



DIPLOMA THESIS ACEX20

# Project Management challenges that affect lifespan of constructions in development aid project

A Case Study through Healthy Hospital Project in Tanzania

*Diploma Thesis in the Engineering Programme*

*Civil and Environmental Engineering*

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CHALMERS UNIVERSITY OF TECHNOLOGY

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## ABSTRACT

The purpose of this thesis is to investigate different factors that are causing dependency on external resources within aid projects. We have conducted a case study based on a field visit in Tanzania. The field study has been made in cooperation with Engineers Without Borders for their Healthy Hospital Project (HHP) in Mkula village. Project management challenges in HHP are analysed to ensure the quality and standard of the project process to ensure long-lasting constructions. Key challenges to analyse are selected due to the circumstances and outcome of the project. This, to get a wider understanding of the wide spectrum of long-term and short-term solutions in development aid. More specifically, how HHP strives for a qualified lifespan on constructions where need of future resources and maintenance are within the project cost and effort.

The HHP 2020 was divided in three sub-projects. The rebuilding of a laboratory that lacks proper space and equipment, was the primary focus for us. Furthermore, we have been supervising an ongoing project of a new Reproductive Child Healthcare (RCH) unit that was built during the entire visit. We have also participated in a storm water study to investigate how to prevent leakage into buildings due to heavy rain. We acted as supervisors, coordinators, and technical consultants of the ongoing constructions of the new RCH in parallel with the planning process of the drainage system and new laboratory. Throughout the project period, logbook, protocols, drawings, and estimations were made to collect field documents for the research. Themes and examples from previous literature have been connected to the case study together with survey reports and master theses from previous years of HHP. Reflections of the observed process contributed to the possibility of finding research connections for the purpose of this thesis.

Project success has been analysed by two dimensions, “project management success” and “deliverable success”. This, to understand the project management challenges of HHP. Furthermore, frequent occurring issues within the sub-projects in HHP could be recognized as patterns. Thus, four constraining factors discovered within the HHP were defined as characterizing issues that could cause future dependency. (1) *The risk degree of quality* is a constraining factor since it is likely to cause future dependency on external actors. The building quality needs to be prioritized to avoid the need of maintenance in an early stage of the lifespan. (2) *The supervision efforts are limited* which affects the possibilities to deal with needs of maintenance. (3) *The budget inflexibility* causes an uncertainty when the buildings could be maintained. The entire project process is affected by the unknown funding amount in future. (4) *Loose couplings between actors* affects the ability to control the resources and distribute the funding between maintenance and investment cost. Due the Covid-19, the budget for HHP 2020 was not covered.

We have noticed that the loose couplings between actors caused a relationship of dependency. Problems that were not considered in an early stage could cause the actual outcome of the project to differ significantly from its purpose. Thus, we suggest that decisions within HHP should be allocated to a phase where the possibility for the EWB group to influence project outcome is high. The lifespan of the buildings is dependent on the project management method as it is the baseline for the balance between cost, quality, and effort favour long-term achievements.



## **PREFACE**

This thesis is based on a case study which were conducted through the Healthy Hospital Project 2020 in Mkula Village, Tanzania. The project is a foreign aid collaboration between Mkula Hospital, Swedish organizations and Engineers Without Border and had a duration of seven weeks during spring 2020.

Firstly, we would like to give our greatest gratitude to Healthy Hospital Project group. Without the initiative of this cooperation from Sweden this case study would not have been possible. Our warmest gratitude to the people in Engineers Without Borders team which supported us during our entire stay in Mkula.

The case study would not have been able to be conducted without the people at Mkula Hospital. Our warmest gratitude is given to the hospital staff and people in Mkula for their great hospitality. We would like to give a special thanks for the committed support from the Hospital Management Team, especially Dr. Gilala, Dr. Madohou and Mr. Nyamya. Your eager guidance during our stay in Mkula is greatly appreciated. Without you, we would never been able to accomplish this cooperation through Healthy Hospital Project.

Finally, we would like to give our biggest thanks to our examiner and supervisor, Martine Buser. Your guidance and expertise have been an invaluable source for our writing of this thesis. Our warmest thanks are also given to our partners in crime, our two student co-workers. Our stay and accomplishments in Mkula would not have been the same without you.

1	INTRODUCTION	- 4 -
1.1	Background	- 5 -
1.2	Purpose & Research Questions	- 6 -
1.3	Limitations	- 6 -
2	METHOD	- 7 -
2.1	Participatory Action Research	- 7 -
2.2	Case study	- 7 -
2.3	Selection of Subprojects	- 8 -
2.4	Participation and actors	- 9 -
2.4.1	Stakeholders	- 9 -
2.4.2	Participation in HHP	- 10 -
2.4.3	Relationship between actors	- 11 -
2.4	Literature	- 12 -
2.5	Analytic Process	- 12 -
3	RESULTS	- 13 -
3.1	Mkula	- 13 -
3.2	Our Project	- 13 -
3.2.1	Timeline	- 14 -
3.2.2	Result of Sub-projects	- 15 -
3.2.3	RCH	- 16 -
3.2.4	Laboratory	- 16 -
3.2.5	Drainage system	- 17 -
3.2.4	Weekly report on project progress	- 17 -
3.3	Overview of factors affecting lifespan	- 28 -
4	THEORETICAL FRAME	- 31 -
4.1	Background	- 31 -
4.2	Aid in Tanzania	- 31 -
4.3	Importance of quality control & maintenance	- 34 -



5	ANALYSIS & DISCUSSION	- 35 -
5.1	Different dimensions of project success	- 35 -
5.1.1	The ambulance issue	- 35 -
5.2	Laboratory Discussions of different outcomes	- 36 -
5.2.1	Option 1. Keeping the existing roof and foundation: Project management success	- 38 -
5.2.2	Option 2. Demolishing and rebuild the roof and foundation: Deliverable success	- 39 -
5.2.3	Decisions and discussions within the team	- 42 -
5.3	RCH: Project management challenges in the implementation phase	- 43 -
5.3	Drainage System: Ensure a long lifespan for existing buildings on hospital area	- 45 -
5.4	Summary of project challenges within the sub-projects	- 46 -
6	CONCLUSION	- 47 -
7	REFERENCES	- 49 -



## LIST OF FIGURES

Figure 3.1. Original timeline of Healthy Hospital Project 2020. ....	- 14 -
Figure 3.2. Actual timeline of Healthy Hospital Project 2020. ....	- 14 -
Figure 3.3. Current laboratory and old RCH. ....	- 16 -
Figure 3.4. Schedule of project procedure. ....	- 18 -
Figure 3.5. The first draft of the new laboratory. ....	- 19 -
Figure 3.6. First draft of drainage system. ....	- 22 -
Figure 3.7. Drawing of all elements that are included in the estimation of quantities. ....	- 23 -
Figure 3.8. Finalized drawing of the new laboratory. ....	- 25 -
Figure 3.9 Clogged gutter at Kolandoto Hospital 2020. ....	- 26 -
Figure 3.10. Estimation of lifespan for the extension of laboratory. ....	- 28 -
Figure 5.1. Timeline of project outcome 2020-2021. ....	- 37 -
Figure 5.2. Estimation of lifespan for the extension of laboratory showing risk degree. ....	- 40 -
Figure 5.3. The implementation phase of the new RCH. ....	- 43 -

## LIST OF ABBREVIATIONS

**EWB – Engineers Without Borders**

Organisation that runs the Healthy Hospital Project.

**HHP – Healthy Hospital Project**

Continuous project which concerns a cooperation between EWB and Hospitals in Tanzania. The project was established in 2015 at Kolandoto Hospital and has continued since 2018 at Mkula Hospital.

**HMT – Hospital Management Team**

Refers to the team which was involved in the Healthy Hospital Project 2020 represented the Mkula Hospital point of view. Also mentioned as beneficiaries. The constellation of people varied during meetings and usually consisted of two doctors and two HMT administrators.

**ID – International Development**

Refers to International Development projects and cooperations conducted in Africa.

**ODA – Official Development Assistance**

Governmental aid given to developing countries as a cooperation of official agencies.

**PAR – Participatory Action Research**

The method is a way of approaching a research whereof action and participation are the key factors for the investigation

**RCH – Reproductive Child Health care unit**

Facility where health care is provided for children and mothers.

**SPG – Student Project Group**

Four students from Chalmers University of Technology present during the field study including the authors of this thesis.



# 1 Introduction

We have been participating as supervisors in the Healthy Hospital Project (HHP) and has furthermore conducted a case study through the organisation Engineers Without Borders (EWB). The work of this thesis has been distributed as joined efforts between the two of us. Observations of our field visit has resulted in a further investigation of relations between cost, quality and maintenance work in HHP. The literature suggest that these relations differ significantly from traditional projects. The supervision abilities within EWB is often restricted to a short time which are causing difficulties to discover defects of ongoing projects. We believe that many of these defects could be prevented in an early stage if supervisors would have more influence on how projects unfold. The lack of knowledge of future budget possibilities due to dependence of funds from external companies is a challenge. Furthermore, we found that the budget funds were allocated insufficiently between maintenance and construction phase because of uncertainties regarding budget.

EWB is a non-profitable, non-governmental organisation and has a long-last cooperation in Tanzania through the HHP (Engineers Without Borders Sweden, n.d.). The cooperation started at Kolandoto Hospital in 2015 and has further on continued to the Hospital in Mkula since 2018. It all has been a collaboration between the organisations such as Chalmers University of Technology, Engineers Without Borders, Architects without borders and the co-workers at the hospital.

The Mkula Hospital has an increased number of patients and is continuously facing infrastructural challenges due to required expansions of several departments. The Healthy Hospital Project 2020 consisted of three overlapping sub-projects. We were altogether four students of Chalmers University of Technology representing EWB while writing our thesis. Firstly, our student role was to follow up and monitor the building process regarding the new Reproductive Child Health care unit (RCH) by being present on the construction site as a part of the supervising team. Secondly, we were planning for a new laboratory. Finally, we investigated the future development possibilities for a drainage system. In parallel with these three sub-projects, a consistent challenge in our role was to handle project management in development aid which will be part of the focus of this thesis.

The project management method affects the balance between investment verses maintenance costs. This in turn influence the quality and lifespan of buildings. Limited access to supervision and resources, affects the possibility of independence. The HHP strive for long lasting constructions where the sub-projects are intended to be followed up through maintenance and quality control. Furthermore, HHP strive for an independence from external resources.

## 1.1 Background

Foreign aid has been a common phenomenon in Sub Saharan Africa since 1950 and has partly evolved from need-based aid. Tanzania has received the second largest aid amount in Sub-Saharan Africa (Tripp, 2014). The author claims that foreign aid has directly strengthened the democracy as it has partly supported civil society and political reforms for human rights. Unintended consequences of aid could be described as the risk of corruption which at a national level affects political finances and indirectly democracy. All aid projects, both at national and local level, must keep indirect and direct effects in consideration.

*“Donors need to consider not only the direct effects of their actions, but also the contingent and often unintended indirect consequences.” (UNU-WIDER, 2012)*

Awareness of indirect influence has been a key factor for the understanding of foreign aid in recent time. Swedish International Development Cooperation Agency has evolved a strategy plan aiming for sustainability and development in cooperation with Tanzania (Regeringskansliet, 2013). Main factors affected by aid are productive business, agriculture development, sustainable energy, education, and entrepreneurship. Their overall focus is aiming for democratic accountability and greater awareness of human rights, rather than need-based aid.

The effects of development aid have in other words been key factors for our understanding of the context in HHP in Mkula. We researched through previous documents and theses that were based on experiences through HHP. Furthermore, this inspired for a long-term mindset and made us consider possible unintended effects of our project. We want the hospital not to be dependent on the HHP for infrastructural improvements. Thus, our striving is to ensure hospital independence. The HHP is planned to be a periodic cooperation and provide for the most urgent needs to moreover become independent in the future.

## 1.2 Purpose & Research Questions

We wanted to identify the challenges to ensure quality and long lifespan on constructions. The lifespan is dependent on the ability to maintain the construction. Failures could appear if not considered during the planning phase in the project. Based on the case study from our participation in the HHP we have analysed the project management challenges to strive for a long lifespan when conducting the different sub-projects. The diploma thesis is analysing the wide spectrum of the long-term and short-term solutions in development aid. More specifically, the report is studying the relation between quality, maintenance and investment cost based on a case study of the HHP at Mkula Hospital in Tanzania.

We believe that the urge to save money while designing projects could affect the long-term mindset which in turn could affect the lifespan of the building. Further on these factors will be acknowledged and followed up by measures that could be implemented in our project. Project management challenges could be analysed out of two dimensions of project success according to Ika (2012), “project management success” and “deliverable success”. This will be connected to how decisions in HHP has been made in order to avoid embedding weak links. We believe that these observations can be useful in future projects within EWB.

The aim is detailed by the following research questions:

- *How has the project management challenges been dealt with in the project, that in turn, affects the lifespan of the building?*
- *How has the quality and need of maintenance comparing to cost and effort been balanced in the Healthy Hospital Project in Mkula?*

## 1.3 Limitations

HHP has been the main focus during the two months of the case study. The thesis has therefor been formed and shaped by our experiences within HHP. The project has also been the main source for inspiration and collection of information. Identified stakeholders mentioned in this thesis are the Student Project Group (SPG), EWB team, Hospital Management Team (HMT), district engineer and contractor. The study is firmly based on observations from three sub-projects during 2020 and contains a wide range of different occurrences. They are as following: A new RCH building, an extension of an already existing laboratory and a drainage system at the hospital area. The entire project was dependent on previous phases of the HHP which were conducted in earlier years.



## 2 Method

To study the project management challenges in the HHP we have chosen to carry a case study as it is suitable for investigations of continuous processes and evaluations based on experiences (R. K. Yin, 2014). Vissak (2010) claims that case studies could be used for theory-building where the research question could be based on reflections and experiences. The intentions for this thesis are to find themes and examples in previous literature which supports research questions.

### 2.1 Participatory Action Research

The approach to this case study could be referred to Participatory Action Research (PAR). The method is a way of approaching a research whereof action and participation are key factors for further investigation (Lawson et al., 2015). Furthermore, the community studied, has asked for specific issues to be investigated. In this case, HMT specified a request of new RCH, new laboratory and drainage system. PAR-method aims for researchers to address real world events and participate with an active role in the process. Therefore, this method is applicable for the HHP since the SPG is interacting with HMT by participation. PAR is useful for HHP as the investigators, represented by the SPG, have influence of behavioural occurrences. However, SPG is an independent actor and is not directly affected by the actions of people.

