Status of CE and HTM in Rwanda

**Acronyms**

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<tr>
<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>CE</td>
<td>Clinical Engineering</td>
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<td>EWH</td>
<td>Engineering World Health</td>
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<td>BMET</td>
<td>Biomedical Equipment Technicians</td>
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<td>GE</td>
<td>General Electric</td>
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<td>CEBE</td>
<td>Center of Excellence in Biomedical Engineering and eHealth</td>
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<td>IPRC</td>
<td>Integrated Polytechnic Regional College</td>
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<td>DH</td>
<td>District Hospital</td>
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<td>DP</td>
<td>Development Partner</td>
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<td>HCs</td>
<td>Health Centers</td>
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<td>HTM</td>
<td>Healthcare Technology Management</td>
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<td>HFs</td>
<td>Health Facilities</td>
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<td>MoH</td>
<td>Ministry of Health</td>
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<td>PH</td>
<td>Provincial Hospital</td>
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<td>RBC</td>
<td>Rwanda Biomedical Center</td>
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<td>WHO</td>
<td>World Health Organization</td>
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BACKGROUND

Historically, the health sector in Rwanda was of poor quality in general; CE and HTM included, but in recent decades has seen great improvement. Together with a number of partners; Rwanda operates a universal health care system, and is considered to have one of the highest-quality health systems in Africa.

INTRODUCTION

In the framework of geographical accessibility and service delivery, equipment and infrastructure play an important role. Apart from drugs and other related health commodities, physicians require safe and appropriate infrastructure, including proper equipment for diagnostic treatment and support.

The objective of the Ministry of Health, through the Rwanda Biomedical Center (RBC), is to ensure health facilities have functioning equipment and infrastructure is maintained and expanded to increase geographical accessibility and quality health care services for the population. However, challenges in terms of equipment and infrastructure management have been observed. Various assessments and audit reports conducted in health facilities and in the Ministry of Health have raised issues related to poor equipment and infrastructure management. Insufficient budget for asset management, inadequate structure of technical staff in health facilities, and poor interaction between central and decentralized levels have been highlighted as challenges.
DEFINITIONS

Assets: consist of infrastructure, medical and general equipment, computer equipment and other office automation devices, communication and logistic equipment.

Infrastructure: buildings, structures, technical installations (water, electricity and sanitation systems), utilities, and roads for health facilities.

Maintenance: preventive and corrective maintenance carried out to maintain assets in good condition, the function in order to provide users with quality equipment and infrastructure.

Preventive Maintenance: set of routine activities performed by users and maintenance technicians that are aimed to ensure adequate functioning, to increase asset life, to reduce the risk of failure, and to ensure the health and safety of users and beneficiaries.

Corrective Maintenance: activities carried out by users and maintenance technicians to restore physical and operating conditions when breakdowns occur.
CURRENT CE and HTM CHALLENGES in Rwanda

The health sector has experienced and is now experiencing various challenges of maintenance of existing medical equipment and health infrastructure at all levels, including:

**General:**
- Lack of standard operating procedures.
- Insufficient, inefficient and ineffective communication across all levels (e.g. between central and decentralized levels, between RBC and MoH, and between technicians/engineers and clinicians)
- Insufficient and inappropriate logistical support (e.g. transport, spare parts, etc.)
- Lack of ownership of asset management at the decentralized level
- Lack of ability to proactively address asset management priorities due to continual, urgent requests

**Human Resources:**
- Insufficient number of qualified engineers and technicians compared to workload and WHO recommendations at all levels
- Lack of a functioning technical reporting system for decentralized level technicians
- Limited enforcement of ToRs for decentralized level technicians during recruitment
- Lack of job descriptions for decentralized level technicians
- Low skill level for staff at all levels due to lack of specialized training
- Insufficient capacity building at the decentralized level
- Low level of staff motivation due to inadequate salaries compared to responsibility level for biomedical technicians

**Equipment Challenges**
- Poorly allocated equipment as needs assessments are not always conducted prior to planning and budgeting
- Lack of clearly defined communication and approval process for health facilities to express their equipment needs, leading to an inability to aggregate the national need and duplication of equipment
- Biomedical Technicians are not involved or consulted while conducting a needs assessment at the decentralized level
Equipment is supplied to HFs without considering required end user and technician skills, infrastructure, pre-installation works, consumables and spare parts.

