



# Advice report

## Introduction

The strategic plan published by KCMC for the years 2015-2020 clearly shows that the level of service provided by the IT department does not adequately match the current and future needs of KCMC. Largely caused by insufficient resources, both in equipment and (as a result of that) in knowledge. The government will require more and more fast and sufficient information about the figures and performance of the hospital.

By automating the administration and underlying processes KCMC will achieve a higher degree of efficiency. And the KCMC will be able to meet future demands off the government and (external) donors.

The IT department can help to improve the level of health care, thereby achieving another important objective from the strategic plan.

IT technology has become increasingly important and at the same time it has become more complex. This requires a good vision and offers opportunities to grow to a future-proof hospital. At the same time, KCMC will have to realize that these goals can only be achieved if investments are made in good IT specialists and IT staff members.

The KCMC executives has responsibilities to bind well-trained and experienced employees to the KCMC IT department and give them properly responsibility.

The quality of the employees is more important than the quantity. Costs can be saved on staff by implementing a professional IT environment. But more important.... the reliability and safety of IT systems will be at a higher level.

Team-IT-NL and the IT department of KCMC, started building a new IT infrastructure in 2018 with refurbished IT devices (network, storage and server equipment) from the Netherlands. Economically written off but still good for at least 3 to 5 years of reliable service.

As always, the needs and wishes are greater than the possibilities. Not because of device shortage, but more because of the available time of the Dutch team to improve the knowledge of the KCMC employees. Only the most important IT innovations have been taught in a training course

The Team-IT-NL do realize that there are more issues that require attention for the coming years. Most of these items are further elaborated in this document.

## Advise and Roadmap

Although much has been achieved in recent months, a lot has to be done in the coming years to professionalize the IT department and upgrade the central systems.

This means that a systematic improvement plan is needed that supports the management objectives. With this plan comes yearly budgeting to cope with the future IT challenges.

The plan (roadmap) contains the steps that have to be taken in the coming 3 years. Each step has a priority, requires a certain budget and resources. The amount of the budget determined what is possible within the project.

The advised roadmap contains three main topics:

1. *Organization and staff;*
2. *Training;*
3. *IT projects.*

### 1. *Organization and staff*

The IT challenges based on good vision and realism require the commitment of KCMC executives. We have to realize that IT changes takes time and strategy. That is why we recommend the appointment of a strategic manager in addition to the current IT manager.

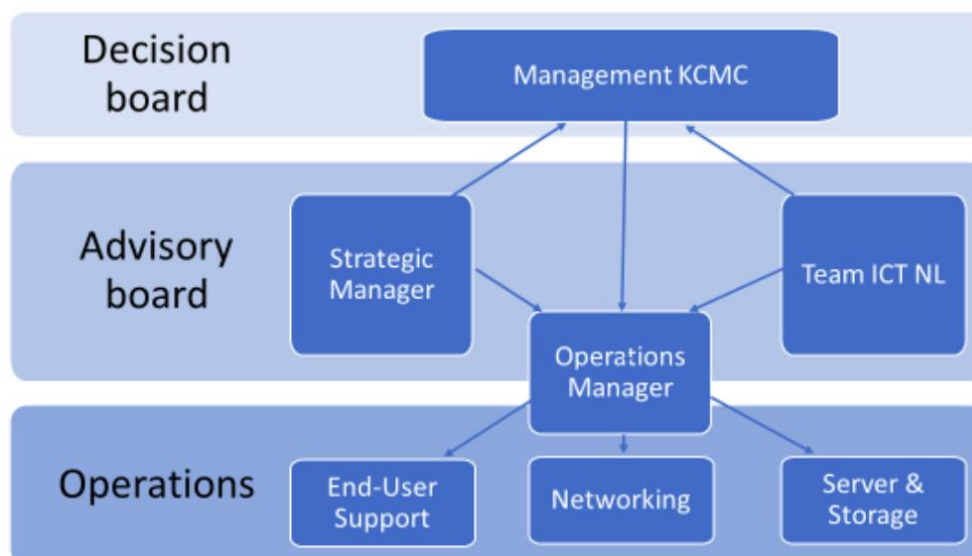
The IT manager can then fully concentrate on the day-to-day operations and various IT projects, while the strategic manager manages the long-term strategy. He will also be the bridge between the executive's, IT management and Team-IT-NL.

