

**ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS
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**IMPACT OF RESOURCE MANAGEMENT ON CONSTRUCTION PROJECTS: IN
CASE OF MISAC GENERAL CONSTRUCTION PLC**

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ADDIS ABABA UNIVERSITY SCHOOL OF COMMERCE
GRADUATE PROGRAM

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By: Hirut Kebede

Approved by Board of Examiners

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Examiner	Signature	Date

DECLARATION

I, the undersigned, declare that this thesis entitled “**Impact of Resource Management on Construction Projects: In Case of Misac General Construction PLC**” is my original work, prepared under the guidance of the research advisor Teklegiorgis Assefa (Assistant Professor). All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

HIRUT KEBEDE

.....

Name

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June, 2020

Addis Ababa, Ethiopia

ENDORSEMENT

This is to certify that this project work, “**Impact of Resource Management on Construction Projects: In Case of Misac General Construction PLC**” is undertaken by Hirut Kebede for the partial fulfilment of Master of Arts in Project Management at Addis Ababa University, is an original work of Hirut Kebede and not submitted earlier for any degree either at this University or any other University.

Research Advisor

Teklegiorgis Assefa (Ass. Prof.)

Date

Addis Ababa, Ethiopia

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Abbreviations and Acronyms

CPM	Critical Path Method
ECM	Ethiopian Construction Ministry
EEA	Ethiopian Economic Association
HRM	Human Resource Management
MAPM	Master of Arts in Project Management
PERT	Project Evaluation and Review Technique
PLC	Private Limited Company
PM	Project Management
PMBOK	Project Management Body of Knowledge
SD	Standard Deviation
SPSS	Statistical Package for Social Science
WBS	Work Breakdown Structure

Abstract

Resource management is a significant component of any construction project management. The success of construction projects highly depends on proper and effective management of construction resources. The general objective of this study was to assess the impact of resource management techniques on construction projects: in case of Misac General Construction PLC. The study employed both quantitative and qualitative methods. The target groups in this study were professionals from the construction industry. A total of 40 respondents were targeted to involve in survey. They were selected employing purposive sampling method i.e. staff members having adequate experience working on construction projects and able to provide information on the study theme. Thirty-seven respondents returned the filled in questionnaires. The reliability results have shown that all the variables exceeded the acceptable limit of 0.7. The researcher used SPSS software 20 to analyse quantitative data. The quantitative data were supported by interviews conducted with selected groups of participants. In conclusion, to overcome those challenges occurring in construction projects, it's better to manage construction resources separately by classifying by the type of resource they are as; Material resources, Manpower (Labour) resources and Machinery resources. In addition to classifying the resources to overcome the challenge of resource management on construction projects it's advisable to use some software like Ms. Project and Primavera which are introduced to manage projects in a suitable way. The software will support in resource management process of the project and helps to avoid time and cost overrun. Finally, giving priority and highest attention for resource management techniques on construction projects is a very crucial thing and must be done by all construction project stakeholders.

CHAPTER ONE

Introduction

1.1 Background of the Study

Resources are assets, such as materials, people, equipment and physical facilities that have limited availabilities, can be scheduled, or can be leased from an outside party. Some are fixed and others are variable. In any case, they are essential to the scheduling of project activities and supportive to timely complete project.

Most significant component of a project which helps for successful completion are resources. Resources used in construction projects mostly are material resources, equipment resources and labour resources like project manager and skilled labour. To finish projects with in the scheduled time and budget it's essential to provide resources suitable for the project (Nagaraju and Reddy, 2012). Projects may involve resources from a variety of external organizations that may be locally or globally based. Hence, the project manager is responsible to engage in resource management tasks at different administrative levels as well as geographical boundaries. Context specific training on resource management is paramount for project managers.

It is clear that managing project resources is one of the roles of a project manager. The time that has to be permitted for a given activity depends on the availability of both human and material resources. The project manager is in a position to determine the types and when resources are required for a particular project. The project manager then bids and negotiates with the functional managers in order to secure the necessary commitment of resources for the project. This also generates the need for a senior level of project sponsor with sufficient authority to overcome any impasse that may arise between the project and functional managers. Given the project manager's ultimate responsibility for the project's outcome, he (she) needs to acquire a clear view of the project as a whole with key abilities necessary to successfully manage the project tasks. One of these abilities to focus on ensuring that people and material resources are obtained and utilized in an integrated way – including reorganizing to overcome

problems and difficulties that will inevitably arise from time to time. Obviously, this helps to accomplish the project's goal and objectives.

Lack of resources is one of the common reasons to not successfully meet project objectives. This occurs mostly in systems where team accomplishment generates growth. In such cases, it is significant that resources used into the system should be reliable to the project schedule. Mismatch between the criteria for project success and resource investment is one of the main reasons why project teams tend to suffer from quality compromises.

According to Master of Arts in Project Management (MAPM) 505 Book, the need for project management has become apparent due to the current organizational structures are unable to accommodate the wide variety of interrelated tasks necessary for successful project completion. It is usually first identified by those lower-level and middle managers who find it impossible to control their resources effectively for the diverse activities within their line organization. Quite often middle managers feel the impact of a changing environment more than upper-level executives. Once the need for change is identified, middle management must convince upper-level management that such a change is actually warranted. If top-level executives cannot recognize the problems with resource control, then project management will not be adopted, at least formally. Informal acceptance, however, is another story. As project management developed, some essential factors in its successful implementation were recognized. The major factor was the role of the project manager, which became the focal point of integrative responsibility.

It is indicated in MAPM 505, no one individual or industry is responsible for the concept of project management. Often it is attributed to the early space programs of the 1960s, but its origins go back much further. Elements of project management probably first came to light in the great construction works of history, such as the Pyramids, the Great Wall of China and the Roman roads and aqueducts. These techniques have been improved and developed over time. What is common to all construction works through history is that they all require special organizations, workforces, facilities and resources for the single purpose of completing the job or the project.

Similarly, it is noted that the tools and techniques used in project management are becoming ever more refined and sophisticated. Complicated techniques are used in almost every aspect

of project management today. At the same time, developments in information technology has provided much-improved capabilities for planning, budgeting, monitoring and controlling, using highly complex but easy to- use computer programs. Relatively low-cost software will calculate variances, smooth out resources, define the critical path, forecast cash flows, and carry out many other complex tasks at the push of a button or click of a mouse.

Project managers (by definition) tend to think ahead. There is often a tendency for project managers to bring in key resources early in order to ensure that they will be available when required and with no delay. Otherwise, it may lead to increase project costs.