- Lack of replacement plan for obsolete equipment
- Incomplete database of all equipment available at HFs and their status
- Undefined, short, random, and poorly coordinated planning process that is not reflective of actual needs
- Lack of budget for equipment and maintenance at HFs and an insufficient budget at the Central Level
- Lack of harmonized equipment
- Lack of clearly defined regulatory framework for handling visas, importation licenses, tax exemptions, etc.
- Lack of equipment management committees at DHs and PHs.

**Commissioning:**

- Commissioning is done by unqualified technicians from suppliers
- Lack of training for new equipment
- Many equipment is not installed
- Lack of technical documentation provider to end users and technicians (user and service manuals, etc.)
- The supplier usually trains the end users only; not technicians
- Unclear commissioning guidelines

**Maintenance:**

- Lack of availability of spare parts at site
- Inability for the HF to directly procure
- Insufficient maintenance training for technicians on high value and high technology equipment (e.g. CT scan)
- Lack of transportation and allowance resources for technicians to support HCs
- Lack of availability of infrastructure and tools for maintenance workshops at HFs
- Lack of PPE for technicians
- Mentality of buying new equipment rather than maintaining existing equipment at health facility management levels
- Irregular preventive maintenance
- Lack of systematic outsourcing strategy for maintenance
Infrastructure Challenges

- Needs assessment is not included in planning for construction of health facilities (i.e., geographic accessibility, population to be served, capacity of health facility, size, etc.)

Planning:

- Long term plan for health infrastructure is not available
- Plans are only based on available budget rather than services needed
- Beneficiaries and local administration are not involved in planning process
- Limited communication between central and decentralized levels
- Roles and responsibilities for planning of health facilities are not clearly defined within MoH

Engineering (Designing):

- Specialists (personnel or firms) for design of health facilities are not available within or outside of health sector
- Specialized engineering services (i.e., medical gas system, firefighting system, mechanical ventilation, sewage water treatment) are not available within or outside of health sector
- Professional medical guidance for proper design from qualified practitioners is not available

Training of User

- User training is not completed by contractors after completion of construction

Inspection & Certification

- Inspections to commission health facilities are not conducted
- Norms and standards for health infrastructure designs
- Norms and standards do not exist guiding design and construction of healthcare infrastructure
Master plan of health facilities

- Master plans of health facilities are not available

Structural Challenges

- Organizational structure, from central to decentralized levels, is not appropriate for management of health infrastructure
- Inadequately trained human resources for the management of health infrastructure
- Health facilities do not have an engineer in charge of infrastructure and instead medical technicians manage the infrastructure

EQUIPMENT MANAGEMENT PROCESS

- Needs assessment, Planning and Budgeting

Needs assessment is a complex process, incorporating a number of variables, that provides decision-makers with the information necessary to prioritize and select
appropriate equipment at a national, regional or hospital level. This is a process for determining and addressing the gaps between the current situation or condition, and the desired one. It is a strategic activity and an input to the planning process that aims to improve the current performance or to correct deficiencies. It is critical for equipment management committee to be involved in conducting this assessment to ensure it is comprehensive. This assessment must be conducted once a year. As this process must be completed prior to the action planning process, it must be completed by end August. In order to influence the MTEF, the needs collected from health facilities should have a 3-year scope. Further, the assessment should include equipment that would be procured by both the central and decentralized level. RBC will aggregate and analyze the national needs, validate them with Districts and health facilities and present to MoH leadership.

Planning for equipment should be driven by the priority public health needs for the country. After aggregating and analyzing the national needs, the planning process starts and consists of the following closely connected activities:

- **Prioritization:** as there are insufficient resources to meet all needs, it is necessary to rank them in order to decide which needs should be met first and which will be met later.
- **Option appraisal:** there is more than one way of meeting the needs identified. Various options should be considered, and the evidence in favor of each should be weighed carefully.
- **Action Plan:** When agreement has been reached about how the needs are to be met, an action plan and timetable should be drawn up, including a plan for resource allocation.

The action plan is then used to develop the budget request submitted to MINECOFIN. Additional rounds of prioritization may be needed depending on the funding envelope.

- **Procurement and Contract Management**

Effective equipment procurement practice leads to safe, equitable and quality health care. Procurement should be based on the annual action plan, and the first step is to develop a procurement plan. As a part of the procurement plan process, the finance department should be consulted to ensure that the included activities are budgeted for.

After the RBC procurement plan is approved by MoH and RBC leadership, the tendering process can begin. This process involves conduction of a technical and technology assessment, preparation of technical specifications, preparation of bidding documents, notification and advertisement of the bid, provision of clarification as needed, and bids reception in view of the
selection process. Each of these steps must be complete timely to ensure equipment is procured effectively and efficiently.