We propose a part-time job of 2-3 days a week for a period of 24 months

The role of the Dutch team and the strategic manager are temporary.

The suggested IT organization for the coming 3 years is shown below.

### Organization diagram



The strategic manager and the operational IT manager are accountable to the executives of KCMC. The Dutch IT team must be seen as remote counseling and can provide solicited and unsolicited advice to the operational (IT) and strategic manager.

The strategic manager is responsible for:

- Establish long-term goals in collaboration with the executives;
- Drafting and monitoring budgets of projects;
- Weekly consultation with the operational IT manager about problems, progress and planning;
- Establish priorities in the implementation of projects;
- Schedule periodic consultation between the operational IT manager, KCMC executives and Team-IT-NL.
- The operational IT manager is responsible for:
  - Daily operation;
  - Determine budgets for daily operations;
  - Training planning for employees in the underlying IT teams;
  - Performance interviews with the team members;
  - Determine an annual plan.

Our advice is to divide the IT department in several teams. By splitting the IT department in 3 operational teams it will be better to focus on different IT specialisms and the responsibilities that come with it.

Each team should have a senior IT member who has knowledge of the specific IT area and is able to motivate and lead the team to the best results.

#### **Support team,**

Minimum of four IT members with one or two years of experience with IT and knowledge of basic computer techniques like AD, DNS, Mail, IP networking, wireless, virtualization, scripting, etc. A member of the support team must have communication skills because he/she is the intermediate between the hospital employees and the IT-staff.

The support team can resolve 75% of the issues and incidents up to a basic level, for more difficult issues it cooperates with the colleagues of the other operational IT teams.

#### **Network team,**

Consisting of at least three IT members with knowledge of networking techniques and management. The level of CCNA (Cisco Certified Network Administrator) has to be met for all members. At least one of the team members must be an expert on network-security (CCNA-security) and one team member must be an expert on Wireless technology (CCNA-wireless).

#### **Server & Storage team,**

Consisting of at least three members with knowledge of Microsoft server techniques and virtualization. People need to take exams from Microsoft and VMware to become certified (MCP / VCP).

## *2. Training*

It is important to invest in training the IT members at KCMC so they can properly manage the new IT infrastructure. IT is both complex and business critical.

Beside training, they need equipment to practice without the risk of disturbing the live production IT environment of the hospital.

We advise to build on standards for both equipment and software instead of using and installing whatever is available through donations. It is impossible to have knowledge of all types and brands of hardware and software, even for someone with a lot of experience and a high level of knowledge.

Gaining knowledge and self-improvement is a matter of time. A lot will be training on the job. The lack of knowledge we see today is not because the IT employees are unwilling or incompetent, it is much more a matter of not being able to work with the proper tools and equipment.

It is the intention that team ICT-NL will return to Tanzania in the coming years to help achieve the IT objectives for KCMC. This will always be around November.

Support from the team ICT-NL will be necessary, but will gradually decrease if the local IT team has sufficient knowledge to manage the ICT environment itself.

We strongly advise to hire at least two well trained and experienced IT seniors, one with main focus on networking (CCNA level minimum) and another one with focus on servers and storage (MCP/VCP certified). These seniors must be prepared to train the IT staff of KCMC during the work.

## *3. Future IT Projects*

### **LAN/Wi-Fi extension**

We have to extend the Wi-Fi internet facilities to all the premises of KCMC. As stated earlier, because of budget and time issues, only part of the KCMC departments has Wi-Fi accessibility. There is one Main Equipment Room (MER) and 23 Satellite Equipment Rooms (SER) at KCMC. For the moment half of the SER's have connection to the MER and therefore only half of the KCMC premises have Wi-Fi coverage. And also, in some occasions, extra equipment (AP's) has to be added in order to guarantee good Wi-Fi coverage in that specific area.