A project plan expresses the objectives & requirements of the project in terms of project scope, project schedule, and resource requirement, project cost estimation, project quality and project risk management. It enables project manager to translate project requirement into Work Breakdown Structure (WBS), tasks list, Gantt charts, resource assignment and risk register, etc. Time is an interesting resource. It can't be inventoried. It is consumed whether we use it or not. The objective for the project manager is to use the future time allotted to the project in the most effective and productive ways as possible.

The construction sector in Ethiopia is booming and still continuing to have a leading industry. The fast growth of the construction industry resulted in increase in the number of contractors joining the industry. However, several challenges are being noted in the sector that need immediate actions.

Every construction project consumes resources. Most construction resources are materials, machinery and manpower. It's better to plan, schedule and manage these resources independently.

Materials constitute large fraction of the overall construction cost. They widely differ based on the nature of projects. However, most commonly used construction material resources are;

- Concrete (cement, aggregate, sand)
- Water
- Admixture
- Reinforcement steel
- Etc

The aim of construction materials management is to procure materials in the right quantity, of the right quality, at the right time and with the right cost.

An appropriate material management helps to maintain an appropriate supply of materials to the project site and also reduces construction costs by minimizing the wastage of materials.

Mechanization and use of heavy duty equipments are an important part in modern construction projects. Selection of appropriate equipments in terms of type and size has implication on the completion time of a construction project. The governing factors in selecting a construction equipment are productivity and total cost. Common types of equipment resources in construction projects are:

- Excavator
- Driller
- Concrete mixer, vibrator
- Compactor
- Etc

To increase the productivity of labours on site it's advisable to provide a good quality of equipment on site. Factors to be considered in selecting construction equipment resources are:

- Size of the job
- Time constraint
- Soil conditions
- Availability of equipment
- Cost of transportation of equipment
- Climatic condition

The modalities to acquire equipment resources include purchase, rent and lease.

The management of construction workforce focuses on estimating the size of workforce and scheduling the use of manpower during various stages of the construction project.

1.2 Background of Target Organization

MISAC General Contractor has been in the construction sector under the present name since 1999 G.C. Originally, as of 1958 G.C, as a General Partnership of Renato Miotto and Ermano Santilli, and from 1971 G.C as Miotto and Santilli General Contractors PLC. Now the

Company is owned and directed by Gianfranco Molinari, Ernesto Molinari and Taufik Mohamed Idris. The Company has mainly executed building projects, but has also undertaken from time to time water lines, roads works and other civil engineering tasks.

The major share of activity has been in public and private works and for thirty-five years has concentrated its operation mainly in Addis Ababa. However, it has also executed projects in different parts of the country including South (Gambo & Hawassa), East (Dire Dawa and Harar) and West (Jimma).

MISAC is self-sufficient for ancillary works like steel and wood works and has the necessary up to date construction equipments, for good execution and finishing of any type of building construction.

The organization has also a qualified technical staff, skilled and qualified workers which all together have contributed to the company becoming one of the most successful private owned firms in Ethiopia.

1.3 Statement of the Problem

The study attempts to assess the impact of resource management on construction projects in the construction company and tries to indicate possible solutions for problems observed.

The importance of resource management is not properly considered in most construction projects in particular at the stage of planning phase. But resource management is the backbone of any construction project, without proper managing resources it's very difficult to achieve the desired project goal. Providing inadequate attention to resource management coupled with other challenges are possible reasons for incurring additional costs and overrunning schedule of construction projects.

The construction industry is challenged with problems such as rising of labour prices, scarcity of trained labour and efficient productivity (Leeds, 2016). Besides, Fletcher (2017) argues that Brexit threatens the fluctuation of skilled labour into the United Kingdom, which adds pressure onto the already constrained labour market. These problems impact project performance by causing time delays, cost overrun and profit margin erosion. Additionally, most construction projects face a challenge of cost overrun caused by wastage of resource and not properly managing resources due to over allocation of resources. Resource optimization is acceptable

method to appropriately utilize scarce resources. Also another challenge faced by most construction companies is availability of resources, this mainly occurred by not knowing where to find what resource or in other words most construction professionals are not planning and scheduling for construction resources by categorizing the resources as material, manpower and machinery resource independently. This eventually affects the projects since it will be difficult to find and differentiate critical resource needed from the generalized construction resources as a whole.

Resources are any consumables used for implementation of projects– availability of materials, manpower, equipments and facilities are examples. Accountants can tell us about the use of less amount in terms of quantity of materials and finance. Nobody can deny this reality from the perspective of value for money and we need to plan and properly utilize resources to achieve project goal. Project resources are subjected for monitoring and controlling by the project manager.

In Ethiopia, many projects face resource limitations including manpower, finance, materials and equipments. Availability of materials with the right quality and quantity at the project site has a significant impact on construction projects. It is found out that inadequate research has been conducted on the topic of resource management focusing on construction projects. This has brought knowledge gap in the theme of the research.

Banaitien and Banaitis (2012) reported that in recent years, project-based companies have found it more challenging to accomplish the predicted profit margins on projects that are the main source of cash flow. Accordingly, these organisations do not have the cash flexibility to invest in massive, expensive digital innovations to solve the causes of margin erosion (Leeds, 2016). Managing the limited resource effectively and efficiently is a dynamic solution.

1.4 Research Questions

- A) What are the major effects of resources on construction projects?
- B) What are the effects of material resources on construction project?
- C) What are the effects of labour resources on construction project?
- D) What are the effects of equipment resources on construction project?

- E) To what extent do construction companies give attention to one of the knowledge areas of project management i.e. resource management?

1.5 Objective of the Study

1.5.1 General Objective

The general objective of this study is to identify, evaluate and understand the impact of resource management on construction projects. The findings of the research will be an input to improve the resource management practice of organizations involved in management of construction projects.

1.5.2 Specific Objectives

Based on the general objective of the study and the research questions mentioned under 1.4, the following specific objectives are set out:

- A) To understand the current resource management practices in regard to project teams, labour, material and equipment;
- B) To identify, evaluate and analyse resource management techniques being used in construction projects;
- C) To assess the importance of resource utilisation and management in construction projects;
- D) To examine the effects of resources on construction projects;
- E) To analyse the priority and attention given by companies to resource management techniques in construction projects and
- F) To identify and recommend successful experiences of resource management techniques applicable for construction projects.

