS.
 - (Countermeasure) To resolve the lack of operational capacity related to HIS, it plans to transfer technology for specialized training to computer room operating personnel before and after HIS operation. Also, it ensures that training is provided for current users at the MNH-Upanga at least once.

5.2. Defect and Maintenance Plan

5.2.1. Construction

- For public construction projects in Tanzania, using the Form of Contract specified by the Public Procurement Registration Authority (PPRA) is mandatory. The Form of Contract stipulates a one-year defect liability period, with different defect correction

warranty periods depending on the type of construction work, such as structural work and equipment.

- When contracting with the construction company for the project, specify the defect liability period for the building and require the submission of a defect liability insurance bond amounting to 3%–10% of the contract value as a condition for final payment to the contractor.
- The client will conduct the final inspection based on the project completion report prepared upon the hospital construction completion. If any modifications or improvements are needed due to construction defects, they should promptly be implemented to avoid delays in the handover process.
- Construction company will conduct training for the maintenance and repair of the building during the trial period.
- After the expiration of the defect liability period as specified in the contract, the responsibility for maintenance lies on MNH-Upanga. MNH-Upanga must acquire an adequate workforce for maintenance and include costs in the hospital's operational expenses.

5.2.2. Medical Equipment

- Consultant's plan to support warranty and maintenance
 - When preparing equipment specifications, the consultants should first determine whether the manufacturers have authorized local distributors (or official importer, etc.), and then draft a common specification based on that particular manufacturers' equipment.
 - To ensure the sustainability of medical equipment, it is essential that equipment users and biomedical technicians in the hospital are knowledgeable in the correct usage and maintenance of the equipment. Therefore, the consultant should develop the specification based on products that allow procurement equipment supplier to provide equipment manuals in English or local language.
 - During the O&M period, the consultants should monitor the efficiency of the supplier's repair and maintenance activities and document the findings in a report.
- Maintenance plan through manufacturer's authorized distributor
 - Major radiological equipment (MRI, CT, etc.) and major analytical equipment (biochemical analyzers, immunoassays analyzer, etc.) must be serviced and maintained by the manufacturer or the local authorized distributor.
- Maintenance through local partners of supplier in Tanzania

- It is vital for the equipment supplier to establish a cooperative relationship with local partners that can provide maintenance and supplies to ensure that equipment runs smoothly during the free maintenance period.
- ❑ Maintenance through supplier's engineers.
 - To maintain sustainable equipment usage and maintenance, after the equipment installation is completed, the supplier's maintenance engineer will be dispatched quarterly for three years to provide repeated capacity building to the equipment users and biomedical technicians.
 - ❑ Self-maintenance plan through capacity building for biomedical technicians in MNH-Upanga.
 - It is not practicable for MNH-Upanga to sustain maintenance contracts with distributors of all equipment after the end of the free maintenance period due to budgetary issues.
 - Therefore, to strengthen the capacity of biomedical technicians at MNH-Upanga to repair their own equipment, basic capacity building for equipment users and biomedical technicians will be organized during the commissioning and relocation phase of the equipment, before the opening of the hospital, through medical equipment supplier and its local partners.
 - To ensure sustainable utilization of the equipment, repeated in-depth capacity building will be provided to equipment users and biomedical technicians even during the warranty period.

5.2.3. HIS

- ❑ The supplier's warranty period for HIS is 3 years.
 - Except in unavoidable cases, it plans to supply HIS hardware through local Tanzanian official importers or partners with local maintenance personnel and have them participate in software development to enable local personnel to perform maintenance.
- ❑ Meanwhile, the consultant will monitor and inspect the supplier's free warranty and maintenance work for 24 months after completion.
 - The HIS consultant will periodically monitor whether the construction organization's maintenance support is being performed appropriately during the O&M period after the operation of HIS and will prepare a report and present it to the ordering organization.
 - It is expected that if the consultant continuously transfers know-how on maintenance management methods and strengthens monitoring during the 24-month maintenance period, maintenance management can proceed smoothly not only during the

remaining 1-year of the project implementation period after the end of the consulting services, but also thereafter.