This extension is pretty easy to establish. As soon as the other SER's can connect to the MER and the Wi-Fi Access points are placed on the right positions it will work almost automatically. The access points are available. The current IT-team at KCMC knows how to do this.

### **Incident registration**

Because we want to know how many issues we meet, how long it takes to resolve them and because we want to learn from issues we met before, we want to make a registration of all the problems we see and take care of. KCMC needs a database to log all information on issues, like type of computer, time, names, actions taken, etc, etc.

A lot of software applications are available for this purpose, varying from very complex and expensive to pretty easy and freeware. It will be part of the project to choose the best option. It might be a good idea to have a student from college for a period of time of several months to run this project, starting with choosing the best software, define and optimize the process and perform the installation.

### **Power supply**

As the ICT systems can be seen as crucial for at least a great part of the departments of the KCMC is absolutely necessary to have it available 7\*24 hrs. Already during the implementation of the infrastructure we recognized that during the day there are several power-outages, differing in time from one second to sometimes two hours or more. The total power consumption of the IT equipment in the MER is estimated at 3000 Watts at least. Power is now supplied by using different Uninterruptable Power Supply (UPS) systems. These UPS devices are not new and therefore they do not deliver the full capacity anymore.

For all of the IT devices it is advisable to establish a normal shutdown procedure instead of switching it off only. But especially server and storage do require a proper shutdown otherwise hardware may become defect or data may become corrupt and unusable.

We strongly advice to install a good UPS system of at least 20kVA in the MER for powering all the centralized IT equipment. When there is a power outage this backup power system will keep the system running for at least one hour, which should be more than enough to start the generator for back-up power.

### **Storage back-up**

We provided you with a storage device. This device has 10 disks of 4TB. For safety reasons we keep 4 disks 'outside the device' as a spare part. If one of the disks fails, one of the spare disks will automatically fill up the gap. This leaves app. 20TB of storage available for the moment and we foresee this will be enough for the next 18 months at least. During this period of time we will have to see how fast disk-usage grows

The data needs to be back-upped to another device for security reasons. If for no matter what reason the complete system would fail (ic. fire), it would mean that all data of KCMC would be lost. Data is one of your main assets, without it, there is no administration, no history and therefore no future either. Making a 'disaster-recovery plan' for KCMC ICT is one of the tasks for the strategic manager.

### **Mail**

KCMC now uses different mail accounts from several providers like gmail, outlook, etc. Besides the fact that this is not very safe, it is not efficient. Using a central mail system and the domain xyz@kcmc.ac.tz means that you can share mailboxes if you want, share agenda's and use many other tools that makes your work simpler. This saves time and money and above all, it is much safer.

## **Redundant firewall**

We installed a firewall device to secure all incoming internet traffic. With additional software we're also able to filter traffic in order to avoid unwanted software and applications to use the internet bandwidth.

This firewall is now a single point of failure. If it fails, there will be no internet at KCMC for staff or patients. It is possible to create a fail-over situation with two similar firewalls.

## **End-point management**

It is important to have centralized control over all users and computers the network. In November 2018 Windows Active directory was installed. Active Directory is an umbrella title for a broad range of directory-based identity-related services.

A server running Active Directory Domain Services is called a domain controller.

It authenticates and authorizes all users and computers in a Windows domain type network assigning and enforcing security policies for all computers and installing or updating software.

For example, when a user logs into a computer that is part of a Windows domain, Active Directory checks the submitted password and determines whether the user is a system administrator or normal user. Also, it allows management and storage of information, provides authentication and authorization mechanisms, and establishes a framework to deploy other related services: Certificate Services, Active Directory Federation Services, Lightweight Directory Services and Rights Management Services.

This all means that working with Active Directory makes the management of an IT environment not only easier but also safer.

Therefore, it's very important to add all the end-point computers (PC's, notebooks, tablets, etc) of KCMC to the domain. Even those which are now function basically as stand-alone computers.

