ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF COMMERCE

PRACTICE AND CHALLENGES OF PROJECT PLANNING AND SCHEDULING: THE CASE OF INDUSTRIAL ENERGY MANAGEMENT PROJECTS IN ETHIOPIA

By: Addisu Amare Habte

June 2022

Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS
SCHOOL OF COMMERCE

PRACTICE AND CHALLENGES OF PROJECT PLANNING AND SCHEDULING: THE CASE OF INDUSTRIAL ENERGY MANAGEMENT PROJECTS IN ETHIOPIA

By: Addisu Amare Habte

A Project work Submitted to Addis Ababa University School of Commerce in Partial Fulfillment of The Requirements for The Award of The Degree of Master of Arts in Project Management

Advisor: Abraraw Chane (PhD)

June 2022
Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF COMMERCE

PRACTICE AND CHALLENGES OF PROJECT PLANNING AND SCHEDULING: THE CASE OF INDUSTRIAL ENERGY MANAGEMENT PROJECTS IN ETHIOPIA

By: Addisu Amare Habte

Approved by Boards of Examiners:

Abraraw Chane (PhD)	_____	_____
Advisor	**Signature**	**Date**
_____	_____	_____
Internal Examiner	**Signature**	**Date**
_____	_____	_____
External Examiner	**Signature**	**Date**

Declaration

I, the undersigned, declare that the research project on the topic titled " Practice and Challenges of project planning and scheduling: the case of industrial energy management projects in Ethiopia" is my original work, and that it has not been submitted for any award at Addis Ababa University or any other institution. When other sources of information were used, they were properly acknowledged.

Declared by:

Name: Addisu Amare

Signature: _____

Date: _____

Certification

This is to certify that Addisu Amare Habte has carried out his research work on the topic entitled "Practice and Challenges of project planning and scheduling: the case of industrial energy management projects in Ethiopia". This work is original in nature, and it is sufficient for submission as the partial fulfillment for the award of MA degree in Project Management.

Advisor: Abraraw Chane (PhD)

Signature: _____

Date: _____

Acknowledgment

First and foremost, I would like to thank the almighty God, who gave me the courage to complete the study through his unending love and blessings. I would also like to express my utmost thanks to my advisor, Abraraw Chane (PhD) for his constructive comments and feedback. I would also like to thank all the experts who assisted me in gathering data and information. My wife, Merry Ayalew, and my sons, Nati and Dagi, deserve special appreciation for their unconditional love, patience, and support throughout this project.

Table of Contents

List of Tables

List of Figures

List of Acronyms

CCIDC	Chemical and Construction Inputs Development Center
EE	Energy Efficiency
EMP	Energy Management Programme
EMS	Energy Management System
EnDev	Energizing Development
EPEA	Petroleum and Energy Authority
GDP	Growth Domestic Production
GIZ	German Technical Cooperation
GMSE	Green Manufacturing Strategy of Ethiopia
IEA	International Energy Agency
MoI	Ministry of Industry
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMPO	Project Planning Quality Assessment Model
UNIDO	United Nation Industrial Development Organization

Abstract

The practice and challenges of project planning and scheduling in Ethiopian industrial energy management projects were studied in this thesis. In Ethiopia's manufacturing industry, there are a variety of energy-related projects at various stages of execution, including energy efficiency and energy management, fuel switching to biomass energy, and Refused Derived Fuel Projects. A descriptive analysis was conducted to determine what is currently being done in terms of project planning and scheduling. The respondents' primary data was acquired using a structured 5-point Liker questionnaire. In addition, interviews with carefully selected experts were conducted. A mixed strategy to primary data collection was used to fully comprehend and describe the research topic. There are 23 planning processes, 16 organizational support processes, and 9 questions on scheduling tools in the closed ended questions. Purposive sampling was used to choose the sample, which was based on experience and involvement in energy efficiency and energy management projects. A total of 59 energy efficiency and energy management project practitioners have been contacted (48 by questionnaire and 11 via interview). A statistical package for social scientists (SPSS) software was used to verify the dispersion of the responses for descriptive statistics. The overall ranking of importance of the researched elements was then examined using a relative importance index (RII) analysis approach. The RI values were translated into five essential levels to make comparisons easier. The study's findings revealed that project planning processes typical of project manager know-how areas (such as budget determination and estimation, time estimation, define activities, project scope, WBS, and so on) were implemented at a medium to high level, whereas processes related to communication, stakeholder engagement, and risk planning were implemented at a relatively low level. Similarly, the availability of organizational support mechanisms was discovered to be extremely low during project planning. The Gannt chart scheduling method was widely used though there is a strong need to diversify scheduling tools. The main challenges were identified as insufficient planning and scheduling knowledge and skills; a lack of enforcing mechanisms, and energy efficiency specific project management trainings and guidelines; a weak project office, and a lack of awareness, benefit, and scope of energy efficiency projects. Organizations should establish a support structure to help with the planning and execution of industrial energy efficiency and energy management projects. Furthermore, there should be a comprehensive national energy management program that includes policy frameworks with support mechanisms and tailored project management guidelines, as well as an advanced training platform.

Key Words: *- Project planning practice, scheduling practice, planning processes, organizational support processes, planning challenges, energy efficiency, energy management projects*

CHAPTER ONE

1. INTRODUCTION

1.1.Background of the study

The (PMI, 2017) defines a Project as a temporary endeavor undertaken to create a unique product, service, or result, and a Project management as the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Project management is accomplished through the appropriate application and integration of the project management processes identified for the project. The PMI framework of project management is comprised of five process groups, 49 processes, and ten knowledge domains, according to the sixth version of the Project Management Body of Knowledge (PMBOK). The processes are to be implemented in each of the process groups depending on the type of project. However, the planning processes have not been used in full or to a substantial amount in many Ethiopian projects. Previous study by (Whittaker, 1999), (Dvir, Raz, and Shenhar 2003), and others has suggested that inadequate project planning is one of the reasons for project failure in developing nations, as stated in (Lemma, 2014). According to Richard (2012) planning is often cited as the most critical of the management functions in determining the overall project performance. And it is also considered the most important and critical phase to the success of an organization in meeting its goal and objectives.

Projects must be executed on schedule, on budget, and to the acceptable standard of quality. However, due to different reasons directly and/or indirectly related to it, many projects take longer to finish, cost more than necessary, and some projects are terminated. From both an economic and a technical standpoint, project failures have a huge impact. When a project takes longer to complete, it necessitates more resources and budgets, which raises labor, material, machinery, and equipment costs (Yimarilign, 2019). This has an impact on the budgets of other projects, as well as the country's economy in general. Similarly, individuals and the economy must wait longer than necessary for public and service facilities due to delays in project implementation. Because the output produced by infrastructure such energy, construction, manufacturing, and IT projects serves as input for many other sectors of the economy, project failure hinders economic growth. According to Emblemsvag et al. (2014) quoted in Deribe (2018), the United States Government Accountability Office

investigated 413 projects that failed to meet their objectives, with poor planning accounting for 79 percent of the causes. According to a study conducted by (effectiveness), the majority of Ethiopian projects failed to apply planning knowledge areas effectively, with only 20.35 percent implementing risk planning, 33.6 percent implementing quality planning, 44.2 percent implementing communication planning, 46.5 percent implementing integration planning, and 48.85 percent implementing scope planning.

Project failure is also a major issue in our country; for example, 79 percent of completed projects fail to reach their goals (Deribe, 2018). Project performance issues (cost overruns, time delays, and quality deficiencies) are caused by factors such as project selection, planning, execution, and control, among others. However, one of the biggest reasons for project failure in poor nations, according to Haugan (2002), is a lack of adequate planning processes. Similarly, in Ethiopian projects, some planning stages are disregarded, and project execution is frequently launched without a project plan or with poor project planning. According to PMI (2017), planning processes are critical, and project execution without proper/poor formulation of a project plan frequently results in delays, excessive costs, and general execution issues.

Resources cannot be managed or structured without a good plan and estimate, risks cannot be reduced, dates and budgets cannot be anticipated, effective reporting cannot be done, and the metrics of success will be flawed from the start. The lack of a well-implemented project plan has generated issues in all aspects of project management, making it impossible for the management team to maintain the necessary level of control over project activities. Various scholars have demonstrated the influence of project planning on project performance in this regard. According to Wang and Gibson's (2008) research, spending time on project planning activities reduces risk and increases project success. Other project planning scholars, such as Thomas et. al. (2008), have found that insufficient analysis and planning will result in a failing project, but that the more planning a project has, the more successful it will be. As a result, even if all the resources are present, poor project planning will lead to project failure, according to this data.

According to Kreith and Goswami (2016), for industrial energy efficiency and energy management programs, realistic overall target and project parameters in energy savings

should be determined based on overall information in the corporate record, expected activities, and future fuel costs and supply. Designing an industrial energy efficiency program takes time and must be undertaken with some care (UNIDO, 2007). Project management knowledge, as well as project-based investment grade audit development for energy efficiency and energy management projects, are both missing in Ethiopia. According to MoTI (2019), industrial energy efficiency projects are expanding with little experience in overall project identification, planning, and execution

Therefore, for a more effective project implementation, practicing managers should implement new management strategies that foster knowledge-based planning and scheduling concepts, and it is necessary for practitioners to professionalize project planning and scheduling by using a more proactive and knowledge-based approach (AlNasseri , 2015). Most industrial energy efficiency and energy management projects in Ethiopia fall short of expectations in terms of quality, timeliness, and cost. This is primarily due to project practitioners' lack of basic project management expertise, as well as their inefficiency in project planning and scheduling.

The researcher believes that meaningful project success in Ethiopia industrial energy efficiency and energy management projects necessitates a thorough examination of project planning and scheduling prior to undertaking or implementing projects. As a result, systematic improvements in project planning are required to improve the performance of project outcomes. In addition, recognizing the main issue areas and taking essential action is required during project planning activities. Industrial energy management projects are a growing sector in Ethiopia with enormous potential to boost GDP. However, in terms of research, little or no work has been done in the country on project planning and scheduling for industrial energy efficiency and management projects. By focusing on the practice and challenges of project planning and scheduling in industrial energy efficiency and energy management projects, this thesis research tried to fill some of the gaps in project planning and scheduling. The assessment of this study was limited to the offices of the Ethiopian Petroleum and Energy Authority (EEA), the Ministry of Industry (MoT), and the Chemical and Construction Inputs Development Center (the former Chemical and Construction Inputs Development Institutes), GIZ Energy programme and at the level of selected individual consultants.

The thesis offered a critical information, actions, and procedures in a systematic approach to improve the problem of project planning in industrial energy efficiency and energy management projects after analyzing and identifying the practice and problem areas of project planning and scheduling.

1.2.Background of the Target Organizations

1.2.1. Ministry of Industry

The Ministry of Trade and Industry (MOTI) oversees promoting and expanding industry development by creating a favourable enabling environment for the development of investment and technological capacity in the industry sector, as well as providing effective support and services to development investors. This is mostly carried out by the MOTI's seven autonomous "development institutions" (established by Ethiopia's Council of Ministers in 2014 and converted into centre with the new arrangement). The Ethiopian Green Manufacturing Strategy and Manufacturing Industry Energy Efficiency Strategy have been developed and being implemented by the Ministry of Trade and Industry, which has resulted in the implementation of various energy efficiency and energy management projects in the industrial sector

1.2.2. Chemical and Construction Inputs development Center

The Chemical and Construction Inputs Industry Development Institute was founded in 2013 under the former Ministry of Trade and Industry. Now under the new proclamation 2022, the manufacturing Industry development institute is established where the former chemical and construction inputs industry development institute become a centre functioning under it. The new institute is the sole government-funded organization that provides technical and supervisory assistance to the manufacturing sector. In terms of energy efficiency and energy management projects, the institute is mandated to undertake doing research and developing alternate energy sources for manufacturing industry sector, assist industries in optimizing their energy consumption and provide assistance in industrial related emission reduction among others.

Most of the energy efficiency and energy management activities going in the cement industry which is the most energy intensive industry. Energy efficiency, energy auditing, and fuel switching projects are now being implemented in Ethiopia by the centre. A three-year program funded by the European Union and fully focusing on environment and energy in the manufacturing sector is being implemented by the centre.

1.2.3. Ethiopian Petroleum and Energy Authority (EPEA)

Responsibilities include cross-sectoral energy efficiency regulation and facilitation. Involved in energy management efforts for the industry. The Directorate of Energy Efficiency and Conservation has a pool of energy auditors that might be expanded into a canter of expertise for energy efficiency and management activities. Several energy efficiency and energy management projects, notably in the manufacturing industry sector, are now being implemented by PEA.

1.2.4. GIZ German Technical Cooperation/Energy Programme

As an international cooperation enterprise for sustainable development with worldwide operations, the federally owned Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH supports the German Government in achieving its development policy objectives. GIZ promotes complex reforms and change processes. In Ethiopia, GIZ has been working for more than 40 years in bilateral cooperation on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) and on the commission of the Ethiopian Government and other international donors.

Energizing Development Ethiopia (EnDev) Ethiopia (being implemented by GIZ) supports a sustainable supply of energy services to lower-income households, social institutions and small to medium sized industries with a focus on rural areas. EnDev is a multi-donor and multi-implementer energy access partnership. It is currently financed by six donor countries – the Netherlands, Germany, Norway, the United Kingdom, Switzerland, and Sweden.

1.3.Statement of the Problem

The energy transition, especially the ecological transition, which seeks to reduce reliance on fossil fuels, is significantly reliant on industrial energy efficiency and management. By 2040, it would reduce CO2 emissions by 44 percent, compared to 36 percent for renewable energy and 6 percent for nuclear power (IEA, 2017). According to MoTI (2019), Ethiopia's goal of becoming a middle-income country by 2025 includes increasing gross national income through expansion in the manufacturing industrial sector. According to the World Bank's World Development Indicators, the manufacturing industry contributed a little more than 5 percent of GDP in added value to the economy in 2020. A manufacturing sector growth objective of more than 20%

necessitates greater energy generation capacity to meet growing industrial electricity consumption.

Currently, fossil fuels (oil products and coal) account for more than 80% of Ethiopian industry's energy needs, with electricity accounting for less than 20%. This consumption pattern is mostly due to onsite electricity generation utilizing fossil fuel generators. However, increasing generation capacity cannot be Ethiopia's sole focus in order to achieve its manufacturing sector goals. To support resource efficient growth and eliminate waste where possible, attention and expertise are required. Ethiopia has also devised a strategy to demonstrate that improving industrial energy efficiency and managing energy is a necessity for accomplishing the aim.

According to the EMES (2019), the Ethiopian manufacturing industry's energy intensity is 0.326 tons of oil equivalent per 1000 USD added value. The energy intensity is much higher than that of developed countries, but it is also significantly higher than that of developing country peers such as Bangladesh. At the same hand, high energy intensity suggests a considerable potential for increasing total available energy supply through energy efficiency projects. For the industrial sector, several energy efficiency and energy management projects have been created and are now being implemented. An energy intensity estimate for the industrial sector or firm is set in the industrial energy efficiency strategy, and a 40 percent savings target for industrial energy efficiency strategies is advocated by 2025. This would allow the industrial industry to expand output by 66 percent without requiring more energy, adding 3.7 percent to GDP on its own. Importantly, every new kWh delivered by the country's energy system would have a 66 percent stronger growth effect than if the country's energy intensity remained same.

