



**ADDIS ABABA UNIVERSITY  
COLLEGE OF BUSINESS AND ECONOMICS  
SCHOOL OF COMMERCE**

**Assessment of Biomedical Engineering Project Monitoring and Evaluation  
(in the case of Tikur Anbessa Specialized hospital)**

**BY**

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Business and Economics School of Commerce in Partial Fulfillment of the  
Requirements for the Degree of Master of Arts in Project  
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**ADDIS ABABA UNIVERSITY**  
**SCHOOL OF COMMERCE**  
**DEPARTMENT OF PROJECT MANAGEMENT**

This is to certify that this project work is prepared by Nebiyou Mikre, entitled: “Assessment of Biomedical Engineering Projects Monitoring and Evaluation (in the case of Tikur Anbessa Specialized Hospital)” and submitted in partial fulfillment of the requirements for the degree of Masters of Arts in project management complies with the regulations of the University and meets the accepted standards concerning originality and quality.

**Approved by the Examining Committee:**

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_____	_____	_____
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_____	_____	_____
<b>External Examiner</b>	<b>Signature</b>	<b>Date</b>

## **Statement of Declaration**

I, Nebiyou Mikre, declare that this project work entitled “Assessment of Monitoring and Evaluation of Biomedical Engineering Projects: in the case of Tikur Anbessa Specialized Hospital” is a product of my determination and that all source of resources used for the study has been duly acknowledged. I have organized and shaped it independently except for the guidance and suggestion of my research advisors. This study has not been submitted for any degree in this University or any other University. It is presented for the partial fulfillment of the degree of Master of Art in Project Management.

By: Nebiyou Mikre

Signature \_\_\_\_\_

Date: \_\_\_\_\_

## **Statement of Certification**

This is to certify that Nebiyou Mikre has carried out this project work entitled: “Assessment of Monitoring and Evaluation of Biomedical Engineering Projects: in the case of Tikur Anbessa Specialized Hospital” under my supervision. This work is original and it is sufficient for submission as the partial fulfillment for the award degree in Masters of art in project management.

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**Advisor Signature Date**

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## **Abstract**

The research sought to investigate the factors affecting the effectiveness of monitoring and evaluation system for biomedical engineering projects at Tikur Anbessa Specialized Hospital. The research implemented a descriptive research design in pinpointing the research problem. The research targeted 32 employees of Tikur Anbessa Specialized Hospital that are directly involved in the biomedical engineering projects, in which the researcher conducted a consecutive sampling method. Due to the current pandemic most of the institution physicians were involved in providing health care services for Corona Virus (COVID-19) victims, in which the response rate was 68.75%, where most of the data collection was performed through online survey. The research utilized a questionnaire and interview to collect primary data. The collected data from the questionnaires were analyzed through SPSS statistical package version 26. The findings were analyzed using means, standard deviation, percentages and frequencies then presented in a table format, in which the interview questions were used to discuss the findings. The main findings of the research are; the stakeholder management and participation, as well as the biomedical engineers and radiology technologist, are not involved in the project from planning to closure, there is no service agreement for most of the machines that have been installed, the institution doesn't have a higher involvement in the procurement procedure, skilled professionals are not properly chosen, team organization and teamwork are not properly managed, communication plan being vague. The research suggests most of the knowledge areas in the project management field investigated in regards to the factors influencing the effectiveness of monitoring and evaluation in biomedical engineering projects.as well as the replicating this study in other public health institutions, to enable generalization.

Keywords: Project management, Project knowledge area, Project Monitoring and Evaluation, Tikur Anbessa Specialized Hospital (TASH), Stakeholder, Team, End-User, Service, Procurement, Training, Communication

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# Chapter one

## 1. Introduction

### 1.1. Background of the study

In life, we analyze what we have done, what we will do, and what holds for the future. One of the disciplines that have been important for human beings is evaluation. It permeates all areas of human activity and has important implications for maintaining and improving services and protecting people in all ranges of interest to humanity. Evaluation is a method for giving confirmation to such matters as reliability, effectiveness, cost-effectiveness, efficiency, safety, ease of use, and righteousness. Society and individual clients are at risk to the level that services, products, and other objects of interest are of poor quality. Evaluation helps society by providing assertions of worth, value, progress, approval, and accountability-and, when necessary, a credible, defensible, none illogical basis for terminating bad plans or, equally, expanding good plans.

Objects of evaluations may be programs, projects, policies, proposals, products, equipment, services, concepts and theories, data, and other types of information, individuals, or organizations, among others. The existence of comprehensive evaluation does not necessarily assure high value in services or that individuals in authority will regard the instructions of evaluation and take desirable corrective actions.

As such, the lack of accessible quality healthcare is a big problem in Africa and other developing countries. This is not only due to the inaccessibility of resources but also to the absence of an organized developmental process for the plan and administration of healthcare facilities. Crucial to the actual and well-organized exploitation of healthcare institutions and biomedical technology, the support of biomedical engineers, who form the connection between technology and medical practice is essential. Certainly, biomedical engineers, composed of nurses, doctors, and other professionals in the health care services, form pillars of healthcare organizations in the developed world.

In Ethiopia deficiency of appropriate management of medical equipment has limited the ability of health organizations to provide adequate health care. It is estimated that only 72% of medical equipment found in Addis Ababa public hospitals are functional and in some hospitals in the regions functional equipment are near to 50% (Ethiopian Hospital service transformation guideline, 2017).

Biomedical engineering has only been developed as its own discipline, relative to many other engineering fields, especially in the case of our country which started the study of Biomedical engineering studies since 2006.

The three main causes for the rising amount of non-functional medical devices are being lack of coaching, lack of health technology management, and lack of infrastructure (Perry & Malkin, 2011).

Monitoring and evaluation is described as a process that supports project managers to scale up performance and effect the results. It aims at improving the present and future use outputs, outcomes and impact (UNDP, 2012). Gyorkos (2013) asserts that monitoring delivers management and stakeholders with strong indicators of developments and accomplishment of forecasted outcomes using the available resources.

Day (2010), states that effective monitoring and evaluation is progressively being valued as an important necessity for both project and portfolio management. This is because it provides ground for being responsible in utilizing the resources presented for development. Further, monitoring and evaluation can be applied to make the project even sturdier at the design stage, implementing it and inspiring potential partners among the stakeholders.

The study takes place in Tikure Anbessa Specialized hospital (TASH), one of the leading public hospitals in Ethiopia, and as well as professionals that are currently working in private hospitals. The aim of the study is to investigate the biomedical projects monitoring and evaluation, in regards to Tikur Anbessa Specialized Hospital and the private sector.

## **1.2. Background of the company**

Tikur Anbessa Specialized Hospital (Black Lion Hospital) is Ethiopia's principal general public hospital and one of the University Hospitals in the Country. In 1998 Tikur Anbessa Specialized Hospital (TASH), which is the principal referral hospital in the country, with 800 beds, was transferred to Addis Ababa University by the Federal Ministry of Health, and it has since developed into a university teaching hospital. It is now the main teaching hospital for both clinical and preclinical training in most disciplines. It is also an establishment where specialized clinical services that are not available in other public or private institutions are provided to the entire nation. The faculty is the oldest and the principal among the health training institutions in the nation, operated with the most senior specialists.

The hospital delivers a tertiary level referral treatment and which is open 24 hours for emergency services. The hospital is managed by Addis Ababa University and is the largest and oldest teaching hospital among all in Ethiopia providing teaching for about 300 medical students, 350 Residents, and a sizable subspecialty fellow in the numerous clinical disciplines every year.

Tikur Anbessa Specialized Hospital provides diagnosis and treatment for approximately 370,000 - 400,000 patients a year. The hospital has 800 beds, with 130 specialists, 50 non-teaching doctors. The emergency department sees around 80,000 patients a year.

Tikur Anbessa Specialized Hospital has 200 doctors, 379 nurses, and 115 other health professionals dedicated to providing healthcare services. The numerous departments, faculties, and residents under specialty training in the School of Medicine make available patient care in the hospital. The hospital also has 950 permanent and contract management staff to support the hospital activities. Furthermore, almost all regional and federal hospitals in Addis Ababa are associated with the School of Medicine as clinical services and training sites.

### **1.3. Problem Statement**

The medical devices installed in the different public hospitals are more or less reliant on the manufacturer of the equipment and most of the manufacturers train only their specialized technicians. As a result, the medical device industry in Africa is mainly absent and there is overdependence on foreign firms to repair and design biomedical equipment and resolve technical problems.

It has been a long journey for the Ethiopian Health service and the Educational System, to finally get the Biomedical Engineering that has been a looming problem for the vast majority of hospitals and equipment that have been constructed and installed. There is a big heartache that most of the medical gadgets that have been installed in the health service institutes all around Ethiopia are not working at their full potential or not at all, especially the ones in public hospitals.

Even though universities like Gondar, Hawassa, Jimma, Mekelle, and Addis Ababa Institute of Technology have educated students to feel the gap that exists; the deficiency is still palpable. Although these trainees have graduated and been hired by the different hospitals and institutions that required the help of these young educated individuals, nonetheless the results are still grim. It can be observed from the private and public sectors that the gap is huge, it is worth mentioning that more of these complaints are observed in the public sectors.

Project success rests on various factors, one of the key factors is devising a thorough monitoring and evaluation system and practices to make informed decisions, document lesson learnt for future programming, design and implement (Gudda, 2011).

The objective of monitoring and evaluation is to deliver information that can help informed decisions, develop performance and attain planned results (Ottosson, 2013). Gudda (2011) states monitoring and evaluation as one of the management functions called controlling and it is the process of monitoring, evaluating, and comparing planned results with actual results to determine the progress toward the project objectives. Determining the relevance and fulfillment of project objectives, developmental efficiency, effectiveness, impact and sustainability based on Project monitoring and evaluation guide (IFRCS, 2011). However, the quality of data reported, the consistency of the reporting period, the effectiveness of this system, its strength and weakness has not been studied in regards to biomedical engineering projects. The importance of the system on the institutions project performance and success has also never been clearly identified and properly peached to the company staff as well.

Therefore, in order to fill this gap, the study has assessed the biomedical engineering projects monitoring and evaluation; in the case of Tikur Anbessa specialized hospital. The question of stakeholder participation, team work and procurement plan have also been studied. Furthermore, possible recommendations have been forwarded with a strong believe that the institution will be able to appreciate the benefits.

#### **1.4. Research question**

##### **1.4.1. Main Research Questions**

1. What is the biomedical project monitoring and evaluation framework in Tikur Anbessa Specialized Hospital?
2. How are the project monitoring and evaluation process practiced in Tikur Anbessa Specialized Hospital?
3. What are the challenges and significance of using monitoring and evaluation in biomedical engineering projects at practice at Tikur Anbessa Specialized Hospital?

##### **1.4.2. Specific research questions**

1. Valuation of Biomedical Engineers and en-user role?
2. Evaluation of the structure of communication and the overall chain of command?
3. Assessment of the practice of the service agreement (additional support, training provided by the manufacturer companies, and others)?

4. Valuation of teamwork between the various stakeholders in the hospital concerning biomedical projects?
5. Evaluation of procurement procedures and methods used in biomedical projects?

## **1.5. Objective**

### **1.5.1. General Objective**

The general objective of this study is to assess the biomedical project monitoring and evaluation practices at Tikur Anbessa Specialized Hospitals and illustrate to the policymakers the different methods that are being applied in the government versus the private sectors of Ethiopia.

### **1.5.2. Specific Objectives**

The specific objectives of the study include:

- To investigate the existing monitoring and evaluation method of Tikur Anbessa Hospital.
- To evaluate the monitoring and evaluation practices of Tikur Anbessa Specialized Hospital compared to professionals that are involved in the private sector biomedical projects in Addis Ababa.
- To identify the challenges occurring during the monitoring and evaluation process.
- To recognize the significance of using monitoring and evaluation at the institute

## **1.6. Significance of the Study**

Any equipment that is bought even in our home has a big value for us, whatever the use is, it is bought for a reason. And when the reason is the health of the people of the country it has the highest place in anyone's mind.

Monitoring and evaluation have a great impact on any project that has been implemented. They show the flaw, deviation, correction and many more, which an institution such as Tikur Anbessa Specialized Hospital can use and implement in the days to come. The lack of such a project management instrument has had a great effect on all involved.

This study has tried to demonstrate the problems related to the sustainability of medical equipment projects in the government hospitals of Ethiopia and recommend possible resolutions. Recommend new landscapes in which the hospitals are working and improve it for the good of the people they are serving and the satisfaction of doing the right thing. It has tried to show that including and developing the Biomedical engineering sector in any hospital is as

important as the hospital itself. Recommend areas where gaps in technical knowledge with regards to defining performance indicators, the retrieval, collection, preparation, and interpretation of data can be improved on if need be. There are a lot of innovative ways that other countries are going to develop their biomedical manpower that can be adapted on to the Ethiopian landscape. This has been demonstrated in the context of Tikur Anbessa Specialized Hospital which the researcher has tried to show the different project managers and policymakers how they can go about.