6. Consulting Plan

6.1. Necessity of Consulting Services

□ Medical Sector

- To support the stable operation of MNH-Upanga after reconstruction, comprehensive consulting on medical planning and hospital operations is required. In particular, expert consulting throughout the project is essential due to the risk of medical gaps caused by demolition and relocation.
- To enhance MNH-Upanga's capacity to provide advanced medical services as a top-tier medical institution, there is a need for the development of Standard Operating Procedures (SOP) for newly established clinical departments, hospital operation consulting, and capacity building.

□ Construction

- a general hospital is a complex facility with its various departments operating efficiently. Additionally, the MNH-Upanga redevelopment project entails relocation, demolition and new construction, further increasing its complexity. Thus, consultants with extensive experience in hospital design and construction are required.
- These consultants will base architectural plans on the results of the F/S and finalize them through discussions with the Project Implementation Unit. Consultants will collaborate with local consultants in Tanzania to ensure that the design documents comply with local building regulations.
- During construction, consultants with significant experience in similar-scale medical facilities will supervise quality control, managing and responding appropriately to various situations that arise on-site.

□ Medical Equipment

- Medical equipment must be supplied on time to ensure that there are no interruptions in patient care and running of the hospital. For this purpose, consulting services are required in the process of selecting and procuring medical equipment. Before selecting a medical equipment supplier, the consultant will conduct market research to assess the business environment. After the selection of a supplier, the consultant will offer the business management consulting services to facilitate timely equipment procurement, installation and capacity building.

❑ HIS

The involvement of a professional consultant with experience in similar-scale hospital information systems is essential. The consultant will align the HIS configuration with MNH-Upanga's medical and operational plans, address potential issues after the hospital opens, and ensure seamless internal and external integration.

6.2. Scope of Consulting Services

6.2.1. Medical Planning and Hospital Operation Consulting

❑ Main scope of work

- Medical plans and hospital operation plans for MNH-Upanga will be established through medical consulting. During the consulting period, experts will be periodically deployed to oversee the overall progress of the project and provide assistance for local decision-making when necessary.
- Supporting the bidding process for the main procurement of this project and managing the overall project supervision. Providing technical advisory consulting after completion to ensure stable and efficient hospital operations.

6.2.2. Capacity Building Consulting

- ❑ Prior to the hospital's opening, the consultant's scope includes developing capacity building plans, facilitating invitational training in Korea, and supporting operation simulations. Following the launch, the consultant will provide on-site educational training to ensure operational stability

6.2.3. Design and Construction Supervision Consulting

❑ Architectural Design

- Topographical Survey and Geological Investigation.
- Collaborate with users and stakeholders to finalize the Space Program and confirm optimal architectural plan
- Establish an architectural plan that accounts for the demolition and relocation without disrupting the hospital operation
- Draw design documents in compliance with local building laws and regulations by collaborating with local Tanzanian consultants
- Complete building permits in collaboration with local consultants

- Collaborate with the local ESIA consultant to ensure that ESIA approval is obtained prior to the commencement of construction.
- Support bidding process for selecting construction company
 - Prepare necessary documents and establish plans to select construction company
 - Provide support for contract evaluation and evaluation report preparation
 - Provide support with contract negotiations with construction company
- Construction Supervision
 - The Consultant, in collaboration with a local consultant, should allocate the agreed site engineers and conduct the construction supervision in accordance with the detailed construction schedule.
 - Supervisors in each field with experience in carrying out similar medical facilities are assigned to the site to supervise construction quality and appropriate on-site response.
 - The consultant should supervise the contractor to complete commissioning of the hospital and maintenance manuals before the completion of the construction, and conduct a pre-delivery inspection during commissioning period so as to hand over the hospital to the client.