1.6 Significance of the Study

This research paper examines the impact of resource management on construction projects. It identifies and analyses resource management techniques of the selected construction company with adequate experience in the sector.

The findings from this research regarding the impact of resource management on construction projects can benefit other construction companies who are suffering from cost and schedule overrun due to lack of giving attention to resource management for construction projects which is one of the knowledge areas of project management.

The outcomes of the research contribute toward improvement in resource management practice of construction projects in general and resource management techniques in particular. It will enable construction companies to identify and focus on applicable resource management techniques and evaluate their experience accordingly.

The research gives an insight into the knowledge and practice of resource management in construction projects. Also, it enhances the skills of project managers who involve in management of construction projects.

Furthermore, it can help as a source document and stepping stone for other researchers who want to make further study on related subject matters.

1.7 Scope of the Study

The scope of the study focuses on assessing the impact of resource management on construction projects limited to one construction company located in Addis Ababa City Administration but having operations in other regions.

In this study, both quantitative and qualitative methods are used. In quantitative design, questionnaire developed and shared with a construction company project team. The project team returned the filled in questionnaires which also incorporate open ended questions for qualitative data collection. The researcher also took part in filling out both structured questionnaires and checklists for qualitative data collection. The researcher gained in depth understanding from the entire process of data collection. Purposive sampling has been employed to target appropriate respondents who have knowledge and experience pertaining to the study theme. The project team members who provided data are project managers, engineers and site supervisors of the company selected for this study.

Out of all the various resources of a construction project the study concentrates only for the three resources which are material resource, labour resource and equipment resource of construction projects.

1.8 Limitation of the Study

The study doesn't include clients and consultants who cooperate with the target company and usually take part in the construction projects. In addition, focus has been made on one construction company which might make it hard to generalize the findings to the entire construction industry.

Shortage of time and unwillingness of construction companies are the major challenges. These challenges forced the researcher to focus on one construction company. In addition, the number of respondents is small as the target organization is only one. Therefore, it should be noted that the views of project team members are reflected.

1.9 Organization of the Paper

The paper has five chapters. The first chapter deals with introduction, statement of the problem, research objectives, research questions, significance of the study, scope of the study and limitation of the study. The second chapter addresses review of related literature. The third chapter presents research design and methodology, sources of data, target population and sampling technique, tools of data collection and method of analysis. The fourth chapter describes data analysis and interpretation of the results. The last chapter five contains the summary of findings, conclusions and recommendations of the study.

CHAPTER TWO

Review of Literature

2.1 Introduction

In this chapter, a review of related literature which contains both theoretical and empirical parts is provided. Literature review can be considered as a guide and provides framework for the entire study. Data generated from internet, published books and unpublished reports.

2.2 Theoretical Review of Literature

2.2.1 Construction Industry

Construction industry in developing countries is a significant sector as it has massive role in the financial growth. All infrastructure accommodations needed to pursue progress such as transportation, telecommunication, electric and power facilities and socioeconomic facilities such as teaching institutions, health organisations, factories etc. are being commenced by the construction industry. In developing countries, construction industry plays a critical role in economic growth.

However, construction project management practice is undeveloped and its impact is quite notable. According to Voropajev (1998), construction project management is more important in evolving economy than in settled economies since risks and variations are very high in the evolving countries. In developing countries, construction project management procedures have been broadly implemented by many organizations to solve their issue of managing rare resources and achieve project objective. (Andersen, 2008).

Abera and Fekadu (2016) have pointed out that the construction industry plays a vital role in countries across the globe. It highly contributes to the evolution and growth of the economy in developing countries like Ethiopia (Jill Wells, 2001). The construction industry has a major role in developing countries since it is an essential industry for employment of most of the world's construction workers specially in less developed countries (Jill Wells, 2001). Construction project is a task commenced to generate a unique product or service within the specified cost, quality, time and scope (Chitkara, 2004).

According to Kerzner (2009), effective project management can be defined as having accomplished the project objectives:

- On time,
- On budget,
- On the requested quality and specification level,
- By managing the allocated resources effectively and efficiently and
- By getting customer satisfaction.

Wubishet (2004) argues that in every construction project, project management is the essential and one of the most significant tasks that helps for the successful achievement of the project objective.

In the view of Belete (2017), construction industry in Ethiopia is a sector that has an influence for the evolution of many other industries. The sector involves many resources such as cement, reinforcement and metal products, block and clay work, etc. The advancement of these manufacturing industries merely depends on the growth of the construction industry. Similarly, when the building and makeover of housing rises, the request for home furniture will increase; thus, this supports the development of the furniture industry. Ethiopian Economic Association (EEA) (2006/07) concluded that the construction industry stimulates the development of other industries. In relation to this relationship income generation will increase from corporate income taxes of companies, the rental income, sales tax, capital gain tax and employees' income tax from those employed in the construction industry. In turn, the income generated from the mentioned sources goes to supporting community services such as teaching and health institutions.

In the study of Westland (2006), project management is defined as “the skills, tools and management processes required to undertake a project successfully”. These skills, tools and processes are required to implement a project and achieve project objective successfully. The elements contained in the skills, tools and processes are mentioned below:

Skills are special knowledge, skills and experience required to reduce the level of risk and increase the likelihood of success of a project.

Tools are used by project management to improve the chance of success. Examples are checklists, specific software, templates etc.

Processes can be various and in combination with techniques are used to monitor and control time, cost, quality and scope of projects.

Therefore, project manager should advance his (her) skills, tools and processes in order to achieve the project success. These project management's skills, tools and processes are used to manage every project and are accomplished at different stages including initiation, planning, execution, monitoring, controlling and closure.

2.2.2 Cause of Delay in Construction Project Delivery

Marzouk, et al. (2013) summarized the sources of delays in construction projects that are suggested by different researchers in different countries as follows: delays occurring due to materials, contractor's underprivileged performance, owner's contract administration technique, insufficient primary planning & design, government issues, site & climatic condition and poor site administration (in Saudi Arabia), severe climate, lack of labour, and delay related to sub-contractors (in USA), poor risk management and supervision, unpredicted site conditions, late decision making for necessary variation (in Hong Kong), design changes, less efficiency of labours, and insufficient planning for resource (in Indonesia), difficulties in funding & payment for finished work, poor contractor management and change in site condition and lack of materials (in Nigeria). Similarly, the causes of project delivery delay in Egypt include poor contract management, impractical scheduling, financial problems of owners for finished work, design modification during construction and lack of materials such as cement and steel.