According to MoTI (2019), by 2025, at least 50% of manufacturing companies will have implemented an energy management system, conducted a comprehensive energy audit, and established and recorded baseline data; by 2030, 95% of companies will have done so with the implementation of various energy efficiency and energy management projects. The planning processes are extremely important in project management, and project execution without proper/poor formulation of a project plan frequently results in delays, excessive costs, and general execution difficulties in the project PMBOK (2017). According to studies by Wang and Gibson (2008) and others, as summarized

by Deribe (2018), time spent on project planning activities reduces risk and increases project success, while insufficient analysis and planning results in a failed project. However, the more planning a project has, the more successful it will be. According to Endalkachew (2018), project failure is also a major issue in our country, with 79 percent of completed projects failing to reach their goals.

Project performance issues (cost overruns, time delays, and quality deficiencies) are caused by factors such as project selection, planning, execution, and control, among others. Planning and scheduling, according to Hammad and Radhlina (2015), are time-cost-oriented activities that present a challenge to project managers and planners while managing their applications and claimed that scheduling is an important aspect of project management. Scheduling must consider the trade-offs between time and cost based on resource utilization. While minimizing project length and resource planning, it is necessary to build dependable timetables. Project managers and schedulers oversee making sure that there is enough management coordination and that the sequences are right, Hammed and Radhlinah, (2015) quoted from (Winch and Kelsey, 2005). Infrastructure initiatives, such as energy efficiency and fuel switching, require more coordinated planning, scheduling, and control than businesses that just have one or a few projects at any given moment.

Realistic overall target and project parameters in energy savings should be set based on overall information in the corporate record, predicted activities, and future fuel costs and supplies for industrial energy efficiency and energy management programs (Kreith and Goswami, 2016). Similarly, Craig and Kelly (2016) argued that for energy management program project initiation and planning is a key. In Ethiopia, project management knowledge is generally lacking for project-based investment grade audit development for energy efficiency and energy management programs. According to MoTI (2019b), the number of industrial energy efficiency projects is growing, but there is a lack of experience in overall project identification, planning, and execution. For a more effective project implementation, practicing managers should implement new management strategies that foster knowledge-based planning and scheduling concepts. It is necessary for practitioners to professionalize project planning and scheduling by using a more proactive and knowledge-based approach.

As discussed above, most Ethiopian projects fall short of expectations in terms of quality, time, and cost. The main reason for this is that project practitioners lack basic project management expertise and are inefficient at planning and scheduling projects. Industrial energy management projects are a growing sector in Ethiopia with enormous potential to boost GDP. However, the difficulty of project planning and scheduling for industrial energy management and energy savings programs has received little study attention. As a result, the goal of this study was to assess, identify, and evaluate project planning practices and problem areas in Ethiopian industrial energy efficiency and energy management projects, as well as to draw lessons and make recommendations for future industrial energy efficiency and energy management projects' implementation.

1.4.Research Questions

The researcher attempted to answer the following basic research questions in light of the above-mentioned problem statement:

- What is the current industrial energy efficiency and energy management projects' planning practice in Ethiopia?
- What is the current practice in terms of support provided by the organization to support project processes?
- What is the level of familiarity of project practitioners with the use of different project scheduling methods and tools?
- What are the major challenges in planning and scheduling of industrial energy efficiency & energy management projects in Ethiopia?

1.5.Objective of the research

1.5.1. General objective

The general objective of the study was to assess current practice and challenges of project planning and scheduling in Ethiopian industrial energy efficiency & energy management projects.

1.5.2. Specific objectives

- To assess the existing project planning and scheduling practice in industrial energy efficiency & energy management projects in Ethiopia
- To assess the level of support provided by the organization to support project processes in energy efficiency and energy management projects.

- To assess levels of familiarity/knowledge and their suitability with the use of different project planning and scheduling methods and tools
- To identify challenges and analyze in relation to project planning and scheduling

1.6.Scope of the Study

The scope of this study focusses to assess the existing project planning and scheduling practice in industrial energy efficiency & energy management projects in Ethiopia. In addition, the level of support provided by the organization to support project processes and levels of familiarity/knowledge and suitability with the use of different project planning and scheduling tools in the industrial energy efficiency and energy management projects were assessed. Besides, challenges, both at theoretical and practical level was identified and analyzed in relation to project planning and scheduling.

According to the researcher's own assessment and knowledge, a multitude of energy-related projects are being implemented in Ethiopia's industrial sector, including energy efficiency projects, energy audits, energy management system implementation, and energy management program implementation. Alternative Energy Projects, such as the generation of Refused Derived Fuel (RDF), are included in the domain of alternative fuels development for industry. RDF is a combustible waste fraction made from solid waste (paper, plastics, rubber, wood, cardboard, and PET bottles) and is part of a Biomass Fuels Switching (fossil fuel such as coal replacement) Project (prosopis Juliflora plant). As a result, the term "Industrial Energy Efficiency and Energy Management Projects" is used in this study to refer to all of the above type of projects in the industrial sector.

The researcher selected four organizations for this research purposes namely Ministry of Industry (the former Ministry of Trade and Industry), Chemical Construction and Inputs Development Center (the former Chemical Construction and Inputs Industry Development Institute), Ethiopian Petroleum and Energy Authority (the former Ethiopian Energy Authority, and German Technical Cooperation/Energizing Development Office. The major target population of the study were staff member of the chosen organizations who have participated in the implementation of energy efficiency and energy management projects. In addition, individual consultants, and experts in the field of manufacturing industry energy efficiency and energy

management projects were reached out. The study considered active and past projects related to energy efficiency and energy management in the selected organizations.

1.7.Significance of the study

The study tried to assess the current practice and challenges of project planning and scheduling in Ethiopian industrial energy efficiency & energy management projects. Fundamental concerns should be investigated and improved based on the literature study for project planning and scheduling to be successfully implemented in the industrial energy efficiency and energy management projects. Practitioner practice and perspectives must be investigated, and these practice and perspectives must be used to gauge planning and scheduling awareness.

In this study, a series of questions were used to investigate practitioner understanding of key concepts and principles underlying planning and scheduling, including the planning processes implementation, organizational support process available during project planning, familiarity, and suitability with different scheduling tools. Effective project planning is inextricably linked to the availability of relevant information. The study was tried to produce information about the implementation of project planning processes, organizational support process implemented, and challenges in industrial energy efficiency and energy management projects, which are believed to be key in implementing projects successfully. Given the importance of the energy efficiency and energy management projects to the Ethiopian economy, the findings of this study could be extremely valuable. The outcomes of this study can potentially be utilized as a reference for future energy efficiency and energy management projects in Ethiopia and provide benefits to the studied organizations.

1.8.Organization of the study

The research is divided into five chapters, each with its own set of divisions and sub-sections. The first chapter covered the study's background, problem statement, specific and general objectives, study methodology, research questions, study importance, scope, and study limitations. The review of important literatures and earlier research works on the problem area were discussed in Chapter Two. The research design, data sources, sample strategies, and data analysis methodologies are covered in the third chapter. The fourth chapter included data analysis and interpretation of findings. Result summary, conclusion and recommendations were offered in the fifth and final chapter.

CHAPTER TWO

2. LITERATURE REVIEW

The relevant literature review and preceding studies are resented in this chapter to support the study's objectives. This chapter also includes theoretical background on basic concepts, empirical reviews, and the study's conceptual framework.

2.1.Definition of key terms

2.1.1. Energy Efficiency

According to Environment and Energy Institute (EEI) USA, energy efficiency simply means using less energy to perform the same task – that is, eliminating energy waste. Further EEI describes that Energy Efficiency brings a variety of benefits: reducing greenhouse gas emissions, reducing demand for energy imports, and lowering our costs on a household and economy-wide level.

International Energy Agency (IEA) defined Energy Efficiency as something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input. While renewable energy technologies also help accomplish these objectives, improving energy efficiency is the cheapest – and often the most immediate – way to reduce the use of fossil fuels. According to EEI, there are enormous opportunities for efficiency improvements in every sector of the economy, whether it is buildings, transportation, industry, or energy generation.

Energy Efficiency in the context of a growing manufacturing sector /Industry means producing more added value while keeping energy consumption constant or constrained to a lower growth rate than manufacturing output (MoTI, 2019b)

2.1.2. Energy management Programme

According to MoTI 2019a, an Energy Management Program (EMP) is a written management system comprising explicit personalized responsibilities and actions aimed at systemizing a company's efforts to reduce its consumption of energy per unit of output, thus reducing the company’s unit costs and increasing profits, while simultaneously reducing the entity’s environmental footprint. It includes rules, procedures, planning activities, responsibilities, and resources that affect the organization's success in meeting the energy policy's objectives and targets.

According to IEA(2011), Energy management system (EnMS) a means by which organizations establish the systems and processes necessary to achieve operational control and continual improvement of energy performance. EnMS components include the various energy management activities that all together make up the EnMS such as energy audit, energy manager, energy conservation project's identification and planning, implementing, monitoring, reporting etc. While Energy management programmes (EnMP) is an initiative to promote effective EnMS.

According to ISO 50002: 2018, based on the well-known "Plan-Do-Check-Act" Deming's cycle, EnMS, establish closer linkages between energy management business practices and core industry values, such as cost reduction, increased productivity, environmental compliance, and global competitiveness

2.1.3. Energy Efficiency projects in the manufacturing Industry sector

According to the researcher's own assessment and knowledge, a multitude of energy-related projects are being implemented in Ethiopia's industrial sector, including energy efficiency projects, energy audits, energy management system implementation, and energy management program implementation. Alternative Energy Projects, such as the generation of Refused Derived Fuel (RDF), are included in the domain of alternative fuels development for industry. RDF is a combustible waste fraction made from solid waste (paper, plastics, rubber, wood, cardboard, and PET bottles) and is part of a Biomass Fuels Switching (Coal Replacement) Project (prosopis Juliflora plant). As a result, the term "Industrial Energy Efficiency and Energy Management Projects" is used in this study to refer to all of the above type of projects in the industrial sector.

2.2.Project

A project, according to the Project Management Body of Knowledge (PMBoK6), is a plan or proposal that consists of a series of distinct, complicated, and interconnected operations with a single objective or purpose that must be accomplished on time, on budget, and according to specifications. A project is made up of a series of tasks that must be accomplished in a specific order. Each project's activities should be distinct. A project like this has never been done before, and it will never be done again under the same circumstances. When the actions of a project are repeated, something will always be different. The project's activities aren't easy, monotonous tasks like mowing the grass, painting the house, washing the car, or loading the delivery truck. They're

complicated. Designing an intuitive user interface for an application system, for example, is a difficult task.

Project planning is one of the most significant parts of the project among these several phases. The project team's management of the project elements will be addressed in project planning. By addressing all parts of the project, it will create a high level of confidence in the organization's capacity to achieve the scope, timing, cost, and quality objectives. Deliverables follow planning, and bad planning leads to project delays, cost overruns, and low-quality work, among other factors. To ensure a smooth flow of work, value for money, and timely completion, it is critical that the project team plans precisely and appropriately prior to the execution of operations. As a result, planning has been regarded as a critical project management component for project success (Kerzner, 2009).

Hence, this study is particularly concerned with the practice and challenges of project planning and scheduling of industrial energy efficiency and energy management projects in Ethiopia.

2.3. Project Management

The application and integration of modern management and project management knowledge, skills, tools, and techniques to the overall planning, directing, coordinating, monitoring, and control of all aspects of a project from inception to completion, as well as the motivation of all those involved to produce the project's product, service, or result on time, within budget, and to the required quality and requirements, as well as the satisfaction of participants. Project management concerned with coordinating resources and managing people and change (Haugan, 2002).

In general, project management entails identifying needs, setting clear and attainable objectives, balancing competing demands for quality, scope, time, and cost, and adapting specifications, plans, and approaches to the many stakeholders' concerns and expectations. Project management is defined as "the application of knowledge, skills, tools, and procedures to project activities in order to achieve project requirements, according to the Project Management Institute (PMI, 2017).

2.4.The Project Life Cycle

A project life cycle is the sequence of phases that a project goes through from start to finish. A project phase is a collection of logically related project tasks. It comes to a close when one or more deliverables are completed. It has a start and end, as well as a control point. Sequential, iterative, or overlapping processes are all possible. According to PMI (2017), a Project Life Cycle is the series of phases that a project passes through from its start to its completion.

The project life cycle is influenced by the features of the organization, the industry in which the project's hosting organization operates, the hosting company's development method, and the technology used by the organization. According to Kerzner (2009), Project-oriented businesses have a well-defined beginning and end and are not self-perpetuating. Business must be generated on a project-by project basis rather than by creating demand for a standard product or service. It provides the essential foundation for project management, regardless of the specific situation. Regardless of project size or complexity, a typical project can be mapped to the following project life cycle structure: beginning the project, organizing, and preparing the project, carrying out the project's work, and closing the project.

2.5.Project Management Process Group

A Project Management Process Group is a logical grouping of project management processes to achieve specific project objectives. Process Groups are independent of project phases. Project management processes are grouped into the following five Project Management Process Groups (PMI 2017):

- **Initiating Process Group:** Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase.
- **Planning Process Group:** Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.
- **Executing Process Group:** Those processes performed to complete the work defined in the project management plan to satisfy the project requirements.
- **Monitoring and Controlling Process Group:** Those processes required to track, review, and regulate the progress and performance of the project; identify any

areas in which changes to the plan are required; and initiate the corresponding changes.

Closing Process Group: Those processes performed to formally complete or close the project, phase, or contract.

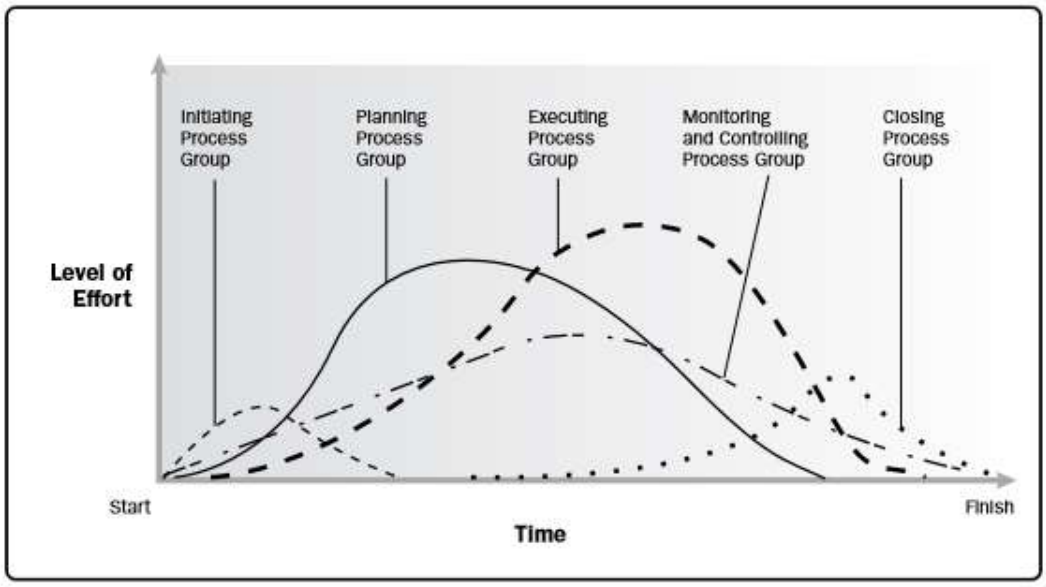


Figure 2.1.: Process Group Interactions Within a Project or Phase (Source: PMBOK, sixth edition)

2.6.Project Planning and scheduling

Though distinct, project planning and scheduling are two sides of the same coin in project management. Choosing and implementing effective policies and techniques to achieve project objectives is at the heart of 'project planning.' 'Project scheduling,' on the other hand, is the process of assigning tasks and allocating necessary resources to fulfill them within a given budget and schedule. As cited in Serrador (2012) different writers defined projects differently. Among them are Mintzberg (1994) describes planning as the effort to formalizing decision-making activities through decomposition, articulation, and rationalization; in construction, pre-project planning is defined as the phase after business planning, where a deal is initiated and prior to project execution (Gibson & Gebken, 2003).