Contract management begins immediately after the contract award has been successfully completed (i.e. contract signed by RBC and the successful bidder) up until goods are supplied and works or other services are completed and final handover is conducted.

Procurement and contract management of equipment should be done under one procurement entity within RBC to reduce duplication and increase coordination.

- **Commissioning**
Commissioning of equipment is defined as the process by which equipment is tested to verify if it functions according to its specifications and designed objectives.

This work should be done by a competent and qualified engineer according to the instructions from the manufacturer and in accordance with normal principles of good health care technical services practice. Commissioning includes verification of proper and safe operation and compliance with technical specifications, which must be performed prior to clinical use.

Once the equipment is installed, the recipient should implement a program of periodic inspection, maintenance and calibration to ensure that the equipment is maintained in a safe and effective operating condition for its remaining useful life.

For the better use of the equipment, the supplier must train the end users and engineers on how the equipment should be properly used and maintained in reference to manufacturer instructions and based on the terms of agreement.

Final acceptance should be confirmed to the supplier and is confirmed once the equipment is installed and fully functioning, but the final reception will be confirmed after the warranty period.

- **Maintenance**
Equipment maintenance is essential to ensure that such equipment continues to function effectively in good working condition. Proper maintenance can extend the life of equipment. This is essential for providing good health services and saving scarce resources. There are two different types of equipment maintenance, preventive and corrective maintenance.
INFRASTRUCTURE MANAGEMENT PROCESS

- **Needs Assessment**
  Needs assessments ensure equitable geographical accessibility to healthcare services. Hospital infrastructure needs assessment needs to take into account population density, health needs, access, land availability, urban planning, current physical infrastructure condition, and power, water, and sewage access.

- **Planning**
  Planning will enable MoH to understand long-term health development plans and budgets. This planning will ensure smart execution and coordination to reach established GoR targets across the health sector.

- **Procurement**
  A strong procurement process will ensure that the health sector recruits competent and cost-effective firms for the implementation of planned infrastructure projects.

- **Engineering (Design)**
  The engineering (design) guidelines will make sure the infrastructure is built according to set norms and standards, ensuring the construction of safe and cost-effective healthcare infrastructure across the health sector.
❖ Construction & Supervision
The construction and supervision procedures will ensure the implementation of the planned design of healthcare facilities.

❖ Training of User
Training users will enable full utilization of the health facility.

❖ Inspection & Certification
Inspection and certification ensures quality control of newly constructed health infrastructure.

❖ Maintenance
I strongly believe that a well maintained health facilities will have a longer life span, reducing the replacement costs.

❖ Norms and Standards for Health Infrastructure Designs
Norms and standards will ensure consistent, high-quality designs which will lead to higher quality healthcare infrastructure.

❖ Master Plan of Health Facilities
A master plan of health facilities gives complete engineering details about the compound, buildings, and its use to guide future planning.

HUMAN RESOURCE AND CAPACITY BUILDING

This holds a very great portion of power in mitigating challenges faced in CE in Rwanda. Human resource capacity building is necessary across technical staff at all levels to ensure high quality service delivery.

It is in this regard, that in 2009, the first biomedical equipment technician (BMET) training program began in Rwanda took place thanks to the partnership with Engineering World Health (EWH) and GE Foundation. This was aiming to seek for a sustainable solution to hospital equipment repair.
Through a three to four year curriculum tailored to each country's needs, EWH works with a local educational institution (Rwanda Polytechnic- IPRC Kigali) and Ministry of Health to train BMETs to international standards, train local teachers to carry on the program in the long term, and establish a permanent, accredited BMET training program. This program is now sustained and graduates are released every year.

Later came; The Regional Centre of Excellence in Biomedical Engineering and eHealth (CEBE) which is conceived as an institution that will provide the administrative leadership, intellectual capacity, and the resource infrastructure required to accelerate the delivery of cost-effective, technology-supported healthcare services in Rwanda and the surrounding region. The CEBE operates in an innovation, consultancy, and service ecosystem to achieve high-impact results in support of several key health sector initiatives including medical equipment and devices, rehabilitation and mobility, and e-health services.

Rwanda Association of Biomedical Engineering (RAME) and Rwanda Allied Healthcare Professions Council are trying to put professionals together for advocacy and consolidation but most of the challenges are above their abilities.

However more investments need to be made in skill development, specialized trainings, in-house trainings, short courses, higher degree programs, and continuing education programs to mitigate the skills gap.