### 2.2 Case study

The case study is made to understand the boundaries and connections of the context. The study focuses on contemporary events based on the cooperation within HHP at Mkula Hospital. Research questions are defined according to the methodology of a case study as “how” questions (Yin, 2014). These are based on the source categories: archival data, observations, and documentations. It is preferable to use as many sources as possible where these three source categories are qualified to be investigated from a real-world perspective. Multiple sources are used as primary and secondary sources in order to achieve a wider perspective.

Woodside (2010) defines the case study as an individual process. The case study is a way of describing, understanding, and analysing a phenomenon within its real-life context. This could be directly connected to the sub-projects in Mkula. The researchers or investigators are in this case represented by the SPG (who were participants of HHP). Researchers of the study aims to achieve an understanding while participating in the process observed. Documentation, conversations, and discussions were parts of the observation process. There is no demand for the study to rely on prior empirical evidence or literature to be defined as a case study, but it could be preferable. However, findings in the HHP have both been supported by previous research within the field and real-life observations.

The perception of a case study that Woodside (2010) presents, is supported by substantial evidence that shows that parts of the thinking processes occurs unconsciously. These are important matters for researchers to keep in mind. The own thinking-doing processes are limited and affected by more than one person. Conversations and decisions regarding different subprojects were made through meetings between the SPG and the HMT. During these conversations, influence of others should be considered due to the limited thinking-doing process mentioned by Woodside. The unconscious own-thinking process together with hierarchical and culture differences are some of the factors which could imply different outcomes of conversations during the meetings.

## 2.3 Selection of Subprojects

The scope of the different sub-projects was decided the first week in cooperation between EWB Team, HMT, and SPG. Decisions were based on previous years whereof investigations and research has been made to get a full understanding of the circumstances and prerequisites at Mkula Hospital. Participants of the SPG from previous years of HHP are currently part of the EWB Team. Their knowledge was represented in the discussion together with survey reports. The SPG has been writing these reports during 2018 and 2019.

The specific methods to gather data for answering the research questions are not based on measurable events. Information are gathered by participation and observations during meeting and occurrences connected to the subprojects. Qualitative studies are made as explanations of behaviours and events to analyse the processes from a project management point of view (Bell et al., 2019). The focus has been on contributing to the sub-projects at the request from the HHP. The study for this diploma thesis has naturally been a non-measurable collecting of data throughout the entire working process.

## 2.4 Participation and actors

### 2.4.1 Stakeholders

HHP at Mkula Hospital 2020 consisted of different actors with different involvements which together is defined as the “project group” or as members for the Healthy Hospital Project (HHP). The project group, divided into sub-groups are further defined and specified as followed:

#### Student Project Group (SPG)

Four students from Chalmers University of Technology were representing EWB at the hospital site. These students were separated in two original groups that have been working together during the entire project. All students are doing their thesis as civil engineers where two of them are studying their third year and the rest are studying their fifth year. The authors of this thesis are represented by the third-year students. All four students participated in the HHP as coordinators, supervisors and technical consultants for all three the sub-projects.

#### EWB team

Previous members of the SPG from year 2015-2019 of the HHP. They were supporting with both experience and technical competence as they are currently working as civil engineers and architects. There were in general six members who acted as contributors in the project. They were also coaching the SPG through digital continuous meetings. Moreover, they were also a part of all the decisions and were supporting the project as a sounding board. Furthermore, the EWB team was managing the payments for the HHP.

#### Hospital Management Team (HMT)

Refers to the team which was involved in the HHP 2020 representing the Mkula Hospital point of view. The constellation of people varied during meetings. Usualy it consisted of two doctors and two HMT administrators.

#### District Engineer

Hospital Engineer who was representing the entire district of Busega whereof one of the hospitals was Mkula Hospital.

#### Contractor

Responsible for the physical construction process of the new buildings. During the entire visit of the case study they were working on the RCH and were also going to be responsible for the building process of the extension of laboratory which EWB funded. The group consisted of four people including a leader which was main responsible for their work.

### 2.4.2 Participation in HHP

Three people from the EWB team arrived at the hospital area for an introduction week for the SPG as we are new contributors of the project. This week, a contract of agreement where signed to ensure the quality of cooperation. Furthermore, the project group created a timeline for future work through Healthy Hospital projects 2020 during the stay of the SPG which is visualised in Figure 3.1. We had an insight in every part of the project. The project process was divided in different tasks where our daily, concrete doings could be summed as following:

Meetings consisted in following constellations of actors:

- All four students in the SPG
- SPG and HMT
- SPG, HMT and district engineer
- SPG and EWB team

Supervision of the ongoing construction of the new RCH

- Observation of the construction process
- Limited communication because of language challenges with contractors and HMT regarding the process on sight.

Technical Consultants

- Investigating technical solutions for the projects
- Creating drawings and documentations for the extension of the laboratory
- Estimation of materials and cooperating with district engineer and EWB team regarding bill of quantities

Coordinators and supervisors for the extension of laboratory and drainage system

- Mails, phone calls and meetings.
- Link between EWB team, HMT and district engineer.
- HMT did the direct contact with the contractors and while SPG created contract of agreement between the two actors on their demands.

SPG has then been acting as coordinators, supervisors and technical consultants for the subprojects. One of the main tasks for the SPG was to coordinate continuous meetings, both with EWB team digitally and HMT physically at the hospital. Contributors such as visitors at the hospital and district engineer were attending the meetings occasionally. During the meetings, protocols were written complemented by subjective notes. These documentations together with a logbook of notable events and field notes were collected as data sources. The specific notable events were presented in a scheduled logbook to get an overview of the process work which could be seen in Figure 3.3. Archival documents such as changes in drawings and measurements were also documented to follow the full process. As a daily routine the SPG visited the hospital area to observe the continuous work of the construction of the new RCH. Observations of construction process created opportunities to communicate with construction workers to some extent. Data for the study was therefore simultaneously gathered through conversations with HMT and hospital staff. Data collection for the rest of the subprojects had the same kind of qualitative methodology but appeared in a practically different way as the laboratory and drainage system were in the planning phase.

HMT had a direct contact to the staff and represented their thoughts during the meetings. The main shaping and research for the extension of laboratory had been made earlier years through workshops and other methods, to involve every hospital function, including hospital staff requests. Conversations, discussions, and decisions were made during the meetings complemented by communication through mail, mobile phones and hospital tours for observations and measurements. All members of the HMT spoke English which simplified the communication through the project. Most of the hospital staff could speak basic English as well. The conversations with the contractor were conducted with a member from the HMT as an interpreter.

### **2.4.3 Relationship between actors**

The relationship between different actors and people need to be considered. There is a hierarchy in the HMT which could affect the contributions and statements during the meetings. As Penttinen et al. (2019) mention in their research report, “hierarchy did not allow for open genuinely interactive discussions” which could be a case in the HHP considered.

SPG acted as a main channel between district engineer, HMT and EWB project team. During the visit in Mkula for two months a friendly relationship outside work evolved with at least two members of the HMT which could affect the actions and outcome of the meetings and work. The SPG and EWB project team have had meetings back in Sweden during the autumn which created another kind of relationship before. Relationship outside the original work schedule, both with different actors and between different groups could affect how the project was handled. Research performed by Leonard (2013) illustrates that project management methodology is a factor for the outcome of the project as well as social relationships which could not be ignored. Contribution from members of project teams are more than only knowledge and competence (Leonard, 2013).

## 2.4 Literature

The different kind of literature used in this thesis were found both before, during and after the field study. The texts studied before arrival was primarily old master theses and survey reports which have been written in relation to the HHP all over the years. This, in order to understand the context of the HHP. Also, these reports gave information about the previous work and circumstances of Mkula Hospital. Other documents studied were academic journals, peer reviewed articles, organisational documents, and books to get a background of aid projects, especially in Tanzania. Furthermore, we were participating in a preparation course through Swedish International Development Cooperation Agency where we accessed tools on how to organize our field study.

During our stay in Mkula, we looked for documents regarding construction projects in Tanzania to understand the challenges of quality we were dealing with within the project. Academic journals and conference articles retrieved from either universities or libraries were studied. These documents were collected from institutions in Tanzania or countries with similar conditions in order to understand the general construction process in Tanzania and what challenges the buildings could face in the future.

All the previous background research could be used as a base to understand aid projects in Tanzania and what challenges HHP faced. After the case study, peer reviewed articles and books were studied to analyse themes and connections even deeper. This, together with all the previous studied documents, shaped the theoretical frame.

## 2.5 Analytic Process

Research questions are analysed based on the case study. The research process consists of finding examples and themes which are related to the challenges of project management and compare them to the theory. All documentations were summarized as key events for every subproject to find a common theme. Through analysis, comparisons and theory research connections were established whereof the research questions could be stated. The case study highlights specific events and research questions could be analysed in parallel with literature.

## **3 Results**

### **3.1 Mkula**

Mkula Hospital and village are situated in a small area of 16 000 inhabitants in northern Tanzania. The Hospital has a catchment area of around 200 000 persons covering the Busega District (National Bureau of Statistics Ministry of Finance Dar es Salaam & Office of Chief Government Statistician President's Office, Finance, Economy and Developement Planning Zanzibar, 2013). The hospital was established in 1986 by the organisation African Inland Church of Tanzania and are currently governed and run by the same organisation (Cronemyr & Lexell, 2018). It has a general number of inpatients around 50 per day and 40 outpatients per day (Cronemyr & Lexell, 2018).

### **3.2 Our Project**

The information in this chapter regarding the hospital circumstances and condition have been collected from previous student work done within HHP. Therefore, the references in this chapter concern previous student theses within the project. Reproductive Child Health care department (RCH) is being rebuilt during the field visit as it was one of the most urgent issues identified (Axelsson & Schön, 2019). The earlier construction and area were not suitable for the required function. Patients of RCH are mainly outpatients which should not go further into the hospital area where the old RCH is placed. Furthermore, the old building did not have enough space to satisfy the need of examination (Nygqvist, 2019). The new RCH unit will open up areas that enables an expansion of a new laboratory. Currently, laboratory tests are sent away for investigation where the rebuilding of the laboratory would be of major significance as the tests could be done at site instead. Furthermore, this will enable hospital staff to increase the number of patients. Another identified issue was a need of a drainage system due to heavy rainfalls. The overflow of water could affect the lifespan of the buildings as indication of dampness was discovered on already existing buildings.

### 3.2.1 Timeline

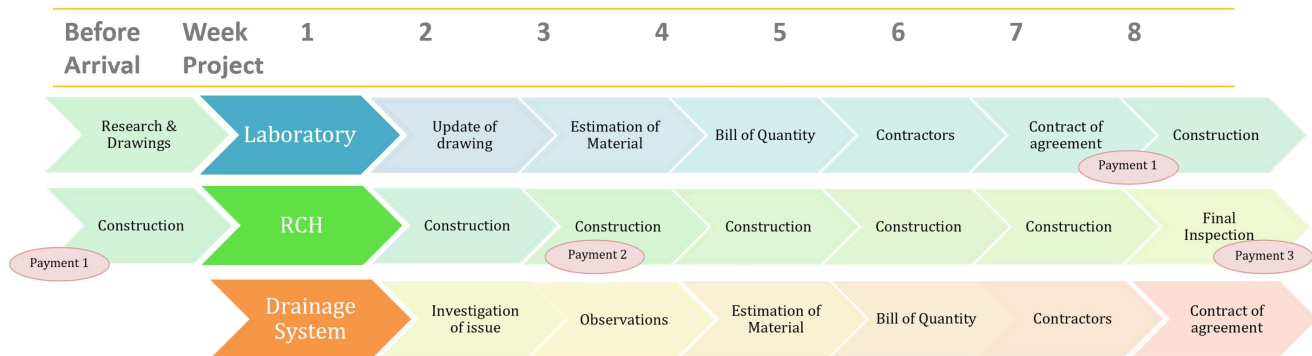


Figure 3.1. Original timeline of Healthy Hospital Project 2020.

During our first week of our stay in Mkula we created a simple timeline to get an overview of HHP 2020 and how we wanted it to unfold. HMT, SPG and EWB team all agreed on a timeline according to Figure 3.1. All the three sub-projects were planned to be conducted in parallel during the procedure of seven weeks. Main events are illustrated by the boxes in the figure. Furthermore, time and need of payment are visualised in the circular shapes.

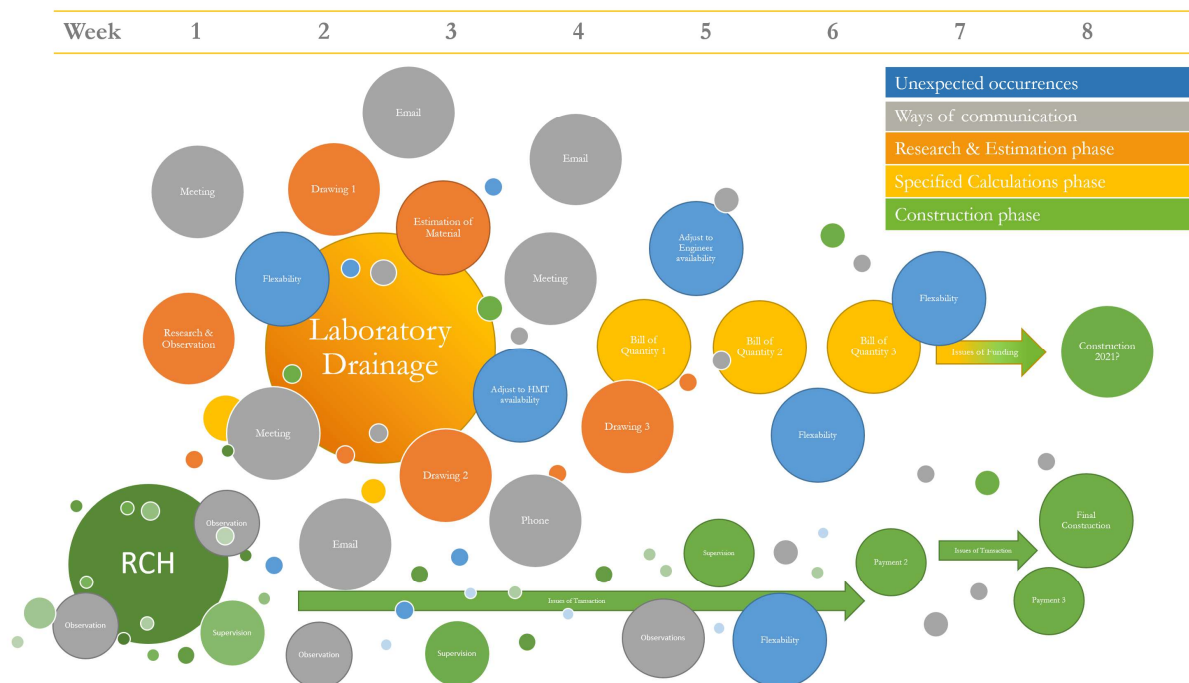


Figure 3.2. Actual timeline of Healthy Hospital Project 2020.