The complete project is the foundation of project planning. Project scheduling, contrary to popular belief, focuses solely on project-related tasks, project start/end dates, and project dependencies. As a result, a 'project plan' is a detailed document that outlines the project's objectives, scope, costs, risks, and timeline. A project schedule, on the

other hand, lists the projected dates as well as the project tasks that must be completed in order.

The first thing we need to do before starting any activity is plan it out. Any decent project manager recognizes the need of meticulous project planning. A project plan expresses the objectives and requirements of the project in terms of PMBOK (2014) cited in (Endalkachew ,2018)

- Project Scope
- Project schedule
- Resource requirement
- Project cost estimation
- Project quality and
- Project risk management

In industrial energy efficiency projects, it has been found out that the lack of a well-implemented project plan has generated issues in all project management areas, making it impossible for the implementation team to maintain the necessary control over project activities. There are problems in the area of translating project requirements into WBS, task lists, Gantt charts, resource assignments, and risk registers, among other things.

2.7.Project management knowledge areas

Processes are classified into Knowledge Areas in addition to Process Groups. A Knowledge Area is a specified area of project management that is described in terms of its component processes, practices, inputs, outputs, tools, and techniques and is defined by its knowledge requirements. From a production or manufacturing standpoint, according to Saver, 2001, referenced in AlNasseri (2015), knowledge about schedule management is a significant issue that must be addressed to judge timetable problems using both experience and knowledge. Many scheduling issues stemmed from a lack of understanding or awareness of the planning and scheduling systems in use (J. Meredith and S.J. Mantel, 2010).

Although the Knowledge Areas are related, they are defined individually from the standpoint of project management. According to PMI (2017), the ten Knowledge Areas identified are used in most projects most of the time and they are:

- **Project Integration Management:** Includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups.
- **Project Scope Management:** Includes the processes required to ensure the project includes all the work required, and only the work required, to complete the project successfully.
- **Project Schedule Management:** Includes the processes required to manage the timely completion of the project.
- **Project Cost Management:** Includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so the project can be completed within the approved budget.
- **Project Quality Management:** Includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements, in order to meet stakeholders' expectations.
- **Project Resource Management:** Includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project.
- **Project Communications Management:** Includes the processes required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and ultimate disposition of project information.
- **Project Risk Management:** Includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project.
- **Project Procurement Management:** Includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team.
- **Project Stakeholder Management:** Includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution.

Table: 2.1.: Project Management Process Group and Knowledge Area Mapping interactions (source: PMBOK, edition six)

Knowledge Areas	**Project Management Process Groups**				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	4.7 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Schedule Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Manage Quality	8.3 Control Quality	
9. Project Resource Management		9.1 Plan Resource Management 9.2 Estimate Activity Resources	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	9.6 Control Resources	
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Monitor Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses	11.6 Implement Risk Responses	11.7 Monitor Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Engagement	13.3 Manage Stakeholder Engagement	13.4 Monitor Stakeholder Engagement	

2.8.Project Planning Process Group

However, according to Richard (2012) one of the main reasons of project failure in developing countries is lack of effective planning processes. Some planning stages, such as scope planning and risk planning, are overlooked in industrial energy efficiency projects in Ethiopia, and project execution is frequently initiated without establishing a project plan or with poor project planning. Different research shows the effects of

project planning on project performance, as stated by (Hammed and Radhlinah, 2015). Inadequate analysis and planning will result in a failed project, however the more planning a project has, the more successful it will be.

The Planning Process Group, according to PMI (2017), comprises of procedures that define the overall scope of the endeavor, define, and refine the objectives, and determine the course of action needed to achieve those objectives. The Planning Process Group's processes create the project management plan's components as well as the project documentation needed to complete the project. For extra analysis, the nature of a project may necessitate the utilization of recurring feedback loops. Additional planning will almost certainly be required as more project information or qualities are obtained and understood (Zwikael and Globerson, 2005). Significant changes in the project life cycle may need revisiting one or more of the planning procedures, as well as one or both initiating activities. Progressive elaboration refers to the continual development of the project management plan, implying that planning and documentation are iterative or ongoing tasks. The main benefit of this Process Group is that it helps to identify the steps that must be taken to complete the project or phase successfully (PMI, 2017)

It is discussed I several studies Zwikael and Globerson (2004), Thomas et. al. (2008), Hammad and Radhlinah (2015) that due to the complexity of this process group, the project management team seeks input and promotes participation from all key stakeholders while designing the project and preparing the project management plan and project documents. The authorized version of the project management plan is regarded a baseline once the initial planning process is accomplished. The Monitoring and Controlling processes compare project performance to baselines throughout the project. According to Endalkachew (2018), most Ethiopian projects failed to apply planning knowledge areas effectively, with only 20.35 percent implementing risk planning, 33.6 percent implementing quality planning, 44.2 percent implementing communication planning, 46.5 percent implementing integration planning, and 48.85 percent implementing scope planning.

The Planning Process Group is the most difficult to understand because it includes processes from all knowledge areas. This stage, however, is important to the project's success. You would have a clear and actionable roadmap for project delivery after the

Project Management Plan and other outputs of this process group are established. When you believe something has to be modified at any time, you return to the planning process and make the appropriate changes or updates.

Table 2.2.: Planning process group processes

Planning process group	Description of the process
Plan scope management	creating a scope management plan that documents how the project and product scope will be defined, validated, and controlled
Collect requirements	determining, documenting, and managing stakeholder needs and requirements to meet objectives.
Define scope	developing a detailed description of the project and product
Create WBS	subdividing project deliverables and project work into smaller, more manageable components
Plan schedule management	establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.
Define activities	identifying and documenting the specific actions to be performed to produce the project deliverables.
Sequence activities	identifying and documenting relationships among the project activities.
Estimate activity durations	estimating the number of work periods needed to complete individual activities with estimated resources.
Develop schedule	analyzing activity sequences, durations, resource requirements, and schedule constraints to create a schedule model for project execution and monitoring and controlling.
Plan cost management	defining how the project costs will be estimated, budgeted, managed, monitored, and controlled
Estimate costs	developing an approximation of the monetary resources needed to complete project work
Determine budget	aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline
Plan quality management	identifying quality requirements and/or standards for the project and its deliverables and documenting how the project will demonstrate compliance with quality requirements and/or standards.
Plan resource management	defining how to estimate, acquire, manage, and utilize physical and team resources.
Estimate activity resources	estimating team resources and the type and quantities of materials, equipment, and supplies necessary to perform project work
Plan communications management	developing an appropriate approach and plan for project communication activities based on the information needs of each stakeholder or group, available organizational assets, and the needs of the project
Plan risk management	of defining how to conduct risk management activities for a project.
Identify risks	identifying individual project risks as well as sources of overall project risk and documenting their characteristics.
Perform qualitative risk analysis	prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics.
Perform quantitative risk analysis	numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives
Plan risk responses	developing options, selecting strategies, and agreeing on actions to address overall project risk exposure as well as to treat individual project risks.
Plan procurement management	documenting project procurement decisions, specifying the approach, and identifying potential sellers.
Plan stakeholder engagement	developing approaches to involve project stakeholders based on their needs, expectations, interests, and potential impact on the project

Source: adopted from PMBOK sixth edition

2.9.Benefits of project Panning

Careful and exact planning aids us in reducing risk and, as a result, uncertainty in any given project. The project manager of a well-planned project seeks to account for predicted incidences of uncertainty ahead of time. On the other hand, Meredith, J., and

Mantel, S.J. (2010) mention that planning reduces uncertainty and argued that though we never expect project work to go exactly as planned, planning the task allows us to think about the possible outcomes and take corrective action as needed.

According to Antvik & Sjöholm (2007) cited in AlNasseri (2015), planning processes are critical, and project execution without proper/poor formulation of a project plan frequently results in delays, excessive costs, and general execution issues. Resources cannot be managed or structured without a good plan and estimate, risks cannot be reduced, dates and budgets cannot be anticipated, effective reporting cannot be done, and the metrics of success will be flawed from the start.

Meredith, J., and Mantel, S.J. (2010) further discussed that Planning increases understanding and improves efficiency. Planning allows us to gain a better understanding of the project's goals and objectives. The exercise would have been beneficial even if we didn't follow through with the plan. Once we've defined the project approach and the resources required to carry it out, we can plan the work to take advantage of resource availability. We can also schedule work in parallel, which implies we can finish everything at the same time instead of sequentially. By completing jobs in parallel, we can shorten the project's overall duration. We can make greater use of our resources and complete the project faster than we could if we used other approaches.

2.10. Challenges of Project Planning and Scheduling activities

Planning and scheduling are critical to understanding project performance in infrastructure projects, and both processes must be addressed appropriately and efficiently to guarantee that projects accomplish their goals. Furthermore, these processes are critical in the life cycle of infrastructure projects, such as energy efficiency & energy management projects, because they entail the selection of the most appropriate techniques and tools, the definition and organization of a diverse set of activities, and the estimation and allocation of the most cost-effective resource deployment.

According to Brisgone A. (2007), to develop a project plan, it involves more than just opening a project plan and entering activities. It demands meticulous activity description, scheduling, and resource estimation, as well as direct integration with the program's entire development life cycle. The development and application of standard

estimating models and templates connected to the program's development life cycle is one of the first steps in successfully constructing a plan that can provide true status of progress.

According to Haugan (2002), referenced in Hammed and Radhlinah (2015), planning and scheduling are time-cost focused activities that present a challenge to project managers and planners while managing their applications. Within project management, scheduling is an important role. Scheduling must consider the trade-offs between time and cost depending on resource usage while reducing project duration. It is unlikely that scheduling to succeed without sufficient knowledge of the work being planned. Moreover, an incomplete planning process might impair the worth of schedules and, hence, lead to an uncontrolled flow of project progress (Andersen, 1996).

Brisgone (2007) further argues that there are a variety of issues that affect the quality of project planning and, as a result, the overall project performance such as:

- Time Management
- Determining budget
- Prioritizing Project tasks
- Getting up-to-date information
- Availability of qualified personnel
- Meeting the required quality
- Identifying risks
- Coordinating the various stakeholders, etc.

2.11. Project planning tools and techniques

The "Planning phase," in which all work to be done is determined and outlined, is one of the most significant phases of project management. The most time-consuming set of actions is planning, but it pays off if done correctly. Work breakdown structure (WBS), Gantt charts and networks, Program Evaluation and Review Technique (PERT), critical path method, and other techniques are utilized at this phase. Chua and Godinot (2006) noted that a well-defined work break- down structure (WBS) in the planning phase improves the interfaces between parties and thus allows for more dynamic,as well as functional, schedules. Tables are used to display project activities as well as pertinent information such as length, dependencies, and costs, as well as the start, end, and required resources. It can be utilized for implementation and monitoring and is

employed during the planning and controlling phases. One of the oldest and most useful planning strategies is the Gantt chart.

Hammed and Radhlinah (2015) argued that the use of different planning and scheduling tools and techniques implied that there is a need to assess practitioners' familiarity with the fundamentals of planning and scheduling as manifest in different methods and techniques. It is straightforward and simple to use and comprehend. Because the interdependence of activities is difficult to depict, especially in large projects, networks are used. A network is a graphical representation of a project's operations that shows their interdependence. Project managers and schedulers oversee making sure that there is enough management coordination and that the sequences are right (Winch & Kelsey, 2005), cited in (Hammed and Radhlinah, 2015). Over the years, several network approaches have been invented and used. Depending on the sort of project, one of two types of networks can be used: deterministic and probabilistic techniques. The project is represented using either activity-on-arrow (AOA) or activity-on-node (AON) models.

The probabilistic method is known as the program evaluation and review technique (PERT), whereas the deterministic method is known as either the precedence diagramming method (PDM), which uses the AON method for representation, or the arrow diagramming method (ADM), which uses the AOA method for representation. For determining the project length, critical path(s), floats, and other important data, all of the approaches use the critical path method (PMI, 2017).

2.12. Models for assessing the quality of project planning

According to PMI (2017), there are various known approaches to ensure project quality. Namely Six Sigma, Cost of Quality, Total Quality Management, Failure Mode and Effect Analysis and International Organization for Standardization 9001, etc.

According to Feris et.al. (2017), decisions about whether or not to approve a project plan for execution are critical. A decision to stick with a bad plan may result in a failed project, whereas requesting extra planning for an already high-quality plan may be counterproductive. However, psychological biases such as the endowment effect, optimism bias, and ambiguity effect can influence these decisions, which are exacerbated when uncertainty is high, and information is incomplete. As a result, a non-

biased model for evaluating project planning quality is critical for improving planning approval decisions and resource allocation.

In project implementation, if the planning is faulty, the project will not result in the expected outcome and vice versa. Hence, carrying out a project according to its plan does not necessarily ensure a successful outcome. High-quality planning increases the chances that the project will be properly executed and successfully completed (Zwikael & Globerson, 20024). Because planning is primarily a manager's responsibility, the manager must ensure that it is carried out to the highest standard possible, ensuring the complete satisfaction of all relevant stakeholders. As a result, the manager is expected to ensure that planning is implemented on some sort of baseline, just as project executions are carried out in accordance with the plan baseline.

In order to create an effective plan, project managers must follow the planning processes described in the PMBOK® Guide, according to Zwikael and Globerson (2004) and Feris et al. (2017). Some maturity models, on the other hand, followed the PMBOK® processes but ignored the organizational support component. Thus, for proper project planning, the following two components should be included: the use of PMBOK® Guide-defined planning processes and project management organizational support. A model that includes these two components can be used to assess the quality of an organization's project planning processes, identify weak areas that need to be improved, and thus improve planning quality Ibbs and Kwak (2000) cited (Zwikael & Globerson, 2004). The following project planning quality assessment models were reviewed from literature.

2.12.1. Project planning quality assessment (PMPQ) model

This model is developed by (Zwikael & Globerson, 2004). The methodology for evaluating project planning quality was created using expertise from the disciplines of project management, control, organizational maturity, and organizational support. The model, known as Project Management Planning Quality (PMPQ), is made up of two parts: Organizational support processes produce the means that the organization provides at the disposal of the project manager in order to support proper project planning, execution, and completion. Project know-how procedures are described as those planning processes done by the project manager.

This model comprises a total of 33 products, 16 of which are project know-how processes and 17 of which are organizational support processes (13 from various project maturity models and 4 from PMBOK). As previously stated, there are two types of processes: PMBOK-covered processes that have already been assessed and organizational support processes. "Organizational Systems," "Organizational Cultures and Styles," "Organizational Structure," and "Project Office" are the four supporting knowledge categories identified by PMBOK. The PMBOK focuses primarily on the appropriate project manager's know-how, with little attention paid to organizational support. As a result, while the four key areas described above appear to fit other models, the PMBOK only offered a few goods for the above knowledge domains. As a result, from the hundreds of maturity models created in recent years, the PMPQ model identified an additional 13 organizational support processes.

2.12.2. Checklist technique

A checklist technique is used in the other project quality evaluation paradigm. Checklists are a typical way to analyzing planning quality and risks, as highlighted by (Faris et al., 2017). Software-development projects frequently employ checklists to assess whether the planning phase is complete, and the project can go on to the next phase, to direct reviews, and to ensure project teams follow protocols, all rely on expert knowledge. Checklists offer direction on important questions to ask as well as a methodical approach to the various stages of preparation. Checklists are possibly the most straightforward and effective method for assessing quality.