### **1.7. Scope of the study**

This study takes place in the Ethiopian context of the Tikur Anbessa Specialized Hospital Biomedical Engineering projects, which has involved the medical department (Radiology, ICU, laboratory and procedure room), biomedical engineering department, and some of the departments that have a direct relation to the equipment's that are being used in the Hospital. To show the gap between the public and private sectors, one or two private sector hospitals with high and low tech have been included. It doesn't analyze in-depth the stakeholders involved except the hospital. This study won't be applicable to generalize the entire biomedical system of the hospital.

# Chapter Two

## 2. Literature Review

### 2.1. Introduction

Literature review enables the main points of the existing knowledge area including applicable findings as well as theoretical and working contributions to a particular topic to be identified and studied. Since it is secondary sources, it doesn't account for any new or original investigational work. The following are some of the points the research and based on. It shows the previous point considered concerning this particular research.

### 2.2. Theoretical review

#### 2.2.1. Project

A project generally refers to a brand-new endeavor with a specific objective and varies so widely that it's very difficult to exactly define it. a number of the commonly quoted definition are as follows. A project may be a temporary endeavor undertaken to form a singular product or service or result (American National Standard ANSI/PMI99-001-2004). A project may be a unique process, encompassing a collection of harmonized and measured activities with start and finish dates, undertaken to comprehend an objective conforming to detailed requirements, including the constraints of your time cost and resource (ISO10006). These are a number of the final description of the project but there's plenty full that has got to be checked out for any project to be truly called a successful project, which is shown within the following sections.

Every project is built to satisfy a particular objective. These objectives, which are frequently defined as a part of the commercial situation and taken off within the project, must meet three important criteria (Eur Ing Albert Lester, CEng, FICE, FIMechE, FStructE, FAPM, 2003):

- a. The project must be finished on time;
- b. The project must be completed within the budgeted cost;
- c. The project must adhere to the prescribed quality requirements.

For a project to achieve success, the project team should select appropriate processes required to fulfill the project objectives, use an outlined approach that may be adapted to fulfill requirements, establish and maintain appropriate communication and engagement with stakeholders, go with requirements to fulfill stakeholder needs and expectations, and balance

the competing constraints of scope, schedule, budget, quality, resources, and risk to supply the required product, service, or result (PMI, 2013).

### **2.2.2. Project Management**

Different scholars are giving their definitions, of what project management must define, out of all the definition the foremost authoritative one is defined as follows: a singular set of coordinated activities, with a certain starting and finishing points, undertaken by a private or public organization to achieve detailed objectives within the defined timetable, cost and performance limitations (BS 6079 'Guide to Project Management').

A key feature that differentiates project management from just management is that it's this final deliverable and finite duration, unlike management which is a continuing development. Thanks to this a project professional needs a good range of skills; often technical skills, and positive people management skills, and good business awareness.

Project management has core components that outline it collectively of the required management divisions. These are; defining the explanation why a project is critical, capturing project requirements, specifying the quality of the deliverables, estimating resources and timescales; preparing a business case to justify the investment; securing corporate agreement and funding; developing and implementing a management strategy for the venture; leading and inspiring the project delivery team; managing the risks, issues, and changes on the project; monitoring progress against plan; managing the project budget; maintain communications with stakeholders and also the project organization; provide management; and shutting the project in a very controlled fashion when appropriate are a number of the most core components of project management (APM, 2019).

### **2.2.3. Project Monitoring and Evaluation**

Monitor and control of project work is “the process of tracking, reviewing, and regulating the make meet the performance objectives defined within the project management plan” as stated in (PMI, 2017). It further explains that monitoring includes status reporting, progress measurement, and forecasting. Performance reports deliver information on the project performance concerning scope schedule, cost, resources, quality, and risk which may be used as inputs to other processes.

Monitoring and evaluating a project is extremely important to numerous players including project stakeholders because it would certify similar projects are replicated elsewhere as

observed in various projects undertaken within the various departments of the organization (in the research case, in various medical departments). Monitoring gives data on where a policy, program, or project is at any given time, relative to particular targets and outcomes. Monitoring focuses specifically on efficiency, and the implementation of resources. Evaluation deals with questions of cause and effect. It's measuring or estimating the worth or impact of an intervention and is usually done on a routine basis perhaps daily, weekly, monthly, or yearly or at the tip of a phase of a project or program.

There are many misconceptions, and myths surrounding monitoring and evaluation namely: it's difficult, it's expensive, it requires high-level skills, it's time and resource-intensive, and it only comes at the top of a project and it's someone else's responsibility.

As stated by (Magondu, 2013) financial availability is that the main resource in any functional organization as far as other resources like humans are concerned. to line up a monitoring department, finances are required. This has been explained further by the author, stating that staff capacity both in numbers and skills are very instrumental in any effective implementations and sustainability of monitoring and evaluation.

It provides establishment, development managers, the private sector, and public society with better means for learning from past practice, refining service delivery, planning and assigning resources, and signifying results as a part of the responsibility to key stakeholders. While evaluation is distinguished from monitoring, they are of course interdependent. Monitoring offers what has been delivered and evaluation answers the question "what is going on as a result of the intervention?".

The program performance enables the improved management of the outputs and outcomes while encouraging the allocation of effort and resources within the direction where it'll have the best impact. It can play an important role keep projects heading in the right direction, create the idea for reassessing priorities and make an evidence base for current and future projects through the systematic collection and analysis of knowledge on the implementation of a project.

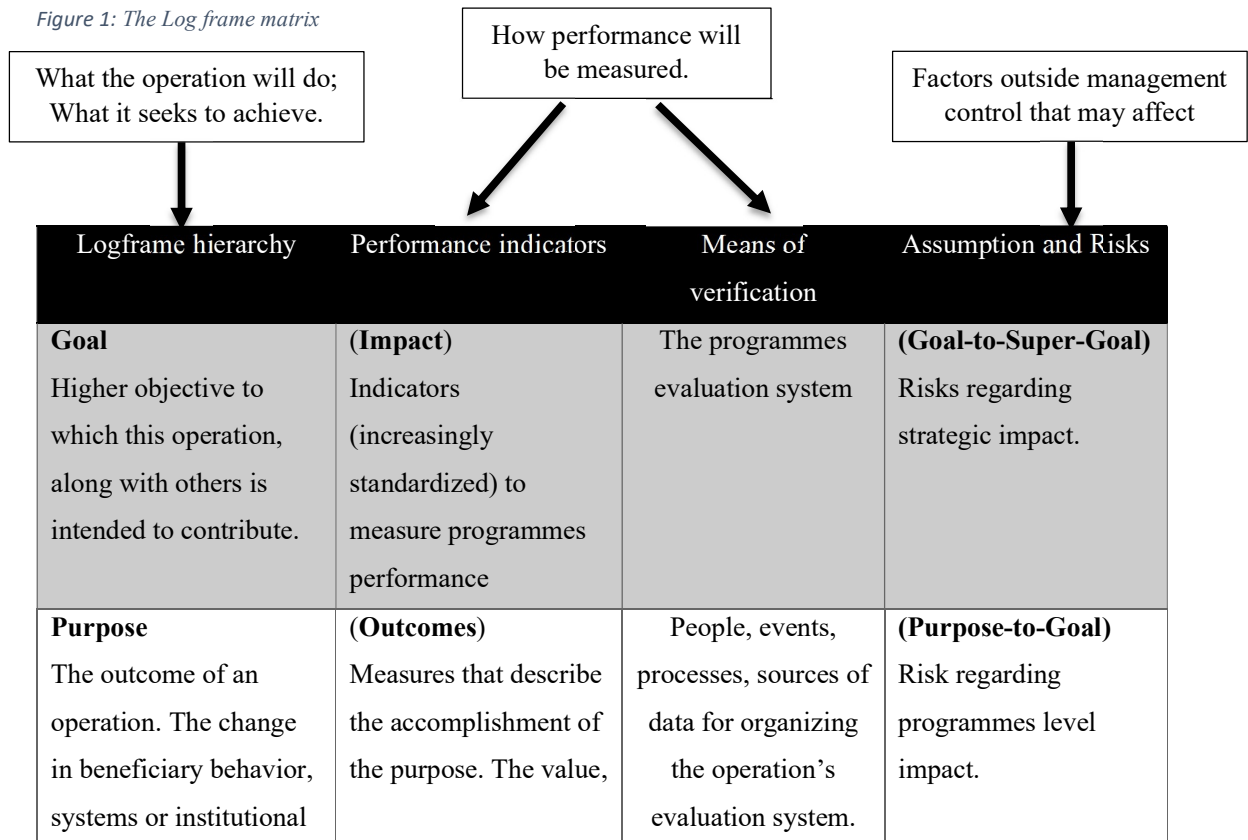
Managing Stakeholders, teamwork among members, and monitoring the progress of the project work are a number of the key processes accustomed to managing the project work (Georgieva & Allan, 2008). A truthful monitoring team is the one that has good stakeholders' depiction. Likewise, a monitoring and evaluation team which believes in teamwork may be a mark of strength and an element for better project performance.

(Gwadoya, 2012) found that there was a common need for an appropriate understanding of monitoring and evaluation practices in donor-funded ventures. This is a sign that there was an absence of a common understanding of monitoring and evaluation practices in donor-funded projects among the various teams. With proper enchantment and capacitating of the monitoring teams, there would be more teamwork and hence more productivity.

### 2.2.3.1. Log frame

The logical framework is one among the foremost common approaches employed in project management for both the planning and monitoring of projects. Log frame matrix could be a tool that's applicable for all organizations both government and non-governmental that are engaged in development activities (Middleton, 2005; Martinez, 2011). within the practical world, workers could also be limited by constraints that may prevent their continued use of either a log frame or some overly pragmatic approach to monitoring and evaluation, whichever the approach is employed, a minimum of the fundamental principles for monitoring and evaluation which are measurable objective, performance indicator, target, and periodic reporting should be employed in a reporting tool. The advantage of the log frame includes simplicity and efficiency in data collection, recording, and reporting.

Figure 1: The Log frame matrix



performance because of the combined output strategy and key assumption.	benefit and return on the investment.		
<b>Outputs</b> The actual deliverables. What the operation can be held accountable for producing.	Output indicators that measure the goods and services finally delivered by the operation.	People, events, processes, sources of data-supervision and monitoring system for validating the operation's design.	<b>(Output-to-Purpose)</b> Risks regarding design effectiveness.
<b>Activities</b> The man activity clusters that must be undertaken in order to accomplish the outputs.	<b>Inputs/Resources</b> Budget by activity. Monetary, physical and human resources required to produce the outputs.	People, events, processes, sources of data-monitoring systems for validating implementation progress.	<b>(Activity-to-Output)</b> Risks regarding implementation and efficiency.