According to Ali et al. (2010), causes of delay related to contractor are mostly lack of materials due to unsuitable plan, unproductive communication, unreliable supplier's and delay for the supply of material. In addition, Mochal (2003) indicated that inappropriate planning is among the first shortcomings appearing in project management. This would result in shortage of materials on site and dissatisfaction at the completion stage of the project. On top of this, cash flow at the time of construction and poor site administration are the other factors causing delay (Enshassi et al., 2009).

Belete (2017) identifies the following common causes of delay by contractor: Economic problems, resource management, planning & scheduling issues, insufficient site review,

equipment management problem, scarcity of manpower, failure to assess the site and design, construction imperfection, contractor management problem and scarce resource.

Abdo (2006) found out that in Ethiopia, 94% of 52 surveyed public building projects constructed by local contractors in the years between 1995 and 2005 suffered delays.

According to Abdul-Rahman (2006) cited in Dayang (2009), delays in construction projects are considered as one of the most common difficulties causing a crowd of undesirable effects on the project and its participating parties. Along with delay, the regularly tackled consequences are project failure, decrease of profit margin and unsatisfaction of citizen in government funded projects. When delays do occur, projects will extend their duration beyond the scheduled completion date. These can't happen without incurring some additional costs.

2.2.3 Resources of Construction Projects

Mostly used resources in construction projects are material resources, equipment resources and labour resources like project manager and skilled labours (Nagaraju, et al. 2012). The influencing factors regarding construction resources for the success of construction projects mainly depend on the availability of resource since all activities on construction projects involve a resource. Each individual activity must be provided with the resource it requires in order to complete the project within the scheduled time and budget. Otherwise, it will cause cost and schedule overrun. Resource availability on construction projects guarantees that the project will complete with in the estimated time and budget since they are directly related with out some other external factors. To determine the time required for project implementation it's better to breakdown the activities associated with the resource of defined quantity. The skill of the contractor to understand the interdependencies of various resources on construction projects will impact the project performance of the construction activity.

According to Robert (1976), construction industry contends with the growing complication resulting from technology, but must realize the necessity of meeting the requirements of new technology with a greater limitation of resource availability and a greater demand to use resources economically.

The main variables available to the industry are its resources, labour, money, material, equipment, time and space. Adaptive control of these variables will allow the opportunity to meet the requirements of the dynamic environment. Many procedures have been planned to

meet these requirements. The Critical Path Method (CPM) is one of these procedures which were developed by Kelley et al. (1959) to meet the growing need for resource control within a dynamic construction process.

Robert, Lowell & Preston (1976) have mentioned that early applications of critical path techniques for the most part do not treat the application of manpower and other resources required to perform the different work elements of construction project. Sufficient resources were either assumed available to meet the schedule or the resource problem was ignored entirely.

A construction project necessitates an arrangement of resources according to some preconceived plan. This specific arrangement contains materials, manpower and equipments that are generally required along with some element of time as well as space. In a practical sense, each of these elements shares a common resource i.e. money (Robert, Lowell & Preston, 1976). The cost of resources is very often a significant factor in the overall project cost and minimizing resource costs can easily outstrip project duration to minimize the overall project cost.

2.2.4 Resource Management a Knowledge Area of Project Management

As described by Bernie (2018), the project manager spends most of his (her) time in managing the project resources on site. The responsibilities vary from ordering supplies to providing training and paying bills to project team. Meanwhile, the project team is one of the most important contributors to project success. It is important to have confidence on the project team who is able to get the job done right, on time, and under the planned budget. Resource management knowledge is well articulated in the Project Management Body of Knowledge (PMBOK).

In this regard, the six knowledge areas identified are: Plan resource management, estimate activity resources, acquire resources, develop team, manage team and control resources. Here under we shade light on each of these knowledge areas.

1. Plan resource management: Before any project can proceed, the project resource requirements need to be defined. The main part of this initial planning step involves identifying the type and quantity of resources that are required, including people. Some resources have a grade or skill level associated with them, such as experience level of people, or size of

crane. Job descriptions are created for the project team members. The project resource management plan is part of the overall project management plan, summarizes the resource planning step. The major elements contained in project resource management plan are inputs, tools and techniques and outputs.

Inputs:

- Project charter
- Project management plan: Quality management plan and Scope baseline
- Project documents: Project schedule, requirements documentation, risk register and stakeholder register
- Enterprise environmental factors
- Organizational process assets

Tools & techniques:

- Expert judgment
- Data representation: Hierarchical charts, responsibility assignment matrix, text-oriented formats, organizational theory
- Meetings

Outputs:

- Resource management plan
- Team charter
- Project documents updates: Assumption log and risk register

2. Estimate activity resources: The resources required to carry out the project must be estimated during the planning stage. Resources are classified by type and quantity, as well as other factors that might affect the cost or schedule, such as grade, quality, availability, and so on. The three primary methods of estimating are ‘analogous’, ‘parametric’ and ‘expert judgement’ in conjunction with bottom up or top down estimating to determine the resource requirements.

Inputs:

- Project management plan: Resource management plan, scope baseline
- Project documents: activity attributes, activity list, assumption log, cost estimates, resource calendars, risk register
- Enterprise environmental factors
- Organizational process assets

Tools & Techniques:

- Expert judgment
- Bottom-up estimating
- Analogous estimating
- Parametric estimating
- Data analysis, alternatives analysis
- Project management information system
- Meetings

Outputs:

- Resource requirements
- Basis of estimates
- Resource breakdown structure
- Project documents updates: activity attributes, assumption log, lessons learned register

3. Acquire resources: Once the project execution phase is underway, the resources identified in the resource management plan must be acquired. The project schedule is consulted to determine when the resources are needed. The procurement management plan is a separate component of the project management plan that guides the purchasing process for materials and equipments to be purchased. Project team positions are advertised and the workers are hired.

Inputs:

- Project management plan: resource management plan, procurement management plan, cost baseline

- Project documents: Project schedule, resource calendars, resource requirements, stakeholder register
- Enterprise environmental factors
- Organizational process assets

Tools & techniques:

- Decision making: Multi-criteria decision analysis
- Interpersonal and team skills: Negotiation
- Pre-assignment
- Virtual teams

Outputs:

- Physical resource assignments
- Project team assignments
- Resource calendars
- Change requests
- Project management plan updates: Resource management plan, cost baseline
- Project documents updates: Lessons learned register, project schedule, resource breakdown structure, resource requirements, risk register, stakeholder register
- Enterprise environmental factors updates
- Organizational process assets updates

4. Develop team: Most projects require additional knowledge to complete their deliverables. The project team must obtain this knowledge at the appropriate point in the project timeline. Unlike tools and equipment, project team members require rewarding work, future opportunities, and career development, or they will leave.