2.12.3. Quality of planning (QPLAN) tool

Fris et al. (2017) developed the QPLAN. It is a cutting-edge tool that can be used to assess the planning quality of any software project and thereby help make better decisions. QPLAN, as a knowledge management-based decision support system, aids decision making by assisting users in storing, processing, and retrieving information. QPLAN is made up of four parts: i. a model for assessing planning quality (resulting in the QIPlan index), ii. an extended map for recognizing planning's strengths and limitations, iii. a diamond model of project characteristics based on novelty, technology, complexity, and pace, and iv. a knowledge base that allows for learning from previous projects generated by the same company.

The PQMP was created to evaluate the quality of project planning from the perspectives of organizational support for project planning as well as the application of the project planning process during the planning process. As this research intends to assess the planning practice of the industrial energy efficiency project in Ethiopia, most of the guides and the advice of the PQMP were be used in the current study.

2.13. Review of Empirical Studies

The PMI framework of project management is comprised of five process groups, 49 processes categorized in ten knowledge areas, according to the sixth version of the Project Management Body of Knowledge (PMBOK). The processes are to be implemented in each of the process groups depending on the type of project. However, the panning processes have not been used in full or to a substantial amount in many Ethiopian projects.

According to a study conducted by Tesfaye (2018), most Ethiopian projects failed to apply Planning knowledge areas effectively, with only 20.35 percent implementing risk Planning, 33.6 percent implementing quality Planning, 44.2 percent implementing communication Planning, 46.5 percent implementing integration Planning, and 48.85 percent implementing scope Planning. Whereas Deribe (2018) argued that 79 percent of completed projects fail to reach their goals. Haugan (2012) argued that one of the biggest reasons for project failure in poor nations is a lack of adequate Planning processes. Previous study by Whittaker (1999), Dvir and Shenhar (2003), and others has suggested that inadequate project Planning is one of the reasons for project failure in developing nations, as stated in (Lemma, 2014).

According to Zwikael and Globerson (2004), project Planning process such as time related processes were found to be the strong ones, while “Risk Management” and “Communications” processes are the ‘Achilles heels’ of project Planning. The quality of organizational support processes was lagging the project know-how processes, pointing out that hose organizations have not yet developed the proper project management infrastructure required for an effective support. According to PMI (2017), Planning processes are critical, and project execution without proper/poor formulation of a project plan frequently results in delays, excessive costs, and general execution issues. Insufficient analysis and Planning will result in a failing project, but that the more Planning a project has, the more successful it will be (Thomas et. al., 2008). As a

result, even if all the resources are present, poor project Planning will lead to project failure, according to this data. Meredith and Mantel (2010) further discussed that Planning increases understanding and improves efficiency. Planning allows us to gain a better understanding of the project's goals and objectives.

Planning and scheduling, according to Hammad and Radhlina (2015), are time-cost-oriented activities that present a challenge to project managers and planners while managing their applications and claimed that scheduling is an important aspect of project management. The authors further argues that the use of different Planning, and scheduling tools and techniques implied that there is a need to assess practitioners' familiarity with the fundamentals of Planning and scheduling as manifest in different methods and techniques. Project managers and schedulers oversee making sure that there is enough management coordination and that the sequences are right Winch and Kelsey (2005) cited in (Hammed and Radhlinah, 2015).

Planning and scheduling, according to Hammad and Radhlina (2015), are time-cost-oriented activities that present a challenge to project managers and planners while managing their applications and claimed that scheduling is an important aspect of project management. Scheduling must consider the trade-offs between time and cost based on resource utilization. Project scheduling is the process of assigning tasks and allocating necessary resources to fulfill them within a given budget and schedule (Serrador, 2012). Project scheduling, contrary to popular belief, focuses solely on project-related tasks, project start/end dates, and project dependencies. Many scheduling issues stemmed from a lack of understanding or awareness of the planning and scheduling systems in use (J. Meredith and S.J. Mantel, 2010). Scheduling must consider the trade-offs between time and cost depending on resource usage while reducing project duration and it is unlikely that scheduling to succeed without sufficient knowledge of the work being planned (AlNasseri, 2015).

According to Feris et.al. (2017), decisions about whether or not to approve a project plan for execution are critical. A decision to stick with a bad plan may result in a failed project, whereas requesting extra Planning for an already high-quality plan may be counterproductive. High-quality Planning increases the chances that the project will be properly executed and successfully completed (Zwikael & Globerson, 20024). Because Planning is primarily a manager's responsibility, the manager must ensure that it is

carried out to the highest standard possible, ensuring the complete satisfaction of all relevant stakeholders. According to Zwikael and Globerson (2004) and Feris et al. (2017), in order to create an effective plan, project managers must follow the Planning processes described in the PMBOK® Guide,

Some maturity models, on the other hand, followed the PMBOK® processes but ignored the organizational support component. Thus, for proper project Planning, the following two components should be included: the use of PMBOK® Guide-defined Planning processes and project management organizational support. A model that includes these two components can be used to assess the quality of an organization's project Planning processes, identify weak areas that need to be improved, and thus improve Planning quality Ibbs & Kwak, 2000, cited in (Zwikael & Globerson 2004).

According to Kreith and Goswami (2016), for industrial energy efficiency and energy management programs, realistic overall target and project parameters in energy savings should be determined based on overall information in the corporate record, expected activities, and future fuel costs and supply. Designing an industrial energy efficiency program takes time and must be undertaken with some care (UNIDO, 2007). According to Richard (2012) Planning is often cited as the most critical of the management functions in determining the overall project performance.

According to Wang and Gibson's (2008) research, spending time on project Planning activities reduces risk and increases project success. According to MoTI (2019a), industrial energy efficiency projects are expanding with little experience in overall project identification, Planning, and execution. Therefore, it is necessary for practitioners to professionalize project Planning and scheduling by using a more proactive and knowledge-based approach (Hammad and Radhlinah, 2015).

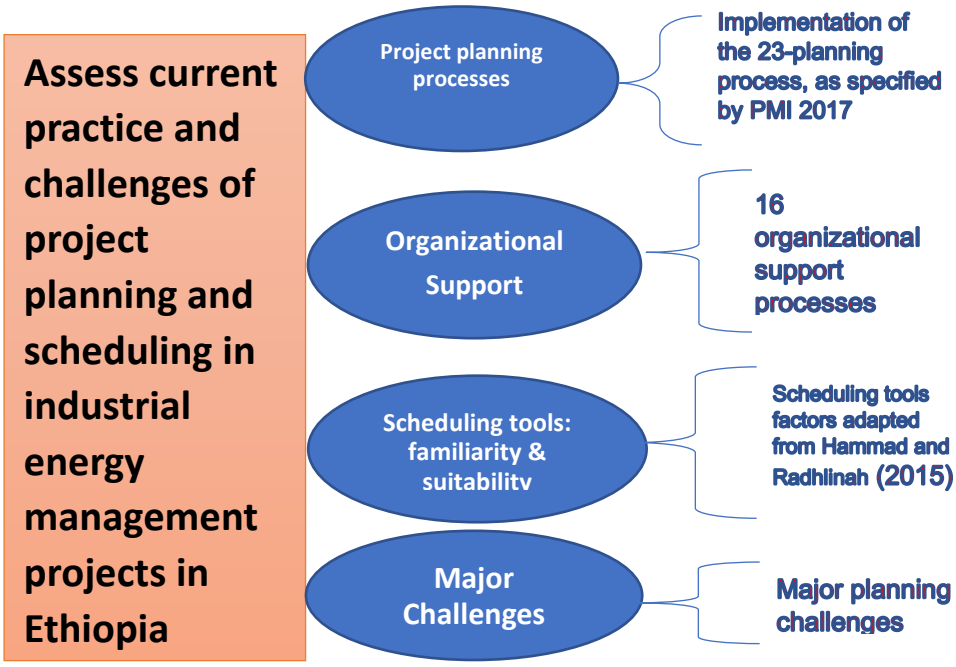
Craig and Kelly (2016) argued that for energy management program project initiation and Planning is a key. In Ethiopia, project management knowledge is generally lacking for project-based investment grade audit development for energy efficiency and energy management programs. Moreover, an incomplete Planning process might impair the worth of schedules and, hence, lead to an uncontrolled flow of project progress (Andersen, 1996). While an enterprise may have technically competent personnel, energy management is a separate topic that often needs to be learned. Energy efficiency

projects require what in many cases will be seen as a non-traditional way of calculating economic benefits (MoTI, 2019).

2.14. Framework of the study

A framework for the study has been constructed based on the literature review completed above, as indicated in Picture 2.3 below. The framework depicts the statements used in the study to evaluate industrial energy efficiency and energy management project planning and scheduling procedures. During energy efficiency and energy management project planning in industry, the implementation of the 23-planning process, as specified by PMI (2017), was evaluated.

Similarly, 16 organizational support processes areas were identified and their application practice in the planning of industrial energy efficiency and energy management projects was analyzed using the PMQM model established by Zwikael and Globerson (2004). Factors for assessing familiarity and suitability of scheduling tools were adapted from (Hammad and Radhlinah, 2015)



Picture 2.3.: Framework of the study

CHAPTER THREE

3. RESEARCH METHODOLOGY

The third chapter of this research is Research and Methodologies. It commences with an introduction of the research's overall approach and techniques, which were employed to assess the practice and challenges of planning and scheduling industrial energy efficiency and energy management projects in Ethiopia. The methodology section attempts to describe the methods by which the study's objectives can be answered after fully comprehending the problems to be studied and the knowledge area that supports the study in chapters one and two. It describes the research design, population and sample techniques, data collection methods and tools, study validity and reliability, and lastly data interpretation and presentation procedures.

3.1. Research design and approach

The study assessed Ethiopian industrial energy efficiency and energy management project planning and scheduling practices. It assessed through the extent of this practice as well as the present exercise in detail. The study employed both qualitative and quantitative research methods. A questionnaire-based (open-ended and closed-ended) survey is a strategy that is particularly recommended for descriptive research aimed at investigating and analyzing these types of study concerns. As a result, I'd go with a descriptive study design to describe what the current project planning and scheduling practice of Ethiopian energy efficiency and energy management projects looks like, including what's going on and what's happened in terms of project planning and scheduling.

A questionnaire-based survey is a positivist strategy, according to Oyedele (2013), quoted in Hammed and Radhlinah (2015), especially for descriptive research trying to investigate and analyze research problems within an area where theory has been well covered in the literature, such as planning and scheduling. It was also thought that a questionnaire-based survey will allow numerous targets to be met at a low cost and in a short amount of time. The primary goal of descriptive research is to describe the current condition and report on what has happened or is happening.

3.2. Description of study variables

As discussed above, the main objective of this research employed to assess the practice and challenges of planning and scheduling industrial energy efficiency and energy management projects in Ethiopia. Hence, implementation of the 23-planning process, as defined by PMBOKv6 were assessed during energy efficiency and energy management project planning in industry (Table 2.20). This planning process comprises of procedures that define the overall scope of the endeavor, define, and refine the objectives, and determine the course of action needed to achieve those objectives. These are project know-how processes and defined as those planning processes executed by the project manager (Zwikael, O.& Globerson,S., 2004). Similarly, based on the PMQM, 16 organizational support processes areas were identified and their application practice in during planning of industrial energy efficiency and energy management projects has been assessed (Table 4.4a and Table 4.4b)

In addition, familiarity and suitability with project management scheduling methods was assessed covering mainly the knowledge and familiarity with the scheduling techniques such as Gantt Chart, CPM and PERT. Moreover, the industrial energy efficiency and energy management projects implementations practitioners' level of agreement with the suitability of the current scheduling techniques has been assessed. The questionnaire for this section was prepared by adapting from AlNasseri (2015).

3.3.Description of study area and target population

The population of this study were project management practitioners/staff of the Ministry Industry, the Chemical and Construction Industries Development Center, Ethiopian Petroleum and Energy Authority. In addition, Individual consultants on Energy Efficiency and Energy Management projects have been included. The project staff of Germen International Cooperation who have experience in Energy Efficiency projects have been also included.

3.4.Sampling technique/methods and sample size

The sample selection was followed purposive sampling based on experience and involvement in energy efficiency implementation projects for the offices of Ministry of Industry, the Chemical and Construction Inputs Industries Development Center, and the German International Cooperation Energy office. The purposive sampling technique was employed because of the nature of the energy efficiency and energy management projects implementation where it involves selected staff in the

organizations studied. This method suits this kind of arrangement. Purposive sampling was best helped the researcher understand the problem and the research question (Creswell, 2014). In addition, EPA (few staff involving the energy efficiency related projects) and individual/Independent energy auditing, energy efficiency & energy management consultants, interview approach was implemented. Questionnaires was sent to the participants through email and a constant reminder was followed to get the questionnaires back on time. A total of 59 (48 through questionnaire and 11 through interview) energy efficiency and energy management project practitioners have been reached out. Few industrial energy management projects are currently in progress; thus the researcher made every effort to get in touch with project staff and consultants who are actively involved in the firms selected for this research.

3.5.Data type and source

Primary data is collected from the respondents based on a structurally designed questionnaire. It included both closed ended and open-ended questions. In addition, interview method was employed. Mixed approach of primary data gathering was employed aiming to comprehend and thoroughly describe the area of the research.

A questionnaire was employed because it has been proven to be more convenient because respondents can respond whenever they choose. Questionnaires was produced based on the research questions outlined for this study as well as the literature analysis completed in order to conduct a survey to assess the potential of criteria or factors derived from the literature and the research questions. The researcher employed open-ended and closed-ended questionnaires, which allowed respondents to express themselves fully on the questions that were asked to elicit further information about the study.

The questionnaires developed had a 5-point Likert scale (i.e., 1 = strongly disagree, 5 = strongly agree). A Likert-type scale assumes that the strength/intensity of experience is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured. Respondents may be offered a choice of five to seven or even nine pre-coded responses with the neutral point being neither agree nor disagree (McLeod, 2008)

The questionnaires were designed to clearly measure respondents' viewpoints on project planning and scheduling procedures in their organizations, the adequacy of the project planning and scheduling tools they use, the organizational support processes, and their awareness and knowledge in project planning and scheduling domains. The questionnaire consisted of four main parts which were: first part covered respondents' attitude on the application of project management planning process consisting of 23 questions, second part on project planning & scheduling techniques consisting of 8 statements, third part on organizational support processes that consists of 16 statements dived in into 4 sub-groups. And lastly an open-ended question aimed to give respondents an opportunity to express themselves further on the questions asked.

3.6.Data analysis

The respondents' level of agreement with a set of statements or criteria generated was gathered using 5-point Likert scale questionnaire (i.e., 1 = strongly disagree, 5 = strongly agree). Likert-type or frequency scales use fixed choice response formats and are designed to measure attitudes or opinions and these ordinal scales measure levels of agreement/disagreement (McLeod, 2008). To verify the dispersion of the replies for descriptive statistics such as frequencies the data gathered via surveys was evaluated with descriptive statistics using statistical package for social scientists (SPSS). The raw data were coded and entered into computer for processing using SPSS.

The Likert scale data was summarized using a mode and the observation was distributed using bar graph. According to McLeod (2008), Likert scale data can be best summarized using a median or a mode (not a mean); the mode is probably the most suitable for easy interpretation and display the distribution of observations in a bar chart (it can't be a histogram, because the data is not continuous).

The relative importance index (RII) analysis method was used to examine the overall ranking of significance of the researched elements in the study after the dispersion of the replies for descriptive statistics conducted on SPSS. Because the values of gathered replies through ordinal scales cannot be assumed equal, RII is a good approach for conducting analytical surveys of the planned research that incorporate ordinal scale data from the Likert Scale. The RII produced a more accurate average index on interval variables and measure. The overall rankings of significance of the researched project

planning and scheduling components in the study was conducted using the Relative (Impact) Importance index (RII).