Figure 2: Monitoring Questions and the Log frame

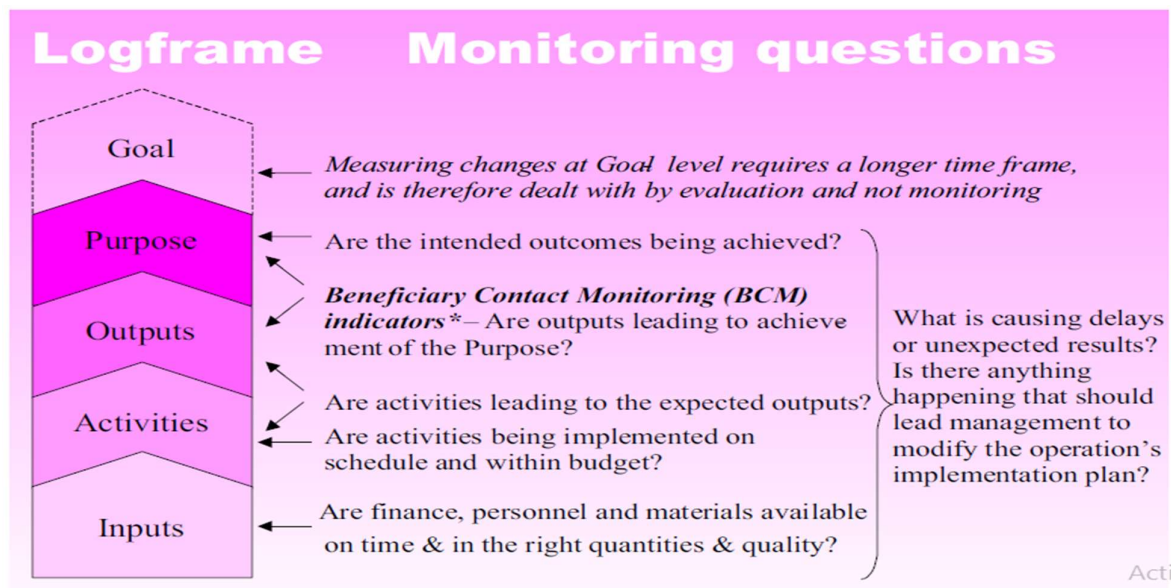
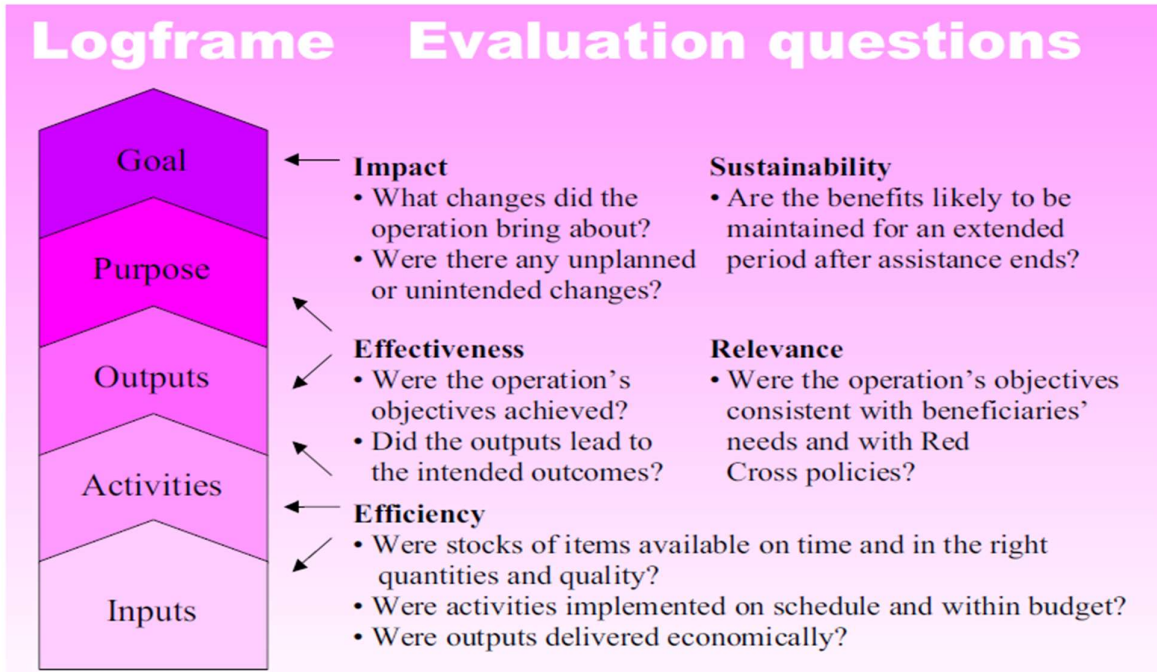
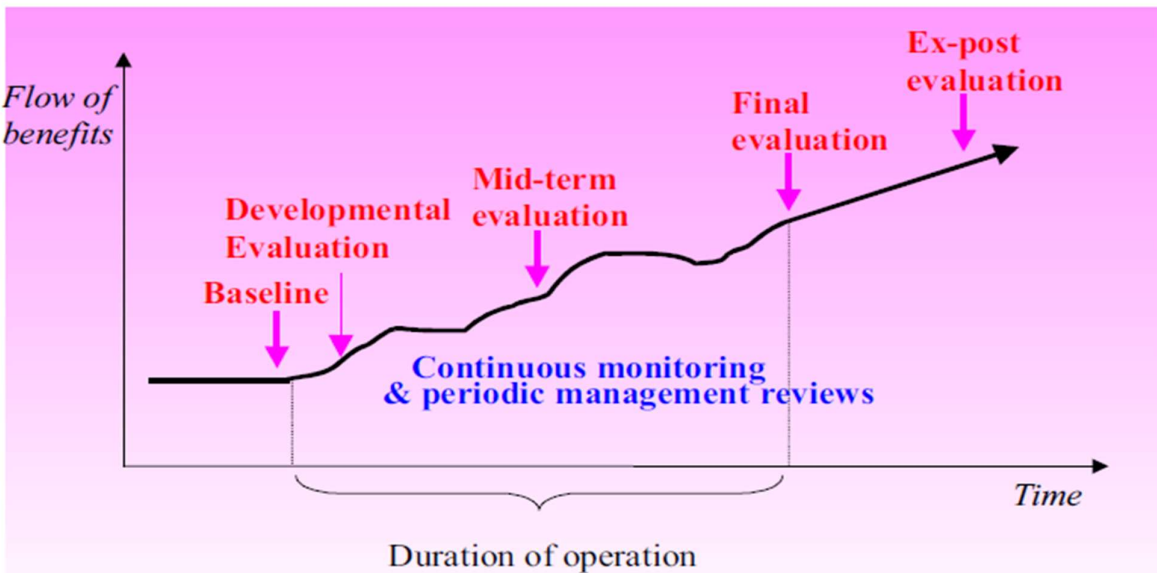


Figure 3: Evaluation questions and the Log frame



Monitoring occurs throughout the operation. A baseline study is typically conducted before the operations begin. Evaluations can occur for various purposes at different points on an evaluation.

Figure 4: monitoring and evaluation throughout the lifespan



The steps in designing a monitoring and evaluation system are described within the (IFRC\_Monitoring and Evaluation handbook, 2015) as follows:

<b>Step</b>	<b>To-Do-List</b>
<b>Check the operation's design</b>	<ul style="list-style-type: none"> <li>• Review and revise (and if necessary, prepare) a logical framework</li> <li>• Ensure the objectives for Goal (impact), purpose (outcome), Outputs, and assumptions are clearly stated and measurable.</li> <li>• Ensure that indicators are adequately specified with quantity, quality, and time.</li> </ul>
<b>Assess capacity for monitoring and evaluation</b>	<ul style="list-style-type: none"> <li>• Identify what human and financial resources are available</li> <li>• Assess training requirements for all monitoring staff, both from international and national.</li> <li>• Specify training requirements</li> </ul>
<b>Plan for data collection and analysis</b>	<ul style="list-style-type: none"> <li>• Check existing information sources for reliability and accuracy, to determine what data is already available.</li> <li>• Decide what additional information should be collected, for baseline purposes, for monitoring, and evaluation</li> <li>• Set a timeframe and schedule for data collection and processing, and agree on responsibilities.</li> </ul>
<b>Prepare the monitoring and evaluation plan and budget</b>	<ul style="list-style-type: none"> <li>• Summaries agreed on the information needed, data collection, information use, reporting, and presentation in a monitoring and evaluation plan.</li> <li>• Summaries capacity building and support requirements.</li> <li>• Cost all monitoring and evaluation activities, and identify funding sources.</li> </ul>
<b>Plan for reporting and feedback</b>	<ul style="list-style-type: none"> <li>• Design the reporting system, specifying formats for reports.</li> <li>• Devise a system of feedback and decision-making for management.</li> </ul>

*Table 1: steps in the design of a Monitoring and Evaluation System*

<b>When does evaluation occur?</b>	<b>Goal of evaluation</b>	<b>Methods to use</b>
<b>In the workplace</b>	Did the training meet needs or goals?	Questionnaires Performance appraisal reviews

		Evaluation interviews
	Application of learning in the workplace	Action planning Behavioral observation Critical incident analysis Evaluation interviews Questionnaires Performance appraisal review Participant observation Pre or post sampling of work
<b>Organizational effectiveness</b>	Changes in organizational performance	Analyses of performance indices- operational Measures such as output, quality or quantity, sales volume, wastage, expressed customer satisfaction, financial measures such as cost, return on investment
	Cost-effectiveness of training	Costing Cost/benefit analysis Cost-effectiveness analysis
	Congruence of training and organizational vision	Interview Content analysis of formal and operative policies
<b>Social or cultural</b>	Contribution of training to national goals and objectives	Cost-benefit analysis Values analysis Surveys

*Table 2: Evaluation, adapted from Meyer, 2002: 334*

## **Procurement**

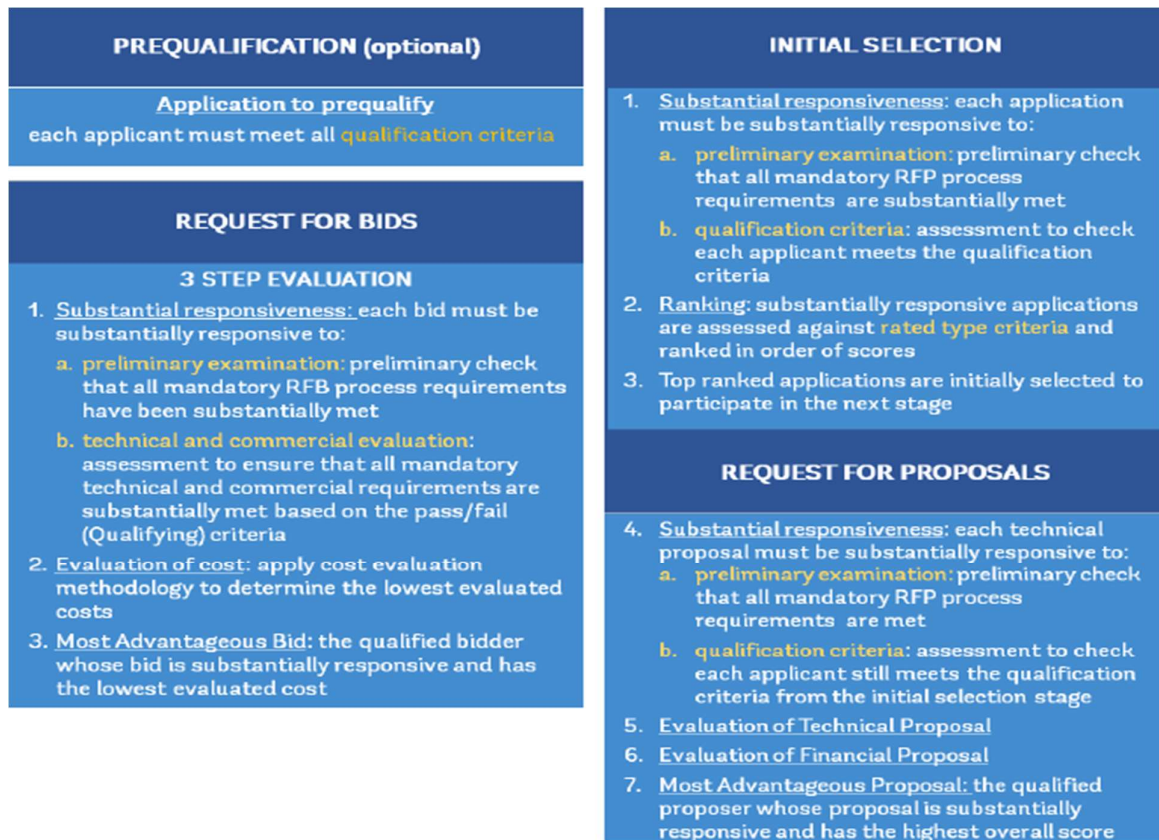
Evaluation criteria must be recognized in the premature periods of the procurement to support transparency, the value of money, and integrity in the procurement method. After the contact requirement have been demarcated and the selection technique decided, the evaluation standards are set so that the institute can appropriately evaluate which contractor is best able to deliver the requirements and make the most of the value for money.

To achieve Value for Money, the valuation criteria may take into reasoning such factors as the following:

- a. Cost: evaluation of cost utilizing a practice that is suitable to the nature of the procurement including:
  - i. Adjusted contractor price; or
  - ii. Adjusted contractor price plus the running/recurrent cost over the valuable lifetime of the asset on a net present cost basis;
- b. Quality: evaluation of quality using practice to determine the grade to which the goods, works, non-consulting services or consulting services meet or exceed the requirements;
- c. Risk: criteria that mitigate the pertinent assessed risk;
- d. Sustainability: standards that take into reasoning stated economic, environmental, and social aids in support of the project objectives, and may comprise of the flexibility of the Proposal to adapt to possible changes over the life-cycle; and/or
- e. Innovation: criteria that allow assessment of innovation in the design and/or delivery of the goods, works, non-consulting services, or consulting Services and that allow a contractor to include, when appropriate, in their bids/proposals, solutions that surpass the requirements or substitute solutions that could deliver better value for money.

Depending on the assortment technique that is selected, for example, request for bid with or without pre-qualification, or request for tender with initial selection, some different methods or processes can be used to primarily select/qualify firms, and to evaluate their bids/proposals to select the most advantageous bid/proposal.