The actual outcome of the project is presented in Figure 3.2 and differs from the original road map which was created at the beginning of the first week. We choose to present the actual timeline as a circle ratio. This figure visualises the mashup of structure as topics and issues where handled spontaneously all over the project time. Unexpected occurrences are represented by the blue bubbles while the ways of communication is represented by the grey ones. The rest of the coloured bubbles visualises the different phases of the construction process. The small bubbles represent micro activities such as phone calls, taking pictures and daily conversations regarding the project. We were flexible with time as the possibilities to attend meetings differed for all the actors. The project was in other words adjusted to the prerequisites of the involved actors. The special context of HHP should be considered. Working process, culture, and relation to time, differs. We are used to the importance of structure, planning and deadlines. During meetings and other similar occasions, we experienced another way of how to view time. This had effects on how the project was conducted whereof meetings could be rescheduled without forewarning.

The sub-project of RCH had a steady routine whereof the only difference from the original were issues regarding transaction of money. The laboratory and drainage system were dependent on different actors during the entire project. In the beginning, we (SPG) were main actors of the HHP as we were creating all the documentations to visualise the project. Further on, the district engineer was responsible for the bill of quantities whereof the project group needed to wait for almost two weeks until the district engineer had time to do the proposition. It also occurred different editions of bill of quantity where options of keeping both roof and foundation for the laboratory were compared to the option of re-doing everything from scratch. Meanwhile, we needed to schedule meetings with EWB team to get input and approval regarding all the decisions. By the end of the project duration, price was reduced and contract of agreement between actors were supposed to be signed. A pandemic issue appeared which decreased the possibility of further funding which in turn led to no signed contract. Almost the entire amount needed was collected before which resulted in a decision to delay the project as soon as all the funds would be received.

### **3.2.2 Result of Sub-projects**

Decisions regarding each sub-project were made upon the requests of HMT. Furthermore, major decisions were discussed and initiated by the EWB group in Sweden. Decisions concerning technical matters that were made during supervision of the RCH were mainly based on previous knowledge, shared knowledge from the contractor and knowledge from the EWB group. Although, the language barrier caused difficulties of knowledge exchange between the project group and the contractor, HMT contributed with translation. Besides, decisions regarding the expansion of the laboratory were made by the project group under supervision of the EWB Team and upon the request of HMT. Payments were divided in sub-payments, and decisions regarding transaction were made upon request from HMT who were constantly communicating with the contractor.

### 3.2.3 RCH

In 2019, four students were present on site at Mkula Hospital while conducting their Master thesis. They were responsible for the rebuilding of a new RCH during their participation in HHP. The purpose of the RCH is primarily to facilitate the casualty unit. Half of the current emergency cases that are received at the casualty unit in Mkula are difficult births. Therefore, the RCH unit is an essential contribution to the decrease of birth mortality (Nygqvist, 2019). Tanzania has a ratio of 410 per 100 000 maternal deaths which is one of the highest numbers comparing to countries all over the world (National Institute for Medical Research, 2016). The RCH will be equipped with a lecture hall in order to organise info sessions to create awareness among mothers. Topics presented are HIV spreading, family planning awareness and importance of vaccines together with knowledge of how to decrease mortality for children under five. Furthermore, the new RCH will be equipped with examination rooms that will give the mothers privacy since the previous examinations were held in storage areas where staff passed by to get equipment.

Our role as members of the SPG 2020 was to be present on-site during start-up of the project. More specifically to monitor and supervise the different stages within the construction phase as the previous team had been responsible for the design phase. The purpose of our supervising role was to ensure the quality of the new construction and minimize the risk of corruption by being present on-site. Moreover, our role was to oversee all the calculations before payments were transferred. We had access to all documents for the building to follow up the sub-project of the new RCH that was already in progress at our arrival.

### 3.2.4 Laboratory

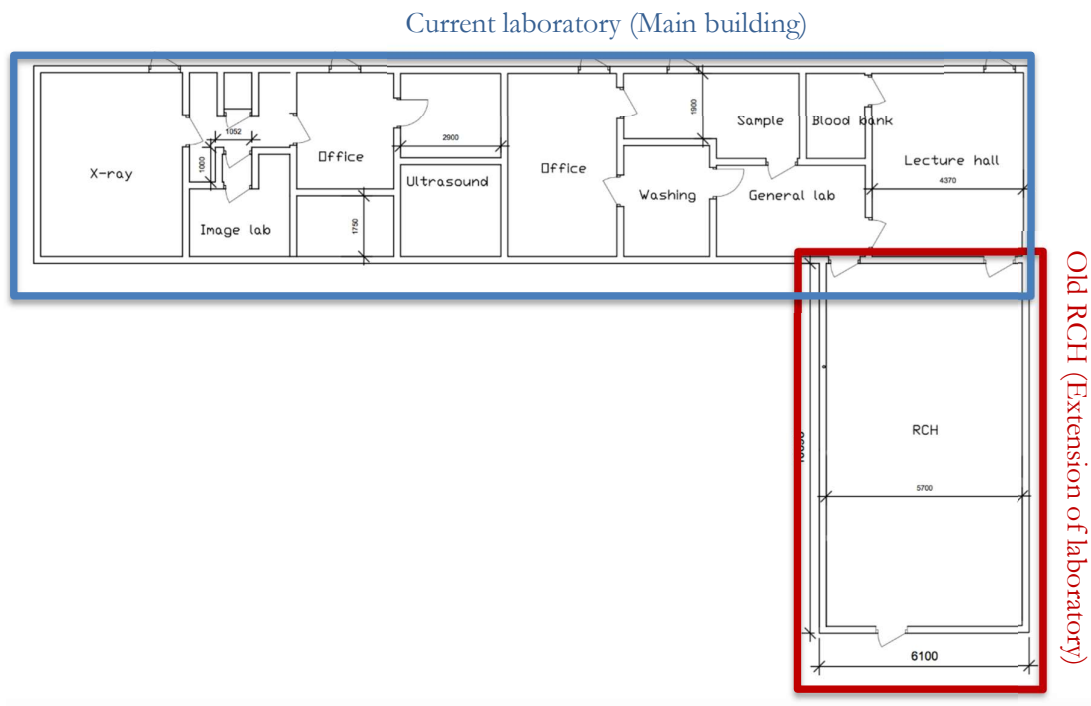


Figure 3.3. Current laboratory and old RCH.

The current laboratory (Figure 3.3. **Current laboratory and old RCH.**) is lacking space which makes the staff unable to analyse all the samples of test results. Tests are now sent away for analysis which is causing delays to receive results. The rooms are according to HMT and staff too narrow to get a functioning laboratory and are therefore one of the most urgent issues. The rebuilding of the laboratory requires space from the current RCH. The current laboratory and RCH are visualised in Figure 3.3. Vaccines are given to patients in the narrow entrance where staff pass by on their way to analyse test results. Because of the narrow space several departments and functions are sharing space. The function of the RCH will continue in the old building and leave space for the expansion when the new RCH is finished.

### **3.2.5 Drainage system**

The existing drainage system at the hospital area is mostly filling its purpose except from the circumstances regarding heavy rainfalls which occur periodically. The current system has not been maintained in several, unknown years. Hospital staff needs to remove the water from overwhelming parts of the hospital area for hours during the worst heavy rainfalls. The circumstances of heavy waterflows have affected some of the buildings as indications of dampness is visible. For example, the HMT notified us that it is a crucial issue in the surgery building is caused by penetration of rainwater. The drawings for the new drainage system intend to divert the water masses from the hospital area. Further on, it would lead the water alongside the road and connect it to the main ditch.

### **3.2.4 Weekly report on project progress**

The current RCH consists mainly of a lecture hall that only has two outer walls that are unconnected to the roof with no ceiling. The third wall is no higher than one meter allowing wind and heavy rain to enter the building. The bearing function is ensured by bearing columns on the sides of the ails along the buildings that carries the weight of the roof. Furthermore, the walls do not have any windows since daylight is provided by the open wall. The foundation differs 0.5 meter from the laboratory and the extension part because of the sloping terrain.

The original laboratory was built in 1986 and is made from concrete blocks with openings for the window frames. The roof is carried up by trusses that are casted in the outer walls placed with a regular distance and the bearing function is ensured by columns on the sides of the ails. None of the inner walls are load bearing which makes demolition of inner walls an option for the reconstruction. Furthermore, the roof consists of a one-layer tin roof and the ceiling only exist in the main part of the building and not in the extension of the building. The existing laboratory has cross ventilation since the windows are covered by a metallic net and adjustable glass-plates that enables the staff to manually adjust the ventilation. This is the most common type of windows that also function as ventilators. Because of the tropical weather condition, the indoor climate is difficult to adjust to achieve a comfortable working environment.

Different options of the rebuilding procedure were discussed during regular meetings with HMT according to schedule shown below. Meetings were held at the request of SPG and HMT together with other involved stakeholders. Additionally, meetings with EWB team were held weekly to follow up the procedure of the rebuilding process. A specified overview and schedule of the activities are visualised in Figure 3.4.

Week		Monday	Tuesday	Wednesday	Thursday	Friday	Weekend
48-51	Hours	48					
	Activity	Writing Minor Field Study Application in combination with research about Healthy Hospitals Project and case study. Meeting with Project Group Healthy Hospital.					
3	Hours			8	10	4	
	Activity			Preparation Course SIDA (Case Study)	Preparation Course SIDA (Case Study)+brainstorming theory	Preparation Course SIDA (Case Study)	
4	Hours	2					
	Activity	EWB team Meeting Healthy Hospitals. Preparation					
5	Hours			3			
	Activity			EWB team Meeting Healthy Hospitals. Time-plan			
6	Hours	3			4	2	4
	Activity	EWB Team Meeting. Update. HMT+project group Meeting and tour at Hospital.			HMT + EWB team Meeting. Time plan. Laboratory. RCH. Revit+Drawing. (1st)	HMT+EWB team Meeting. Laboratory+Drainage system. Revit+Drawing (3st)	Measurements. Double check and understand the building
7	Hours	1	6	1	3	1	8
	Activity	HMT Meeting. Time Plan. Laboatory and RCH. Drainage system drawing.	Student Project Group. Final Drawings (4st)	RCH Check. Demand second payment.	Student Project Group. Preparation. HMT+Engineer meeting. Technical discussions. Inspection of buildings and infrastructure.	RCH Check.	Student Project Group. Visualisations, Final Drawings+Revit (5st)
8	Hours	6	1	1			
	Activity	Student Project Group. Estimation of material	Send info to district engineer. (in cooperation with EWB team & EWB engineer)	RCH Check.			RCH Check.
9	Hours	1	1			1	
	Activity	EWB Team Meeting. Comparison previous project. Project plan.	RCH Check.			RCH Check.	Contact and discussion with district engineer
10	Hours			1	2	1	
	Activity			Student Project Group Meeting. Analysis and contact with solar panel+VVS Company.	RCH Check.	HMT + District Engineer meeting. RCH update. Laboratory + Drainage system. Best solution?	RCH Check.
11	Hours			1	2	1	
	Activity			Second payment for RCH recived.	RCH Check.	Student Project Group. Solar panels+VVS contact and research.	RCH Check.
12	Hours	2	2	2	1	1	
	Activity	Student Project Group. Analyse of bill of quantity from district engineer.	Student Project Group. Investigation and company contact.	Student Project Group. Investigation and company contact. EWB Team Meeting. Money and Construction.	EWB team meeting. Contact with HMT and district engineer regarding price reduction.	Kolandoto Hospital Study Visit	
13	Hours	1	2	3			
	Activity	HMT Meeting + district engineer.	EWB team Meeting. Reduction of price. Quality and construction discussion.	Final HMT Meeting. Finalize RCH. Laboratory to expensive -> will wait. Cooperation will continue.			

EWB Project team  
Student Project Group  
Hospital Management Team (HMT)  
District Engineer  
Contractors

Figure 3.4. Schedule of project procedure.

## Week 1

The first week, we were accompanied by the Swedish EWB team who introduced us to the field study and the ongoing projects. We overviewed the RCH construction and the progress that had been made. Furthermore, we investigated the previous plans and documents for the laboratory that had been created by the SPG last supervision period. The plan was made from discussions they had within the project group last year. The plans of the RCH were also prepared by the previous SPG which were present on site together with us during the first week to follow up the development of the building process. The concrete foundation was already casted, and the initiation of the columns had already been prepared at our arrival. Also, we got to see the hospital area and talk to HMT about future improvements.

We scheduled a meeting with the HMT to clarify our role. Also, we specified the expectations within the project. We strived to come up with a common goal of our stay regarding all different sub-projects. Moreover, we talked about the improvement that had been made during the previous years. Two days later, we talked about the laboratory and brought forward suggestions to plan for the expansion. An overview of the current laboratory was made where the design, the quality of construction and building materials were investigated further. Furthermore, we presented the first draft of drawing of the new laboratory to get the opinions about the function from the perspective of the hospital, including both HMT and staff. The first drawing of the laboratory is visualised in Figure 3.5.