The importance index was computed using the following equation (Tam and Le (2006); Hold (2014) cited in Hammad and Radhlinah, 2015)

$RII = \Sigma w / NA$ (…… (1)

$RII = (5*n_5 + 4*n_4 + 3*n_3 + 2*n2 + 1*n_1)/N*5$……... (2)

Where w is the weighting given to each factor by the respondent, ranging from 1 to 5, (n_1 number of respondents for strongly disagree, n_2 number of respondents for disagree, n_3 number of respondents for neutral, n_4 number of respondents for agree, n_5 number of respondents for strongly agree. A= 5, the highest weight for 5 scale Likret scale used for the current study. And N is the total number of samples. As a result, RII values are always positive and less than unity.

The RII method uses the relative mean of all responses to determine the RII value. The relative importance index ranges from 0 to 1 (Tam & Le 2006). According to Akadiri (2011), RI values are converted into five essential levels: high (0.8 RI 1), high-medium (H–M) (0.6 RI 0.8), medium (0.4 RI 0.6), medium-low (M-L) (0.2 RI 0.4), and low (L) (0 RI 0.2).

3.7.Reliability and validity analysis

3.7.1. Reliability

In this study, reliability was improved by including closed-ended questions in the interview schedule, creating appropriate survey questionnaires, and thoroughly recording the actions involved in doing the research so that it may be replicated in the future. Furthermore, the research objectives were stated clearly and succinctly to ensure the research's credibility.

3.7.2. Validity

To triangulate the data, the researcher employed a variety of sources including literature, questionnaires, interviews, and document review. Senior energy efficiency and energy management professionals and consultants contributed advice and guidance to help validate the data collection methods, tools, and approach employed in this study. According to Cronbach (1975), cited in Biniam (2018), these types of results could not be extended in a scientific sense as it involved purposeful sampling. Instead, they

should be considered "working hypotheses, not conclusions" (Cronbach, 1975, p. 125). This means that the current study's findings and conclusions are limited to energy efficiency and energy management planning and scheduling implementation practices and changes in doing so.

3.8. Ethical Consideration

To the best of our ability, respondent ethical concerns have been addressed. When developing and implementing data gathering tools and methodologies, research ethics were considered to avoid any form of inconvenience or violation. The goal of the study was explicitly stated when mailing the questionnaire to all responders and during interviewees. The identity of responders was strictly kept secret.

CHAPTER FOUR
4. DATA ANALYSIS AND INTERPRETATION

The fourth chapter of this research article presents data analysis and interpretation of data collected for the study through questionnaires and interviews. The assessment results of existing project planning and scheduling practice in industrial energy efficiency and energy management projects, the level of support provided by the organization support structures to the project, and the levels of familiarity/knowledge with the use of various project planning and scheduling methods and tools were all presented in this chapter. In addition, the chapter summarizes the findings and discusses the identified challenges in planning and scheduling industrial energy efficiency and energy management projects in Ethiopia

The chapter is further divided into five sub-sections, with section 4.1 presenting the chapter's introduction, section 4.2 presenting demographic information about respondents' personal and professional characteristics, section 4.3 presenting the results and discussion of project planning process group, section 4.4 presenting the results and discussion of project scheduling tools familiarity and suitability, section 4.5 presenting the findings and analysis of organizational support processes. Finally, the chapter presents and discuss its findings on challenges of project planning practices in section 4.6.

4.1.Characteristics of respondents

For the purposes of this study, 48 questionnaires were distributed. Three responses were not responded to, and six responses were eliminated because they did not meet the study's criteria. Among the qualified questionnaires for the study, 7 respondents were in charge of managing energy efficiency and energy management projects with different level of project management education and training, 20 advisors/experts and 12 senior advisors/experts working on energy efficiency and energy management projects, and 7 were individual consultants and 4 were project managers and/or coordinators chosen for the interview.

The profile of the responders is summarized in Table 4.1. The bulk of responses were between the ages of 30-40 and 40-50, accounting for 48 percent and 39 percent of the overall population, respectively. The age groups 20-30 and >50 years each account for 7% of the total. The majority of respondents have 5-10 years of work experience in the

subject of energy efficiency and energy management project implementation, accounting for 52 percent of the total. Years 1 to 5 and years 10 to 15 had 26% and 20% of experience, respectively.

Table 4.1: Profile of respondents

Variables	Classification of variables	Frequency	Percentage
Age-year	20-30	3	7
	30-40	22	48
	40-50	18	39
	>50	3	7
Work experience-years (EE & EM specific)	1 to 5	12	26
	5 to 10	24	52
	10 to 15	10	20
	>15	1	2
Education	1st degree	11	24
	MSc	33	70
	PHD	2	6
	Others	0	0
Positions	Mangers	7	15
	Experts-Advisors	20	43
	Senior Experts	12	26
	Consultants	7	15

EE & EM= Energy efficiency and energy management

In terms of education, Table 4.1 shows that almost 70% of respondents have an MSc degree, followed by 24% who have a first degree, the two combined accounting for 94 percent of the total. Only 6% of the responders have a doctorate degree. Generally, this shows that there is a good educational preparation in terms of education. Respondents who work as project managers have received project management training in some form or another, ranging from short-term to advanced project management training.

Respondents who work as project managers account for 15% of all respondents. Experts/advisors and senior experts/advisors make up most of the group, accounting for 69 percent of the total. Individual consultants in the field of industrial energy efficiency and energy management projects made up the remaining 15% of respondents.

4.2.Practice of project planning process

The practice of energy efficiency and energy management projects implementer's perspectives was analyzed and explored in this study. Accordingly, this sub-section

presents the assessment results and discussion of levels of practices of the project planning process. Project managers know-how–includes processes for which a project manager is responsible directly or indirectly (Zwikael and Globerson, 2004). For this study purpose, these processes were derived from the PMBOK and were grouped according to its respective knowledge areas.

On a 5-point Likert scale, which was applied for this research purpose, the possible score goes from 1 to 5, with 3 being the hypothetical average score. The RII method uses the relative mean of all responses to determine the RII value. The relative importance index ranges from 0 to 1 and the values were converted into five essential levels: high (0.8 RI 1), high-medium (H–M) (0.6 RI 0.8), medium (0.4 RI 0.6), medium-low (M-L) (0.2 RI 0.4), and low (L) (0 RI 0.2).

There were 23 planning processes coded from AQ1 to AQ23 (Table 4.3a and Table 4.3b), and their application during the planning and implementation of energy efficiency and energy management projects was analyzed and discussed. Picture 4.3 shows that for the project management plan preparation process during project planning (QA1), 44 % disagree that this is a practice that exists during the planning and scheduling exercise for energy efficiency projects, while about 36 percent responded neutrally. In terms of project scope management knowledge areas, 56 % demonstrated that project scope management plan preparation (QA2) was implemented during energy efficiency planning, stakeholder need determination (QA3) agreed 38 percent and 54 percent were neutral, detailed description of project product and service developed (QA4) agreed by 64 percent, and work break down structure agreed by 64 percent.

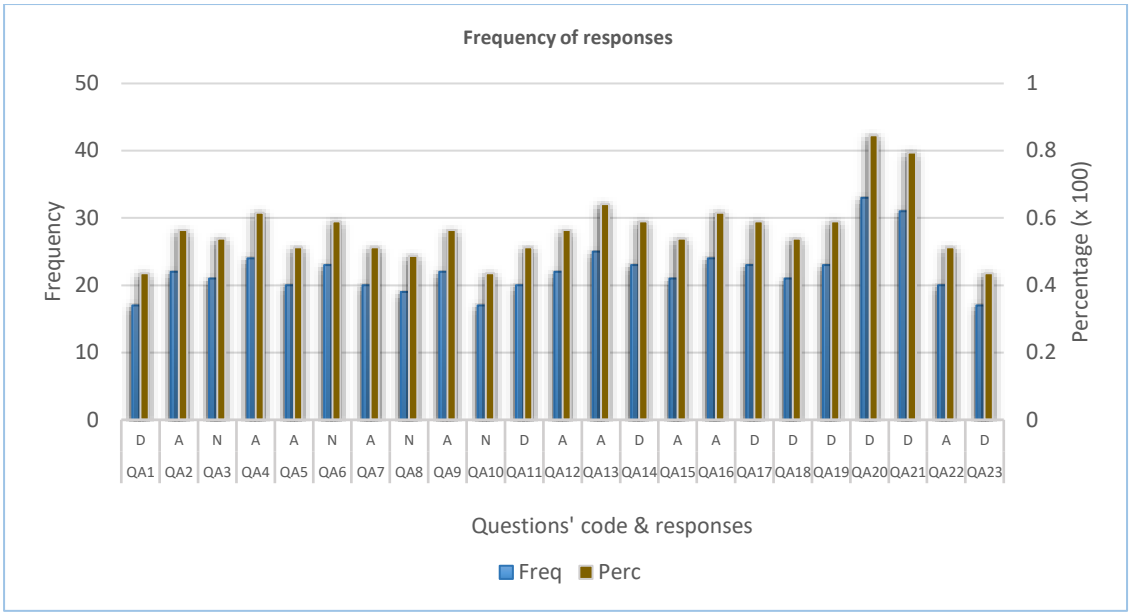


Figure 4.1: Frequency of responses planning processes

As shown in Figure 4.3, 59 percent of respondents remained neutral on developing a project schedule management plan (QA6), while 28 percent agreed that it was implemented during the planning of energy efficiency projects. Almost half of the respondents, 51%, said the project specific activities/actions (QA7) process was implemented, while 49% said they were neutral about the preparation of the relationship between activities (QA8). Implementation of estimating the amount of time each activity will take (QA9) was agreed upon by 56 percent of respondents, while project schedule preparation (QA10) was agreed upon by 31 percent, with 44 percent remaining neutral.

Table 4.2a: RII value and ranking: project planning process group (QA1 -QA13)

Knowledge areas	**Code**	**Planning processes (in described form)**	**Frequency of responses**					**N**	**∑w**	**RII**	**Rank**
			1	**2**	**3**	**4**	**5**				
Integration mgmt.	QA1	Project Management plan developed	0	17	14	5	3	39	111	0.57	15
Project scope mgmt.	QA2	Project scope management plan developed	0	0	13	22	4	39	147	0.75	4
	QA3	Stakeholders need and requirements determined & documented	0	0	21	15	3	39	138	0.70	11
	QA4	Detail description of project product, service or result boundaries, acceptance criteria developed	0	1	12	24	2	39	144	0.73	7
	QA5	Work Break Down is developed	0	2	12	20	5	39	145	0.74	5
Schedule mgmt.	QA6	Project schedule management plan developed	0	3	23	11	2	39	129	0.66	12
	QA7	Project specific activities/actions to be performed are defined & documented	0	2	10	20	7	39	149	0.76	3
	QA8	Relationship among project specific actions/activities are identified and documented	1	11	19	7	1	39	113	0.58	14

	QA9	The amount of time each activity will take to complete is estimated	0	1	8	22	8	39	154	0.79	1
	QA10	Project schedule is developed by analyzing activity sequence, duration, resource requirements, constraints	0	7	17	12	3	39	128	0.66	13
Cost mgmt.	QA11	Project cost management plan developed (how cost estimated, budgeted, managed, monitored, controlled)	0	20	8	8	3	39	111	0.57	15
	QA12	Project cost estimation is developed through approximation of the monatory resources needed to complete the project work	0	2	13	22	2	39	141	0.72	8
	QA13	Project budget is determined by aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline	0	2	5	25	7	39	154	0.79	1

For cost management knowledge areas, respondents agreed with 51 %, 56%, and 64% on project cost management plan (QA11), project cost estimation (QA12), and project budget determination (QA13). This demonstrates that processes such as preparing project cost management plans that show how costs were estimated, budgeted, managed, monitored, and controlled were implemented well during the planning phases of industrial energy efficiency projects. These are very important process that ensures project cost estimations preparation through approximating the monatory resources required to complete project work, and project budgets determination by aggregating estimated costs of individual activities.

Similarly, 59 percent of respondents disagreed that the Project quality plan process (QA14) is not implemented during the planning phase of energy efficiency projects. Project resource management plan preparation (QA15) and project resource estimation (QA16) were agreed upon by 54% and 64% of respondents, respectively. This demonstrates that fair practices were followed when implementing these planning processes during the energy efficiency project planning. These are critical processes that ensure team resources, as well as the types and quantities of materials, equipment, and supplies required to complete project work, are prepared and procedures for estimating them are defined.

Table 4.2b: RII value and ranking: project planning process group (QA14 -QA23)

Knowledge areas	Code	Planning processes (described form)	Frequency of responses					N	∑w	RII	Rank
			1	2	3	4	5				
Quality mgmt.	QA14	Project quality management plan is developed by identifying quality requirements and/or standards for the project and its deliverables	6	23	8	1	1	39	85	0.44	19
Resource mgmt.	QA15	Project resource management plan developed showing how to estimate, acquire, manage, and utilize physical and team resources	0	1	13	21	4	39	145	0.74	5
	QA16	Project team resources and the type and quantities of materials, equipment, and supplies necessary to perform project work is estimated	0	4	10	24	1	39	139	0.71	10
Communication mgmt.	QA17	Project communication plan is developed to engage stakeholders effectively and efficiently by presenting relevant information in a timely manner	0	23	9	4	3	39	104	0.53	17
Risk mgmt.	QA18	Project risk management plan is developed by defining how to conduct risk management activities for a project	11	21	5	1	1	39	77	0.39	22
	QA19	Individual project risks as well as sources of overall project risk are identified and documented	10	23	4	1	1	39	77	0.39	22
	QA20	Qualitative and quantitative risk analysis is conducted by prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact etc.	1	33	3	1	1	39	85	0.44	19
	QA21	Project risk response is prepared by developing options, selecting strategies, and agreeing on actions to address overall project risk exposure as well as to treat individual project risks.	0	31	6	1	1	39	89	0.46	18
Procurement mgmt.	QA22	Project procurement plan developed by documenting project procurement decisions, specifying the approach, and identifying potential sellers	0	2	14	20	3	39	141	0.72	8
Stakeholders mgmt.	QA23	Stakeholders' engagement is planned by developing approaches to involve project stakeholders based on their needs, expectations, interests, and potential impact on the project	10	17	9	2	1	39	84	0.43	21

Implementation of a project communication plan preparation (QA17) was disagreed by 59 % of the respondents. Project managers typically rate this process as very low. According to Zwikael and Globerson (2004), while communication is recognized as an essential and critical knowledge area, there is little formal project knowledge and tools to support its planning processes. Likewise, as shown in Figure 4.3 above, the planning process from risk management knowledge is not significantly employed in industrial energy efficiency project planning; correspondingly, 54 percent disagreed, and 28 percent strongly disagreed that project risk management plan (QA18) is implemented during energy efficiency project planning. Respondents disagreed with 59 percent, 85 percent, and 79 percent for individual project risk identification (QA19), qualitative and

quantitative risk analysis (QA20), and project risk response preparation (QA21), respectively. Risk-related processes were demonstrated with a low level of implementation during the planning of energy efficiency projects, which requires further attention.

The procurement management plan (QA22) is agreed upon by 51% of respondents, while the stakeholders' engagement plan (QA23) is strongly disagreed upon by 21% and disagreed upon by 44%. Again, this demonstrates the need for improvement in their implementation.

As shown in Tables 4.3a and 4.3b, the Relative Importance Index of each planning process was calculated and ranked in order to assess the important planning processes that are currently being implemented. According to Akadiri (2011) classification, the RII values fell into three categories: high-to-medium (H–M) (0.6 RI 0.8), medium (0.4 RI 0.6), and medium-low (M-L) (0.2 RI 0.4).