Figure 5: Application of evaluation criteria



## 2.2.4. Biomedical Engineering

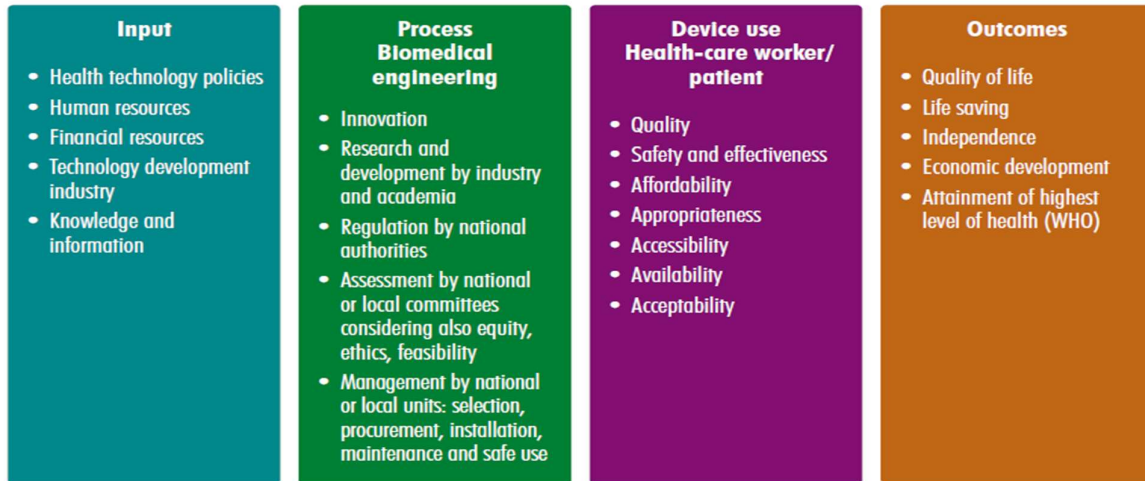
Biomedical engineering is one in every of the more recently recognized disciplines within the practice of engineering. it's a field of practice which brings many, if not all of the classical fields of engineering together to help in developing a much better understanding of the physiology and structures of the build, and to support the knowledge of clinical professionals in the prevention, diagnosis, and treatment of disease and modifying or supplementing the anatomy of the body with new devices and clinical services.

Biomedical engineering is taken into account because the profession is accountable for innovation, research and development, design, selection, management, and safe use of all kinds of medical devices, including single-use and reusable medical equipment, prosthetics, implantable devices, and bionics, among others.

A key objective of biomedical engineers is to own devices that are of excellent quality, effective for the intended purpose, available, accessible, and affordable. When these objectives are met and devices are used safely, patients' lives could also be saved, quality of life increased and there'll be positive economic outcomes; the ultimate goal is the attainment of higher levels of

care. The prerequisites for this to happen are health technology policies in national health plans, available human and financial resources, and scientific and technological advances that cause usable knowledge and data. The interrelation of this idea can be observed in the figure below.

Figure 6: Medical device process from policies to health outcomes (WHO: Human resources for medical Devices, 2017)



Medical and Biomedical engineering integrates physical, mathematical, and natural science with engineering principles for the study of biology, medicine and health systems and the applying of technology to enhance health and quality of life. It creates knowledge from molecular to organ systems levels, develops material, devices, systems, information approaches, technology management, and methods for assessment and evaluation of technology, for the prevention, diagnosis, and treatment of disease, for health-care delivery, and patient care and rehabilitation.

Biomedical engineering includes equivalent or similar discipline, whose names could be different, like medical engineering, electromedicine, bioengineering, medical and biological engineering, and clinical engineering.

### 2.2.5. Biomedical Engineering in Africa

While the givers of healthcare are surely doctors, clinicians, and nurses, and in some cases within the developed world, biomedical engineers are well known as being the basis of any medical facility with technology diagnostic and therapeutic equipment and devices.

In the less developed or emerging countries, the role of engineers within the hospital context is a smaller amount well consolidated. Indeed, the scarcity of available quality healthcare in Africa is inextricably connected not only with the scarcity of resources but also with the lack of sufficiently trained biomedical engineers.

Moreover, medical equipment doesn't have common standards or operational protocols, undeniably in most developed countries, hospitals and clinics have very expensive upkeep agreements with producers who train their own specialized technicians. As a result, the medical device manufacturing in Africa is absent and there's an over-reliance on foreign companies to repair and style biomedical instrumentation and resolve technical problems.

Very often developed countries donate machines to African hospitals and clinics. While this is often an honorable act, the machines usually find yourself being abandoned after they shut down because of a lack of adequate maintenance.

Trained and qualified biomedical engineering professionals are required to style, evaluate, regulate, maintain and manage medical devices, and train on their safe use in health systems around the world.

From the results of surveys and studies conducted, a publication about the role of biomedical engineers has been established. Human resources for medical devices, the role of biomedical engineers, is a component of the Medical device procedural series, WHO presents the various roles the biomedical engineer can have within the life cycle of a medical device, from conception to use. It's recognized that medical devices are getting ever more indispensable in the health-care provision and among the key specialists accountable for their design, development, regulation, evaluation, and training in their use – are biomedical engineers.

#### **2.2.6. Biomedical Engineering in Ethiopia**

The field of biomedical engineering is fairly new in Ethiopia, where its history is predicated in meeting the requirement for the maintenance of medical devices. In early 1997, a techno center was established at one amongst the biggest hospitals within the country, Black Lion Hospital, by a gaggle of technicians and electrical engineers, primarily to handle major maintenance problems throughout the country. These professionals weren't biomedical engineers but had certifications on medical devices like X-ray scanners, autoclaves, anesthesia machines, and suction machines. At the time, the available health facilities comprised around 96 hospitals, 282 health centers, and 802 health posts (El-Saharty et al., 2009). The number of technical professionals was inadequate to service all the health facilities. Additionally, spare parts for equipment weren't readily available. Most of the devices were imported donations, many of which weren't functional. A study published in 2011 revealed that around 39% of the hospital medical equipment in Ethiopia was out of service in 2008, the three main causes being lack of

coaching, lack of health technology management, and lack of infrastructure (Perry & Malkin, 2011).

In the early 2000s, the number of health facilities increased significantly. In 2004–5, there have been around 130 hospitals, 600 health centers, and 4,210 health posts (El-Saharty et al., 2009). This increase in the number of health facilities increased the interest of donors to produce support in equipping these facilities. Developing the equipment list and specifications was a challenge, as were installation and maintenance. None of the schools at the time had programs to coach the needed technical hands. In 2006 the Ministry of Health entered an agreement with Tegbare-id Polytechnic College, the national capital, for the latter to coach diploma level biomedical technicians to handle basic installation and maintenance. Training associated with biomedical engineering in Ethiopia has mainly focused on equipment maintenance.

### **2.3. Empirical Review**

Management and leadership further as project teams, is additionally emphasized within the literature as having a big effect on the project's success. Management and leadership also play a key role in supporting the monitoring and evaluation of projects. Yang et' al (2011) carries out an analysis that suggested that increases in levels of leadership may enhance relationships among team members. The study also indicated that teamwork encompasses a statistically significant influence on project performance.

Yang et' al (2009) analyzed the varied factors which are critical to the success of a project most of which were centered on managing stakeholders. Assessing attributes (power, urgency, and proximity) of stakeholders. Comprising conflicts among stakeholders effectively. Formulating a transparent statement of project missions, predicting stakeholders' responses for implementing the plans or policies, analyzing the transformation of stakeholders' impact and relations during the project course, and assessing stakeholders' behavior. Yang's critical success factors were mainly focused on stakeholder management. It's the role of management to appear into the affairs of stakeholders. However, stakeholder management isn't the sole responsibility of management as regards project success.

Management's competence, commitment to the project, communication, and cooperation with the project teams contain a significant contribution towards the success of a construction project. These factors were found to be of significance as assessed in the Malaysian housing industry (Yong & Mustaffa, 2012).

Muriithi and Crawford (2003) identified several issues associated with approaches to project management in Africa. These issues include the necessity to address political and community demands on project resources, the recognition that economic rationality and efficiency, assumed as a basis for several project management tools and techniques doesn't reflect local realities; which use of such tools and techniques won't enhance project success if they run counter to cultural and work values.

Hidaya (2011) in the research states that Construction projects need skillful management, as they are complex and face many challenges and constraints, such as cost, time regulations, materials and environmental rules or customs. In construction projects several activities happen and take place at the same time, but still are connected and integrated. Therefore, there is a need for a thorough and effective follow up, communications and collaboration to manage and control these activities.

The importance of planning monitoring and controlling projects in construction projects was stated in the research conducted by (Abebe, 2015). The criticalness of evaluating progress reports and also forwarding feedback on the results of these evaluation was also stated in this research.

The data collected through a monitoring and evaluation system should have an excellent quality, since it is going to be used in the decision-making process of the company. In addition to that the data collection mechanism should be effective too. Trainings on M&E system should also be provided for the Organization staff so that their interest and knowledge can mature to the expected level (Demissie, 2014).

In summary, management contains a role in enhancing project success by supporting the monitoring and evaluation team. Such support could also be achieved through factors like Communication, Commitment, Leadership Style, Team work and Motivation.

#### **2.4. Conceptual framework**

Based on the literature observed and the various findings information's that shines a light on the status of the biomedical engineering projects, which have been grouped and arranged to a framework that has guided the research in an attempt to provide a solution to the research problem.

### **Independent Variables**

Communication  
Leadership  
Procurement plan  
Teamwork  
End user Requirement  
Equipments and Materials  
Monitoring and Evaluation  
staff skills  
Stakeholders representation



### **Dependent Variables**

Successful Development  
and Implenentation of  
Biomedical Engineering  
Projects

## **Chapter Three**

### **3. Research Design and Methodology**

#### **3.1. Introduction**

The subsequent chapter identifies the types of research design and methodology that have effectively addressed the research problem. It includes research design, approach of the study, target population, sampling design, data source, and types, validity and reliability of research instruments, data collection procedures, ethical consideration, and data analysis techniques.

#### **3.2. Research Design**

The research adopts the descriptive research approach, which involves gathering data that describes events then organizes, tabulates, depicts, and describes the info collection. It doesn't fit neatly into the definition of either quantitative or qualitative research methodologies, but instead, it can utilize elements of both, often within the identical study.

This has enabled the researcher to stipulate the biomedical engineering project management practices, in Tikur Anbessa Specialized Hospital. In a descriptive survey research design, objectives are predetermined allowing data collection relevant and sufficient to the study problem (Kothari, 2004).

#### **3.3. Research Approach**

It has been argued that the basic principle of mixed methods research is that multiple varieties of data should be collected with different strategies and methods in ways in which reflect complementary strengths and non-overlapping weaknesses, allowing a mixed methods study provide insights out of the question when only qualitative or quantitative data are collected (Johnson and Turner, 2003). Put in our way, mixed methods research allows for the “opportunity to make amends for inherent method weakness, maximize inherent method strengths, and offset inevitable method biases” (Greene, 2007, p.xiii).

#### **3.4. Target population and Sampling design**

The population into consideration for the researcher is comprised of the Project managers, project team, medical department (Radiology, ICU, laboratory and procedure room), and the Engineering Department. These are the accessible population within which the research can apply the conclusions on. It's from this population that the researcher is drawing samples from.

The research is going to be implementing the consecutive form of sampling technique. It is very much liked the convenience sampling technique (samples are selected because they're accessible to the researcher) except it seeks to incorporate all accessible subjects as a part of the sample. This can be one in each of the categories of non-probability sampling techniques (it isn't a product of a randomized selection process rather the samples are usually selected on the premise of their accessibility or by the purposive judgment of the researcher) that encompasses a been considered because the better of all of the non-probability samples because it includes all available subjects that produce the sample an improved representation of the whole population. This may enable the choice of samples that are more focused on Biomedical engineering projects.

The staff members that are directly involved in the biomedical engineering projects, as instructed by the management and the department's heads were a total of 32 individuals. 2 from Biomedical engineering department, 1 from management and 29 from radiology department. And as well as 12 professionals from the private sector that have been practicing monitoring and evaluation in the biomedical engineering projects.

### **3.5. Data Source and Type**

The primary and secondary styles of data sources are implemented within the research, as both have weaknesses and strengths that complement one another. The first data is acquired using Questioner and interviews (Semi-structured). The desire allows the researcher to directly process the info obtained from the info collection methods.

Secondary data could be a valuable resource for monitoring and Evaluation work especially for baselines and background information. It's usually available at no cost. The information is from existing sources: project documents, company reports, articles, journals, books, and various online platforms that are related to the project under investigation. Given limited resources, it's also often counterproductive to overwhelm government agencies with duplicating efforts of knowledge collection of indicators. Especially were already established internationally; sources are available and may be readily accessed for both inter-temporal and international comparisons.

### **3.6. Data Collection**

The research data, collection method have included both Quantitative and Qualitative collection methods. Form the categories of collection closed-ended surveys are used. It offers predefined answer options that the respondents must select from. It consists of Likert-scale

questions and involves a group of predefined values to settle on from on a set scale, during which the question is going to be formed by standards questioner method yet as input from a number of the project managers to urge a stronger and informed result. These sorts of data collection methods are an excellent choice when looking to urge a straightforward and simply analyzable count.

In the qualitative data collection methods, the research has implemented the one-on-one interview. This data collection technique is ideal when it's needed to collect highly personalized data. It is a semi-structured to a certain extent to administer a more organized analysis of the responses.