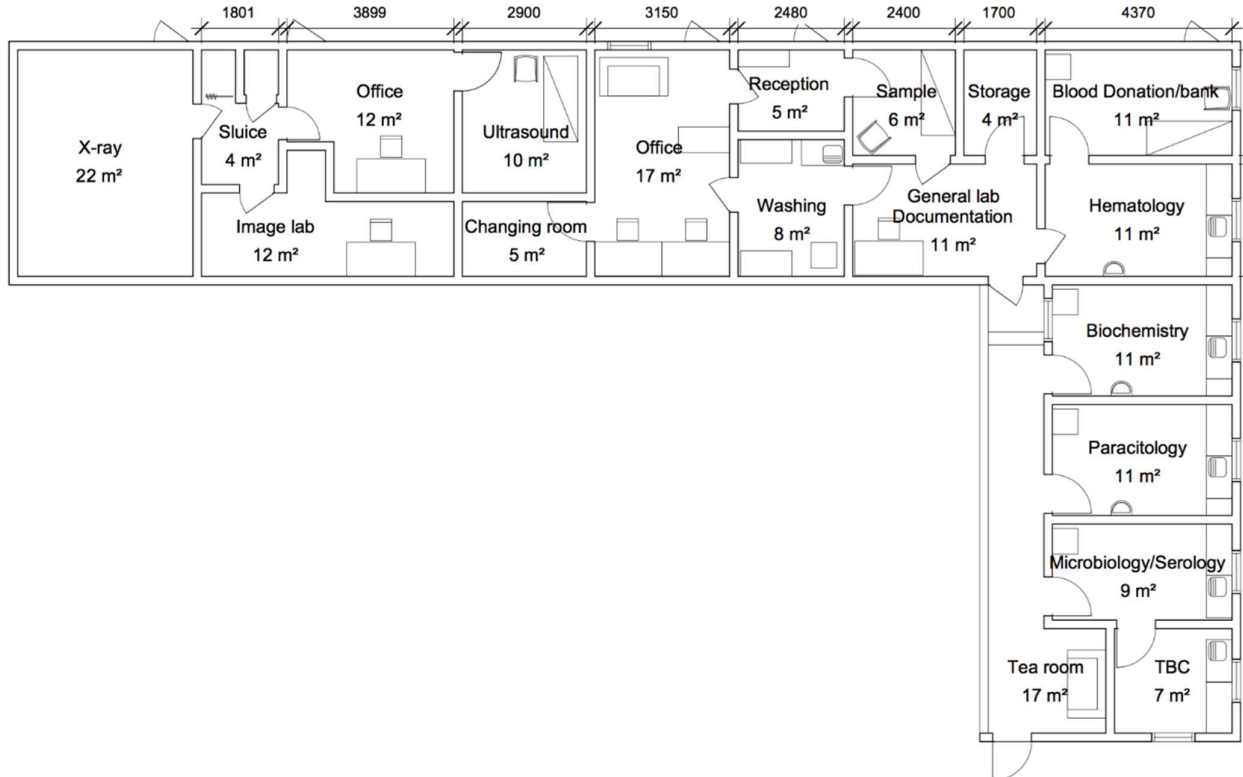


Figure 3.5. The first draft of the new laboratory.

Discussions were held regarding the development of the laboratory during the meetings. We decided together with all present actors that the purpose of our stay was to finalize the drawings of the laboratory. The finalization of the RCH was crucial for the start-up of the rebuilding of the laboratory since the facilities were currently in use which would prevent the project from starting. Additionally, HMT and the EWB project team recommended and preferred the same contractor that was responsible for the new RCH which was also a constraining factor since all the construction workers were occupied. Therefore it was important for us to make sure they received the sub-payments in time since the payments were divided in to three subtotals. Otherwise the project would be delayed if the contractor would not have enough money to pay the employees. We needed to keep regular contact with HMT which in turn communicated to the contractor. Also, the transaction of funds needed to be considered in an early stage as it took some weeks to receive the money after the decision to send it had been made. According to previous experience within the HHP, the long durability of transaction was mainly affected by the limited administration possibilities within EWB and security barriers between banks in Sweden and Tanzania. This could also cause potential project delays. Therefore, it was a mutual decision to have the second payment done as soon as possible since the first payment was already received.

Other discussions that were held during the meetings concerned use of materials, reinforcement work on existing construction and space allocation between rooms. We tried to make the plan according to movement patterns, accessibility to laundry room, looking into what different units shared equipment and checking which departments that needed sinks. These matters were discussed with HMT and we tried to clarify priorities of previous mentioned factors to rearrange the rooms for the requested function. Because of the equipment that was used in each department some rooms needed to be bigger than our estimation which was considered while designing the plan view.

## **Week 2**

The following week different suggestions about the new proposal were discussed. Also, we invited the district engineer to attend the meeting for him to make a quality check and estimate the possibility of demolishing walls. It was difficult for us to schedule an appointment with him since he is responsible for the entire Busega district and therefore we were not able to have the quality check until the end of the week. The need of a further investigation was crucial for us to proceed with our plan since we had no access to the original documents of the existing building.

Furthermore, we measured the entire building to make sure that all the measurements on our drawing were accurate. Also, we made sure that all the current walls existed in the drawings and took notes of the installations to see which walls that were possible to demolish. Height measurements were also taken to investigate the difference between the old RCH and the current laboratory. The height of the walls of the RCH is two meters which is not high enough to create a ceiling for the Biochemistry, Parasitology, Microbiology/Serology, Tuberculosis (TBC) and Tea room. Therefore, the option of demolishing the existing walls in the RCH was discussed.

As we studied the building, we noticed a joint in the façades between the extension part and the main building. This could imply that the extension is an addition that has been built later on. Moreover, there was a joint separating the foundations which is another reason to believe that the old RCH was built in a different stage. The HHP group decided to keep the wall that separates the main building from the extension and add inner walls for the rebuilding. A few changes were made for the new proposal in the plan sketch. The tearoom is used by the staff on their break and was now decided to be closed walls to give staff more privacy.

As we got in touch with the district engineer, he told us that the quality of the wall was uncertain, and he recommended us to demolish the walls. The existing walls were made from solid concrete which was a further reason not to keep them. New walls would ensure the quality and possibilities to add windows. To ensure good air quality and provide with enough daylight, windows were needed. However, air condition was required in Haematology, image lab and Biochemistry by Hospital staff on order to ensure a good working climate for the employees. This was also something that we asked the district engineer to consider while looking into cross ventilation options. Since the cost of electricity is a high expense for the Hospital the initial thought was to investigate the possibility of installing off grid solar panels in order to provide with electricity during daytime. Another request was to install a new air condition for the operating theatre that would be connected to the off-grid panels since the current one is out of order.

We decided to finalize the drawings before scheduling the next meeting with the district engineer. Other discussions that were held during the meeting concerned a proposal of a drainage system. It was also decided that we were to conduct a storm water study in order to investigate the damage that heavy rain is causing to the buildings. The drawing of the drainage system and the laboratory were to be presented for the district engineer during the next meeting.

### **Week 3**

The accurate measurements were added to the drawings and additions of walls were also added upon the requests of HMT. We also placed furniture into the drawing for the HMT to get a view of the size of the rooms. Furthermore, we were able to show a 3D view to visualize the rooms and the expected function of the room which made it easier for us to agree on changes that needed to be done. We also took measurements on equipment, to ensure that the rooms were designed for the requested function.

Furthermore, we conducted a storm water study to see how the waterflow is affecting the area, what part of construction is badly damaged and how the drainage system should be dimensioned in order to reduce the damaging effects on the constructions. During heavy rainfall we were present on the hospital area to study how the waterflow moves. Defects and cracks in the concrete foundation was thereby observed. Also, loss of sand mass due to heavy waterflow was noticed which exposed the concrete foundation. Thus, the option of backfilling was discussed within the project team. A meeting was held in order to discuss the improvements that needed to be done. Furthermore, we studied the infrastructure in the village to find what drainage options there were. The most common options we found was to either make a gutter in solid concrete or make a drainage with casted rocks. A first draft of a drainage system was also made from the previous teams that we looked into before proceeding with a closer investigation.

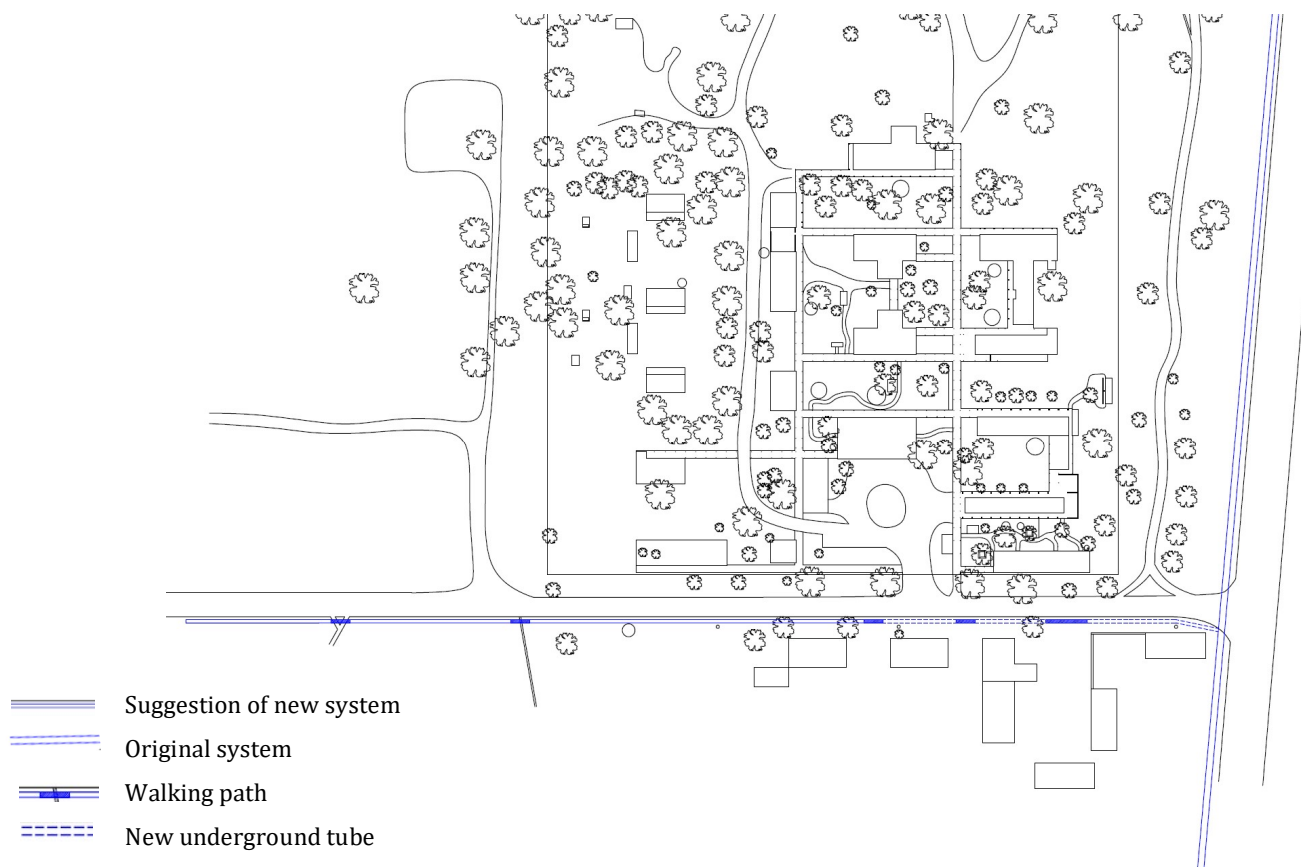


Figure 3.6. First draft of drainage system.

The blue lines in Figure 3.6 is visualising a simple drawing of the drainage system. The straight line alongside the main road is showing the original main gutter and the other line alongside the hospital area is representing the suggestion of the new drainage system. The dotted line visualises the suggestion of an underground tube connected to the main gutter. The function of the planned drainage system is to remove water masses that are causing damage to the hospital facilities. Due to the sloping terrain, the hospital area receives water masses from nearby area that are causing leakage into buildings. Therefore, the drainage is designed to reach alongside the road to further on connect to the gutter along the main road. There were some concerns about the nearby houses that would be affected by the gutter which was also discussed during the meeting with HMT.

Different types of gutter were discussed. A gutter without any additional protection or a gutter with filling of large gravel, were considerable options. We relied on the experience and knowledge from the district engineer and HMT as they knew what is required in the Tanzanian hot climate. We also consulted with the EWB team. The HHP group decided to go for the common Tanzanian solution which is suitable for heavy rainfalls and would hopefully not need that much maintenance efforts of the drainage system. It is a channel made of concrete and stones. Concrete tubes are supposed to be added in front of the houses which, together with open bridges on the pathways, will not limit the daily action of people. Although it would increase the cost, we consider this as the best solution for the common interests of the citizens. Also, the placement of the gutter was decided to be on the opposite side from the hospital area to protect the road from being flooded because of the slope. This would decrease the maintenance efforts.



Furthermore, we finalized the drawings of the laboratory which is visualised in Figure 3.7. Also, the first draft of the drainage was approved by the HMT which made it possible for us to discuss cost estimations with the EWB team. We talked through the new proposal of the laboratory and discussed the different options for the use of materials. Since there were no documentation of the current laboratory, the condition of the materials was unknown. We agreed on demolishing the existing outer walls for the old RCH since the condition was uncertain. The EWB team recommended us to keep the foundation since it constitutes the major cost.

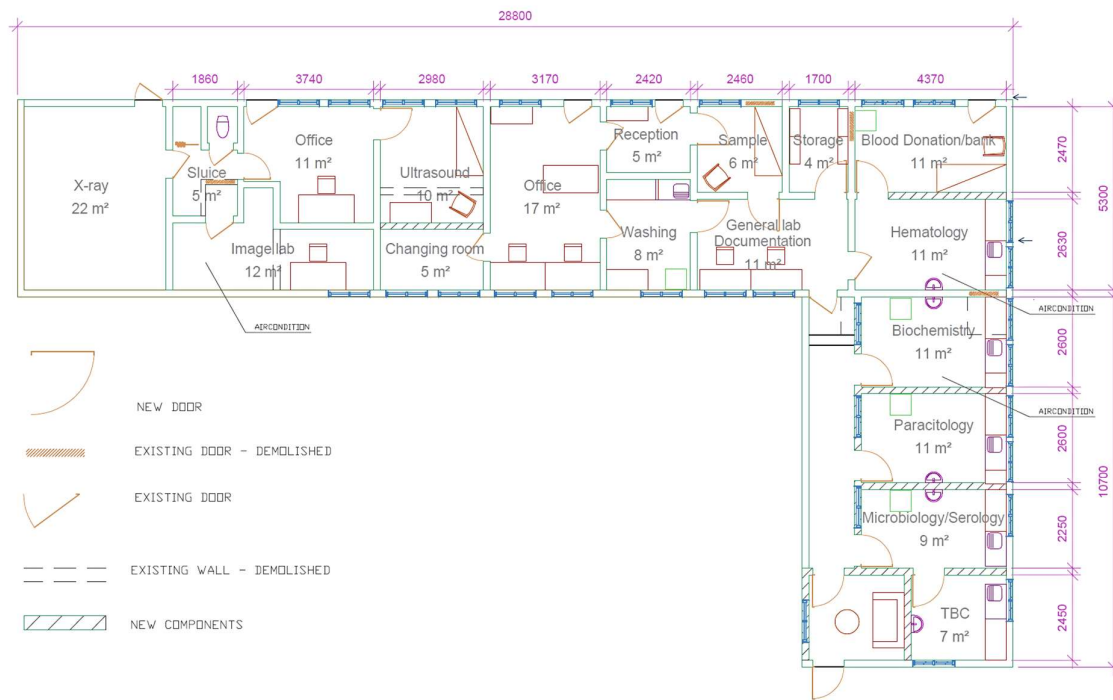


Figure 3.7. Drawing of all elements that are included in the estimation of quantities.