As a result, 12 panning processes were classified as high-to-medium level. Specifically, project budget determination-QA13 (RRI=0.79, rank=1), estimation of the amount of time each activity will take-QA9 (RRI=0.79, rank=1), project specific activities/actions-QA7 (RRI=0.76, rank=3), project scope management plan preparation-QA2 (RII=0.75, rank=4), work break down structure-QA5 (RII=0.74, rank= 5), project resource management plan-QA15 (RII 0.74, rank 5), project resource management plan -QA15(RII 0.74, rank 5), detail description of project product and service-QA4 (RII =0.73, rank 7), procurement management plan-QA22 (RII=0.72, rank 8), project cost estimation-QA12 (RII=0.72, rank 8), project resource estimation-QA16 (RII=0.71, rank=10), stakeholder need determination-QA3 (RII=0.70, rank=11) and project schedule management plan-QA6 (RII=0.66, rank 12).These were processes that were implemented at varying levels ranging from medium to high during the planning of energy efficiency projects.

On the other hand, processes that demonstrated in the range of medium level important included: project schedule preparation-QA10 (RII=0.66, rank =13), relationship between activities-QA8 (RII=0.58, rank=14), project management plan-QA1 (R=0.57, rank 15), project cost management plan-QA11 (R=0.57, rank=15), project communication plan-QA17 (R=0.53, rank=17), project risk response-QA21 (R=0.46, rank=18), qualitative and quantitative risk analysis-QA20 (R=0.44, rank=19), project

quality plan-QA14 (R=0.44, rank 19). These were identified as areas for improvement in the planning processes' implementation.

Similarly, project risk management plan-QA18 (RII=0.39, rank=22) and individual project risk-QA19 (RII=0.39, rank=22) were categorized as medium to low importance, indicating that very little consideration was given during the planning exercise of energy efficiency and energy management projects.

These findings are in line with Tesfaye (2018) whose finding revealed that the majority of Ethiopian projects failed to apply planning knowledge areas effectively, with only 20.35 percent implementing risk planning, 33.6 percent implementing quality planning, 44.2 percent implementing communication planning, 46.5 percent implementing integration planning, and 48.85 percent implementing scope planning.

4.3.Project scheduling methods and tools: familiarity and suitability

This section contains the assessment results as well as a discussion of the levels of familiarity/knowledge and suitability with various project planning and scheduling methods and tools. There were 9 prepared statements that to ask respondents about their familiarity, knowledge, and suitability of the planning and scheduling methods and tools (table 4.3). The statements were adapted from the study conducted by (Hammad and Radhlinah, 2015.

Gantt charts (BQ1.1), Critical Path Method (CPM) (BQ1.2), and Program Evaluation and Review Technique (PERT) were prepared to demonstrate familiarity and knowledge (BQ1.3). Ethiopian industries have little experience with energy efficiency project implementation (GMSE ,2019). In light of this, only common and traditional scheduling and planning tools are being considered for this research. As shown in Figure 4.3, 24 respondents (62 percent) agreed to statements for BQ1.1, while 32 disagreed (82 percent) and 31 strongly disagreed (79 percent) for familiarity with the tools BQ1.2 and BQ1.3. According to the researcher, the reason for this could be a lack of awareness about the tools or exposure to using them.

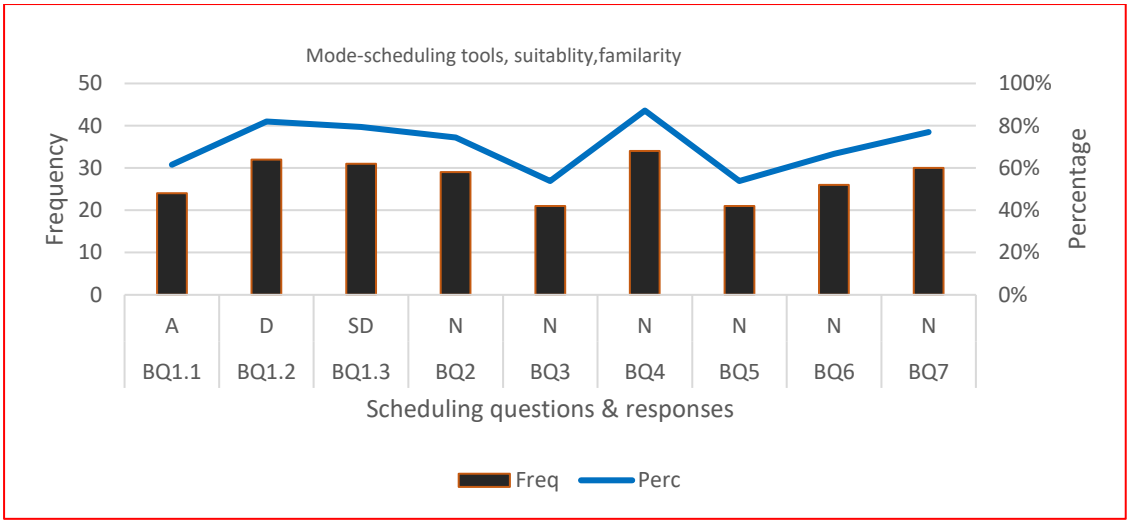


Figure 4.2: Mode and frequency of scheduling methods

The following statements were prepared to ask respondents to assess the suitability and related satisfaction of the planning and scheduling methods and tools in use: suitability and satisfactory level of existing method (BQ2), whether the procedures are easy to follow while scheduling (BQ3), full understanding exists about the current methods (BQ4), sufficiency of the existing method to meet the scheduling needs (BQ5), skilled team uses the existing methods/tools (BQ6), continue to use in future (BQ7). From BQ2 to BQ7, the respondents were neutral for all statements for which they were asked to answer questions. This demonstrates that respondents took a neutral stance on the suitability and satisfactory level of existing scheduling and future use of the tools. Respondents also found it difficult to follow procedures when scheduling their projects. Respondents also preferred to take a neutral stance in responding to the existence of fully comprehended existing planning and scheduling tools, their sufficiency in meeting the scheduling needs of energy efficiency projects, the availability of skilled team that uses the methods, and future application of existing method/tools.

This demonstrates the importance of diversifying scheduling tools in the implementation of industrial energy efficiency and energy management projects, as well as the importance of working harder to bring practitioners' knowledge to a standard level and equipping them with planning and scheduling tools and methods that meet the scheduling needs of industrial energy efficiency and energy management projects. The study's findings revealed that significant improvements in planning and scheduling methods and tools, as well as skill development, are required.

According to Table 4.3 below, respondents prefer BQ1.1, which is ranked first in terms of familiarity and knowledge of using various planning and scheduling methods and tools (RII 0.74). This could be due to the scheduling tool's relative ease of use and simplicity. Similarly, BQ1.2 and BQ1.3 are ranked very low, with RIIs of 0.38 and 0.25, respectively, out of a total of 9 statements.

Table 4.3: RII value and ranking: familiarity and suitability with project management scheduling methods

Frequency of response	BQ1.1 Gantt charts	BQ1.2 Critical Path Method (CPM)	BQ1.3 Program Evaluation and Review Technique (PERT)	BQ2. The existing method is suitable and satisfactory	BQ3. The existing method has easy to follow procedures during scheduling exercise	BQ4. Full adaptation and understanding of existing methods exist in the organization	BQ5. The existing planning methods is sufficient in meeting scheduling needs of energy projects	BQ6. In your organization/ team skilled team used to implement existing methods	BQ7. In your organization/team the existing methods are considered suitable for continued use in the future.
Strongly disagree	0	5	31	2	0	0	0	0	0
Disagree	2	32	5	8	5	5	15	10	6
Neutral	9	2	3	29	21	34	21	26	30
Agree	24	0	0	0	11	0	2	2	3
Strongly agree	4	0	0	0	2	0	1	1	0
N	39	39	39	39	39	39	39	39	39
∑w	173	90	58	126	127	129	137	142	148
RII	0.74	0.38	0.25	0.54	0.65	0.55	0.58	0.6	0.63
Rank	1	8	9	7	2	6	5	4	3

Table 4.3 shows that most of statements were fall in the range of medium RII values. Accordingly, BQ2 was ranked 7 (RII 0.54) And BQ3 was ranked 3 (RII 0.65). BQ7 and BQ6 was ranked third (RII=0.63) and fourth (RII=0.6), respectively. A lower RII value indicates that knowledge of the tool's operations must be improved and demonstrates the requirement for a skilled team, and the method is not recommended for future use.

Similarly, BQ5 and BQ4 were ranked 6 (RII=0.55) and 5 (RII=0.58), respectively. This demonstrates that current methods are inadequate and that a thorough understanding of various scheduling methods and tools is required. This could be due to a scarcity of specialized schedulers or a lack of understanding of the underlying theories of scheduling concepts and various types of scheduling tools.

4.4.Organizational support processes

Organizational Support Processes, according to Zwikael and Globerson (2004), generate the means that the organization places at the disposal of the project manager to support proper project planning, execution, and completion. In this study, the above-mentioned authors' organizational support process (developed by assessing different

project management maturity models and using the Project Management Body of Knowledge) was adapted and used to assess their level of implementation during the planning of industrial energy efficiency and energy management projects.

According to PMBOv6, there are four organizational supporting knowledge areas. Organizational Systems, Organizational Cultures and Styles, Organizational Structure, and Project Office are the four components. The four PMBOK-presented processes were added to the 13 organizational support processes, for a total of 17 organizational support processes (Zwikael and Globerson, 2004). The two processes were combined for this research, and a list of 16 organizational support processes was adopted and developed.

Accordingly, for *organizational systems* supporting knowledge areas QC1.1 and QC1.2, for *organizational culture and styles* supporting knowledge areas QC2.1, QC2.1, QC2.3 and QC2.4 were identified and codded. Similarly for *organizational structure* supporting knowledge areas QC3.1, QC3.2, QC3.3, QC3.4, QC3.5, and QC3.6; for *project office* supporting knowledge areas QC4.1 QC4.2, QC4.3 and QC4.4 were identified and coded (Table 4.5a and Table 4.5b)

Figure 4.3 shows that for project-based organizational arrangements-QC1.1 (64 percent strongly disagreed) and project management procedures-QC1.2 (56 percent disagreed). Similarly, respondents were chosen to be neutral 44 percent of the time and agreed 30 percent of the time when it came to the project manager's engagement during the start-up phase (QC2.2). This appears to be fair support for this support process. In terms of communication between project managers and the organization throughout project planning phases (QC2.3), 44 percent of respondents were undecided, whereas about 15% agreed that the culture exists. While a large proportion of respondents disagreed that organizational level project success measurement- (QC2.4) culture exists at the organizational level.

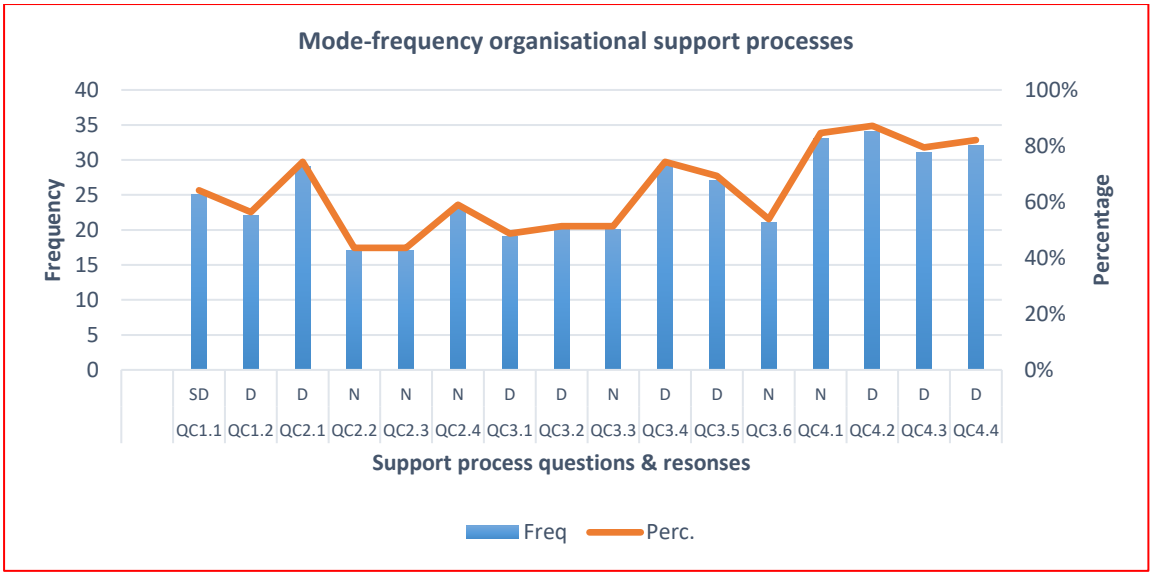


Figure 4.3: Frequency of responses organizational support processes

Respondents disagreed (49 percent) and (neutral 41) that supportive project organizational structure (QC3.1) exists in the knowledge domains of supportive organization structure (Picture 4.3). When it came to the existence of interactive inter-departmental project planning groups (QC3.2), 51 percent of respondents disagreed, while 38 percent were nuetral. In addition, it is acceptable to claim that the support structure for organizational projects resource planning (QC3.3) is lacking, with 51 percent of respondents being neutral and 33 percent disagreed. A large percentage of respondents disagreed that organizational level projects risk management (QC3.4) and organizational level projects quality management (QC3.5) were available in their organizations, with 74 percent and 69 percent disagreeing, respectively.

On the question of whether their firm has ongoing project management training programs (QC3.6), 54 percent of respondents were undecided. This analysis reveals that almost all of the supporting processes under the organizational structure knowledge areas were rated neutral or disagreed, indicating that such supports not exist sufficiently in the respondent's organization. As a result, it is recommended that these support areas be prioritized for improvement.

Table 4.4a: RII value and ranking: Organizational support processes (Organizational systems, culture, and styles)

Supporting areas	Code	Support Processes	Response Frequency					N	∑w	RII	Rank
			1	2	3	4	5				
Organizational system	QC1.1	Project Based Organization arrangement exists	25	3	7	3	1	39	69	0.35	16
	QC1.2	Project management procedures exist in the organization	11	22	5	1	0	39	74	0.38	15
Organizational Cultures and styles	QC2.1	Appropriate Project Manager Assignment culture exist in the organization	0	29	10	0	0	39	88	0.45	9
	QC2.2	The Project Manager involves during project initiation Stage	0	10	17	12	0	39	119	0.61	1
	QC2.3	Communication Between the Project Manager and the Organization During the Planning Phase exist	13	2	17	6	1	39	97	0.5	5
	QC2.4	Organizational level project success Measurement exist	6	10	23	0	0	39	95	0.49	6

For Project office support areas, involvement of project office in the planning and scheduling (QC4.1) 85 % of the respondent were neutral. While 87%, 79% and 82% of respondents disagreed that they use standard project management software (e.g.: Ms-Project) in project planning and scheduling (QC4.2), implemented project accumulated knowledge and best practice during planning and scheduling (QC4.3) and implement new project tools and techniques during planning and scheduling (QC4.4), respectively.

This is consistent with the findings of part 4.3's assessment of the familiarity and suitability of scheduling tools and methodologies used during project planning and scheduling of energy efficiency and energy management projects. It should be noted that organizational support mechanisms should be effectively created to ensure that energy efficiency and energy management project planning and scheduling processes receive the essential support.