### **3.7. Data Analysis Techniques**

The data is analyzed using both quantitative and qualitative techniques. Data are evaluated supported response form the distributed questionnaire and every response was administered by using SPSS (Statistical Packages for Social Science) software, within the case of quantitative chemical analysis. Within which descriptive statistics (mean, median, mode, frequency, minimum and maximum values, and percentages) are going to be linked to encapsulate available data. Qualitative data that has been collected is analyzed using methods of content, narrative, and discourse analysis, which are revisions of the first data by the researcher.

### **3.8. Ethical Consideration**

Some of the atrocities done during the Second World War in the name of medical research derived for the development of a commonly acknowledged code of research ethics which spread from the medical ground to all other research disciplines. In following the origin of ethics, this research has adapted The Belmont Report, in which the research has conducted; in respect for the individuals involved, beneficence (persons are treated in a principled manner, not only by regarding their choices and protecting them from an impairment but also by making efforts to protect their well-being.) and justice.

All guidelines of the company understudy have been undertaken as well as all personal ethical guidelines have been undermentioned before requesting the respondents participate in the research. All individuals involved are voluntary and on their own volition. The data collected has only been used for the research undermentioned and all data has remained confidential.

## Chapter Four

### 4. Data Presentation, analysis and interpretation

#### 4.1. Introduction

This section provides the findings of the research from the questionnaire and interview designed to illustrate the monitoring and evaluation of importance in the case of Tikur Anbessa Specialized Hospital. To show a better understanding of the monitoring and evaluation process, professionals from different private sector hospitals were requested to fill in the same questionnaire and asked the same interview questions. The summaries of the data obtained are presented, analyzed, interpreted, and discussed in detail. Frequencies and mean were used to analyze the data gathered through questioners, interviews, and document reviews and were analyzed using the SPSS software and Google forms to gather the questionnaires due to the current pandemic.

The questionnaire is comprised of 49 questions that have been analyzed to give the most information about the project monitoring and evaluation procedures and related deliverable. This questionnaire was distributed to the personnel of the Tikur Anbessa Specialized hospital and some external professionals that have been working in this field for private hospitals, clinics, and diagnostic centers. Since this field is new to the country the number of specialists in this field is not more than 10 from outside the hospital as it has been gathered from professionals working in this field. Only a few new graduates have been able to work in this particular field which doesn't enable them to give a clear view of the path that the different hospitals, clinics, and diagnostics centers have taken to reach this point, which is a significant part of this research centers.

The questionnaire contains closes ended questions that focus on the monitoring and evaluation method process and difficulties, the stakeholder's involvement, procurement methods, end-user involvement and satisfaction, issues involved in the monitoring and evaluation process, and the monitoring and evaluation process as a whole.

The questionnaire has been arranged on a Likert scale to capture the feelings of the respondents on a scale ranging from 1 to 5. The data has been analyzed in SPSS so that the accuracy of the information is maintained. In addition to this self-administered, semi-structured open-ended interview questionnaire has been used to support the researcher in discussing the issues raised

more clearly. All the interview questions were structured so that it matches the contents of the items enlisted in the questionnaire.

In the following section, the researcher describes the response rate for the questionnaires, the demographic profile of the respondents, the results from the system implemented by the hospital on monitoring and evaluation of Biomedical projects, and finally the summary and discussion of the monitoring and evaluation practice of the Tikur Anbessa Specialized Hospital related to other external hospitals and clinics as well as related research findings with other literature reviewed.

#### 4.2. Response Rate

The questionnaires have been distributed to the departments in the Hospital that have direct involvement in the Biomedical Engineering projects. There are 2 Biomedical Engineers, 3 Radiology Technologists, 26 from the Department of Radiology, and 1 from TASH Administration/ Management. From the 32 questionnaires distributed only 22 were adequately filled and returned. This implies that a 68.75 percent response rate is acceptable as demonstrated by Jack E. Fincham (2008). Interviews were also conducted between the institution's main departments personnel that are daily involved in this type of project. For the private company professionals that were interviewed and participated in the questionnaire, the response rate was 100% but the number of available professionals is small (12) due to the professionals existing on a small scale since Biomedical Engineering is a new field of work in Ethiopia.

*Table 3: Response Rate for Tikur Anbess Specialized Hospital*

Method of Questionnaire Distribution	Number of Distributed Questionnaire	Number of Returned Questionnaire	Response Rate (%)
IN-Person Survey	5	5	100%
Online Survey	27	17	62.96%
Total	32	22	68.75

Source: Field Survey, 2020

Table 4: Response Rate for Private hospitals and clinics working professionals

Method of Questionnaire Distribution	Number of Distributed Questionnaire	Number of Returned Questionnaire	Response Rate (%)
IN-Person Survey	0	0	-
Online Survey	12	12	100%
Total	12	12	100%

Source: Field Survey, 2020

### 4.3. Demographic Profile

In the first part of the questionnaire, the participant's demographic information is obtained. Accordingly, the demographic variables about the respondents were summarized and described using variables such as sex, age, level of education, the current position at the institution, number of years worked in the current position, any involvement in the monitoring and evaluation practice of the institution, and current department working in; are the general questions asked by the researcher to the participants to get the population information and composition.

Table 5: Respondents Gender Profile for Tikur Anbessa Specialized Hospital

Gender	Frequency	Valid Percentage (%)	Cumulative Percentage (%)
<b>Valid</b>	Male	19	86.36
	Female	3	13.64
	Total	22	100.0

Source: Field Survey, 2020

The table above demonstrates the number of male (86.36%) respondents is much higher than female (13.64%) participants. This shows that Gender distribution is not proportional. Since most of the departments have a higher rate of male professionals than female it was difficult to distribute the Gender.

Table 6: Respondents Gender Profile for Private company professionals

Gender		Frequency	Valid Percentage (%)	Cumulative Percentage (%)
<b>Valid</b>	Male	9	75.0	75.0
	Female	3	25.0	100.0
	Total	12	100.0	

Source: Field Survey, 2020

In this table, the gender of the respondents is demonstrated as shown. The number of male respondents (75%) is much higher as in the case of the TASH and the female (25%) respondents have a small ratio. As such the distribution of gender is not even since the field has a much higher rate of male respondents.

Table 7: Respondents Age Profile for Tikur Anbessa Specialized Hospital

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	<= 30 Years	1	4.5	4.5	4.5
	>50 Years	12	54.5	54.5	59.1
	31 – 40 Years	6	27.3	27.3	86.4
	41 – 50 Years	3	13.6	13.6	100.0
	Total	22	100.0	100.0	

Source: Field Survey, 2020

The result demonstrates that one (4.5%) respondent is below the age of 30 years old, while the highest respondents 12 (54.5%) are above 50 years old, 6 respondents (27.3%) are between the age of 31 and 40 years old and 3 respondent (13.6%) are between the age of 41 and 50. The survey result can be seen that for the most part, it has included more experienced and mature professionals.

Table 8: Respondents Age Profile for Private company professionals

Age				
		Frequency	Valid Percent	Cumulative Percent
<b>Valid</b>	<= 30 Years	8	66.7	66.7
	>50 Years	1	8.3	75.0

	31 – 40 Years	3	25.0	100.0
	Total	12	100.0	

Source: Field Survey, 2020

The research demonstrates the percentage of a higher part of the respondents exists in the age group of 30 years (66.7%) or lower. This is due to the field being at its infant stages and most professionals don't have higher experience in this area. The next highest is between the age of 31-40 (25.0%) years. The biggest professional in the Biomedical field and projects that the researcher has a pleasure to interview and receive the questionnaire back is in the age group of 50 years or older (8.3%). The Age group is not distributed as needed. But it allowed the researcher to see the perspective of the younger age professionals with the more mature professionals that have been working in this field of area.

Table 9: Respondents Educational Background for Tikur Anbessa Specialized Hospital

Level of Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	above Master	14	63.6	63.6	63.6
	BSc. Degree	5	22.7	22.7	86.4
	Masters	3	13.6	13.6	100.0
	Total	22	100.0	100.0	

Source: Field Survey, 2020

In Table 9 it can be demonstrated from the survey, most of the respondents are above masters (Ph.D. and related higher grade) (63.6 %), while 5 respondents (22.7%) have their BSc. Degree and 3 respondents have their Masters.

Table 10: Respondents Educational Background for Private company professionals

Level of Education						
		Frequency	Valid Percent	Cumulative Percent		
Valid	BSc. Degree	12	100.0	100.0		

Source: Field Survey, 2020

In the above table, it can be seen that all of the respondents have the educational background of a Bachelor's degree in science. This field as it has been said before is a very new field for Ethiopia and hasn't be developed in the masters and doctorate area as such.

Table 11: Respondents current position at Tikur Anbessa Specialized Hospital

Current position at the institution					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BME Engineer	2	9.1	9.1	9.1
	Doctor	14	63.6	63.6	72.7
	Doctor, MD+	1	4.5	4.5	77.3
	Management	1	4.5	4.5	81.8
	Medical Physicist	1	4.5	4.5	86.4
	MRT Chief	1	4.5	4.5	90.9
	Project coordinator	2	9.1	9.1	100.0
	Total	22	100.0	100.0	

Source: Field Survey, 2020

In Table 11 it can be illustrated from the survey, 2 Biomedical Engineers (9.1%) are currently operating in the institution, while most of the respondents are Doctors (63.6%) 14, one is a Doctor-MD+ (4.5%), one is in management (4.5%), one is a Medical physicist (4.5%), one MRT chief (4.5%) and two project coordinators (9.1%). It can be seen from their current position in the institution that their direct involvement with the Biomedical Engineering project as a User or an implementer or coordinator has allowed them to understand the bases of the questionnaire and the items found within the questionnaire.

Table 12.: Respondents current position for Private company professionals

Current Position at the firm				
		Frequency	Valid Percent	Cumulative Percent
Valid	Engineer	8	66.7	66.7
	Project	4	33.3	100.0
	Total	22	100.0	

Source: Field Survey, 2020

In the private sector, most of the professionals the researcher encountered are in the engineering or project implementation department of the company. The highest being in the Engineering department (66.7%) and the lowest in the project department (33.3%). This shows the more

directly involved in the biomedical engineering projects are the ones that have been included from the private sector.

Table 13: Respondents experience in monitoring and evaluation practice at Tikur Anbessa Specialized Hospital

<b>Have you ever been involved in monitoring and evaluation practice</b>				
		Frequency	Valid Percent	Cumulative Percent
Valid	No	15	68.2	68.2
	Yes	7	31.8	100.0
	Total	22	100.0	

Source: Field Survey, 2020

In table 13 it demonstrates the respondent's involvement in previous project monitoring and evaluation practices within the institution. From the respondents, 15 (68.2%) didn't practice monitoring and evaluation in the institution projects and 7 (31.8%) respondents have practiced monitoring and evaluation in the institution projects. This shows the gap that exists within the institution regarding the project monitoring and evaluation of projects.

Table 14: Respondents experience in monitoring and evaluation practice in the private sector

<b>Have you ever been involved in monitoring and evaluation practice</b>				
		Frequency	Valid Percent	Cumulative Percent
Valid	No	4	33.3	33.3
	Yes	8	66.7	100.0
	Total	12	100.0	

Source: Field Survey, 2020

In the experience of the respondents in the monitoring and evolution of projects, the private sector has more practice in this area. 66.7% of the respondents being involved in the monitoring and evaluation of the project and 33.3% of the respondents having no involvement at all.

Table 15: Respondents Department at Tikur Anbessa Specialized Hospital

<b>Current Department working in</b>				
		Frequency	Valid Percent	Cumulative Percent
Valid	Biomedical	1	4.5	4.5
	Consulting	1	4.5	9.1
	ICU; Biomedical; Radiology	1	4.5	13.6

	Management position	1	4.5	18.2
	Radiology	18	81.8	100.0
	Total	22	100.0	

Source: Field Survey, 2020

Table 15 demonstrates the departments the individuals are located, which in this research shows the respondents involved in the Biomedical projects. Most of the respondents are from the Radiology department (81.8%) and a single respondent (4.5%) from each of the Biomedical, consulting, and Management positions. While one individual is involved in the ICU, Biomedical and Radiology Department at once. From this, it can be observed that the main stakeholders of the Biomedical project, the Radiology department, composed of the highest part of the respondents which has given a clearer view of the projects that have been implemented and what areas shall be improved upon moving forward.