Inputs:

- Project management plan: Resource management plan
- Project documents: Lessons learned register, project schedule, project team assignments, resource calendars, team charter
- Enterprise environmental factors

- Organizational process assets

Tools & techniques:

- Co-location
- Virtual teams
- Communication technology
- Interpersonal and team skills: Conflict management, influencing, motivation, negotiation, team building
- Recognition and rewards
- Training
- Individual and team assessments
- Meetings

Outputs:

- Team performance assessments
- Change requests
- Project management plan updates: Resource management plan
- Project documents updates: Lessons learned register, project schedule, project team assignments, resource calendars, team charter
- Enterprise environmental factors updates
- Organizational process assets updates

5. Manage team: The project team is one of the most important components of project success. In fact the success of any organization depends on its human resource. Project team assignments tend to change as team members learn different project tasks and project managers assess their strengths and weaknesses. Project issues need to be addressed by the appropriate project team members and project work needs to be actively and timely managed.

Inputs:

- Project management plan: Resource management plan
- Project documents: Issue log, lessons learned register, project team assignments, team charter

- Work performance reports
- Team performance assessments
- Enterprise environmental factors
- Organizational process assets

Tools & techniques:

- Interpersonal and team skills: Conflict management, decision making, emotional intelligence, influencing, leadership
- Project management information system

Outputs:

- Change requests
- Project management plan updates: Resource management plan, schedule baseline, cost baseline
- Project documents updates: Issue log, lessons learned register, project team assignments
- Enterprise environmental factors updates

6. Control resources: The project resources require regular, ongoing control procedures to ensure they are being used most efficiently, that they are performing the required tasks, and so on. The Resource Management Plan must be consulted regularly to ensure that project resource usage is according to plan. Cost-benefit analysis and alternatives analysis are utilized to optimize the use of resources.

Inputs:

- Project management plan: Resource management plan
- Project documents: Issue log, lessons learned register, physical resource assignments, project schedule, resource breakdown structure, resource requirements, risk register
- Work performance information
- Agreements
- Organizational process assets

Tools & techniques:

- Data analysis: Alternatives analysis, cost-benefit analysis, performance reviews, trend analysis
- Problem solving
- Interpersonal and team skills: Negotiation, influencing
- Project management information system

Outputs:

- Work performance information
- Change requests
- Project management plan updates: Resource management plan, schedule baseline, cost baseline
- Project documents updates: Assumption log, issue log, lessons learned register, physical resource assignments, resource breakdown structure, risk register

2.3 Empirical Review

2.3.1 Resource Management in Construction Projects

According to Nagaraju, et al. (2012), construction projects use a huge amount of material resource, equipment resource and manpower resource which makes it a very high value industry. Most projects involve heavy investments in terms of finance and technology. This huge investment requires an effective model of resource management.

Since construction projects are highly dependent on resources it is a challenging task to manage resources effectively. To complete construction projects with in the estimated time and budget the project manager must plan for using material, equipment and labour resources effectively and control them in a timely manner. Also, the project plan must address the resource use in describing the construction method on the same way it addresses the technology and process of construction method.

The success of any construction project highly depends on how proper and effective the management and flow of construction resources. Studies show that various factors affect the cost management and have resulted in significant amount of cost overrun worldwide.

A study conducted by Bhajanthri, et al. (2017) depicted that one of the complicated tasks in the civil construction field is managing resource whether it is man power or material. Project managers execute different types of resources every day. However, they are confronted with a number of challenges including allocating the required resources for each activity– in some cases resources are over allocated in another cases they are less allocated. Hence, the optimization process is becoming difficult. Here comes the role of resource management to address optimal allocation and utilization of resources. Resource management simply means supplying, availing and properly utilizing resources to each activities of the project within the project cost.

Bhajanthri et al. (2017) further note that planning and scheduling are important techniques of management. Planning is necessary to understand the proper utilization of human and material resources and to tackle the problems related to delay of construction project. Project management carry out the activities of project as per plan, schedule and allocation of the resource to activities at the right time and right place. The ultimate aim is to complete the project within planned time line and cost. CPM and PERT (project evaluation and review technique) methods are widely used for scheduling of the project and helpful in project management. CPM is a reliable tool of management and provides minimum time needed to complete the project. It provides the information about future problems related to delay of project.

Resource scheduling is very important task for the successful completion of project. It embraces resource allocation to various activities and levelling these resources. On the other hand, resource levelling is a technique to relook and adjust over allocated resources for activities. In large scale industries, it is not easy to come up with accurate planning and scheduling of resources. In this case, a software application simplifies the planning and scheduling process. Primavera software is advanced software than MSP software. The former software is widely used in the large-scale industries and capable of managing hundreds of projects at a time.

Ismail Abdul Rahman¹, Aftab Hameed Memon² & Ahmad Tarmizi Abd.Karim³, 2012) has written that Money is always of special importance to those involved in construction project. Hence, completion of any project within the estimated cost of project is the basic criteria for

success of any project. The success of any project is highly depending on adequate availability and efficient management of various resources. Hence, prior and adequate arrangement for provision of resource involved in construction such as type and quantity of material, manpower, machines and finance are required at each stage of construction. There are various factors that cause failing resources management. More common, the importance of resource management is not considered properly in the conceptual and planning phases of a construction project which resulted in construction cost overrun. Therefore, this leads to the project having inadequate budget to perform its vital function. The necessity of proper budgeting for a project, an explanation of resource management, and the economic benefits that would accrue to the project are addressed. In order to control cost, equipment and labour should be utilized in the most efficient way possible.

Ismail, et al. (2012) also noted that managing resources in the framework of civil engineering construction sector is usually an extremely complex task. Factors contributing to this complexity include the variety and great number of existing resources of both human and material, the diversity of tasks that each working unit is able to execute, the performance of each working unit, the involved costs and the spatial distribution of all resources over the different places leading to the need for displacement from one site to another. All these important factors imply a high number of variables, resulting in a somewhat difficult optimization process. The basic objective of resource management is to supply and support the project so that established time objectives can be met and costs can be kept within the project budget (Just & Murphy, 1994).