An estimation of quantities was made and sent to the district engineer for him to evaluate the cost of the rebuilding of the laboratory and the drainage system. The estimation of quantities contained a list of all walls that were to be demolished, and all walls that were to be added according to the drawing seen below. Also, the documents contained volumes of material. The cost would include all the expenses for materials but also an estimation of working force needed. Furthermore, it excluded the cost of the roof since this was considered low priority. All the hatched walls are new components that will be added, and all the dotted lines shows the walls that will be demolished. A constant dialogue was held with the district engineer by email to let him know if there were any changes in decisions. Also, to check if he had any objections of the current plan. It was hard to reach the engineer which made the procedure of the project difficult. In order for us to know the possibilities of performing the projects we needed to have the bill of quantities as soon as possible.

## Week 4

The height of the roof was discussed as a potential issue. As we talked it over with the HMT, they told us that the roof was old and in need of maintenance. During our quality check with the district engineer the previous week he told us that the quality of the roof was uncertain but so far, no severe visible damage could be seen. The bearing function was ensured by the columns in the ails which could enable us to separate the implementation stage into different parts. Either we would keep the roof that was also attached to the main part of the building, or we would demolish the roof and rebuild it. The budget fluctuated, depending on the funds that EWB managed to collect. Hence, it was uncertain if it would be possible to finance the reconstruction of the roof together with the other ongoing projects. Therefore, it was decided that the district engineer was going to make cost estimations for each suggestion. The SPG got the responsibility of doing estimations of material based on the final drawing (Figure 3.8) while the district engineer would do the bill of quantity for both cases.

As for the new RCH, the communication between us and the contractor was difficult due to the language barrier. We noticed that the casted concrete columns were not properly done due to lack of equipment. As they casted the columns, they did not vibrate the concrete which created air bubbles. Some columns showed up to 20 centimetre of reinforcement exposure. Since the roof was lightweight, the bearing function would most likely not be jeopardized. Although, it could cause the reinforcement to rust when exposed to precipitation. We sent the pictures to the EWB team for them to evaluate whether it was necessary to re do the casting of the exposed areas. They told us to ask the HMT to inform the contractor to cover exposed areas with concrete addition as soon as possible.

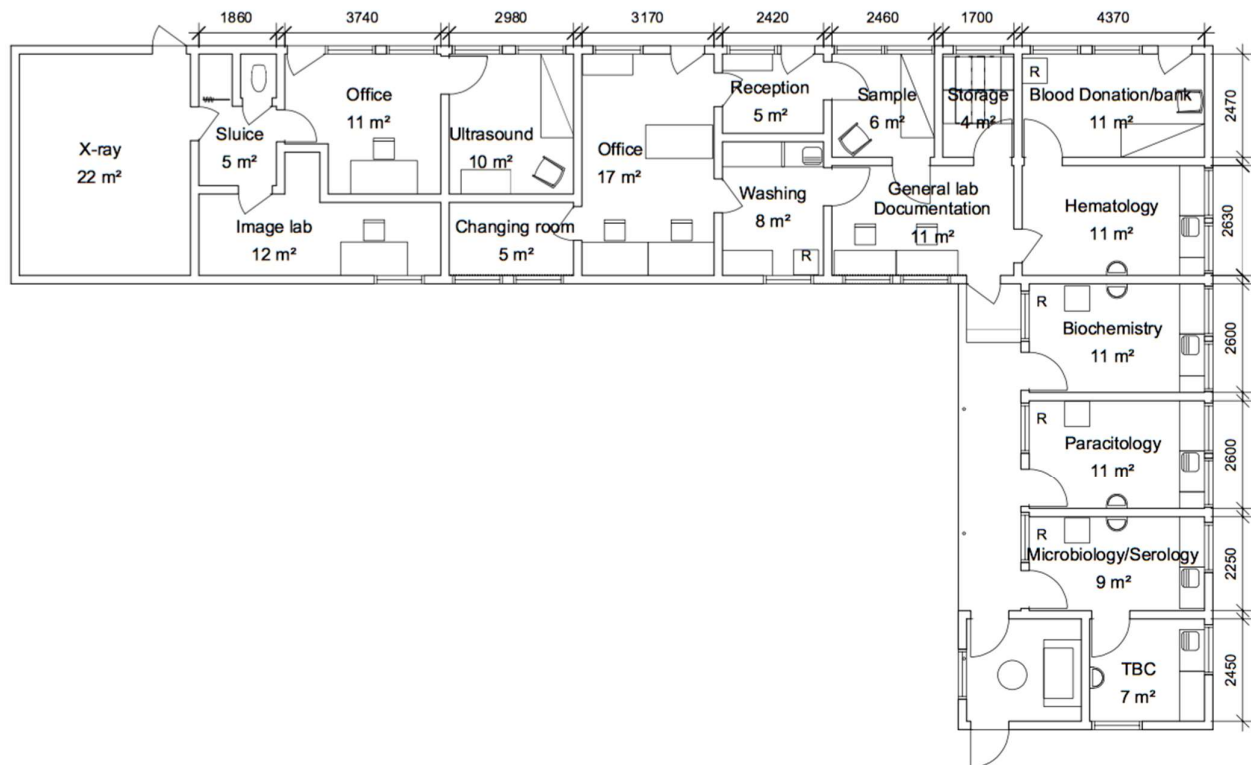


Figure 3.8. Finalized drawing of the new laboratory.

## Week 5

This week we received the bill of quantities and we also managed to schedule a meeting with the district engineer during the end of the week. During the meeting we decided to continue with the option of demolishing the existing roof and rebuild it at the request from HMT. The first estimation of costs was discussed with the EWB team, and the budget did not seem to cover the expenses of the project.

Another problem we faced were that the second payment for the RCH was delayed so the workers did not show up on site which would delay the project execution of the laboratory. We asked HMT if they received the payment but since EWB had problems with the transaction, the workers were not paid. We contacted the EWB team to see when the transaction was made and according to them the payment should already have been made more than three weeks ago. It is a common issue that it takes at least three weeks to do a transaction from Sweden to Tanzania according to the EWB team by experience. We kept regular contact with HMT to see if there would be any updates. The construction workers did not show up throughout the entire week. Since the plan was for the different projects to overlap in the end of March, we could expect the start-up of the laboratory to be postpone at least a week. We were only present on site for eight weeks which would decrease the supervision abilities from EWB for the reconstruction of the laboratory.

## Week 6

The following week we were trying to book a meeting with the engineer to get the cost estimations as soon as possible. We did not manage to reach him. While waiting for response, we investigated the option of installing solar panels through a company that has been used before by EWB. The original thought was to investigate the option of providing the electricity for the air-condition by using solar panels. Since we did not know what the battery capacity was, nor the cost, we started to look into the possibility to connect it to the existing grid. We contacted the company to get an estimation of the cost, and to know if it was profitable to install off-grid panels. He told us that the best option was to look into the possibility of connecting it to the current grid since the battery capacity was not suitable to supply for the panels. Therefore, this was discussed further on with the EWB team for them to evaluate whether this option would be profitable.

As for the RCH, the construction workers came back to finish the construction since the HMT now told us that they received the money. We noticed at site that the wooden frames that were supposed to give the patients privacy were not yet installed. These were crucial to fulfil the function of the RCH which was a concern that we asked HMT to discuss with the contractor. Another concern we had was that the number of constructions workers present on site were fewer. The reason could be lack of chores since the major part of the construction was already finalized. Although, we were still not sure if the employees were paid which was also discussed with HMT.



*Figure 3.9 Clogged gutter at Kolandoto Hospital 2020.*

During the end of the week we went for a study visit to Kolandoto Hospital accompanied by the HMT. EWB have had a long last cooperation in Kolandoto and conducted several projects throughout the years (Axelsson & Schön, 2019). The purpose was to investigate the infrastructure improvements that had been done in order to increase our knowledge of how infrastructural challenges have been dealt with. The hospital had a drainage that reached along the ails along the hospital area, connecting all buildings. This prevented water masses from penetrating into construction. However, we noticed that the slight slope at some points caused sand masses to settle in the gutter which made it clogged as visualised in Figure 3.9. The depth was also lower which filled up the gutter faster with sand and soil. This was an observation that could be useful for our drainage project in Mkula.

## **Week 7**

Bill of quantity was received during the beginning of the week whereof we analysed the new proposition based on the decision of the project group during week five. The deadline for bill of quantity was decided during the beginning of week six but due to prerequisites of the district engineer, the HHP was unprioritized. This edition of bill of quantity included the new roof and a new foundation.

A digital meeting between the SPG and the EWB team was held whereof the new edition of bill of quantity, new RCH and payment were discussed. Comparing the cost from previous sub-projects during other years, it was concluded that the price could be reduced. The bill of quantity was, in this state, not comprehensible with the budget for the project. HMT and district engineer were contacted in order for us to inform them about the budget issue.

## **Week 8**

We had a meeting with HMT and district engineer in the beginning of the last week. The main discussion was about reducing price and what to prioritize in order to be able to proceed to implementation stage. The original price was reduced almost 40 %. A decision was made to prioritize only to finalise the new RCH and the extension of the laboratory whereof the drainage system was postponed to another year.

The day after, we had a meeting with EWB to look into the possibilities of writing a contract of agreement between the actors. The SPG had created the contract based on document from previous years. Due to the Covid-19 pandemic, the decision was made to postpone the project as it was not possible according to budget. To clarify, it was the proposal of the new roof and foundation that the budget did not cover for.

We informed about what was discussed with the EWB team during our last meeting with HMT. We also discussed the new RCH and observed the construction work whereof the building was principally finished except from the connection to the sewage system and a few details. The last payment was therefor decided to be sent as soon as possible. We agreed together with the HHP to strive for continued cooperation and to ensure that the last phase of construction for the laboratory and drainage system will happen in the future.

### 3.3 Overview of factors affecting lifespan

The ability for us to understand the constructions at the hospital is limited as there are no documents available regarding the already existing buildings except from other observations from previous years. Through observations together with district engineer and HMT we could get an overview of the current buildings and what kind of construction techniques that were used. Also, we discussed what techniques could be used for our project. The input from the district engineer is of high value as he has experience of conducting similar projects.

One of the biggest discussions was whether we could keep the foundation from the old RCH and build the extension of the laboratory above. The already existing laboratory and old RCH were two separated constructions even though they were put together into one building. The foundation was separated on different levels and a significant joint between the buildings could be seen. With this information considered, the old RCH could have been constructed after the existing laboratory. Even though all the buildings at the hospital area were not built at the same time we needed to assume that everything was built in 1985 as the earliest. This, to ensure the quality of the building based on lifespan and durability. The estimation is based on the information that the hospital was founded in 1986. Usually, the building process lasts several months whereof the oldest buildings could be expected of being constructed in 1985.

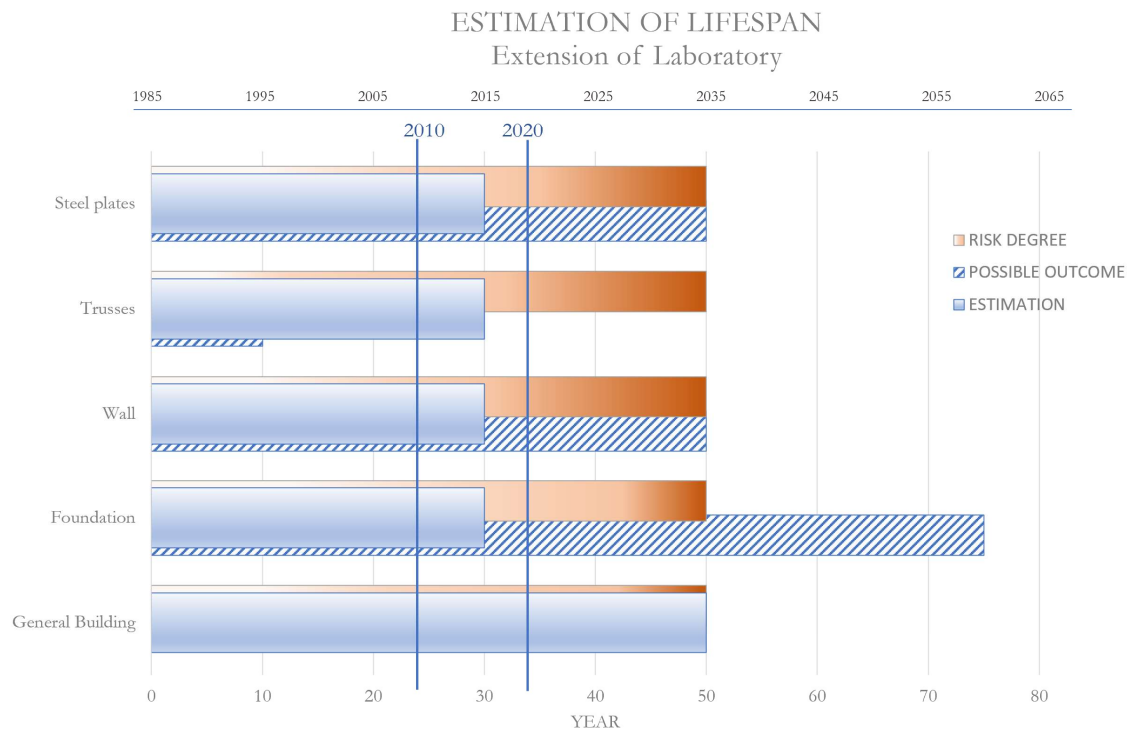


Figure 3.10. Estimation of lifespan for the extension of laboratory.



Figure 3.10 is created during our case study as a way of understanding durability when considering different options for the extension of the laboratory. The roof consists of steel plates without ceiling, leaving empty space between already existing walls and the roof. We discussed if it would be enough to only do maintenance on the steel plates. The roof could be considered as an independent construction as it has individual bearing columns. Everything but the foundation could be demolished in order to keep the roof. The foundation was beneficial to keep since it was one of the larger expenses. As shown in Figure 3.10, the lifespan of the foundation can moreover be expected to last longer.

We conducted the estimation of lifespan for different parts of the building from previous experience and studies. Broader research was made to create an understanding of durability of the old RCH. According to Celadyn (2014), the general building durability for concrete constructions is 75 years, while the European standard is 50 years. The need of renovation and maintenance would probably be required after at least 25 years. The author claims that following main factors affects the average durability of buildings: building function, applied technology, environmental conditions, local culture, and economic and political situation. Among these factors, Celadyn (2014) points out environmental conditions as an overall building destructor. Dry, cold climates are mentioned as satisfactory conditions while hot humid climates could lead to complications for concrete components. The lifespan varies depending on climate zone and geographical location.