Table 16: Respondents Department at private sector companies

Current Department working in				
		Frequency	Valid Percent	Cumulative Percent
Valid	Biomedical	6	50.0	50.0
	Consulting	1	8.3	58.3
	Engineering	5	41.7	100.0
	Total	12	100.0	

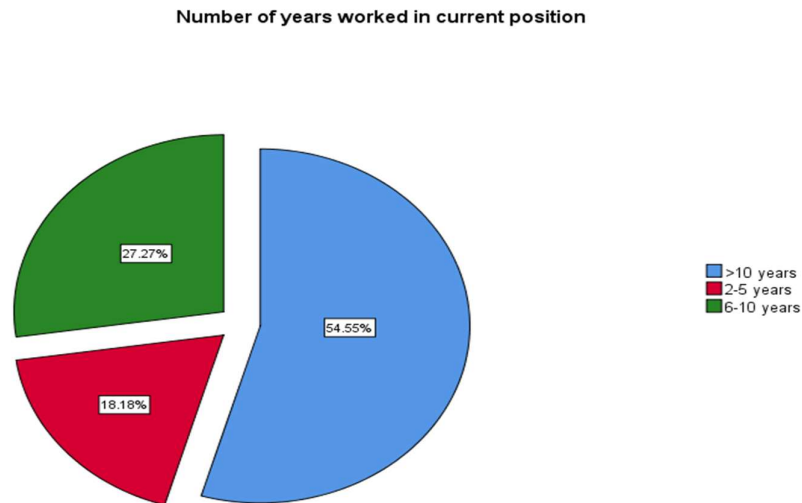
Source: Field Survey, 2020

Table 16 demonstrates the departments the respondents are currently working in, where the highest number of respondents working in the Biomedical department (50%), while the second-highest number of respondents working in the engineering (Electrical and mechanical engineers) department (41.7%) and one respondent working in a consulting company (8.3%). This shows that the respondents are the personnel that is directly involved in the project implementation and after service of the Biomedical engineering project. This skill set and the department they are working in as shown in the previous tables allowed them to understand the bases of the research and the need for monitoring and evaluation of projects.

In the tables above, it can be observed that the educational background, for some the involvement in the monitoring and evaluation practices and the departments they are currently operating in allowed them to understand the implication of the monitoring and evaluation of

projects. It can be observed that the respondents would understand the questionnaires more clearly.

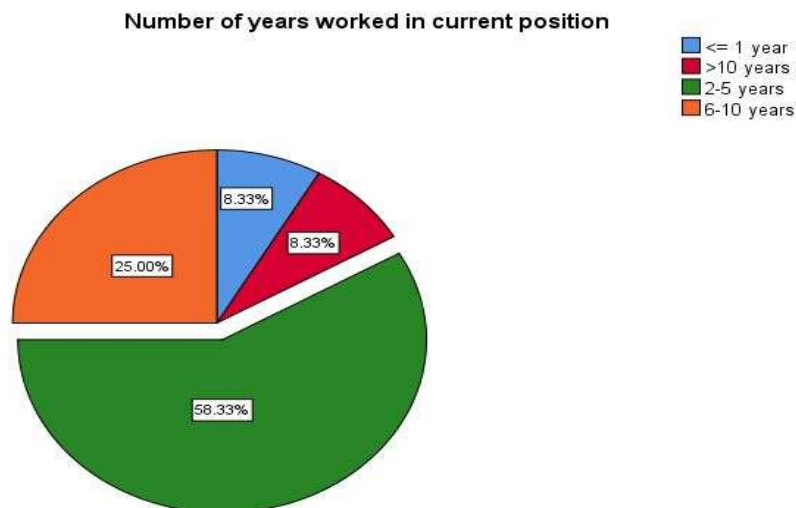
Figure 7: Respondents Professional Experience at Tikur Anbessa Specialized Hospital



Source: Field Survey, 2020

From the pie chart, it can be seen that 54.55% of the respondents have an experience of more than 10 years, the next highest experience range is between the 6-10 years with a percentage of 27.27% and finally, the lowest percentage of the respondent with 18.18% are in the 2-5 years of experience range. The experience of the majority of the respondents as well as their work in the institution thoroughly comprehend the questionnaire and the need for monitoring and evaluation in any form of a project.

Figure 8: Respondents professional experience in the private sector



The professional experience of the respondents in the private sector is more spread out than the public sector as shown in the figure above. The highest being from 2-5 years (58.33%) experience, the next being 6-10 years (25.00%), and the two least number of people with experience are less or equal to 1 year (8.33%) and the biggest experience with more than 10 years (8.33%). For most of the respondents, they have been involved with more projects and have a lot of years of experience which allowed them to respond to the questionnaires that were provided to them.

#### **4.4. Monitoring and Evaluation practice in the Tikur Anbessa Specialized Hospital and the private sector**

After acquiring the general information of the participants, the information regarding the monitoring and evaluation of the biomedical engineering projects starting from the stakeholders up to the effectiveness of the monitoring and evaluation applied on the projects was investigated using the questionnaires. A Likert scale is used to ask the respondents to rate the area of concern. The scales are as follows: 1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 Strongly Agree. In identifying the concerned area, the mean score, standard deviation, and percentage were used to identify and assess the project monitoring and evaluation of the intuition. The mean score allows the researcher to show where the participants agree as the mean has a higher value and disagrees as the mean score has a lower value.

##### **4.4.1. Stakeholder Participation**

As is with the questionnaire, stakeholder participation analysis is the first item that is found in the list of questionnaires. This section allows the researcher to see how deeply the stakeholders are participating in the project monitoring and evaluation from planning to overall participation. Hence, the results are shown below.

Table 17: Stakeholder participation at Tikur Anbessa Specialized Hospital and the private sector

<b>Stakeholder Participation</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
Stakeholders are adequately involved in designing and planning of monitoring and evaluation activities	22	1.77	.869	12	3.42	.900
Stakeholders are involved in monitoring and evaluation decision-making process	22	1.77	.869	12	3.50	.674
Stakeholders are involved in monitoring and evaluation data collection process	22	1.86	.774	12	2.83	.835
Overall Stakeholder Participation in monitoring and evaluation influence the effectiveness of monitoring and evaluation of projects	22	2.14	1.283	12	4.17	.835
<b>Overall Average Value</b>		<b>1.885</b>	<b>0.95</b>		<b>3.48</b>	<b>0.811</b>

Source: Field Survey, 2020

The two tables above show the mean and standard deviation of the Stakeholder participation in the monitoring and evaluation of the Biomedical engineering projects in both Tikur Anbessa Specialized Hospital and the private sector professionals. For Tikur Anbessa Specialized Hospital the overall mean is 1.885 and the overall standard deviation of 0.95. This shows that the stakeholders of the projects are not involved in the projects that have been worked in previous years. The participants that have been interviewed have informed the researcher that the projects have more or less not stakeholder participation after the award of the project to the contractor.

In the case of the private sector, the overall mean is 3.48 and an overall standard deviation of 0.811. This shows that most of the participants agree that the stakeholder has more involvement than in the Tikur Anbessa Specialized Hospital. In the interview, the participants have expressed that the stakeholders are involved from the start of the project until the end. They

might not be highly involved like the End-users and the biomedical engineers in the monitoring and evaluation but they oversee all the activities and the reports.

#### 4.4.2. Organization’s Leadership

In the following table, the researcher has shown the Organizational Leadership that has been implemented by the public and private sector to tackle biomedical projects.

Table 18: Organization’s Leadership at Tikur Anbessa Specialized Hospital and the private sector

<b>Organization’s Leadership</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
The organization uses monitoring and evaluation findings in decision making	22	2.09	1.109	12	4.00	.853
Leaders always and clearly communicate monitoring and evaluation results	22	1.95	.999	12	3.75	.452
Management ensures sufficient resources are allocated to monitor and evaluation	22	2.09	1.377	12	3.67	.492
Overall commitment of organization leadership management influences the effectiveness of monitoring and evaluation system of the project	22	3.73	.703	12	4.67	.492
There exist experts with profound skills for project development	22	1.95	.844	12	3.92	.669
<b>Overall Average Value</b>		<b>2.66</b>	<b>0.977</b>		<b>4.002</b>	<b>0.5916</b>

Source: Field Survey, 2020

As can be seen from the table above Tikur Anbessa Specialized Hospital has an overall mean scale of 2.66 and an overall standard deviation of 0.977. This demonstrates the lack of leadership and other management skills required to monitor and evaluate the project.

In the case of the private sector, the overall mean score is 4.002, and the overall standard deviation of 0.5916. This clearly shows one of the reasons that the private sector is more successful in the biomedical projects in the short term as well as the long term is good leadership and management skill as stated by the participants and as can see from the difference between the private and public sector.

#### 4.4.3. Communication

Communication is one of the essential elements for the successful implementation of a project. As such this is one of its needs for proper monitoring and evaluation of any projects that have been implemented. It shows the significance in monitoring and evaluation the participants have been requested to answer some of the parameters in communication as shown below, with the result of the answers they have given it can be analyzed as shown.

Table 19: Communication at Tikur Anbessa Specialized Hospital and the private sector

<b>Communication</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
The project stakeholders are well informed about the status of the project and the necessary information	22	2.36	1.399	12	3.67	.492
There are good communication mutual respect and effective conflict resolution within project team members	22	2.55	1.438	12	4.17	.835
There is adequate and effective communication between users and the project team	22	1.95	.999	12	3.58	.793
The project manager has sufficient communication with top management	22	2.68	1.171	12	4.25	.452
<b>Overall Average Value</b>		<b>2.385</b>	<b>1.251</b>		<b>3.92</b>	<b>0.643</b>

Source: Field Survey, 2020

In Table 19 it can be seen the communication practice of the organizations, both Tikur Anbessa Specialized Hospital and the private sector. In the case of Tikur Anbessa Specialized Hospital, the overall mean is 2.385, and the overall standard deviation of 1.251. This shows most participants disagree that there is proper communication between all the concerned parties in the project.

The private sector professionals that participated had an overall mean of 3.92 and a standard deviation of 0.643. The communication practice of these institutions has had a better impact on the projects. This has allowed them to follow up and stay on the vision they had while implementing and finalizing the projects.

#### 4.4.4. End-User Requirement/satisfaction

In any project, there are the individuals that have been taking over once the system that has been developed is practically implemented and finished. In all most all projects especially in the service industry, the End-user is involved in the project phases to have their perspective reflected. As such this particular service industry has the highest risk if not properly implemented and is the reason why always the End-users are involved. The following tables show how involved these participants are in the projects.

Table 20: End-user requirement/ satisfaction at Tikur Anbessa Specialized Hospital and private sector

<b>End-User Requirement/satisfaction</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
End Users can state their requirements clearly	22	3.00	1.345	12	4.00	.853
End User requirements and expectations are realistic	22	2.86	.990	12	3.00	.739
End-Users can involve project activities as necessary	22	2.32	1.287	12	3.33	1.073
End Users have the ability to use the deliveries of project	22	2.64	1.364	12	4.17	.835
<b>Overall Average Value</b>		<b>2.705</b>	<b>1.2465</b>		<b>3.625</b>	<b>0.875</b>

Source: Field Survey, 2020

The End-User Requirement and satisfaction as can be seen for Tikur Anbessa Specialized Hospital, the overall mean of 2.705, and overall standard deviation of 1.2465. This illustrates that the institution has a lower consideration of the End-Users and the outputs aren't as satisfactory as required. The Participants have informed the researcher that due to training not being given to the End-User and as well as to the Biomedical engineers on how to use and maintain the system, it more difficult to use the instruments being installed. The Biomedical engineers and the Radiology technologists that maintain and use the system are not even involved in the projects. This is a very big drawback from the perspective of the participants as well as from the project management field.

In the case of the private sector professionals, with an overall mean of 3.625 and overall standard deviation of 0.875. In the private sector, the End-User is as important as the project. The participants consider them vital as they are the ones that have been using them even at the end of the project, and if the End-User is not satisfied they have the power to disqualify and remove the subcontractor from the installation or re-do the project as specified by the End-User, even if sometimes there are areas that the End-User request that is difficult that the sub-contractor has to convince them of a middle point they can meet.

#### 4.4.5. Team

A team allows a group of individuals to come together to achieve a project efficiently and effectively if properly organized. As such the importance of a team in the project monitoring and evaluation must be shinned a light on as its importance is vital.

Table 21: Team description and analysis at Tikur Anbessa Specialized Hospital and private sector

<b>Team</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
The project team is staffed with skilled team players who possess the expertise the project requires	22	2.45	1.184	12	4.42	.515
The team members are motivated and committed to a shared goal	22	2.95	1.290	12	4.50	.522

The technical members have experience relevant to the project	22	2.55	1.011	12	3.67	1.073
The team members are provided with the required training	22	2.59	.908	12	4.33	.651
Each participant in the project has a clear role, responsibility, authority and report relationship with others	22	2.45	1.057	12	4.25	.452
<b>Overall Average Value</b>		<b>2.598</b>	<b>1.09</b>		<b>4.234</b>	<b>0.6426</b>

Source: Field Survey, 2020

As with the other parameters of the research, Tikur Anbessa Specialized hospital has still a lower mean for team organization and work. With an overall mean of 2.598 and an overall standard deviation of 1.09. Teams and teamwork help to encourage development and learning through interaction, problem-solving, cooperation, and collaboration (Johnson and Johnson, 1995). Teamwork and organization shall be developed in a much more efficient and effective method possible.

#### 4.4.6. Procurement plan

Project procurement doesn't deal with taking records of the resources already existing within the institution. Rather, project procurement involves discovering and obtaining the essential resources, whether they are goods or services, which exist external of the institution that is required to fruitfully complete a project.