Completion of a construction project within the estimated cost is the basic criteria for the success. Primary target of practitioners involved in construction projects is to complete the project within budgeted cost regardless of size and complexity of project. However, completion of project highly depends on the construction resources. Project resources provide the means for accomplishing the work objectives (Padilla & Carr, 1991). The management of construction resources is the most important factor contributing to achieve success in terms of finance (Meeampol & Ogunlana, 2006).

Enshassi, Al-Najjar and Kumaraswamy (2009) found out the major factors affecting construction cost (increase in prices of construction materials). These among others include continuous border closures, delay in construction and supply of raw materials and equipment

by contractors, fluctuations in the cost of building materials and constraint of funds and the associated auxiliaries not ready. If the contractor can minimize problems associated with inefficient use and lack of construction equipments and shortage of quality material then the construction budget can possibly be reduced (Meeampol & Ogunlana, 2006).

Ismail et al. (2012) have categorized resource related factors that cause construction cost overrun in to four categories i.e. material, manpower, finance and machinery. The elements contained in each category are indicated and discussed below.

Material: Fluctuation of prices of materials, shortages of materials, changes in material specification and type, delay in delivery of materials.

In construction industry, materials represent a substantial proportion of the total value of the project. Material related issue contributes to majority of cost overrun run (Koushki et al., 2005). Hence, efficient material management is an important criterion for success of any project. A material management system includes the fundamental functions required in any construction project such as identifying, acquiring, storing, distributing and disposing of materials. Regular and adequate supply of the materials is very critical task. Late or irregular delivery or wrong types of material delivered during construction affect the utilization of other resources like manpower and machinery. This leads to poor productivity, time delay and cost overrun.

Manpower: High cost of labour, shortage of technical personnel (skilled labour), severe overtime, labour productivity, labour absenteeism, shortage of site workers.

Manpower is significant resource that plays important role in achieving project success. Good results certainly cannot be achieved without the adequate availability of skilled and unskilled labour, proper assignment and management. Expected construction progress can be achieved only through the attainment of effective man-hour effort and the meeting of scheduled mile stone dates. Effective manpower management can reduce labour costs and thereby increase profits for company. In developing countries, poor labour productivity is a severe problem (Kaming, Olomolaiye, Holt & Harris, 1997). Hence, effective human resource management coupled with improvement in labour productivity can reduce labour costs and thereby increase profitability of the company.

Finance: Financial difficulties of owner, delay payment to supplier /subcontractor, delay in progress payment by owner, cash flow and financial difficulties faced by contractors, mode of financing, bonds and payments, poor financial control on site.

Finance is the first and foremost resource required for construction work. The design and specifications of a project depend upon the financial resource. It is difficult to complete the project without allocating sufficient fund. Hence, availability of sufficient funds and effective financial management are important aspects in project management. Financial management is the use of financial or accounting information at all levels to assist in planning, making decisions and controlling the activities of an enterprise (Lock, 1993). Without proper management of the finance, the management of other resources will fall in problem.

Machinery or equipments: Equipment availability and failure, late delivery of equipment, insufficient number of equipment, high cost of machinery and its maintenance.

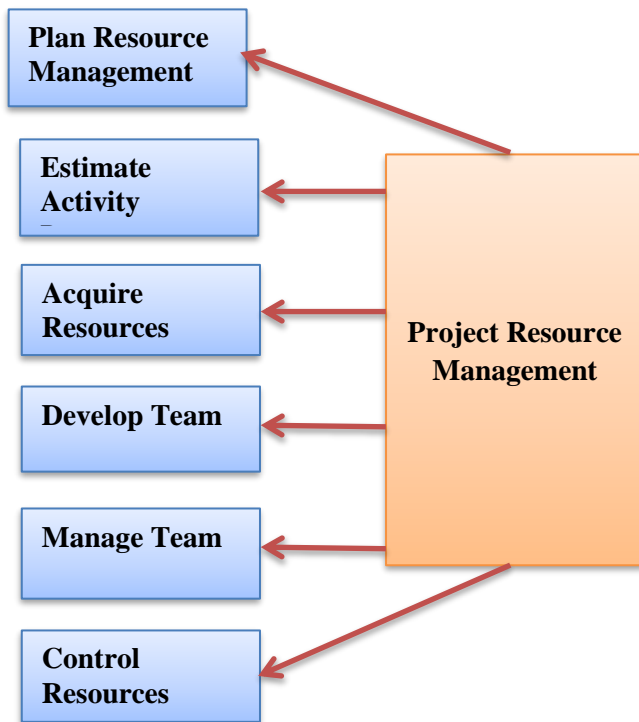
The use of construction equipments brings an advantage position for construction company unlike manpower resource equipments can be continuously operated under adverse circumstances and they require less manpower and other facilities. The selection and utilization of equipments in a construction project must be an integral part of the total plan. The type and number of the equipments required in project operation depends on the nature and size of the project. The selection has significant impact on construction cost.

The above listed 20 resource related factors which have been classified into four common types of resource groups can influence any types of construction project.

2.4 Conceptual Framework

The researcher developed a conceptual framework to guide the process of research on one hand and to deeply understand the interconnectedness between the research themes. The success of project management by and large depends on project resource management. Project management contains six elements (plan resource management, estimate activity resources, acquire resources, develop team, manage team and control resources) which contribute toward efficient/effective project resource management. The interconnectedness between the factors and results are shown in Figure 2.4.1.

Figure 2.4.1 Conceptual Framework



CHAPTER THREE

RESEARCH METHODOLOGY

This chapter provides research methodology which incorporates research design, source & type of data, target population, sample size and sampling techniques and methods of data collection and analysis.

3.1 Research Design and Approach

Research design is the overall strategy of the study in order to integrate different components of the study in coherent and logical manner to properly address research problems.

The study adopted mixed method that employs primarily to discuss and interpret data that are gathered through structured questionnaire and non-structured interview. In order to get a complete picture and in-depth information about the study themes, the researcher has followed both quantitative and qualitative data collection approaches.

3.2 Sample and Sampling Techniques

In this study, the primary target groups are professionals having experience and expertise in the construction industry. They are employees of Misac General Construction PLC. Respondents are project managers, site engineers, engineers with different professional background and site supervisors. The company targeted company has 60 professionals who have engagement with project work. Out of this total number, 40 engineering professionals with adequate experience in construction industry were targeted. In this study, purposive sampling has been employed to target appropriate professionals able to give appropriate response to the study themes. Moreover, attempt has been made to target experts from different level of positions.

3.3 Source and Method of Data Collection

Primary data were collected through applying survey and qualitative methods. Structured questionnaire was administered to collect quantitative data while qualitative data were acquired through conducting interviews using open ended questions. As described under 3.2, the main

source of data were project managers, engineers and site supervisors of Misac General Construction PLC.