Table 4.4b: RII value and ranking: Organizational support processes (organizational structures and project office)

Supporting areas	Code	Support Processes (in described form)	Response Frequency					N	∑ w	RII	Rank
			1	2	3	4	5				
Organizational Structure	QC3.1	Supportive Project Organizational Structure exist	1	19	16	3	0	39	99	0.51	3
	QC3.2	Interactive Inter-departmental project planning groups exists in the organization	1	20	15	3	0	39	98	0.5	4
	QC3.3	Organizational Projects Resource Planning	13	6	20	0	0	39	85	0.44	11
	QC3.4	Organizational level Projects Risk Management exist	4	29	5	1	0	39	81	0.42	13
	QC3.5	Organizational level Projects Quality Management exist	3	27	5	3	1	39	89	0.46	8
	QC3.6	On-Going Project Management Training Programs exist	9	7	21	2	0	39	94	0.48	7
Project Office	QC4.1	The Project Office Involves in the planning and scheduling	0	3	33	3	0	39	117	0.6	2
	QC4.2	Standard Project Management Software (e.g.: Ms-Project) is used in project planning and scheduling	0	34	4	1	0	39	84	0.43	12
	QC4.3	Project accumulated knowledge and best practice used in planning and scheduling	1	31	5	2	0	39	86	0.44	10
	QC4.4	New Project Tools and Techniques used during planning and scheduling	3	32	3	1	0	39	80	0.41	14

As Table 4.4a and Table 4.4b above shows, the relative importance of all the organizational support processes was analyzed and ranked also to check which process were currently being practiced during planning and scheduling of energy efficiency projects. These methods gave us an idea of which process need further attention and development to effectively support the planning and scheduling of energy efficiency projects. Project manager's involvement during project initiation (QC2.2) is ranked 1st with RII value of 0.61 and project office in the planning and scheduling (QC4.1) is ranked 2nd with RII value 0.6. All the other support process reviled that very small variation ranging from RII 0.35 to RII 0.51. This small variation (medium to low) RII value depicts that all the support processes need to be developed and designed in the organizations so that project planning and scheduling practice is supported appropriately.

4.5.Project planning practice, challenges, and improvement areas

The findings of identified planning and scheduling challenges, improvement opportunities, and capacity building needs were summarized in this section. This sub-chapter presents merged results of responses gathered through open ended questionnaire and interview.

4.5.1. Process of project planning and scheduling performed

Project planning methods and techniques were implemented in two ways: (1) planning carried out only by the organization's project staff, and (2) project planning carried out with the help of external consultants. Some responders who design projects with the help of the organization's project management team do so without taking into account the project management body of knowledge and best practices. As a result, scientifically sound project planning and scheduling methods are overlooked. Significant responses have also been received where the project planning process involves top-level managers, mid-level managers, and relevant governmental stakeholders working together to establish a common understanding of project parameters, scope, deliverables, and beneficiaries, followed by a team of experts and lower-level directors defining and developing work-break down structure. According to some of the respondents in this survey, throughout the planning phases of energy efficiency and energy management projects, specialists and managers with experience and exposure in project planning and scheduling will be established, and roles will be assigned accordingly. Project management best practices and scheduling tools such as the Gantt chart will be used during the planning process.

The project team or small planning task force prepares the first draft planning document, which is then followed by collecting relevant comments and inputs from various project staff members in the organization with varying experience and backgrounds related to energy projects. Following that, the project manager and team proceed to build and finalize the planning document, taking into account the feedback gained during the first phase of the process. A project plan is created using an internal project management planning guide, which may include the use of project management tools such as a Gantt chart or an excel spreadsheet, with a special focus on time and resource planning.

4.5.2. Major planning challenges

Interviews and questionnaires were used to gather project management practitioners' perspectives on the challenges of project planning. The following is an analysis summary of the many responses:

Awareness problem *on the benefit of planning industrial energy efficiency projects*

One of the major roadblocks to industrial energy efficiency projects is a lack of knowledge within manufacturing firms and among policymakers about the scope for energy efficiency that is available, as well as the technical solutions to achieve such savings. Policymakers' expertise of energy efficiency is typically lacking. This makes it difficult for government agencies to comprehend the benefits of energy efficiency, much less formulate appropriate policy responses. The absence of energy management skills at both the government and industrial facility levels is one of the difficulties in the industrial energy efficiency industry. Furthermore, one of the major impediments to implementing industrial energy efficiency is a lack of data. To create good energy efficiency strategies excellent data and information essential.

Sometimes, industrial energy efficiency projects are planned as regular activities rather that involving project management specialists who have sufficient knowledge and experience in project planning. Lack of commitment to implement the recommendations suggested projects from the energy audits findings overall organizational support process for the project due to a lack of understanding among industrial management staff and specialists of the benefits of energy management systems and implementations.

Lack of Knowledge in project planning

Insufficient stakeholder consultation, poor identification of all tasks to be completed given the project scope, technological constraints, and vague project specific activities that are not broken down into small manageable tasks are some of the specific project planning problems observed during energy efficiency and energy management project planning. There have been reports of insufficient resource assignment to project tasks, a lack of project quality management and risk planning, a very poor project procurement plan, a poor communication plan, a lack of project scheduling and resource leveling tools such as CPM and PERT, and a poor overall organization support process.

Obtaining consulting services to support industrial energy efficiency projects has also been discovered to be a barrier from the perspective of outside assistance. Less experienced specialists or consultants in the local market, and in the organization specifically, are the largest impediments to having great project planning. Also, a key problem of project planning has been described as a lack of effective synergy and collaboration among departments/projects within the organization as well as with other stakeholders.

Lack of organizational readiness and focus for planned energy management efforts was recognized as a major factor by some responders. Furthermore, the absence of essential information and data for project planning and execution in industries, as well as the lack of energy specialists (people), are areas of difficulty when developing energy efficiency projects. The ability to correctly identify financial sources during planning is often mentioned as a problem. Identifying project risks is one of the most difficult tasks. There was also a lack of capacity in recognizing hazards, conducting risk analyses, and developing suitable risk response strategies.

Lack of compressive national programmes and legal frameworks on energy efficiency and energy management projects

Despite the government's efforts to produce demonstrative projects, one of the primary barriers to project implementation is the lack of comprehensive national programs and legal frameworks on energy efficiency and energy management projects to compel the private sector (Manufacturing Industry sector) to execute energy efficiency and energy management projects. Industries are frequently cautious to invest resources in scaling up and expanding similar efforts in other plants. These are mostly responses from government ministries that plan energy efficiency projects as well as provide budget allocation and project implementation advice to industry. Industrial energy efficiency projects, unlike other types of projects, require strong governmental frameworks that allow and enforce manufacturing industries to initiate and implement projects.

4.5.3. Major improvement areas

Respondents to this survey reported a variety of project planning improvements, including the creation of dedicated project offices and the use of project management planning methods and guidelines, such as the project management body of knowledge. The most important are mentioned in the following bullet:

Dedicated project malmanagement office: to provide direction and criteria for project execution, as well as to provide direction in the form of project templates, established processes, education, and methodology recommendations, and to develop quantifiable goals that align with the overall vision of the organization.

Using advanced project planning tools: advanced project planning technologies, such as Microsoft Office, can be used to create high-quality plans. • Energy management and efficiency activities should be included in the regulatory institution's and industry's yearly plans, and funding should be made available for project follow-up and monitoring to strengthen the institution's follow-up and monitoring actions.

Using conventional project management planning guidance for project planning and scheduling, such as the project management body of knowledge

Giving emphasis in project risk identification and stakeholders communication. Those are the areas where less focus is given by project planning practitioners

- For industrial energy efficiency projects, choose a skilled project manager. Professional project managers are rarely assigned to industrial energy efficiency projects, which has a negative impact on project quality.
- Top management should devote more time and attention to the project office: Create a proper organizational support structure and implement it.
- The project description should clearly define the project's objectives, scope, key deliverables, timetable, and length. The objectives, priorities, parameters, and project results should all be stated in a clear and understood manner in the project plan and timeline.
- In a communication strategy and plan, the overarching goal and major stakeholder group should be identified. The project's methodology, supporting tools, procedures, and processes should all be clearly specified.
- Organizations should cultivate a culture that strikes a balance between project planning and the ability to respond to unforeseen problems. Organizational project management professionals should develop risk identification and analysis as a core ability.
- Advanced project management training and capacity building programs in general, as well as industrial energy efficiency project planning, should be

created and delivered in a long-term way, including worldwide Project management professional (PMP) training programs

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATION

In this research article, the researcher's objective is to assess the practice and challenges of industrial energy efficiency and energy management project planning. The planning practices and challenges of these few organizations engaged in industrial energy efficiency and energy management projects were investigated. Individual consultants/expertise were included in the study's population because the researcher believed they possessed the necessary experience and knowledge in the field of this study to contribute to the achievement of the study's objectives. This chapter summarizes the primary findings of the study, as well as the conclusions reached, and recommendations made.

5.1.Summary of findings

According to the findings of the study, project planning processes, project scheduling tools, and organizational support processes were all implemented at varied levels of importance during the planning and scheduling of industrial energy efficiency and energy management projects. The summaries were created in this section and organized in a way that demonstrates alignments with the study's objectives.

5.1.1. Planning process

- Approximately 44 percent of respondents agreed that the project management plan preparation process was implemented during project planning, while approximately 36 percent were neutral.
- For the implementation of processes in the project scope management knowledge areas, the assessment result showed that 56 % disagreed for the scope management plan preparation process, 38 % agreed & 54 % were neutral for stakeholder need determination, 64 % agreed for detail description of project product and services, and 51 % agreed for WBS.
- For planning processes in the schedule management knowledge areas, 59 % were neutral, and 28 % agreed for developing a project schedule management plan, 51 % agreed for project specific activities/actions, 49 % were neutral for preparing relationships between activities, 56 percent agreed for estimating the amount of

time for each activity, and 31 % agreed, and 44 % were neutral for project schedule preparation.

- Process implementation in the project cost management knowledge areas, project cost management plan, project cost estimation, and project budget determination were agreed upon by 51%, 56%, and 64% of respondents, respectively.
- Implementation of the planning process such as project resource management plan preparation and project resource estimation were agreed upon by 54 % and 64 %, respectively, whereas project quality plan preparation was disagreed upon by 59 %.
- Similarly, individual project risk identification (59% disagreed), qualitative and quantitative risk analysis (85% disagreed), project risk response preparation (79% disagreed), procurement management plan (51 % agreed), stakeholders engagement plan (21 % disagreed & 44 % disagreed)
- The relative importance index (RII) score indicates that 12 panning processes are of high-to-medium importance (H–M: 0.6 RI 0.8).
- According to the findings, project communication plan, project risk response, qualitative and quantitative risk analysis, and project quality plan were all in the range of medium to low importance (M: 0.4 RI 0.6), while project risk management plan and individual project risk were both found in the range of medium to low importance (M: 0.2 RI 0.4).

5.1.2. Suitability and familiarity with different scheduling tools

- Gantt chart methods were agreed upon by 62 percent, while CPM and PERT methods were agreed upon by 82 percent and 79 percent, respectively.
- As a result, respondents took a neutral stance on the suitability and satisfactory level of existing scheduling and planning tools in use. They also did not find it simple to schedule their projects.
- Respondents also preferred to take a neutral stance in responding to the existence of fully comprehending existing planning and scheduling tools, their sufficiency to meet the scheduling needs of energy efficiency projects, and the availability of skilled team that uses the methods, as well as future application of existing method/tools.

5.1.3. Organizational support processes

- Availability of organizational support processes during project planning: project based organizational arrangement (64 strongly disagreed), project management

procedures (56% disagreed), project manager involvement during project initiation (neutral 44% & agreed 30%). communication between project managers and the organization (44% neutral & 15% agreed), project success measurement (59% neutral).

- Similarly, presence of supportive project organizational structure (49 disagree), presence of interactive inter-departmental project planning groups (51% disagree & 38 % neutral), presence of support in organizational projects resource planning (51 % neutral & 33% disagree), presence of organizational level projects risk management (74 disagree), presence of organizational level projects quality management (69 % disagree),presence of on-going project management training programs (54 neutral), involvement of project office (85 % neutral), use of standard project management software, e.g.: Ms-Project (87% disagreed), use of project accumulated knowledge and best practice (79% disagreed), application of new project tools and techniques (82% disagreed), presence of project office (85 % neutral).
- The RII value depicted only project manager's involvement during project initiation and presence of project office among the organizational support process fall in the range of medium RII value. All the other support process reviled that very small variation ranging from RII 0.35 to RII 0.51, medium values.

5.1.4. Major planning challenges

- Project planning was shown to be implemented in many businesses in two fundamental types. Specifically, solely by the project management team of the organization, with the support of external consultants. In the first example, there is a great deal of engagement and collaboration within the project team. Project management best practices and scheduling tools such as the Gantt chart were employed during the planning process.
- A fundamental difficulty in industrial energy efficiency and energy management projects is a lack of suitable competencies and skills for finding, assessing, creating, and executing energy efficiency measures and projects.
- The absence of a legal framework requiring the private sector (manufacturing industry) to identify, plan, and implement energy efficiency and energy management projects. This has been identified as a unique finding to the industrial energy management projects.

- Among the significant issues highlighted were a lack of awareness of the benefits of planning industrial energy efficiency projects, as well as a lack of understanding in specific project planning knowledge areas such as risk management, communication management, and schedule management.
- A major challenge identified was the lack of dedicated project management offices that ensure organizational support processes are delivered during project planning, as well as the lack of advanced training and capacity building programs on project management tailored to energy efficiency projects specifically.

5.2.Conclusion

The following conclusion were made based on the findings of the study.

During the planning and scheduling of industrial energy efficiency and energy management projects, project planning processes, project scheduling tools, and organizational support processes were all implemented at various levels. Twelve planning process was found to have a relative importance value ranging from high to medium out of the 23 processes evaluated. The remaining planning processes were found to have a medium to low relative relevance rating, indicating that they are areas of concern that require improvement to have all planning processes implemented and related products delivered.

The project planning processes typical of project manager know-how areas were implemented at a medium to high level. Planning processes such as preparing a project cost management plan, project cost estimations development through approximation of the monatory resources needed to complete project work, and project budget determination through aggregating the estimated costs of individual activities or work packages to establish a cost baseline were particularly relatively well practiced.

Given the sectors low level of development in planning industrial energy efficiency and energy management projects, key planning processes that ensure the availability of team resources, the type and quantities of materials, equipment, and supplies necessary to perform project work were practiced relatively well. Whereas, during the planning of energy efficiency projects, all risk management planning processes were exhibited with a very low degree of implementation, indicating an area for improvement. Similarly, during the planning of industrial energy projects, planning processes related to communication plan creation have shown a relatively low degree of implementation.

This could be due to project planners' lack of expertise and familiarity with various planning tools.

Gantt charts, a traditional project scheduling method, worked successfully during the scheduling of industrial energy efficiency and energy management projects. Other methods, like as CPM and PERT, were rarely used, possibly due to a lack of understanding, awareness of the tools, and/or experience with them. There is a need to diversify scheduling and planning tools in the implementation of industrial energy efficiency projects, as well as the importance of working better to achieve practitioners' knowledge up to standard and equip them with planning and scheduling tools and methods that meet the industrial energy efficiency projects' scheduling needs.

The availability of organizational support mechanisms during project planning was found to be extremely low, indicating an area that needs to be addressed. It should be noted that organizational support processes should be effectively created to ensure that energy efficiency and energy management project planning and scheduling processes receive the essential support. All but the project office process received a very low relative importance value in the organizational support process groups, with little variation among them, indicating that all support processes in organizations need to be developed and designed so that project planning and scheduling practice is appropriately supported.