The most crucial environmental factors that are causing lower technical durability are solar radiation, precipitation, and wind. How useful life of buildings is dependent on variations in environment has been estimated by Dias(2003). The useful life of reinforced concrete is estimated to 30 years when exposed to wet and aggressive environment where the climate in Tanzania could be represented in this category. The author points out that a “poor quality construction” could reduce lifespan by up to 20 years if the combination of material and environmental issues is unfortunate. Further on, Falade (2000) discusses the issue of buildings in hot climates whereof the environmental conditions are considered a higher risk for the lifespan. Adequate monitoring at sight is required to ensure the quality of concrete due to the hot climate.

Steel construction with general paintings of today is considered to last in 30 years according to International Conference on Construction Materials and Structures (2014). Hot dipped American galvanized plated steel could last for 70-100 years whereof this is not an option in this case scenario. Trusses made of timber could last for only eight years if not maintained, based on studies in Mozambique (Schittich & Sauer, 2012). Brand’s diagram has been used as a source of information whereof foundation and load-bearing elements could last for 30-300 years, in average 50 years(Brand, 1997). Exterior surfaces are considered to be endured for 20 years by Brand.

We believe that buildings at the hospital area share similar characteristics to other concrete constructions observed in Tanzania. Therefore, documents from other building projects in Tanzania could be used as research sources. The conducted bill of quantity for the extension of the laboratory is consisted of mixtures of sand and cement together with typical parts as aggregate and reinforcement in the foundation. It also includes parts of timber for the oversite concrete and ceiling.

The construction process of general buildings in the area were similar according to observations. Therefore, assumptions could be made that the old RCH could have been built in a similar way as the new RCH. To broaden the assumption of how the old RCH could have been created we gathered information from the previous SPGs and made a research of the general construction process in Tanzania. Rubaratuka (2008) have studied concrete buildings in Dar Es Salaam where of issues has been conducted as “main causes of unsatisfactory quality of reinforced concrete”. They are as following: Lack of qualified and experienced technical staff and proper supervision, Design deficiencies, Poor workmanship and Use of improper materials.

This is issues could be considered in the Healthy Hospital Project as we do not have access to the full overview and insight of the entire project process. As an example, about 35 % of contractors working in the construction field are doing quality control (Rubaratuka, 2008). Rubaratuka and Mulungu (1999) have made some other studies in Dar Es Salaam whereof the following quotation is considerable:

*“Complexity in structural form as well as inappropriate construction technology and use, usually influence the sensitivity of the structure to deterioration shorten service life, or require increased efforts in maintenance” (Rubaratuka & Mulungu, 1999)*

As an example, University of Dar Es Salaam has a main cause of damage mentioned in the report as porous concrete structure(Rubaratuka & Mulungu, 1999). Similar observations have been made at the new RCH as exposure of reinforcement was noticed. The old RCH faced the risk of porous damage, since cracks was visible to some extent. Other indications of damage on the old RCH concerned the roof since some steel plates required maintenance. District engineer did some observations as well and considered the old RCH in need of total reconstruction to ensure good quality.

The drainage system was decided to be the third prioritised sub-project. The climate circumstances could aggressively affect both the already existing buildings and the new ones as it is categorized as the worst destructors(Celadyn, 2014). In order to ensure long enough lifespan of the constructions and minimize the risk of damage due to penetration, the drainage system is a crucial measure. This could also affect the current standard of the already existing buildings.

To ensure that we would not make a new construction based on an old, low quality foundation, we assumed that the old RCH construction could have been exposed to above mention risks. In the best-case scenario, it could manage to last for 25 years further. In the worst-case scenario, there is already too much inside damage unavailable to maintain. The summary of our research indicates an estimation of lifespan to be 30 years which passed five years ago, if we assume that the building was created in 1985. Durability could have been extended if maintenance would have been made earlier (Celadyn, 2014). This research is visualised in Figure 3.10 to get an overview of the lifespan of the old RCH which is going to be rebuilt as an extension of the laboratory. With the collected information and previous experience, the entire project group decided to demolish the old RCH and create an entire new extension for the laboratory.



## 4 Theoretical Frame

### 4.1 Background

United Republic of Tanzania was formed as the Tanganyika Union together with Zanzibar in 1964 (Bailey, 2019). The union is in daily contexts exclusively called Tanzania. The country has ever since been a socialistic and self-reliant republic domination. Previous history is consisting of African, Arabic, Asian and European rulers. Tanzania has been both German and British colonies. It was not until the year of 1961 that Tanzania reached independence.

Usual identifications of Tanzania are the agriculture, tourism, and more recently large mineral deposit, especially gold. Natural gas is gradually considered as a potential natural resource in the country. According to Lofchie (Lofchie, 2014), Tanzania has a great potential and capacity to evolve economic benefits from country resources. Development aid aims to contribute for the national demands, including evolving usage of country resources. Official Development Assistance (ODA) is governmental aid given to developing countries as a cooperation of official agencies (Organisation for Economic Co-operation and Development (OECD), 2018). Developing aid from ODA funds 40 % of national budget and 80 % of development budget whereof social infrastructure, primary education and health, is a main attraction. Rotarou and Utea (2009) points out that “maintenance work is seriously undermined by donors” general reluctance to fund recurrent expenditures on aid-funded projects”.

### 4.2 Aid in Tanzania

The implementation of project management in aid projects are often facing difficulties due to circumstances that differ significantly from traditional projects. Ika (2012) is claiming that traditional projects in its most simple form contains of two stakeholders. The clients that benefit from the outcome of the project, hence they are also funding it, and the contractors that are obligated to fulfil the requirements of the client. Aid projects are characterized by the author as three stakeholders, less dependent from one another: the funding agencies, the implementation units, and the beneficiaries. The author is stating different factors that aid projects and traditional projects have in common. They have a set-up timeline, proceed from planning stage to implementation stage and are further on evaluated. They are moreover containing quality requirements, costs, and implementation of different techniques. Although, the purpose of aid is generally to improve economic growth and reduce poverty, aid projects are non-profitable for the funding agencies (Ika, 2012). This creates loose couplings between all involved stakeholders. The number of stakeholders involved are also increasing the risk of draining project funds. This in turn contributes to the common problem of corruption that aid projects are often facing (Moyo, 2009). The general life length of aid projects is between three to five years, but funding for the projects can continue up to ten years (Diallo & Thuillier, 2004)

Furthermore, Ika (2012) claims that disappointment of project outcomes between stakeholders is a common consequence within aid. The problem has been stated as a frequent occurring issue and can be tracked back to the year 1950. International Finance Corporation, discovered that half of the projects that were initiated in Africa and funded by the World Bank failed (Project Management Institute & International Academy of African Business and Development, 2012). Further investigation showed that among the different areas of which the World Bank projects concerned, infrastructure and mobile telephone networks projects were the most successful ones.

Ika (2012) are suggesting three contributing factors to why project management implementations are failing. (1) Structural/contextual problems, (2) institutional/sustainability problems and (3) managerial/organizational problems. Looking further into the organisational issues, the authors recognizes some issues within Aid projects in Nigeria which concerns exclusively project design. Some of the issues they found were stated as follows: projects rarely proceeded according to the request of the beneficiaries, different agendas among stakeholders, delays between design-phase and implementation-phase, lack of risk analysis, cost misjudgements and communication issues.

Among the issues stated above, there are four traps identified that characterizes failed aid projects (Ika, 2012). The One-Size-Fits-All-Trap, which is project coordination under the assumption that all projects share the same characteristics and therefore should be monitored in a similar way (Baum, 1982). This type of management often leads to loss of social, political, environmental and cultural values (Ika, 2012). Furthermore, it is the Accountability-For-Results-Trap in which results, and performance are expected to be presented for an audience. It often lacks follow-up and evaluation processes on how to improve project management. Another trap is the Lack-Of-Project-Management-Trap where political instability, violence, lack of institutional capacity, poor infrastructure or high risks for the project personnel is threatening the project from proceeding. These factors are contributing to inefficiency within the project. Funding agencies are often focused on reducing costs which lowers quality and supervision efforts (Collier, 2007). Lastly, Ika (2012) states the fourth trap which is the Cultural-Trap, as different stakeholders approach rationality and rational thinking in different ways.

*“Project management for ID should refocus on managing objectives for long-term development results and shy away from its emphasis on visible, short-term outcomes and efficiency. In this regard, the internal function and use of results-based management need to incorporate big development goals and key success criteria and factors into the design of ID projects for better chances of project success”. (Ika, 2012)*

Low quality construction is demanding higher maintenance costs in order to keep long term function (Schittich & Sauer, 2012). Factors that are affecting maintenance costs has been recognised by several authors in a study regarding hospital facilities in Saudia Arabia (Hassanain et al., 2013). One of the issues stated is the cost allocated uneven between maintenance and construction phase which leads to lack of maintenance resources. Furthermore, the authors states that the highest contributing factor of public hospitals is “lack of mechanism to control the budget allocated for maintenance”. Hence, there is no knowledge within the construction group of how the budget will cover future costs. Another relevant factor according to author concerning both public and private facilities is the inability to discover causes of defects.

It was identified by Golini and Landoni (2014) that beneficiaries often lack the ability of supervision and direction. This could lead to unfulfilled purpose of the project scope. Communication between beneficiaries and project group in a post-project state has been stated low. This decreases the beneficiaries' ability to impact the project outcome. Therefore, decisions are allocated in favour of project executers rather than the beneficiaries. Furthermore, the authors have recognized that budgets are often fluctuating which creates uncertainties regarding scope of projects. Supervision efforts are also discussed as an ethical matter because of insufficient use of funds to cover for the administrational costs. This makes aid projects dependent on voluntary workers (Golini & Landoni, 2014). Hence, supervision abilities are limited to short term presence at site and discoveries of project failures often rely on beneficiaries.

Project failure could mainly be described by miss adaption to project scope (Golini & Landoni, 2014). Overestimation of budget capacity in relation to outcomes are frequent occurring issues within aid (Ika & Donnelly, 2017). These matters are described as project management issues. Tangible outcomes of project success could be defined by the relationship between budget, cost and time. These factors are mainly determining short-term project management success. Although “project management success” is an important goal according to Ika & Donnelly (2017), “deliverable success” is another dimension of success that is focusing on long-term achievements such as intangible values. Factors affecting “deliverable success” concern sustainability, impact, and relevance according to the authors. These success factors are not necessarily opposites, rather, they are both key factors in order to avoid project failure.

### 4.3 Importance of quality control & maintenance

Schittich & Sauer (2012) points out the importance of upkeep and maintenance as this is a crucial factor for both lifespan and cost for the building. Chapter 3.3 mentions the complexity and importance of building quality due to lifespan where the challenge of quality control is mentioned. The phenomenon of quality control is referring to the inspection, checking, and monitoring during the construction phase (Rubaratuka, 2008). The contractors on sight are usually responsible for doing the actual quality control. Contractors of projects in Dar es salaam is found to do quality control in 35% of the cases. Furthermore, this study indicates that in most of the project scenarios, the construction and supervising staff are not qualified or experienced. Moreover, municipal engineers or inspectors are not adequate to do the quality control.

Another factor identified is the condition of the design drawing whereof details could be more specified (Rubaratuka, 2008). The author states that modifications could be done during construction to improve quality or favour the construction process. This could result in extensions of time, financial differences, and inadequate specifications of material (Rubaratuka, 2008). Moreover, this could be an indication that the design could be analysed in previous stages to ensure less need of modification or improvements during construction phase according to the author. The author claims that there are expectations of not fully detailed preparations during the planning phase. Design deficiencies would occur either way according to following quote. This statement also represents the importance of quality control.

*“It is not ruled out that, there may be some design deficiencies that are not noticed during construction hence not corrected at all and hence resulting in structural deficient structures.”*  
(Rubaratuka, 2008)

The lack of quality control is mentioned as crucial phenomenon in other documents as well. Falade points out the challenges of reinforced concrete buildings in hot climates (Falade, 2000). Identified defects in concrete is not only dependent on physical conditions on site during monitoring. Another aspect noticed is the requirement of close monitoring to ensure the method of maintenance. This, in order to keep concrete structure serviceable in the future. Furthermore, investigations of the environmental conditions and concrete treatment that creates defects in reinforced concrete has been investigated by Rubaratuka and Mulungu (1999). As an example, authors point out the additional cost of maintenance to treat corrode reinforcement as “extremely high” comparing to doing necessary precaution measurements to minimize the risk of carbonation process. The main causes of damage in the University of Dar es Salaam is the structure of concrete which suffer from porous issues in early stages. Further on, the authors mention the process management as an essential factor to ensure quality and service life-span. Good workmanship is stated as a key factor to ensure that all phases of the project process aiming for a successful construction. The project management through good workmanship affects all project stages such as rational designs and qualified contractors. This could further on result in lower risk of need of maintenance which could widen the lifespan.

## 5 Analysis & Discussion

Some of the challenges that Mkula Hospital project faced has been recognized as characteristics for aid projects. Therefore similarities to the stated issues of project management will be analysed and further on discussed. Previous research has been made in order to improve mechanisms within project management. Many of these findings could also be applied to HHP. Further on, we will describe different aspects of project success and moreover define who benefits from the project outcome. Secondly, we will present some constraining factors that has been used as tools for how decisions have been made in HHP. These factors are considered crucial in order to make the project less dependent from external actors. Lastly, we will propose measures that can be done in order to avoid so called “bottlenecks”. Different subprojects will be presented separately and will later on be evaluated as suitable measures are proposed.

### 5.1 Different dimensions of project success

Following discussion will highlight two concepts of success (Ika & Donnelly, 2017). Their purpose is to describe two different dimensions of success as mentioned in chapter 4.2. These factors will be used as tools in order to explain how decisions in HHP has been made, and why. They will also be used in order to separate decisions that has been made during our supervision period for short term results, and decisions that has been made for long term results. Following definitions are based on research made by Ika & Donnelly (2017):

Project management success – Strives to achieve the goal of project plan and to accomplish optimal balance between budget cost and quality. Often more easily measured with tangible outcomes such as construction of a pump or a railway for example.

Deliverable success – Strives to achieve long-term goals with sustainable outcomes. It is more focused on intangible values and how well the measures taken were improving the wellbeing of the beneficiaries. This makes it more difficult to evaluate impact since it relies on subjective perceptions.