The interviews were made with more experienced project managers and other relevant participants to obtain detailed information. The data collected were analysed using both descriptive statistics. Information obtained from qualitative method were integrated with quantitative data at the stage of analysis.

3.4 Validity and Reliability

Attempt has been made to ensure the quality of research and make it credible for the scientific community. The researcher gave due care to both validity and reliability issues of the data at the stage of research process in general, data analysis and report writing. Threats to research reliability (participant's error, participant's bias and research error and research bias) did not occur during the research process. Findings from this study can be generalized to other relevant settings, groups or cases.

3.5 Data Analysis

Quantitative data were organized and entered into software known as Statistical Package for Social Science (SPSS) 20 and analysed using descriptive statistics– percentage, mean, frequency and standard deviation. The analysis of data was followed by descriptive interpretation of findings. On the other hand, the qualitative data interpreted and presented in the appropriate part of the report.

3.6 Ethical Consideration

The researcher has given due emphasis to a wide range of ethical considerations. Verbal consent was obtained from respondents who filled out the questionnaire and involved in interview. Moreover, the confidentiality of the information obtained was explicitly explained to each respondent and the data were treated as such with the utmost regard to the issue of secrecy. All questionnaires were scanned and kept safe. In addition, the names of respondents were not written to keep anonymity. The raw data entered into software were also kept safe.

CHAPTER FOUR

Data Analysis, Interpretation and Discussion

In this chapter, the study presents data analysis, interpretation and findings. Moreover, key variables described among others include response rate; characteristics of study population; reliability test; analysis of material resource; impact of materials management system on construction projects; problems addressed by implementing materials management system; analysis of labour resource management; important factors influencing labour productivity; analysis of factors related to equipment resource and their impact on construction projects; analysis of planning and measures taken for resource on construction projects. The chapter discusses on the influences of resource management techniques on construction projects.

4.1 Response Rate

Table 4.1.1 Response Rate of Questionnaire

Respondents	Questionnaire			
	Distributed	Returned	Valid	Valid among distributed in percentage
Professionals	40	37	37	92.5%

As described in Table 4.1.1 above, the size of distributed questionnaires was 40 and the filled in and returned questionnaires constituted 37. Therefore, the response rate for the survey is 92.5%. From this it is possible to conclude that the response rate is adequate for the study since it is more than what is referred as adequate.

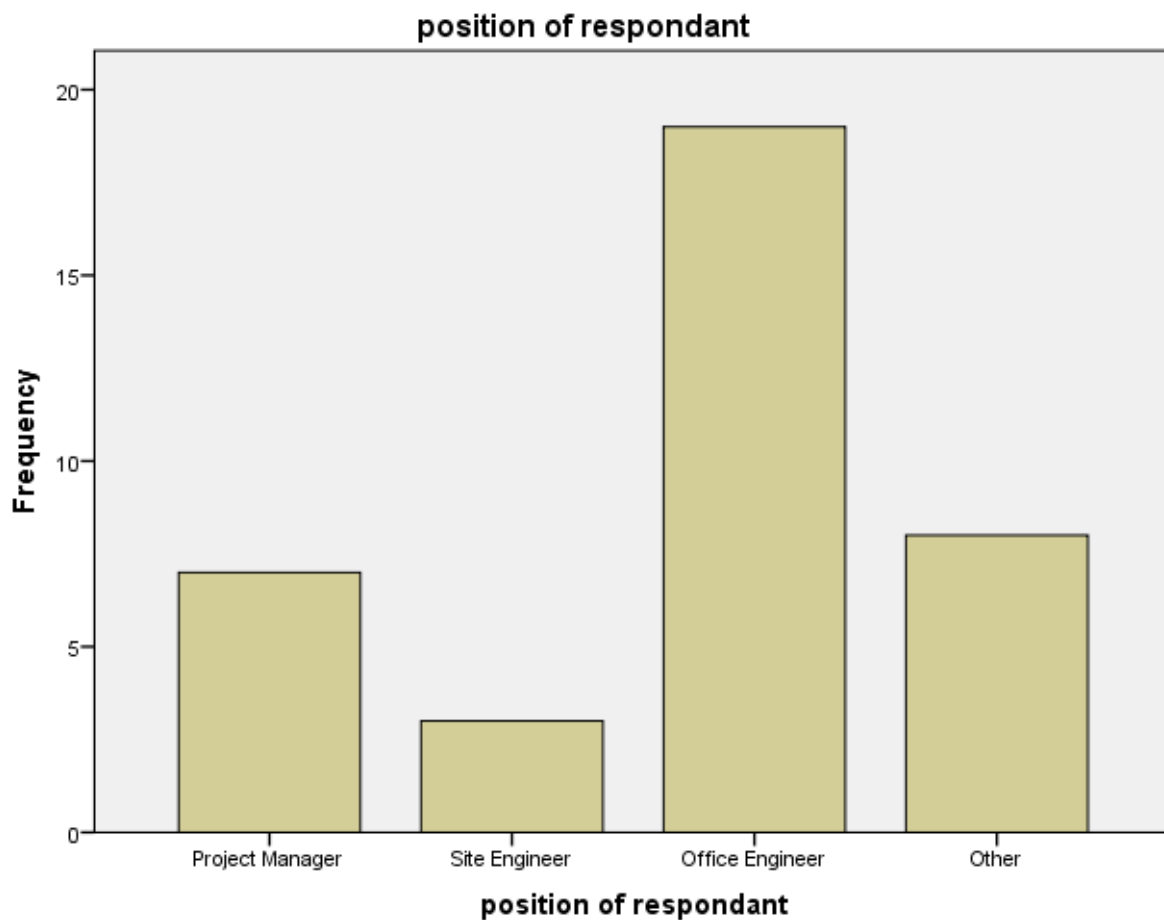
4.2 Characteristics of Study Population

In this sub section, the general characteristics of the study population are provided. According to Ethiopian Construction Ministry (ECM), the target company has Grade 3 contracting license. The company is authorized to engage in building constructions and has more than 20 permanent and many other fixed term employees.

4.2.1 Positions of Respondents

Respondents have different positions in the company. Figure 4.2.1 shows that 18.9% (7) of respondents are project managers, 8.1% (3) are site engineers, 51.4% (19) are office engineers and 21.6% (8) respondents are other than those professions who work on construction projects. The majority (51.4%) of respondents work as office engineers.