6.2.4. Medical Equipment Consulting

- Equipment consulting consists of 4 phases: Phase 1 (Design Phase), Phase 2 (Bidding Phase), Phase 3 (Construction Phase) and Phase 4 (Quality assurance and Maintenance Phase).
- A total of 5 medical equipment specialists will be involved. Each specialist is engaged sequentially according to the progress of equipment installation and capacity building by process.

6.2.5. HIS Consulting

The HIS consulting work scope is structured into four phases—Design, Bidding, Construction, and O&M—covering a total duration of 52 months. Across all stages, two HIS specialists are deployed to perform tasks such as requirements identification, bidding support, project management, and monitoring.

7. Project Implementation Schedule

The total project period¹⁴ is 99 months with a phased schedule consisting of consultant selection, design, bidding, construction, and O&M support.

Table 12. Overall Schedule for the MNH Redevelopment Project

Project Phases	Duration	Remarks
Consultant Selection Period	3 months	
(Stage 1) Design Phase	12 months	
(Stage 2) Bidding Phase	4 months	
(Stage 3) Construction Phase	44 months	<ul style="list-style-type: none"> • Construction: 40 months • Relocation and Installation: 2 months • Commissioning test: 2 months
(Stage 4) O&M Support Phase	36 months	<ul style="list-style-type: none"> • Consultant: 24 months • Construction: 12 months (defect liability) • Medical Equipment: 36 months (warranty and maintenance) • HIS: 36 months (warranty and maintenance)
Total	99 months	

¹⁴ The project duration is defined as up to the point when the project funds are fully executed.

8. Project Feasibility Analysis

8.1. Political Feasibility

8.1.1. Medical Sector

- the reconstruction and operation of MNH-Upanga is expected to contribute to accelerating the achievement of the Tanzanian government's health sector goals. Additionally, this aligns closely with the Tanzanian government's medium- and long-term policies aimed at universal health coverage and improving access to healthcare for the public.
- Alignment with Health Sector Goals in the "Tanzania Third National Development Plan (2021/22-2025/26)"
 - The Tanzanian government aims to develop the country into an industrial nation while also striving to reduce mortality rates, increase life expectancy, and expand healthcare institutions and workforce.
 - The health sector goals within the Third National Development Plan are designed to address high mortality rates for infants, children under five, and maternal deaths in Tanzania. Providing medical services to high-risk newborns and mothers referred to MNH-Upanga is expected to contribute to achieving these national development plan goals.
 - The detailed health sector goals in the Third National Development Plan are composed of 13 intervention areas. This project directly relates to the construction of healthcare facilities and the provision of advanced medical services. It is anticipated that modernizing the facilities and offering advanced medical services at MNH-Upanga will directly contribute to the goal of reducing patients being referred abroad.
- Alignment with Core Health Sector Goals in the "Tanzania Vision 2025"
 - The Tanzania Vision 2025, a long-term development strategy, serves as the foundation for Tanzania's development policies and outlines the direction and philosophy for the country's long-term development.
 - The Vision highlights health as one of the priority areas contributing to improving the quality of life in Tanzania. Enhancing public health is a key factor in boosting economic growth by strengthening physical and mental capabilities, increasing participation in economic activities, and improving productivity.
 - The reconstruction of MNH-Upanga is expected to accelerate the achievement of core health sector goals outlined in the Vision 2025, including strengthening the healthcare delivery system, improving access to health services, and enhancing the quality of services.

- Alignment with the National Health Policy (2017) Goals
 - The vision of Tanzania's National Health Policy (2017) is to achieve a healthy community that effectively contributes to both individual and national development as Tanzania transitions to a middle-income country.
 - The policy goals for key health sector issues are as follows: Among the 22 health issues identified, many are directly or indirectly related to the role and functions of MNH-Upanga, including improving maternal and child health, reducing infectious and non-communicable diseases, rehabilitation, emergency care, trauma treatment, diagnostic services, and elderly health.