A project plan is prepared for some organizations by internal personnel and for others by employing external experts, according to the study. It also revealed that, despite the government's efforts to produce demonstrative projects, one of the primary barriers to project implementation is the lack of enforcing mechanisms or legal frameworks to compel the private sector (manufacturing industry sector) to execute overall planning and implementation of energy efficiency and energy management projects. Issues related to enforcing mechanisms and legal frameworks are a unique finding to the industrial energy management sectors. That, again, requires strategic intervention.

One of the issues in the industrial energy efficiency industry is a lack of knowledge and awareness of the benefits of developing industrial energy efficiency projects. The lack of information and understanding about the scope for energy efficiency that is available, as well as the technical solutions to achieve such savings, among manufacturing enterprises and policymakers, is viewed as a difficulty in the industry. It is also found

out that during the planning and implementation of industrial energy efficiency and energy management projects, the inadequacy of a continuous project management skill development arrangement as well as a dedicated project management office has an impact on the utilization of project management science.

5.3.Recommendations

The research would like to forward the following major recommendations based on the study's findings as well as the conclusions.

1. In industrial energy efficiency and energy management projects, implementation of project planning procedures such as risk management knowledge areas, project stakeholders' management knowledge areas, and project communication knowledge areas should be supported and improved. Similarly, to satisfy the scheduling needs of industrial energy saving initiatives, scheduling methods should be diversified through practitioner skill training.
2. Organizational support processes are important activities that help to guarantee that project management processes are carried out effectively. As a result, organizations should create a support structure to aid in the planning and implementation of industrial energy efficiency and energy management projects. These support processes are not wildly exercised in other sectors' project implementation too. Hence, this recommendation could also be applicable in all project planning and scheduling practices management
3. A dedicated project management office provides direction and criteria for project execution, as well as providing direction in the form of project templates, established processes, education, and methodology recommendations, and the creation of quantifiable goals that relate to the overall vision of the organization. As a result, organizations implementing industrial energy efficiency and energy management projects should establish a culture of functional project offices. This culture of establishing a project management office mostly exist in other sector where projects are implemented such as construction projects. As the industrial energy management projects are an emerging sector, it should be strengthened and supported.
4. Design a comprehensive national energy management program is critical for improving industrial energy efficiency and energy management project planning

and implementation. This could be aided by enforcing mechanisms and legal frameworks to compel the manufacturing sector. The program would also include customized manuals or guidelines that consider the unique characteristics of energy efficiency and energy management projects to help with project identification and analysis, monitoring energy efficiency projects, operational verification of energy efficiency projects, and so on. The program can include a dedicated awareness-raising sub-program on the general benefits of planning industrial energy efficiency projects, the scope of energy efficiency potential, and feasibility analysis to develop energy efficiency competence throughout the organization. This is a recommendation unique to the industrial energy management projects based on the findings of this study as the sector requires tailored approach as discussed above.

5. There is a need for advanced project management training and capacity building programs in general, and in particular for planning industrial energy efficiency and energy management projects. The training program can be used independently or as a component of the above-mentioned comprehensive energy management program design. The training program should also be linked to international energy management standards like ISO 50002:20018, international project management professional (PMP) certification programs, national project management guidelines, and ongoing initiatives like Ethiopian Petroleum and Energy Authority on developing markets for energy managers, energy auditors, and energy efficiency project implementation monitoring and verification experts. To put this into action, all relevant stakeholders must take ownership, collaborate, and coordinate.

5.4.Research limitation and areas of further research

5.4.1. Limitation of the study

The study is limited only to assessing the existing planning and scheduling practices as well as identifying challenges during planning of manufacturing industries' energy efficiency and energy management projects. Therefore, conclusions and recommendations made based on the findings of the study may only serve projects in this sector.

5.4.2. Suggestion for future research

The study recommends conducting research on the role of project planning in the performance of energy efficiency and energy management projects, building on the current findings on planning practice. The researcher suggests conducting a similar study in the future on other sectors such as construction projects, where project management maturity is thought to be higher. Because research on the implementation of organizational support processes during project planning is particularly scarce.

References

AlNasseri, H. A. (2015). Understanding Applications of Project Planning and Scheduling in Construction Projects. Department of Construction Sciences, Lund University.

Akadiri O.P. (2011). Development of a Multi-Criteria Approach for the Selection of Sustainable Materials for Building Projects, PhD Thesis, University of Wolverhampton, Wolverhampton, UK

Brisgone, A., 2007. Project management development program – Cohort "F" project time management. Marlton, NJ: CSC Project Management Development Program,

Craig B. Smith, Kelly E. Parmenter (2016). Energy Management Principles (Second Edition). Elsevier. Page v, ISBN 9780128025062. https://doi.org/10.1016/B978-0-12-802506-2.00028-8.

Creswell J. W. (2014), Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE Publications, Inc.

Chua, D. K., & Godinot, M. (2006). Use of a WBS matrix to improve interface management in projects. Journal of Con- struction Engineering and Management, 132(1), 67–79.

Derebe Worku (2018). Study on Planning and Scheduling of CBE Head quarter building construction. Master's thesis, Addis Ababa University

Endalkachew Tesfaye (2018). Practice and challenges of project planning: the case of Satcon-construction company head office in Addis Ababa Ethiopia. master's thesis, Addis Ababa university

Hammad AlNasseri & Radhlinah Aulin (2015). Assessing Understanding of Planning and Scheduling Theory and Practice on Construction Projects, Engineering Management Journal, 27:2, 58-72, DOI: 10.1080/10429247.2015.1035963

Haugan, G. (2002). Project planning and scheduling. Leesburg Pike, VA: Management Concepts Press. https://www.pmi.org/learning/library/assessing-quality-project-planning-102

IEA (2017). World Energy Outlook. https://www.iea.org/reports/world-energy-outlook-2017

ISO 50002: 2018 (2018). Energy Management System Implementation Guide

Jamieson S. (2004). Likert scales: how to (ab)use them. Med Educ.;38(12):1217-8. doi: 10.1111/j.1365-2929.2004.02012.x. PMID: 15566531.

Kerzner, H. (2009). Project management: A systems approach to planning, scheduling, and controlling (11th ed.). Hoboken, NJ: John Wiley & Sons.

Kreith, F., & Goswami, D.Y. (2016). Energy Management and Conservation Handbook (2nd ed.). CRC Press. https://doi.org/10.1201/9781315374178

Lemma Tekalign (2014). 'The role of project planning on project performance in Ethiopia. Master's thesis, Addis Ababa University.

McLeod, S.A. (2008). Likert scale. Retrieved from https://www.simplypsychology.org/likert-scale.html

Meredith, J., and Mantel, S.J. (2010). Project Management: A Managerial Approach. 7th ed John Wiley& Sons, Inc.

Ministry of Trade and Industry and Industrial Parks Development Corporation of Ethiopia, (2019a). Energy Efficiency Strategy for the Ethiopian Manufacturing Sector.

Ministry of Trade and Industry (2019). Green Manufacturing Strategy for Ethiopia.

Ministry of Trade and Industry and Industrial Parks Development Corporation of Ethiopia (2019b). Energy Management Program for Manufacturing Sector.

Project Management Institute (2017). A guide to the Project Management Body of Knowledge (PMBOK guide) (6th ed.). Project Management Institute.

Richard A. (2012). Project Planning Techniques, Management Concepts, and Vienna, VA.

Serrador, P. (2012). The importance of the planning phase to project success. Paper presented at PMI® Global Congress 2012—North America, Vancouver, British Columbia, Canada. Newtown Square, PA: Project Management Institute.

Tam, V. W. Y., & Le, K. N. (2006). Environmental assessment by power spectrum. Sustainable Development Through Culture and Innovation: Executive Summaries, The Joint International Conference On Construction Culture, Innovation And Management (Ccim), 26-29 November 2006, Dubai Knowledge Village, Dubai, United Arab Emirates.

Tesfaye Hailu (2018). The Effectiveness of Project Management Processes on Performance of Construction Projects: Case Study Analysis in Selected Companies in Addis Ababa, Management, Vol. 6 No. 6, 2016, pp. 203-212. doi: 10.5923/j.mm.20160606.04.

Thomas, M., Jacques, P. H., Adams, J. R., & Kihneman-Wooten, J. (2008). Developing an effective project: planning and team building combined. Project Management Journal, 39(4), 105–113.

UNIDO (2007). Policies for Promoting Industrial Energy Efficiency in Developing Countries and Transition Economies. https://www.unido.org/doc/65592

Wang, Y. R., & Gibson, G. E. (2008). A study of project planning and project success using ANN and regression models. In ISARC 2008 - Proceedings from the 25th International Symposium on Automation and Robotics in Construction (pp. 688-696). (ISARC 2008)

Zwikael, O. & Globerson, S. (2004). Evaluating the Quality of Project Planning: A Model and Field Results. International Journal of Production Research, 42, 8, p. 1545-1556.

Zwikael, O. & Globerson, S. (2005). Critical planning processes for project success. Paper presented at PMI® Global Congress 2005—Asia Pacific, Singapore. Newtown Square, PA: Project Management Institute.

Appendix 1: Questionnaire

Addis Ababa University

Faculty of Business and Economics

Department of Business Administration and Information System

Project Management MA Program

March 2022

Dear, Sir/Madam

This questionnaire seeks information (part I) on the practice and challenge of industrial energy efficiency and energy management project planning and scheduling and (part II) designating an effective country energy management program in Ethiopia. The response will be used as a component of the data required for the project work titled "Planning and scheduling practice and challenges of industrial energy efficiency projects in Ethiopia," which is being conducted as part of an MA program in Project management at Addis Ababa University's Business and Economics Faculty, School of Commerce. The study's findings will contribute to the activity of identifying best practices and gaps in industrial energy efficiency and energy management project planning and scheduling, energy management system program design as well as recommending major improvement areas. Because the success of this study is dependent on the cooperation of all targeted respondents, as well as the information obtained from the questionnaire, you are kindly asked to respond to the questions to the best of your ability. Your sincere and thoughtful response is priceless.

Thank you, in advance for your co-operation and participating in the project work

Addisu Amare

E-Mail: addmare@yahoo.com

Mob.: 0912 288 894

Questionnaire

Part I: Demographic Profile Please respond to the following questions by marking (X) sign:

1. Sex

Male	Female

2. Age

18-29	30-40	41-49	50 and above

3. Educational status

Diploma	1st Degree	2nd Degree (MA/MSc)	3rd Degree (PhD.)	Other

If you have trainings in project management, pls specify_____

4. How long have you been working in Energy-Environment/Energy efficiency related projects?

1-5	6-10	11-15	>15

5. How many years have you worked as member/leader of energy efficiency planning and scheduling team in (industrial) energy project/s?

1-5	6-10	11-15	>15

6. Current position and organization

Position	Organization

Part II: Project planning and scheduling practice

The following set of statements relate to your outlook about application of project planning processes during energy efficiency and energy management project planning in industry

Instructions: Please tick [√] in the provided space which is the most suitable using the given scale. Please also answer all the questions considering the projects you are participated to enhance the objectivity of the project work.
Scale: (1=Strongly Disagree), (2=Disagree), (3=Neutral), (4=Agree), (5=Strongly Agree)

A. Application of project planning process during project planning

No.	Questions	1	2	3	4	5
QA1	Project Management plan developed					
QA2	Project scope management plan developed to guide and direct the project scope management throughout the project implementation.					
QA3	Stakeholders needs and requirements determined, documented, and managed to meet project objectives					
QA4	A detail description of the project product, service, or result boundaries and acceptance criteria developed					
QA5	Work breaks down (WBS) is developed in such a way that it subdivides project deliverables and project work into smaller, more manageable components					
QA6	Project schedule management plan developed to give guidance and direction on how the project schedule will be managed throughout the project					
QA7	Project specific activities/actions to be performed are defined and documented					
QA8	Relationships among project specific actions/activities are identified and documented by defining the logical sequence of work					
QA9	The amount of time each activity will take to complete is estimated					
QA10	Project schedule is developed by analyzing activity sequences, durations, resource requirements, and schedule constraints to create a schedule model for project execution and monitoring and controlling					
QA11	Project cost management plan developed by defining how the project costs will be estimated, budgeted, managed, monitored, and controlled					
QA12	Project cost estimation is developed through approximation of the monetary resources needed to complete project work					
QA13	Project budget is determined by aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline					
QA14	Project Quality management plan is developed by identifying quality requirements and/or standards for the project and its deliverables					

QA15	Project resource management plan developed showing how to estimate, acquire, manage, and utilize physical and team resources.					
QA16	Project team resources and the type and quantities of materials, equipment, and supplies necessary to perform project work is estimated					
QA17	Project communication plan is developed to engage stakeholders effectively and efficiently by presenting relevant information in a timely manner					
QA18	Project risk management plan is developed by defining how to conduct risk management activities for a project.					
QA19	Individual project risks as well as sources of overall project risk are identified and documented					
QA20	Qualitative and quantitative risk analysis is conducted by prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact etc.					
QA21	Project risk response is prepared by developing options, selecting strategies, and agreeing on actions to address overall project risk exposure as well as to treat individual project risks.					
QA22	Project procurement plan developed by documenting project procurement decisions, specifying the approach, and identifying potential sellers					
QA23	Stakeholders' engagement is planned by developing approaches to involve project stakeholders based on their needs, expectations, interests, and potential impact on the project					

B. Familiarity and Suitability with Project Management Scheduling Methods

	Knowledge & Familiarity with:	1	2	3	4	5
BQ1	BQ1.1 Gantt charts					
	BQ1.2 Critical Path Method (CPM)					
	BQ1.3 Program Evaluation and Review Technique (PERT)					
BQ2	The existing method is suitable and satisfactory					
BQ3	The existing method has easy to follow procedures during scheduling exercise					
BQ4	Full adaptation and understanding of existing methods exist in the organization					
BQ5	The existing planning methods is sufficient in meeting scheduling needs of energy projects					
BQ6	In your organization/team skilled team used to implement existing methods					
BQ7	In your organization/team the existing methods are considered suitable for continued use in the future					

C. Organizational support process during project planning

Supporting Area	Organizational support processes	1	2	3	4	5
Organizational Systems	QC1.1 Project-Based Organization arrangement exists					
	QC1.2 Project management procedures exist in the organization					
Organizational Cultures and Styles	QC2.1 Appropriate Project Manager Assignment exist in the organization					
	QC2.2 The Project Manager involves during project initiation Stage					
	QC2.3 Communication Between the Project Manager and the Organization During the Planning Phase exist					
	QC2.4 Organizational level Project Success Measurement exist					
Organizational Structure	QC3.1 Supportive Project Organizational Structure exist					
	QC3.2 Interactive Inter-Departmental Project Planning Groups exists in the organization					
	QC3.3 Organizational Projects Resource Planning					
	QC3.4 Organizational level Projects Risk Management exist					
	QC3.5 Organizational level Projects Quality Management exist					
	QC3.6 On-Going Project Management Training Programs exist					
Project Office	QC4.1 The Project Office Involves in the planning and scheduling					
	QC4.2 Standard Project Management Software (e.g.: Ms-Project) is used in project planning and scheduling					
	QC4.3 Project accumulated knowledge and best practice used in planning and scheduling					
	QC4.4 New Project Tools and Techniques used during planning and scheduling					

Part III. Project planning and scheduling challenge areas

D. Project planning and scheduling challenge areas

QD1. Briefly explain how project planning and scheduling process is performed in your organization.

_____
_____
_____

QD2. List the major challenges of project planning in your organization (Energy efficiency & energy management projects implementations)

_____
_____
_____

QD2. Project planning and scheduling improvement areas (Energy efficiency & energy management projects implementations)

_____
_____
_____
_____
_____

QD3. Project management planning and scheduling capacity building need areas (Energy efficiency & energy management projects implementations)

_____
_____
_____