#### 5.1.1 The ambulance issue

One of the most critical challenges that HHP faced was not necessarily affecting “project management success”, but rather “deliverable success”(Ika & Donnelly, 2017). An example of this issue was recognised during a dialogue held with staff from the HMT. It was discovered that aid organisations had been involved in delivering ambulances to the hospital. However, one of the ambulances got a flat tire at one point and has not been used since. The reason was that an English aid agency had been involved, and the cooperation was no longer active. The new tire would need to be imported from England which was an expense that the hospital budget could not cover for. Although the engine and all other components were functioning, the car was still not in use because local equipment was not compatible. Hence, the project funds were insufficiently used even though “project management success” was achieved, ambulance was delivered, and the purpose of the project was fulfilled. However, “deliverable success” was not achieved because of the embedded weak link that created dependency. This created insufficient use of funds spent for a short-term result.

The example of the ambulance issue, in our opinion, describes one key factor in understanding the issue of miss adaption to project scope. It shows the big gap between values strived for, and actual achievement. It also shows the lack of risk analysis. The investment cost was high in comparison to the values that were created for the beneficiaries. The tire was, in this case, the “weak link” that caused all other links in the chain to lose their function. Thus, embedding a weak link that creates dependency could cause project outcome to differ substantially from project goal. We believe that these unintended consequences that the ambulance project faced could be prevented, if considered in an early stage, by making sure that local components was compatible. Ika (2012) defined the accountability-for-results trap as one contributing factor to project failure. The interests of the funding agencies were often to present short-term accomplishments for an audience and the projects were often lacking evaluation. Thus, patterns of what Ika (2012) described could also be seen in the ambulance project.

What we wanted to highlight with this example is the risk of striving for short term results. The short-term results are the results that can be presented for an audience which we refer to as “project management success”. They are directly measurable after finalizing a project. Although the long-term goals are more difficult to measure and predict. However, we believe that risk analysis and proposal of possible outcomes can reduce the risk of mis adaption to project scope. Ika(2012) claims that one of the organisational issues found, was the lack of risk analysis.

## **5.2 Laboratory: Discussions of different outcomes**

Previous section described an example of an aid project that provided a solution based on a need that was recognized but failed to cater for that need in a long-term perspective. Knowledge of how “weak links” can make planning efforts useless if project coordinators are not considering possible outcomes was an important observation in HHP. Throughout our case study we deepened our understanding of how lack of planning and risk analysis might cause unintended consequences. By widening our knowledge in the field of aid based on literature studies we were able to access tools that helped us make decisions in our projects. Due to financial matters the rebuilding of the laboratory faced two possible outcomes. Following discussion will highlight what challenges each suggestion faced and how decisions were made based on literature. The different outcomes are as follows:

### **Option 1. Keeping the existing roof and foundation**

- Budget would cover costs that would enable us to proceed according to plan. Although, it would not include the cost of reconstructing the roof and foundation. Since the bearing function of the roof is not ensured by any outer or inner walls, it could still enable all remaining parts of construction to be built. Therefor this solution would enable us to proceed to implementation stage and finalize the laboratory.

### **Option 2. Demolishing and rebuild the roof and foundation**

- Project execution would be postponed to the next supervision phase. This, due to unknown quality of the existing roof and foundation. Hence, the new agreement would include the cost of reconstructing the roof and foundation.

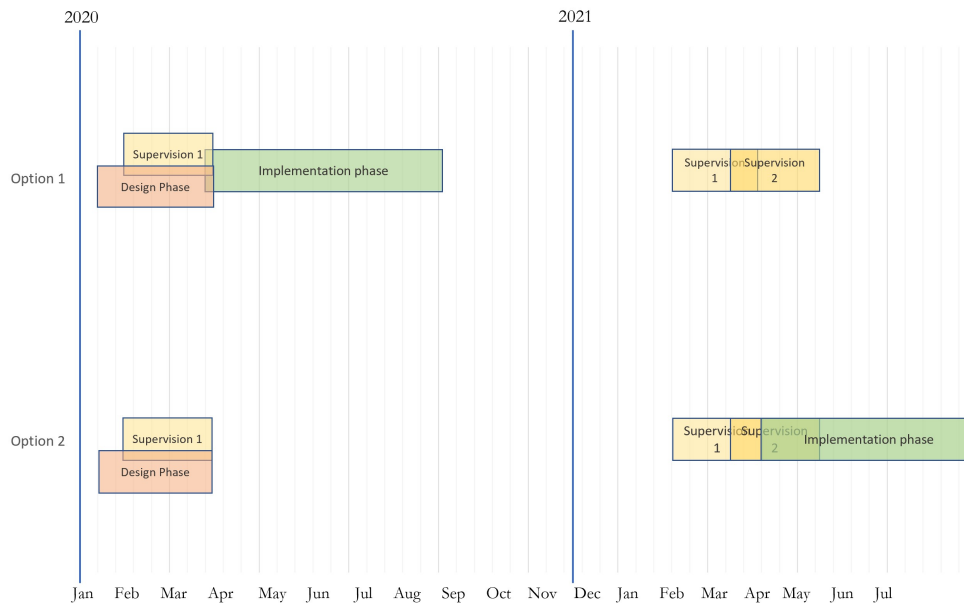


Figure 5.1. Timeline of project outcome 2020-2021.

The timeframe for the different outcomes is illustrated by Figure 5.1. **Timeline of project outcome 2020-2021.** The yellow boxes illustrate the time where supervisors from EWB are present. HHP usually have two teams being present during spring every year (Axelsson & Schön, 2019). The orange boxes show the design-phase and furthermore the green boxes show the range of the implementation-phase. Supervision could be defined as team members participation in the project and their knowledge of the occurrences that appears throughout the design- and implementation phase. Supervisors have the ability to influence project outcome during design phase, and to some extent implementation stage. Depending on which outcome is considered the best option, supervisors' ability to influence implementation stage differs as shown by the overlapping boxes in Figure 5.1. **Timeline of project outcome 2020-2021.**

### **5.2.1 Option 1. Keeping the existing roof and foundation: Project management success**

Different concept of success was described in chapter 5.1. The urge to follow the time plan can be described as a striving to achieve “project management success”. Since the rebuilding of the laboratory was an urgent matter, it was important that all different events occurred at a set timeline. This, because our presence was limited to eight weeks. After our stay, our ability of making decisions would be poor. Therefore it was important that all crucial planning details would be finalized so that project could proceed to implementation stage. The original thought was to be present during project execution to hand over all planning documents. However, delayed occurrences made us unable to participate as planned during the start-up of the construction. Following events can mainly describe why HHP was facing delays:

- Due to delayed transaction and miscommunications between the SPG and the EWB team, the construction workers building the new RCH were not paid in time. This postponed the finalization of the new RCH. Furthermore, the execution of the laboratory was dependent on the finalization of the new RCH since the same contractor would be employed for the rebuilding of the laboratory. Moreover, the facilities where the new laboratory would be conducted were currently in use which made us dependent on the finalization of the RCH.
- Our knowledge of material costs for the laboratory was limited. Therefore, we were dependent on an external actor who would make the calculations. The previous teams told us to get in contact with the district engineer. However, he was responsible for many ongoing projects within the district which made it difficult to reach him. We received the first bill of quantities with a delay of more than two weeks. Furthermore, we decided to get another bill of quantity including the costs of demolishing the entire extension part and moreover rebuild it. This caused a further delay and postponed decisions to the last week of our stay.

Our inability to participate during the start-up of the construction would have as consequences that decisions could be relocated to implementation stage. Hence, any challenges that the project would face during implementation stage could only be managed by contractors and beneficiaries (See Figure 5.1). As Golini and Landoni (2014) described the matter supervision during implementation stage can improve workmanship since beneficiaries often lack resources for technical consultancy. The overlap of supervision and implementation phase is beneficial for knowledge exchange regarding planning documents, drawings and other technical matters. Therefore, we were constantly aiming to finalize the drawings as soon as possible. Firstly, keeping the existing roof and foundation would enable us to start the project as the end of our supervision-phase as intended (see Figure 3.1.). Secondly, it would give the HMT access to the facilities sooner to start their everyday work. Thirdly, the reconstruction of the foundation was the largest expense in the project. Keeping the foundation would save efforts and costs which would enable EWB to fully fund expenses of the first bill of quantities (see Chapter 3.2.4). Lastly, the roof was independent from all the walls which would enable us to separate the reconstruction of new components and roof into separate stages. The roof could therefore be reconstructed later on when budget would cover. Thus, we consider this option more likely to fulfil “project management success” since it results in tangible outcomes that were requested by the beneficiaries.



### **5.2.2 Option 2. Demolishing and rebuild the roof and foundation: Deliverable success**

One identified issue within aid is lack of risk analysis Ika (2012). Due to this matter we analysed the possible risks of us proceeding with the affordable option of keeping the existing roof and foundation for the laboratory. There were no documents available showing the year of construction and different reports within the organisation stated different dates. This created an uncertainty regarding the condition of the roof and foundation. Proceeding with the affordable option would enable project execution. Although, it would cause a potential risk due to unknown condition of the existing construction components and therefor postpone maintenance work to the future. Any damage on the roof could cause destruction on ceiling, new components and equipment which would lead to unfulfilled project scope.

In HHP we strive to avoid the “ambulance phenomenon” (chapter 5.1.1) to occur by considering unintended outcomes in an early stage through a risk analysis. This will be done based on awareness of uncertain conditions in HHP that aligns with previous research within the field of aid. The uncertain conditions are circumstances that the HHP are not able to influence. It concerns for example the hospitals inability to fund infrastructural measures. This has been recognised by several authors as a matter that is causing dependency (Golini & Landoni, 2014; Rotarou & Utea; 2019; Ika, 2012).

Future dependency means that hospital relies on external funding to implement new infrastructural solutions. Thus, based on this knowledge, HHP must consider how implementation of projects affect the hospitals future ability to fund any maintenance or additional costs. This has been done in HHP by us defining four constraining factors that we believe are likely to cause dependency in the future. If not considered in an early stage, we believe that these factors are likely to create “weak links” in the project where the building function is dependent on future funds in order to be used as intended. Moreover, these factors have been used as tools in order for us to adapt suitable measures to achieve long term goals. In other words, we strive to achieve “deliverable success”. They were defined based on characterizing issues of aid that was studied through literature in relation to discoveries that were made in the HHP.

Constraining factors:

- (1) Risk degree of quality
- (2) Supervision efforts limited
- (3) Budget inflexibility
- (4) Loose couplings between actors

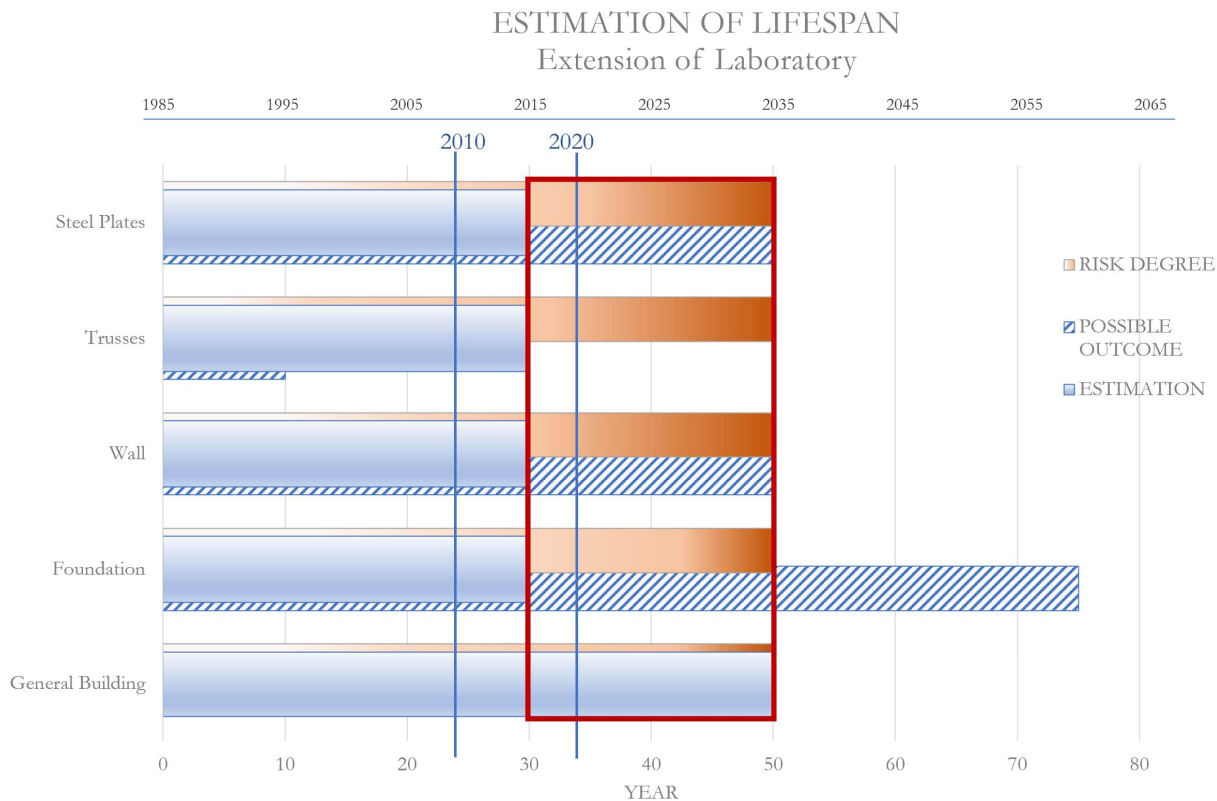


Figure 5.2. Estimation of lifespan for the extension of laboratory showing risk degree.

### (1) Risk degree of quality

As illustrated in Figure 5.2 the likelihood of the roof being intact decreases over time. The box shows the time span where risk of urgent maintenance is considered high. General life length for all construction parts are arbitrarily assumed to be 30 years without maintenance (Dias, 2003). The year of construction is also an assumption which makes the condition of different construction parts uncertain. Some parts, for instance the trusses, can have shorter lifespan due to variations of weather conditions as shown in Figure 5.2 by the hatched boxes. Furthermore, the joint connecting the extension with the main building indicates that extension might have been built later on (Chapter 3.2.4). This is another factor of uncertainty. Thus, the year of estimated maintenance is fluctuating with an unknown range. Considering all mentioned factors of uncertainty, we believed that any damage on the roof in the near future, would be a likely outcome. Additionally, consequences of any leakage of rainwater due to flaws are expected to cause severe damage on new components and equipment. The likelihood of the event to occur and the degree of damage are both considered high risk factors. Thus, keeping the existing roof would rely on external resources in order to fix any urgent future maintenance. This makes *risk degree of quality* a constraining factor since it is likely to cause future dependency.