- Alignment with the Tanzania Fifth Health Sector Strategic Plan (2021-2026)
 - The vision of the Health Sector Strategic Plan V (2021-2026) is to create a healthy and prosperous society that contributes to the development of both the nation and individuals. Its mission is to provide sustainable healthcare services to all citizens without financial constraints, based on regional and gender equity.

8.1.2. Construction

- ❑ The Tanzanian government views the construction of healthcare facilities and ensuring equitable access to medical services as crucial policies as articulated in their Third National Development Plan (2021/22-2025/26) and the Fifth Health Sector Strategic Plan (2021-2026). The construction of this new hospital and enhanced accessibility to modern healthcare services resulting from this redevelopment project are considered to support the government objectives.

8.1.3. Medical Equipment

- ❑ As of 2024, there are a total of 12,068 health facilities in Tanzania and the number is steadily increasing. Currently, the Tanzania government is promoting ‘Tanzanian Health Sector Strategic Plan V 2021-2026’, which aims to improve medical equipment in regional public hospitals and the level of healthcare services in national hospitals.

- ❑ The medical equipment to be installed at MNH-Upanga will consist of the most advanced medical Equipment in line with modern infrastructure. This is aligned with the government's strategic plan for the health sector to build a modernised healthcare delivery and system.

8.1.4. HIS

- The Tanzanian government has a plan to establish an ICT system that meets international standards and provides high-quality services as a strategic priority for the "4. Information and Communication Technology (ICT) in the Health and Medical System Investment and Function Area" of the Fifth Health Strategic Plan (2021-2026). Accordingly, establishing the HIS of the MNH-Upanga, which promotes compliance with international standards and provides high-quality services, is considered to meet political feasibility.

8.2. Technical Feasibility

8.2.1. Medical Sector

- (Hospital Function) MNH-Upanga provides super-specialized medical services to provide medical services that are difficult to address at primary, secondary, and tertiary hospitals, serving as a top-tier referral hospital.
 - By offering advanced medical services, it is expected to reduce the disease burden in Tanzania and decrease the number of patients being referred abroad.
 - Strengthening medical services for maternal and pediatric patients, who are primary patients of the hospital, is anticipated to improve access to healthcare for vulnerable populations.
 - The role of MNH-Upanga includes not only providing top-tier medical services but also functioning as a training hospital. It systematically organizes clinical training programs and Continuous Professional Development (CPD) to cultivate specialized medical personnel, which is expected to contribute to the qualitative enhancement of medical services.
- (Role of the Hospital and Department Structure) To address unmet medical needs in Tanzania, new departments have been established with a focus on treating conditions that are inadequately managed. The medical plan has been designed to ensure that the hospital can provide essential services for severe illnesses as a top-tier facility.
 - To identify unmet medical needs within Tanzania, MNH-Upanga analyzed major diseases for which patients are referred to neighboring countries and assessed conditions that cannot be addressed in Tanzania through consultations with medical personnel in key departments. This analysis informed the planning of new departments.
 - Based on this scientific evidence, the functions of MNH-Upanga have been established. It is anticipated that by connecting with secondary and tertiary hospitals in the community, the hospital will be able to provide more efficient and effective medical services.

- ❑ (Bed Capacity) The proposed bed capacity for MNH-Upanga is 1,301 beds. This capacity has been planned to cover the top-tier medical services in Tanzania by estimating future bed demand. The final bed capacity will be confirmed in consultation with the Tanzanian Ministry of Health, the implementing agency (PEA), and the project implementation unit (PIU).
 - Based on the number of discharged patients and days of stay from before the COVID-19 pandemic (2017-2019), future inpatient volumes have been estimated. The projected inpatient volume has been estimated using the population growth rate over the past 10 years (2013-2022), approximately 3.15% per year. It has been determined that the need for 1,300 beds to meet future demand for tertiary medical services in Tanzania will be around 2038/39.
 - Considering future demand and supply approximately 15 years from now, the proposed bed capacity for MNH-Upanga is deemed to be appropriately calculated.