Table 22: Procurement plan of Tikur Anbessa Specialized Hospital and private sector

<b>Procurement plan</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
The institutions prepared detailed procurement plan of goods and service needed for a project	22	2.73	1.241	12	4.33	.651

Major and or special supply items (such as those required in large quantity or those requiring special manufacturing or long lead time etc.) identified and special attention is given for them	22	2.32	1.492	12	3.67	1.155
There is awareness about the importance of project procurement plan in the enterprise	22	2.32	1.041	12	4.08	.900
The procurement plan of the project revised with the revision of a project time plan	22	2.59	1.008	12	3.67	.492
There exists clearly defined vendor management process in place	22	2.32	1.041	12	3.42	.515
Project vendors can provide sufficient support for the project	22	2.50	1.185	12	3.67	1.557
The institution has standard procurement report format	22	2.50	1.058	12	3.67	.778
Is there vendor service agreement signed that will be implemented by after the completion of the project	22	2.14	1.037	12	3.83	1.267
<b>Overall Average Value</b>		<b>2.42</b>	<b>1.138</b>		<b>3.79</b>	<b>0.914</b>

Source: Field Survey, 2020

In the procurement plan of the Tikur Anbessa Specialized Hospital, it can be seen that it has a lower overall mean of 2.42 and an overall standard deviation of 1.138. it is stated in the (PMBOK, 2018) that contractors may provide a very good or great quality product to suit your needs but they don't have the same motivation as the client. So, to have efficiently and

effectively completed the project that is being undertaken there needs to be a procurement plan that the client and the contractor should adhere to.

In the case of the private sector, the overall mean is higher with a 3.79 and an overall standard deviation of 0.914. This shows that more than TASH the private sector provides more often a procurement plan that is followed to achieve the goal they have set.

#### 4.4.7. Equipment/Materials plan

In any project before proceeding the project resource must be identified and defined. This must be worked on in the initial stages of the project plan. The materials required in this particular project are very expensive and must be present to proceed any further. With this in mind, the main parameters that were considered to be important for this research have been identified, as shown below.

Table 23: Equipment/Materials plan at Tikur Anbessa Specialized Hospital and the private sector

<b>Equipment/Materials plan</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
The institution's project plan includes detail what, how much, and when equipment is needed.	22	2.73	.985	12	3.50	.905
The institution projects have an equipment maintenance plan.	22	2.05	.899	12	3.83	1.267
Material requiring long lead time and critical items given special consideration in planning.	22	2.05	1.046	12	2.92	.996
<b>Overall Average Value</b>		<b>2.27</b>	<b>0.977</b>		<b>3.41</b>	<b>1.056</b>

Source: Field Survey, 2020

Tikur Anbessa Specialized Hospital has a lower overall mean of 2.27 and an overall standard deviation of 0.977. This shows that the equipment/materials plan of the institution is one of the reasons that has caused delays according to the participants and as seen in the table.

The private sector is more organized compared to TASH and has an overall mean of 3.41 and an overall standard deviation of 1.056. This has helped to proceed as planned initially in the planning stage. Sometimes some issues will cause equipment delay but they have put in some contingency in contracting other companies as a standby to bring the equipment if initial companies can provide in the planned time.

#### 4.4.8. Competence of staff handling monitoring and evaluation

One of the ways the effectiveness of monitoring and evaluation is achieved is when the knowledge base is accumulated in the experience of the staff. Monitoring and evaluation can deliver vital information for decision making, in which its structure, systems, and process are anticipated to be cohesive throughout the lifetime of the project. As such acquisition of these skills should be developed and structured using a different form of training and practical experience that will allow the individuals participating in the projects to be competent. As such the following items are analyzed below.

*Table 24: Competence of staff handling monitoring and evaluation at Tikur Anbessa Specialized Hospital and the private sector*

<b>Competence of staff handling monitoring and evaluation</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
The staff has a Technical skill needed to conduct monitoring and evaluation	22	2.05	1.046	12	3.42	.900
The institutions project planning monitoring and evaluations team have formal meetings for monitoring and evaluation of projects	22	2.27	.767	12	3.50	.905
People involved in monitoring and evaluation has knowledge or experience or receive training about monitoring and evaluation of projects	22	2.05	.785	12	3.17	.835

The institution project employee's performance evaluation tracked regularly and feedbacks are provided	22	2.05	.950	12	3.67	.778
<b>Overall Average Value</b>		<b>2.10</b>	<b>0.887</b>		<b>3.44</b>	<b>0.854</b>

Source: Field Survey, 2020

From the table above, it can be seen that the competence of the staff in handling the monitoring and evaluation of the projects in TASH is very low. This is seen by the low overall mean of 2.10 and a standard deviation of 0.887. The participants revealed to the researcher that most of them don't get any form of training either for the monitoring and evaluation or for the technical skills needed to maintain the system. This is mostly due to the contractor not wanting to reveal trade secrets for the most part but for some easily fixable items that don't need the detailed knowledge of how the system operates is not also shared by the contractor. In the eyes of the researcher, this is a pitfall that will result in a lot of delay and stoppages of the system until a new deal is signed or until the contractor send one of their technicians for a huge sum of money. In the case of the private sector, the staff has the skill needed for both monitoring and evaluation as well as for the technical skill required. As can be seen from the table, with an overall mean of 3.44 and a standard deviation of 0.854, the participants for most of them have had the training and practical experience given by the contractor as well as external consulting companies that develop the skill of the staff. One of the pre-condition the private sector put in in the contractor's agreement is that of training the staff of the client is of the highest importance and if any contractor is not willing to participate in full filling this criterion (both project management and technical (without going into detail analysis but the bare minimum needed to maintain the system without the contractor sending its technicians) training) they will be removed from the list of contractors in some cases.

#### **4.4.9. Effectiveness of monitoring and evaluation**

The effectiveness of monitoring and evaluation can be seen in the projects that have been implemented. As has been pointed out by Prabhakar (2008) monitoring and feedback are some of the features influencing project success. As well as Papke-shield et' al (2010) noted that the likelihood of attaining project success seemed to be heightened among other reasons, by continuously monitoring the progress of the project. There is a different tool for monitoring projects, it is also the greatest weakness if not appropriate tools and properly implemented in

the project lifetime. In the following table, the effectiveness of monitoring and evaluation in the institutions as perceived by the participants will be shinned a light on.

Table 25: Effectiveness of monitoring and evaluation at Tikur Anbessa Specialized Hospital and the private sector

<b>Effectiveness of monitoring and evaluation</b>						
	<b>Tikur Anbessa Specialized Hospital</b>			<b>Private Sector</b>		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
The progress report produced by the institution project provides sufficient information to monitor and evaluate the project activity	22	2.23	.869	12	4.25	.452
Results and findings from monitoring and evaluation are relevant and useful	22	3.09	.921	12	4.25	.452
The monitoring and evaluation activities are carried out within schedule	22	2.00	.926	12	3.58	.793
The monitoring and evaluation objectives are largely achieved	22	2.45	.858	12	3.67	.492
Overall monitoring and evaluation of the institution projects is effective	22	1.95	.950	12	3.92	.793
Project is evaluated by projects own report	22	2.95	.950	12	3.67	1.155
Project is evaluated on meetings	22	2.86	.710	12	4.25	.452
Project is evaluated on observation report	22	2.86	.941	12	3.42	.515
The institution has a standard report format	22	2.36	1.177	12	3.00	1.044
The report submission dates are fixed	22	2.55	1.224	12	3.33	.985
The report format includes all the necessary information for management decision	22	2.59	.959	12	3.25	.866

Reports are evaluated and issues are resolved	22	2.14	.990	12	3.67	1.303
Project procurement progress reports are prepared and evaluated regularly	22	2.05	.844	12	3.67	1.155
Quality audits are done in the project are view to determine where project activities comply with policy processes and quality requirements.	22	2.45	.912	12	3.67	1.155
The institution inspects and evaluates the quality of subcontractor work to ensure compliance with quality requirements	22	2.32	.894	12	3.83	1.267
The institution has standards for monitoring the performance of the project equipment their productivity, maintenance cost, time worked, etc.	22	2.45	.963	12	4.33	.651
<b>Overall Average Value</b>		<b>2.46</b>	<b>0.943</b>		<b>3.735</b>	<b>0.845</b>
There is a delay in the institution project due to poor planning	22	3.86	.710	12	2.08	.793
There is a delay on the institution project due to material supply	22	4.05	.722	12	3.58	.669
There is a delay in the institution project due to late equipment delivery	22	4.09	.684	12	4.08	.793
There is a delay on the institution project due to late manpower assignment	22	3.73	.631	12	2.08	1.240
There is a delay in the institution project due to manpower skills and effectiveness	22	3.64	1.002	12	1.75	1.215
There is a delay in the institution project due to decision making	22	3.55	1.184	12	2.50	1.446
<b>Overall Average Value</b>		<b>3.82</b>	<b>0.822</b>		<b>2.68</b>	<b>1.026</b>

Source: Field Survey, 2020

As demonstrated in the table, the participant's response to the effectiveness of the monitoring and evaluation in the case of Tikur Anbessa Specialized Hospital compared is with an overall mean of 2.46 and standard deviation of 0.943 and for the case of delay as listed in the table the overall mean is 3.82 with a standard deviation of 0.822. Even if there is a more positive response from the participants regarding some of the tools used for monitoring and evaluation there is a very big problem with the planning of the project, adhering to the schedule set, reports being used to make a decision, manpower skill and as clearly can be seen everything possible to delay the project does delay it. When asked if the overall effectiveness of the monitoring and evaluation of the institution, as can be seen from the table and the verbal confirmation received from the interview it more or less none.

Time and again the private sector has proved to show that it has more accomplishment in this regard as the overall mean is 3.735 with a standard deviation of 0.845 and for the delay that can be caused by the mentioned items, the overall mean of 2.68 with a standard deviation of 1.02. even if some items delay the project for the most part the project has contingencies to contain it from happening. As for the effectiveness of the monitoring and evaluation, the participants have high regard for what it has helped them accomplish throughout the project life cycle as well as learning from the project to develop and prepare for the next projects they have done.

## Chapter Five

### 5. Summary, Conclusion, and Recommendation

#### 5.1. Introduction

The following chapter provides a summary of the findings that have been deemed important for the research and future researches, as well as giving a conclusion of all parameters of the research that have been observed. Finally, recommendations and points on to which future studies shall include and also put into consideration while doing their research.

#### 5.2. Summary

The research is focused on the assessment of the monitoring and evaluation of biomedical engineering projects in the case of Tikur Anbessa Specialized Hospital. To get a clearer view during the assessment the researcher involved practitioners of this field from different clinics, hospitals, and diagnostic centers to give a view of the gap between the private sector and Tikur Anbessa Specialized Hospital. As such the major findings of the research are shown below.

Biomedical engineers have no role in the project. The role of Biomedical Engineers is to maintain the machines as much as possible as they can and replace some items that are easily replicable like the hilum gas.

The responsibility of maintaining the machines lays on the Biomedical Engineers and Radiology Technologists that haven't been trained by the contractor on how to properly maintain the machines. The machines that have been discarded could have been maintained if the person responsible knew how to maintain them. The bureaucracy of servicing the machines and maintaining the machines is very difficult that end-user gives up on the machines. It is much easier to buy the items than service and maintain them in relation to the time it takes, due to no service agreements or plan for the after installation of the machines not existing.

The stakeholder involvement in the biomedical projects is very few areas and don't participate as needed or required to solve a problem or in decision making in Tikur Anbessa Specialized Hospital. The stakeholders are not cohesive and different disagreements are present due to not proper project plans existing in some cases.

Organizational leadership is present but has less involvement with the activities. The biomedical engineers that are the main parts of the projects are not included and don't have the full support of the leadership in the involvement of the projects, unlike the private sector.

Communication is an important part of the institution but it is essential for the success of monitoring and evaluation, which there is in the Tikur Anbessa Specialized Hospital but there is more feedback from the lower management to the top management but the communication back is very few and not in time to solve the problems of the present. Emails and written letters are the methods of communications but the core idea is lost as it gets sent from one stakeholder to another.

End-user requirements are presented by the Radiology department mainly, Intensive care unit and other departments but the monitoring and evaluation of the end-user criteria and requirements after submitting the proposal is very much lower in the lifetime of the project. The end-users depending on the department are involved as the management level goes higher.

When a team works together cohesively it can be seen what they can accomplish from the football field to the skyscrapers and beyond. In Tikur Anbessa Specialized Hospital teams are not organized according to any guideline or system. The main parts of the team for a biomedical project are the biomedical engineers that have the skills and the experience to work on them once the contractor has finished installing them. But in this case, the client's side biomedical engineers are not included as well as the radiology technologists. Even after the contractor accomplishes the installation, the biomedical engineers are not trained on the basics of how to maintain and give a temporary solution until the contractor sends the technicians.

Tikur Anbessa Specialized Hospital has no foreseeable procurement plan since it has different stakeholders that provide it the items required for its operation in the medical field. This has caused it to suffer significantly by having materials being installed in a longer time than expected, criteria requested not being met, the scope of work, communication, configuration, and many more being different from the specified requirement of the institution. This is due to the Third-party taking over the procurement of the items. This also includes problems in the equipment/materials plan of the institution.