## **(2) Supervision efforts limited**

Golini and Landoni (2014) defines the lack of supervision abilities as a known issue of aid. Thus, the probability of qualified supervision efforts being available at the time where urgent maintenance will be needed, is considered low in our project. Proceeding with keeping the existing roof would allocate decisions to a phase where supervision efforts would be uncertain. Golini and Landoni (2014) describes that communication between project team and beneficiaries is stated low in a post-project state. Furthermore Diallo & Thuillier (2004) describes that project cooperation generally last for three to five years but funding can continue up to ten years. Therefore, this matter is considered a constraining factor since the future cooperation is uncertain. If the cooperation would still be active at time where urgent maintenance is needed, lack of supervision abilities could potentially develop to a so called “bottleneck”. Any measures done would need to be dealt with within EWB. Thus, it would cause potential delays. Supervision is mainly needed in order for EWB to have knowledge of how funds are distributed in the project. However, all projects do not require supervision but as Golini & Landoni (2014) described the matter, it increases the likelihood of fulfilling the project scope. Awareness of how recourses are spent in the project is crucial, in order for the beneficiaries to receive what they request, as there is a risk of corruption.

## **(3) Budget inflexibility**

Discovery of urgent need of maintenance would rely on beneficiaries (Golini & Landoni, 2014; Hassanain, 2013; Falade, 2000). Further on, they would either contact an external actor to perform the work, or they would reach out to EWB in order to apply suitable measures. Since the hospital budget does not cover infrastructural measures, EWB would most likely be funding all additional costs. Since the risk degree is increasing, the possibility of urgent maintenance work is therefore increasing. Moreover, it would require flexibility of budget funds in order to cover for future maintenance work or rebuilding of existing roof. It was recognized that when budget funds allocated for maintenance were lacking, quality of constructions was often low (Hassanain et al., 2013). Also, inflexible budget could cause delays on urgent measures. If the future budget does not cover for possible expenses, it could postpone crucial measures. Rubaratuka and Mulungu (1999) describes additional cost of maintenance to treat corrode reinforcement as “extremely high” in comparison to necessary precaution measures during construction. Thus, a possible issue to keep in mind is that any damage on the roof and foundation could generate a higher cost than the total initial cost for reconstruction everything. Furthermore, it would include costs covering potential repair of damaged components and equipment in case of any leakage from damaged roof or penetration of water through foundation.

#### **(4) Loose couplings between actors**

Ika (2012) claims that a loose coupling between actors is a common phenomenon within aid. It has been stated that some of the contributing factors to ensure quality of construction is the ability for project executers to control budget resources and its distribution between maintenance and investment costs(Hassanain et al., 2013). The coupling between the project group present at site and the funding agencies is low. Thus, knowledge of future maintenance possibilities is uncertain which is causing lack of quality check-up. This could lead to miss adaption of project scope. The purpose of the new laboratory is to create new facilities that are suitable for the requirements from HMT. Thus, these are the main values strived for. Any decisions made in order to achieve these values must consider potential risks, even if it prevents project from proceeding according to plan.

### **5.2.3 Decisions and discussions within the team**

Keeping the existing roof would enable us to fulfil the purpose of our stay. Moreover, it would enable hospital staff to use the new facilities. Also, it would ensure project execution to be conducted since it was possible according to budget to fund it. However, this option would more likely fulfil short-term goals as the four constraining factors were described to cause possible dependency. Looking at the example of the ambulance issue (chapter 5.1.1), it was recognised that actual project outcome may differ significantly from its purpose. This highlighted the type of success that can be measured by direct outcomes, and further on be presented to funding agencies (chapter 4.2). Similar consequences that were recognised in the ambulance project could also happen in HHP. They both contained constraining factors that could develop into “weak links”. Hence, the one weak link in the chain would distinguish the entire function. Therefore, HHP would face the risk of not achieving “deliverable success” as the outcomes might be short term due to current circumstances.

Proceeding with the affordable option of keeping the existing roof would embed the risk of urgent maintenance in the future. Moreover, it would create dependency on urgent supervision efforts and budget flexibility. Even though we were very disappointed of not being able to fulfil the purpose of our stay during our supervision period, we still considered that rebuilding the roof and foundation would be the best option. We believed that this option is more likely to fulfil the long-term goals. Hence, it was decided to postpone project execution to the next supervision period (see Figure 5.1). In other words, we decided the solution that were most likely to accomplish “deliverable success” as we wanted to strive for a long-lasting building.

### 5.3 RCH: Project management challenges in the implementation phase



Figure 5.3. The implementation phase of the new RCH.

The construction of the new RCH can be seen in Figure 5.3. We will present some examples of how issues have been dealt with, by addressing project management challenges for the RCH. We will partly address constraining factors which are mentioned in chapter 5.2.2. These will be described as numbers within parentheses. Previous chapter principally addressed measures that could be done during *planning phase* (Timeline is visualized in Figure 3.2). Following analysis will present examples on measures that were done during *implementation phase*. This, in order to analyse the circumstances how quality and maintenance has been balanced to strive for project success.

One example of (2) *limited supervision efforts* could be related to when the casting of the foundation for the new RCH was made. As we arrived to Mkula, making our first supervision round, we discovered that the pipes for the sewage system were not yet casted. Due to communicational difficulties we could not find the reason to why this was not yet made. As we asked the HMT, they explained it to us that it was most likely due to a routine. The holes for the pipes would be drilled later on. Rubaratuka (2008) claims that not fully detailed preparations during the planning phase could lead to higher project costs. This could lead to insufficient use of funds.

If the design would have been analysed in the planning phase, need of modification or improvements during construction phase could have been avoided (Rubaratuka, 2008). In other words, this tangible outcome could have been different if considered during the planning phase. This, in order to strive for “project management success”. Golini & Landoni (2014) mention that beneficiaries often lack resources for technical consultancy which makes observations difficult to prevent in a state where projects coordinators are not present. Thus, additional costs due to flaws in workmanship, intended as well as unintended, are difficult to prevent.

The problem of (4) *loose couplings between actors* might also be a contributing factor for the project outcome. Ika (2012) described that in traditional projects, simplified by two stakeholders, beneficiaries are directly mis favoured by any additional costs. Hence, demands on how the contractor is doing the work are directly made by clients. In HHP this can mainly be made during supervision phase. Couplings between contractor and project group are loose. Thus, important decisions during constructing phase would rely on the contractor. Decisions made by project team is therefore limited to a short time. This could also lead to unsupervised quality control. The phenomenon of quality control is referring to the inspection, checking, and monitoring during the implementation phase (Rubaratuka, 2018). Supervision efforts has moreover been stated crucial to prevent corruption (Moyo, 2009). Thus, presence at site might potentially prevent any additional costs.

One example of where (2) *supervision efforts* might have prevented bad quality, was when exposure of reinforcement was discovered. It was most likely caused by lack of equipment. As a direct measure to this issue, the exposed areas were covered by mortar in an early stage, which in turn could save future maintenance efforts. Thus, we could expect longer lifespan due to higher quality. Rubaratuka & Mulungu (1999) claims that the additional cost of maintenance to treat corrode reinforcement is “extremely high” comparing to doing necessary precaution measures to minimize the risk of carbonation process. Also, our inability to communicate with the contractor is creating (4) *loose couplings between us and the contractor*. If the couplings between SPG and the contractor would have been closer, we could have looked into the option of renting proper vibrating tools. This would prevent porous concrete and thus the reinforcement would be better protected from heavy rainfalls.

It should be real efforts of project management in the planning phase as it affects the prerequisites for the implementation stage (Rubaratuka & Mulungu, 1999). Risk analysis can reduce the risk of mis adaption to project scope in order to understand the (1) *risk degree of quality* of the building (Ika, 2012). If the resources are well distributed, the contractor would have the possibilities and time to prioritize quality. For example, if there are access to functional tools and time for quality control this could prevent the risk of urgent maintenance in the future. The need of maintenance would then be increased and perhaps not even needed within another 25 years which in turn could lead to a building with a long and sustainable life (chapter 3.3). Once again, this is a clear example on how costs are distributed to future maintenance work due to the characterizing issues of aid. This is an example of how we would not face the direct outcome which in turn affect the ability of achieving "deliverable success".

### **5.3 Drainage System: Ensure a long lifespan for existing buildings on hospital area**

The drainage system was a measure initiated by the HMT. By removing water masses from the hospital area, it could prevent penetration of water into the foundation, which in turn affect quality. Dias (2003) claims that one of the most critical factors affecting durability on constructions is heavy precipitation in combination with wind and solar radiation. He furthermore argues that unfortunate combination of weather condition and poorly conducted constructions can reduce lifespan with up to 20 years. Falade (2000) claims that constructions in hot humid climate face higher risk of reduction of lifespan. Thus, we could expect lifespan on constructions to be longer by implementing a solution that would reduce the water masses that affects the area. The planning of the drainage system was initially supposed to be finalized together with the laboratory. However, this project was considered lower priority according to the HMT. Since the funds were not covering all ongoing sub-projects, the project execution of the drainage system was postponed. All the project documents were roughly finished in order for the next group to follow up the work.

Some discoveries made on our field visit showed that the slope on some gutters were too flat. This made sand and soil to settle which was an important observation for our continued planning. The slope was low which could cause potential settlements in the drainage system. It therefor requires well distributed recourses to the planning phase to ensure that actual outcome will not differ from project scope. For example, a risk analysis could be done by study how other drainage systems were built and maintained, by measuring the slope, and by study the technical issue even further. To clarify, this still in an early stage of the planning phase and therefore we have not conducted a full risk analysis. This project could be financed alone, excluding the rebuilding of the laboratory. However, it would postpone the execution of the laboratory even further. Therefore, it was decided to prioritize the rebuilding of the laboratory as soon as the budget could cover.

As we studied how the water masses moved over the area, we could see that some constructions were damaged. Celadyn (2014) points out environmental conditions as an overall building destructor. A new drainage system would prevent heavy rain masses from the nearby area to cause destruction on buildings over time. This is a measure that we consider highly relevant for our project. It thereby decreases the maintenance efforts on several buildings that are facing the risks of cracks in foundations, exposure on reinforcement, corrosion, leakage, and loss of soil masses and so on (Rubaratuka & Mulungu, 1999).

## 5.4 Summary of project challenges within the sub-projects

All project management challenges within the three ongoing sub-projects emphasizes the importance of quality control. Future and long-term outcomes are difficult to predict with a lot of uncertain circumstances. However, supervisors have the ability to influence how projects unfolds in the design phase and partly the implementation stage. This is the time range where decisions can be done. However, we believe that any decisions allocated to the future can be reduced by ensuring high quality for all implemented projects. Examples on how this has been done in the project is by initiating a total reconstruction of the laboratory. Furthermore, it has been done by consistent quality control of the RCH. Lastly, observations of possible risks of implementing the drainage system has been analysed in order for the next SPG to follow up the work.

The range of the subjects we analysed was wide and all projects required unique monitoring. Baum (1982) describes that projects should strive to avoid the One-Size-Fits-All-Trap, and project managers should not assume that they require similar approaches. However, the common goal for all ongoing subprojects was to implement long term solutions in order to achieve “deliverable success” as it concerns success created by fulfilment of long-term goals. Another important matter was also to achieve “project management success” and the way occurrences appeared within the project is described in chapter 3.2. These occurrences did not align with our original intention of how we wanted the project to unfold. Thus, we were disappointed of how we were not able to fund the laboratory and drainage as we had hoped for. However, the result of the RCH was still successful even though the project faced obstacles. This could be described as partly achieving “project management success” for all sub-project. However, “project management success” is still within the range of being achieved next year. Decisions made in the project could still enable projects to be implemented in the future, and possibly ensure higher quality. Thus, there is still a high chance that the projects will be conducted in the future with a long lasting-lifespan.



## 6 Conclusion

### 6.1 Summary of content

The aim is detailed by the following research questions:

- *How has the project management challenges been dealt with in the project, that in turn, affects the lifespan of the building?*
- *How has the quality and need of maintenance comparing to cost and effort been balanced in the Healthy Hospital Project in Mkula?*

To conclude the content in this thesis we want to highlight some patterns that were visible throughout all sub-projects. One of the most important issues regarding the lifespan of the building is that the hospital is dependent on donors. One of the main tasks for the coordinators are to deal with the project management challenges. In the HHP supervisors are responsible for this. We noticed that the loose couplings between actors caused a relationship of dependency. Supervisors were not always present which made their ability to influence the project outcome low. Even after implementing projects, problems could appear that were not considered during planning phase. If the magnitude of these problems would make the beneficiaries unable to cover for additional expenses to fix the problems, we would embed so-called “weak links”. These potential problems are what we identify as constraining factors, which in turn are causing dependency. This describes how actual outcome of the project can differ significantly from its purpose. Moreover, the literature refers to this as unfulfilled “deliverable success”. However, if all different occurrences within the project did not overlap as planned, we refer to this as unfulfilled “project management success”.

One major project management challenge to consider is the importance of risk analysis. We believe that the best analysis could be done if all the stakeholders are involved, including the contractors. To avoid creating dependency, we suggest that decisions should be made in an early stage. The HHP should be monitored to allocate most of the decisions in the planning phase where all stakeholder has a possibility to influence the outcome. We want to decrease maintenance efforts needed in the future by ensuring high quality in all projects, even if it would be at the expense of a higher investment cost. This has been done in HHP by postponing the execution of the laboratory to a phase where supervisors would be present, and the budget could cover for good enough quality of the building. The risk of urgent maintenance of roof and foundation in the future has therefor been decreased. Furthermore, decisions have not been postponed to a phase with many prevailing uncertainty factors. In this way we have ensured good quality and a longer lifespan of the laboratory, with less constraining dependency factors. Project management challenges has been dealt with by defining two dimensions of success, as mentioned in the previous section. Based on these findings we made decisions according to what we considered would benefit Mkula hospital best, in a long-term run.

## 6.2 Recommendations for future work within EWB

We suggest that it is particularly important for project managers within aid projects to allocate decisions to a phase where there are less uncertainty factors. We moreover believe that many aid projects face more uncertainty factors than traditional projects, characterized by two stakeholders. This makes analysis of risks an even more important matter to consider for project managers within aid. Many aid organisations are short on supervisors being present on site. Therefore, risks and possible outcomes must be considered in order not to rely on future supervision and budget funds. Measures done to avoid dependency increases the ability to influence how project funds are spent. It moreover, increases the ability to discover flaws in project management which can improve quality of construction. The lifespan of the building is dependent on the project management method which in turn affects the balance between cost, quality, and effort. This balance needs to be considered in order to strive to favour long-term achievements. To strive for a long-lasting building, the quality needs to be considered throughout the entire project. By doing necessary efforts and consider the total cost all over the lifespan, the need of maintenance could be decreased. Thus, we could decrease future dependency.

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