8.2.2. Construction

- ❑ Project Site Viability
 - The project site is located within MNH-Upanga in the center of Dar es Salaam, ensuring competent accessibility. This location facilitates functional linkage with existing MNH-Upanga hospitals, MOI, and JKCI. Therefore, it is considered a suitable location for performing the functions of a quaternary hospital.
- ❑ Compatibility with Medical Planning
 - Following the review of medical needs and planning analysis, the MNH-Upanga redevelopment project has been confirmed to have a total of 1,301 beds and a floor area of approximately 113,000m². This scale is deemed suitable for linking functions with existing hospitals and performing as a quaternary hospital.
- ❑ Suitability of the Layout Plan
 - The Construction site has been selected to allow uninterrupted hospital operations during the construction period and to simplify the construction phases.
 - The hospital facilities are divided into southern and northern site by a road. Departments are arranged according to the characteristics of these two sites, with a bridge connecting them to ensure efficient and flexible hospital operation and management.
 - The northern site, adjacent to the boundary of MNH-Upanga, primarily houses support and utility facilities. The southern site, which is a center to the overall hospital site, contains key medical departments such as wards, outpatient, and central medical

services. To accommodate future growth and expansion of the hospital, both sites have reserved space for the potential addition of department.

8.2.3. Medical Equipment

- ❑ (Technical Feasibility) The equipment list was prepared based on MNH-Upanga's medical plan and hospital operation plan to reflect the current level and needs of the hospital. In particular, given the age of each medical equipment at MNH-Upanga and the time of construction and opening of the hospital, the supply of new medical equipment for each department is deemed necessary for the stable operation of the hospital.
- ❑ (Technical Feasibility of Maintenance) The current direction of developing and strengthening the maintenance system at MNH-Upanga is considered feasible, given that the utilization rate of medical equipment at MNH-Upanga is high, at 93%, and the maintenance capacity, as well as the employment of biomedical technicians in the organization, are relatively stable. As a prerequisite, 1) the consultant will draw up specifications for major medical equipment so that products from manufacturers with local distributors capable of maintenance are given priority; 2) the procurement equipment supplier will sign annual contracts for major medical equipment so that maintenance can be performed by engineers from local distributors; and 3) the hospital's biomedical department will strengthen their own maintenance capacity thorough repeated in-depth capacity building and invitational capacity building by the supplier.

8.2.4. HIS

- ❑ (Hardware Configuration) To ensure the continuity of HIS services, it designs duplexing of main hardware equipment, and applies a virtual server environment to ensure a flexible expansion and ease of system management for the future.
- ❑ (Calculation of Hardware Sizing) Based on the number of users following the medical and operation plan of the hospital as baseline data, it calculates the appropriate capacity of the server hardware by following the guidelines for "A Guideline for Hardware Sizing of Information Systems" provided by the Telecommunication Technology Association (TTA) of Korea.
- ❑ (Appropriateness of Maintenance Period) There is a shortage of companies in Tanzania specializing in constructing and operating the HIS. As a result, there is limited HIS maintenance capacity and manpower. Accordingly, the main procurement operator will conduct repeated in-depth training through dispatching professional engineers for 36 months of free warranty and maintenance, and inspect

the HIS operation status, etc., and the consultant will conduct tasks such as post-management supervision, operation inspection, and evaluation for 24 months of maintenance. This approach aims to secure the stabilization and sustainability of HIS operation.

8.3. Sustainability Analysis

8.3.1. Medical Sector

- ❑ As Tanzania's population is projected to continue growing over the next decade, the demand for top-tier medical institutions is expected to increase. Through the reconstruction of MNH-Upanga, the goal is to meet the rising medical demand in Tanzania by providing modern infrastructure and advanced medical services. Additional bed capacity, new departments, and the provision of high-level medical services necessitate sufficient recruitment of medical staff.
- A key factor is to enhance the quality of medical services through the recruitment and capability enhancement of specialized medical personnel in newly established and major departments. Specifically, the recruitment of medical personnel should be completed before the reconstruction is finalized to include them in capacity building, trial runs, and simulation processes.
- Moreover, the hospital's training and education functions should cover basic to advanced clinical skills to develop specialized medical personnel and ensure that Tanzanian medical professionals are retained and not lost to other regions.