The staff that is specifically needed for biomedical engineering projects are present at Tikur Anbessa Specialized Hospital, but these individuals are not properly utilized by the institution and as well as not being properly trained to handle the project monitoring and evaluation in some cases.

Overall, the effectiveness of monitoring and evaluation in Tikur Anbessa Specialized Hospital has been deemed by the majority of the participants poor to say the least. The monitoring and evaluation tools exist in the institution at both higher and lower levels but the application is very insufficient.

Tikur Anbessa Specialized Hospital has more or less none existing project management system. The monitoring of projects is mostly done through daily logs by the contractor side in some cases, the schedule is provided from the contractor, not the client, spontaneous decisions are made by stakeholders, the main person that needs to be involved from the start of the project until he ends are not even consulted and the list of challenges that the departments face goes on. This all culminates into the disastrous medical equipment problem that the institution has currently.

The private sector as demonstrated by the descriptive statistics tables provided in chapter four demonstrates the use of the monitoring and evaluation system effectively. They have a lesson learned document to provide the next project manager or the team to learn from the mistakes and the accomplishments of previous projects done. There is training that teaches all levels of the organizations that have direct involvement in this project to be skilled and competent while working on the project. They have service plans that are scheduled in the procurement plan of the project to do after work service subsequently completing installing of the machines, furthermore have an agreement to train the individuals that will be working with machines and help them from a remote place in maintaining the machines if it is not a high fault that doesn't require the need of a specialist. They have contingency after contingency for every project they take on. The personnel that will be working with the machines are involved from the initiation to the closure of the projects. Most of the consultants apply PMI (PMBOK) standards and practices for the projects they take one.

### **5.3. Conclusion**

This research has been developed to demonstrate the gap in the monitoring and evaluation of biomedical projects in Tikur Anbessa Specialized Hospital. The institution is the biggest health center that takes on the higher number of patients in Ethiopia. All cases that are very difficult to be reviewed by the private or public sector hospital, are all sent to Tikur Anbessa Specialized Hospital. As such the Biomedical Equipment's found at the institution are the eyes and hands of the institution. If they can't see they can't diagnose the patient, if they can't open up or touch the patients, they can't provide the needed cure for the ailment of the patient they are seeing.

There is a huge gap in project management in general. The researcher focused on monitoring and evaluation specifically but there is a gap as a whole in the project management. This is mainly due to the institution having external stakeholders from different areas other than the institutions itself which have caused the gap to be present. Since the external stakeholder's takeover the project rather than the institution, the project path, requirement, and plan are changed.

The other main issues are the training of the individuals both in project management and technical skill. Training is one of the pillars for growth and this must not be taken lightly by the institutions. As the private sector analysis shows training is conducted both before the project and on the project. This has helped them develop the staff skill set, in which it has to help them endure the project they have faced.

Generally, the study has demonstrated the level of project monitoring and evaluation in the institution, and from the literature reviewed and the interviews conducted there exists a gap, in Stakeholder involvement, organizational leadership, communication, end-user requirements, team building and teamwork, procurement plan and competence of the staff. In order to move forward, the gap that exists must be reduced by practices in Stakeholder Management (especially external stakeholder management), Communication Management, Resource Management, Procurement Management, Schedule Management, and Scope Management. Furthermore, documentation of all projects conducted and lessons learned documents that are distributed to all departments to learn from the accomplishment and failures of the previous projects.

#### **5.4. Recommendation**

To move forward we need to learn from the past. In essence from the literature reviewed and from the experience of professionals in this field, this is some conceivable commendations provided by the researcher:

All the stakeholders both external and internal, shall put forward the ability in working toward the same project plan and objective. Meet for a project update and an issue that arises, in the decision-making process and involve as much as possible.

Proposal of staff training, conducted for both technical and project management enables the development of the staff competency. The staff training by the contractors as well as the institutions is recommended as often as possible.

The institutions shall advocate, for Biomedical Engineers and Radiology Technologist to be involved in the biomedical engineering project from initiation to closure.

Daily, Weekly, and month project report is recommended to be prepared. This document can be evaluated during the stakeholder meeting or the project team meeting.

The monitoring and evaluation system is proposed to be organized, in which an evaluation plan, guide, and framework is laid out by the institution, to identify problems before they occur or to mitigate and continue on the path laid out on the project plan.

Awareness creation program is one of the areas proposed to be developed more by the institution, to teach and develop the staff and show the previous errors and how to move forward.

The main issue especially from the machine's sides is that they have no service agreement with the contracting company that has installed them. It is recommended for the institutions to sign service agreement between the contractor and the institution for an amount of time that the institutions deem it required. These are machines that save lives, so no downtime must be allowed except for monthly or annual services of the machines.

### **5.5. Suggestion for future studies**

The research has provided information on the problems that exist, but in the analysis, it gives birth to other questions that should be looked into furthermore. Even though the research tried to show the monitoring and evaluation of a biomedical project in Tikur Anbessa Specialized Hospital, it clearly can be observed that there are more gaps than the monitoring and evaluation. The core Project knowledge areas that are necessary for effective project management can be explored more in the institution. Furthermore, research should be made into solving the gaps that are seen in all the knowledge areas.

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# Annex

Addis Ababa University  
College of Business and Economics  
School of Commerce  
Graduate Program in Project Management

Dear Respondents,

My name is Nebiyou Mikre. I am a student undertaking a Masters in Project Management at Addis Ababa University School of Commerce. I am conducting research on “Assessment of Monitoring and Evaluation of Biomedical Engineering Projects: in the case of Tikur Anbessa Specialized Hospital”. The main purpose of this research questionnaire is to collect information about the challenges in Biomedical engineering projects for the partial fulfillment of the requirement for Masters of Project Management at Addis Ababa University. The Outcome of this study will be used for academic purposes only and all the information that is provided will be kept in strict confidentiality.

Your volunteer participation is appreciated and the information you provided will have an added value for the research and certainly will be kept confidential. Therefore, your genuine response to the questions is vital for the quality and successful completion of the study. The accuracy of the information you provide highly determines the reliability of the study. The questionnaire has been limited to just 49 questions and will take approximately 10-20 minutes of your valuable time. Returning the completed survey on time will again be appreciated.

Sincerely,

Nebiyou Mikre

Contact Address:

Email: [mnabeu@gmail.com](mailto:mnabeu@gmail.com)

Phone No: +251912038168

Thank you in advance for your unreserved cooperation.

Section 1: General Information

1. Sex:

Female                      Male

2. Age:

≤ 30 Years                      41 – 50 Years

31 – 40 Years                      >50 Years

3. Level of Education:

Diploma                      Masters [candidate]                      Masters

BSc. Degree                      above Master

4. Current position at the firm:

Project manager                      Project coordinator

Office engineer                      Other (.....)

5. The number of years worked in current position:

≤ 1 year                      2-5 years

6-10 years                       >10 years

6. Have you ever been involved in the monitoring and evaluation practice of the firm?

Yes                      No

7. Current Department working in?

ICU                      Biomedical                      Administration Position

Radiology                      Management position                      other

(.....)

## Section 2: Interview questions

1. Could you please tell me your experience in working with projects, specifically biomedical engineering projects?
2. Do you take any training;
  - a) On technical aspects?
  - b) Prior to the implementation of the project on the project management field?
3. How do the project manager or project coordinator selected and assigned in projects? Do you fell challenges attached to this process?
4. What are the challenges that you face as a project manager or project coordinator in implementing the projects?
5. Do you think the biomedical projects which have been performed by the institution, successful or failed? If so, what do you think contributed to this factor?
6. What do you think the institution should do to the successful accomplishment of the projects?
7. Is adequate attention given to the design and use of monitoring and evaluation systems?
8. Are project monitoring and evaluation performed in your organization? Who is responsible for project monitoring and evaluation? Are the monitoring and evaluation effective? Why or why not?
9. What design is set by the project for monitoring and evaluation of projects? Implementation focused or result based? Elaborate it
10. What are the tools/instruments/used to record the information? Group discussion, direct observation, structured questions...? Elaborate it.
11. Who are the participants in the monitoring and evaluation process?
12. How the organization gathers information for monitoring? Progress report, review meeting, site visit?
13. Who performs internal evaluation? External evaluation?
14. What are the major challenges faced during the monitoring and evaluation process?
15. How decisions are made when problems encountered during the monitoring and evaluation process?
16. In general, what do you comment personally on the monitoring and evaluation process of the projects other than the points mentioned/discussed above?

### Section 3: Questionnaire

Each statement in this part is considered a potential critical success factor for an information system project. Please indicate respective importance to the success of the project from your personal experience and perception by putting a check “√” next to the appropriate scale provided beside each statement.

Scale (Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5)

No.	Assessment of Monitoring and Evaluation of Biomedical Projects.	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
<b>I. Stakeholder Participation</b>						
1	Stakeholders are adequately involved in designing and planning of Monitoring and Evaluation activities					
2	Stakeholders are involved in monitoring and evaluation decision-making process					
3	Stakeholders are involved in monitoring and evaluation data collection process					
4	Overall Stakeholder Participation in monitoring and evaluation influence the effectiveness of monitoring and evaluation of projects					
<b>II. Organization’s Leadership</b>						
5	The organization uses monitoring and evaluation findings in decision making					
6	Leaders always and clearly communicate monitoring and evaluation results					

7	Management ensures sufficient resources are allocated to monitoring and evaluation					
8	The overall commitment of organization leadership/management influences the effectiveness of monitoring and evaluation systems for projects?					
9	There exist experts with profound skills for project development and management					
<b>III. Communication</b>						
10	The project stakeholders are well informed about the status of the project and the necessary information					
11	There are good communication, mutual respect, and effective conflict resolution within project team members on site					
12	There is adequate and effective communication between users and the project team					
13	The project manager has sufficient communication with top management					
<b>IV. End-User Requirement/Satisfaction</b>						
14	End-Users can state their requirements clearly					
15	End-User requirements and expectations are realistic					

16	End-Users can involve project activities as necessary					
17	End-Users have the ability to use the deliveries of project					
<b>V. Team</b>						
18	The project team is staffed with skilled team players who possess the expertise the project requires					
19	The team members are motivated and committed to a shared goal					
20	The technical members have experience relevant to the project					
21	The team members are provided with the required training					
22	Each participant in the project has a clear role, responsibility, authority and report relationship with others					
<b>VI. Procurement plan</b>						
23	The institutions prepared a detailed procurement plan of goods and services needed for a project.					
24	Major and/or special supply items (such as those required in large quantity or those requiring special manufacturing or long lead time etc) identified					

	and special attention is given for them					
25	There is awareness about the importance of the project procurement plan in the enterprise.					
26	The procurement plan of the project revised with the revision of a project time plan.					
27	There exists clearly defined vendor management process in place					
28	Project vendors can provide sufficient support for the project					
29	the institution has a standard procurement report format					
30	Is there vendor service agreement signed, that will be implemented by after the completion of the project					
<b>VII. Equipment/Materials plan</b>						
31	The institution's project plan includes detail what, how much, and when equipment are needed.					
32	The institution projects have an equipment maintenance plan.					
33	Material requiring long-lead time and critical items are given special consideration in planning.					
<b>VIII. Competence of staff handling monitoring and evaluation</b>						

34	The staff has a Technical skill needed to conduct monitoring and evaluation					
35	The institution's project planning, monitoring, and evaluation team have formal meetings for monitoring and evaluating the project progress.					
36	People involved in monitoring and evaluation has knowledge or experience or receive training about monitoring and evaluation of projects					
37	The institution project employees performance evaluation tracked regularly ad feedbacks are provided.					
<b>IX. Effectiveness of monitoring and evaluation</b>						
38	The progress report produced by the institution project provides sufficient information to monitor and evaluate the project activity.					
39	Results and findings from monitoring and evaluation are relevant and useful					
40	The monitoring and evaluation activities are carried out within schedule					
41	The monitoring and evaluation objectives are largely achieved					

42	Overall monitoring and evaluation of the institution projects is effective					
43	Project is evaluated					
	a. Projects own report					
	b. On meetings					
	c. On observation report					
44	Progress Reports					
	a. The institution has a standard report format					
	b. The report submission dates are fixed					
	c. The report format includes all the necessary information for management decisions.					
	d. Reports are evaluated and issues are resolved.					
45	Project procurement progress reports are prepared and evaluated regularly					
46	Quality audits are done in the project are view to determine where project activities comply with policies, processes, and quality requirements.					
47	The institution inspects and evaluates the quality of subcontractor work to ensure compliance with quality requirements					

48	The institution has standards for monitoring the performance of the project equipment their productivity, maintenance cost, time worked, etc.					
49	There is a delay on the institution project					
	a. Due to poor planning					
	b. Due to material supply problem					
	c. Due to late equipment delivery					
	d. Late manpower assignment					
	e. Manpower skills and effectiveness					
	f. Decision making					