This project must be well prepared before it is started. This must first be worked out and described within the advisory board.

## **VMware licenses**

Because no budget was available for licenses of virtualization software, a free license of VMware ESX has been installed as hypervisor on the servers. This has limitations regarding options for backup and maintenance. In order to build a stable and professional server/storage solution official licenses will have to be installed. It will, for instance, then be possible to automatically make daily back-ups

## **Replacement and new hardware or software**

KCMC has to realize that the donated and installed hardware is not new anymore. We expect it to last for at least another 3-5 years, but some parts need to be replaced or added in the years to come.

KCMC cannot rely on donations only, just as it says in its own strategic plan 2015-2020. Another imported fact is that goods that are donated do not always necessarily have to fit in the existing infrastructure. It's not a good idea to add all kinds and brands of hardware or software just because they are there.

It's like building a machine, if you fit in the correct elements the machine will perform better. If you build it from all kinds of materials which come available by coincidence, it is a matter of wait and see what happens.

### **Back-up internet line**

In November 2018 a new fiber connection was established for KCMC, replacing the old (and slower) connection that runs via the university. There is also a third connection to the internet which is connected to a mail server.

It is obvious that all these connection cost money on a monthly basis, often a lot of money. At this moment we do not know anything about up-time guarantees for either of these connections. A back-up internet connection only serves for calamities and KCMC must weigh up the costs for a second (or even third) connection and the risk (and consequences) of failure.

If a back-up line is needed, it must be of another ISP and be connected to different equipment than the first connection. You have to rule out every single point of failure and to do so needs a lot of preparation and probably a lot of money. This is not a top priority at this moment, because the critical processes within the hospital don't require internet access.

### **Virtualization of existing server**

KCMC has a couple of so called 'bare-metal' servers installed in its IT infrastructure. The Hospital Information System and de Packs-application for X-rays run on one specific server. All these applications should be migrated to Virtual Machines (VM's). Working with VM's makes management easier and will ensure a higher up-time of your IT environment (even more if you have VMware licenses) because you can easily move servers from one platform (host) to another without causing downtime.

It also gives the ability to migrate to new hardware in the future without the need to re-install the server/applications. Using the proper tools, you can do load-balancing in order to use your machine capacity best. This project needs a lot of preparation before we can start.

### **Clean-up**

Finally we recommend to remove the equipment of all third parties that are not part of this new IT infrastructure (and will not be so in the future). i.e. the AP's from the university.

We strongly advice that the KCMC makes and maintain budgets for both projects and replacement of components that will fail in the future.

It might be a good idea to investigate on how much the parts, that have been installed now, would cost in Tanzania by just asking one or two quotes from suppliers.

This gives us all a good idea of how much KCMC yearly has to spend in order to keep the ICT infrastructure at a certain level.

We also need to carry out additional projects to add new functionality or to expand. This will mean extra costs. Depending on the budget you have, the needs KCMC feels to have this extra functionality and the resources you have in terms of human capacity these projects will be carried out in the next three years.

The costs will be high, but the benefits will be even higher in the end, in terms of cost-savings and efficiency. Resulting in better care for the patients of KCMC.

## Priority

We added priorities based on what we've seen and what we think can best be done to have the greatest benefits at the beginning. Priority 1 is a 'must-have-now', 2 is a 'Must-have-soon' and 3 will be 'nice-to-have'

Each project should have an owner, someone who knows what has to be done, who takes responsibility and can delegate tasks to his team members.

Over the next years new projects can be added, some may have a higher priority, which means other projects can be delayed. This is a subject of discussion between the advisory board and management of KCMC.

<b>Project</b>	<b>Priority</b>
IT staffing	1
Education	1
Power supply	1
Back-up storage	1
End-point management	1
Redundant firewall	1
LAN/Wi-Fi extension	2
Incident registration	2
Mail	2
Virtualization Servers	2
Repl./New components	3
Back-up internet line	3
Clean-up	3