8.3.2. Construction

- ❑ Sustainable architecture aims to enhance the clinical environment and user satisfaction by considering climate change, securing clean energy, and designing optimized infrastructure.
- ❑ By actively incorporating energy efficiency, durability, eco-friendliness, and natural energy into the design and construction phases, it is possible to minimize natural resource usage, energy consumption, greenhouse gas emissions, and environmental pollution.
- ❑ Review of plans to maximize flexibility in space for sustainability is required.

8.3.3. Medical Equipment

- ❑ When drafting the medical equipment list during the design phase, it is most important to verify whether the manufacturer has an authorized local distributor (or an

authorized import and distribution agent) first, and then create a common specification for only those manufacturers who have a local distributor.

- ❑ Imaging equipment, analysis equipment, surgical equipment, etc. require maintenance through a local official dealer, and must be registered with TMDA. Specifications must be written at the design stage to ensure maintenance and supply of consumables.
- ❑ In the case of Korean-made equipment, it is recommended to establish a system of cooperation with the local distributor in Tanzania even before the tender is announced, and prepare a system for smooth supply and maintenance of equipment that meets local regulations and special environmental factors.

8.3.4. HIS

- ❑ (Software Operation Personnel Involvement) Despite the current operation of the HIS, operational capacity for the existing HIS is significantly limited, as the HIS manufacturer did not transfer the source code. Consequently, it is necessary to push ahead with the participation of software operation personnel as a requirement for the project to enable continuous education and training during the software development period.
- ❑ (Hardware Operation Personnel Involvement) It is essential to mandate the participation of hardware operation personnel as a core requirement of this project to facilitate continuous education and training throughout the construction period. Through this process, it is essential to establish an environment that can solve difficulties during future maintenance.

8.4. Appropriateness of Project Schedule

8.4.1. Construction

- ❑ Architectural design consulting schedule
 - The construction design period is estimated at 12 months, with 4 months for concept and schematic design, 4 months for design development, and 4 months for construction document. In Korea, comparable hospital projects typically necessitate over 18 months. However, the PIU's streamlined decision-making process, and simplification of layouts in consideration of local architecture and climate allow for a reduced design period. Therefore, a 12-month timeline is considered to be appropriate.

❑ Building construction schedule

- The construction period for the MNH-Mloganzila, supported by EDCF, with 608 beds and a total construction area of 42,532m², was 38 months. For a general hospital of approximately 100,000 m² in Korea, the construction period is around 30 months. However, considering factors such as local climate, the expertise of construction labor, the construction technology of local companies, material procurement, and equipment operation in Tanzania, the construction period is expected to be 1.5 times longer than that in Korea. Therefore, a total construction period of 44 months is deemed appropriate.

8.4.2. Medical Equipment

- ❑ During this three-year maintenance period, repeated in-depth capacity building for medical equipment users, such as doctors and nurses, and medical equipment managers, such as biomedical technicians, will be conducted, which will be organized by medical equipment supplier and manufacturers. It is expected that such capacity building will improve the utilization rate of medical equipment by users and strengthen the ability of biomedical technicians to manage their own medical equipment, thereby ensuring stable and sustainable hospital operations.

8.4.3. HIS

- ❑ (Appropriateness of HIS development period) HIS hardware installation can only commence once essential infrastructure, such as electricity and communication, is finalized. Therefore, it is appropriate to schedule this installation to begin during the mid-stage of the project implementation.
- ❑ (Appropriateness of HIS maintenance period) Due to a shortage of companies in Tanzania with sufficient experience in HIS implementation and operation, maintenance capacity remains low and qualified personnel are limited. Accordingly, the contractor conducts repeated in-depth training by dispatching professional engineers during the 36-month maintenance period (including warranty) and inspects the HIS operation status. The consultant performs tasks such as post-management supervision, operation inspection, and evaluation during the 24-month maintenance period. Based on this, the maintenance period is estimated to ensure the stabilization and sustainability of HIS operation.

8.5. Economic Feasibility Analysis

❑ Major Assumptions

In accordance with the EDCF F/S Guidelines, a discount rate of 9% was applied.

The base year for the analysis was set to 2025, the completion year to 2030, and the operation period was calculated from 2030 to 2060.

❑ Benefit

The anticipated benefits are i) medical service provision, ii) reduction in expenditures for patients outflow abroad, iii) travel time savings for patients outflow abroad, iv) reduction in pediatric deaths, and v) reduction in emergency patient deaths.

❑ Cost

Construction costs, consulting services costs, contingencies, and operation and maintenance (O&M) costs were included as cost items.

❑ Analysis Result

The analysis yielded a Benefit-Cost (B/C) ratio of 3.23, a Net Present Value (NPV) > 0, and an Internal Rate of Return (IRR) of 36.79%, leading to the conclusion that the project is economically feasible.

❑ Sensitivity Analysis Result

The project remains economically feasible even under the worst-case scenario – a 20% increase in costs and a 20% decrease in benefits – as confirmed by NPV, B/C ratio, and EIRR.

8.6. Financial feasibility Analysis

This is a policy-driven project by the Tanzanian government to reconstruct a hospital with the aim of improving the quality of life for its citizens. While the project incurs substantial expenditures for construction and operation and maintenance (O&M), revenue is expected to be minimal. Consequently, it is considered that the financial feasibility analysis would have limited practical value.

9. Environmental and Social Impact Analysis

9.1. Project Site and Surroundings

- ❑ Status of the project site
 - The project site is located within the MNH-Upanga in Dar es Salaam.
 - According to the Muhimbili National Hospital Master Plan 2020-2040, the elevation of the MNH-Upanga ranges from 19 to 25 meters above sea level, with a maximum height difference of 6 meters within the site. Given the vast area of the land, the topography is generally gentle and relatively flat.
 - There are several buildings and trees within the project site, with buildings serving various functions such as currently operating wards, emergency facilities, religious buildings, staff accommodations, and research facilities. Most of these buildings are dispersed across the site and are considerably aged.

- ❑ Current status of the surrounding area
 - The project site is bordered by the Msimbazi River to the northwest, Kalenga Street to the east, and Malik Road to the south.
 - It is conveniently located near major roads leading into the central business district of Dar es Salaam, providing easy access to the surrounding areas.
 - Within approximately 1 km of MNH-Upanga, there are several educational institutions, including MUHAS (Muhimbili University of Health and Allied Sciences), as well as various embassies.

9.2. Environmental and Social Impact Analysis System and Procedures in Tanzania

- ❑ Environmental Impact Assessment (EIA) implementation agency and execution system
 - Under Sections 82 and 230 of the Environmental Management Act, Environmental and Social Impact Assessments (ESIA) are legally mandated for all projects carried out in Tanzania. This legislation assigns the National Environment Management Council (NEMC) the responsibility of overseeing and regulating ESIA and Environmental Audits.
 - NEMC's roles include the registration and management of EIA consultant and firms, approval of ESIA scopes, review of ESIA reports, stakeholder consultations, and the issuance of certification.

- ❑ The process of EIA in Tanzania
 - The detailed procedure for conducting the Environmental Impact Assessment (EIA) in Tanzania, as stipulated in the EIA and Audit Regulations of 2005, is as follows:

Table 13. ESIA Procedure in Tanzania

No.	Step	Description
1	Selection of ESIA Implementing Agency/Experts	- The project implementing agency selects an Environmental and Social Impact Assessment (ESIA) implementing agency/expert registered with the National Environment Management Council (NEMC) and commissions the ESIA.
2	Registration of ESIA	- Before conducting the ESIA, the agency is required to register with NEMC and pay the registration fee. The registration fee is 50,000 TZS, and it is the same regardless of the project type.
3	Scope Definition	- After registration, if the ESIA is deemed necessary, the implementing agency/expert determines the project scoping and submits the Scoping Report to NEMC. - The fee for this is 150,000 Tanzanian Shillings (TZS).
4	Conduct ESIA	- Once the scoping and Terms of Reference (ToR) are approved, the ESIA is conducted.
5	Preparation of ESIA Report	- The ESIA implementing agency/expert submits the ESIA report to the project proposer.
6	Request for Review of ESIA Report	- The ESIA report is submitted to NEMC for review.
7	Distribution of ESIA Report	- NEMC circulates the ESIA report to relevant stakeholders.
8	Review by NEMC and Stakeholders	- Stakeholders review the ESIA report and conduct a site inspection. - The project implementing agency pays the review charge.
9	Finalization and Revision of ESIA Report	- NEMC may approve, reject, or request additional information regarding the ESIA.
10		- The final report is submitted, incorporating NEMC's review comments.
11	Issuance of ESIA Certificate	- The Environmental Impact Assessment certificate is issued.

Source: The environmental management (amendment) regulations, 2018

□ Environmental Impact Assessment Status for This Project

- Analysis of the Need for an Environmental Impact Assessment
 - According to the ESIA regulations under the Tanzanian Environmental Management Act, all hospital construction projects are classified as Category B1. As such, a formal ESIA is required to assess the scale, magnitude, and significance of the environmental impacts and to propose appropriate mitigation measures.

Table 14. ESIA Category

Category	Description
A	Mandatory Project
B1	Borderline Project
B2	Non-Mandatory, *Small-scale industrial projects that must be registered with NEMC but do not require a formal ESIA.
Special	*When the proposed project has uncertain potential risks, a preliminary special investigation is required before the ESIA. The evaluation is conducted under the same criteria as Category A.

9.3. Environmental and Social Impact Analysis in accordance with EDCF safeguard policy

- Application and Review of EDCF Safeguard Regulations
 - The environmental and social impact rating was reviewed in accordance with EDCF safeguard regulations.
 - It has been confirmed that this project poses minimal to no environmental or social risks during both the implementation and operational phases. Therefore, the project is expected to be classified as Category B in terms of environmental and social impact risk. In accordance with EDCF Safeguard Policy, the project classified as Category B is required to conduct an Environmental Impact Assessment (EIA).

* Environmental and social category, based on the review of relevant documents (such as Screening Form), will be finalized upon approval of the EDCF project.

9.4. Measures to Decrease Environmental and Social Impact from Hospital Construction

- Environmental Impacts and Mitigation Measures
 - During construction, it is necessary to establish management plans to address environmental impacts such as the generation of dust in surrounding areas, noise and vibrations from construction vehicles, air pollution, noise, soil erosion affecting artificial waterways, and construction waste. Additionally, during the operational phase, the management of medical waste will be required.

- To mitigate dust generated during construction, measures should include regular watering of the site, prioritizing the paving of access roads, implementing appropriate drainage plans, segregating waste for recycling, setting up storage for used oil, and appointing a radiation safety officer.

□ Social Impacts and Mitigation Measures

- The construction and operation of a hospital can significantly impact the surrounding community. During construction, noise, dust, and traffic disruptions are common, which can disturb nearby residents. Mitigation measures like scheduling work during daytime hours, using dust control methods, and implementing noise barriers are essential. Ensuring local hiring and maintaining strict health and safety standards further minimize negative effects.
- In the operational phase, the hospital may influence community health and local infrastructure, particularly through increased traffic and potential environmental risks. Regular monitoring of air and water quality, along with effective traffic management and improved public transportation access, helps mitigate these impacts and ensures the hospital's integration into the community.