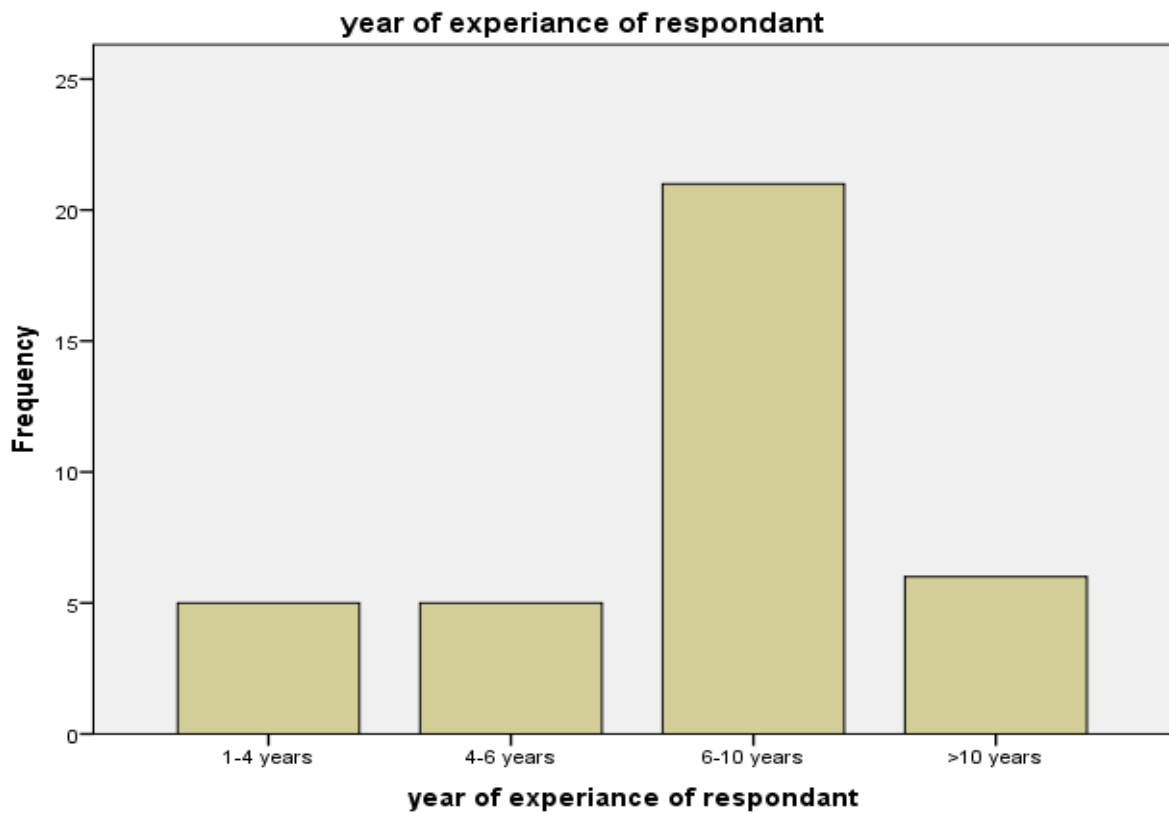
Figure 4.2.1 Positions of Respondents



4.2.2 Work Experience of Respondents

Figure 4.2.2 shows that 13.5% (5) of respondents have experience from one to Four years, 13.5% (5) of respondents have experience from 4 to 6 years, 56.8% (21) of respondents have experience between 6 to 10 years and 16.2% (6) of respondents have experience more than 10 years at construction projects. From this we can conclude that, at average the respondents are well experienced in working with construction industry. Their adequate experience helped them to understand the study themes and properly respond to study questions.

Figure 4.2.2 Work Experience of Respondents



4.3 Reliability Test

Reliability refers to the consistency of a measurement technique and concerned with the stability of the score obtained from a measure of assessment. One of the most common method to test reliability in SPSS is using Cronbach’s Alpha, in which the reliability coefficient is 0.7 or higher, it is considered “acceptable” in most research situations.

Table 4.3.1 Cronbach Alpha Value

No	Field	No of Items	Cronbach's Alpha
1	The impact of materials management systems on construction projects	12	0.764
2	Problems addressed by implementing materials management systems	9	0.945
3	Evaluation of important factors influencing labours productivity	11	0.850
4	Factors related to equipment resource and their impact on construction projects.	9	0.841

According to the Cronbach's Alpha values presented in the above table 4.3.1, the value of individual variables ranges from minimum 0.764 to maximum value of 0.945. Therefore, it is possible to conclude that the values confirm internal consistency and are reliable for further analysis.

4.4 Analysis of Material Resource

Implementation of the management systems of construction materials in construction projects provides the construction company with many benefits and it can solve many problems that may face the company. Data collected to examine the different impacts of resource management on construction projects. Each of the variables was measured on five-point Likert scale. Likert scales are used to measure respondents' perceptions to a particular question or statement. Likert measurements usually coded as: 1 = Not at all important, 2 = Slightly important, 3 = Important, 4 = Fairly important and 5 = Very important.

According to Chileshe and Kikwasi (2014), the mean values which are derived from the 5-point Likert scale can be rated and categorized as follows.

1. 0 >= 1.80 indicates poor or very low or not at all important
2. 1.8 >= 2.6 indicates fair or low or slightly important
3. 2.6 >= 3.4 indicates good or medium or important
4. 3.4 >= 4.2 indicates very good or high or fairly important
5. 4.2 >= 5.0 indicates excellent or very high or very important

4.4.1 Impact of Materials Management System on Construction Projects

In Chapter 2, it is shown that material management system has significant impact on construction projects. Here, we examine this impact on selected variables. Table 4.4.1 summarizes the influence of construction materials management system on construction projects. According to results, implementing construction materials management systems has excellent benefit of minimizing materials cost, proper management of materials, decrease repetition of materials order, on time availability of materials on site with the right quantity, project running on schedule, improving follow up and monitoring of construction materials, decreasing the waste amount and minimum the space for materials on site.

Table 4.4.1 Impact of Materials Management System on Construction Projects

Variables	N	Mean	SD
Minimizes material cost	37	4.46	0.869
Proper management of materials	37	4.65	0.484
Decreases repetitions of materials orders	37	4.41	0.644
On time availability of materials with the right quantity	37	4.70	0.520
Enhances labor productivity	37	4.14	0.673
Project running on schedule	37	4.46	0.650
Improvement of quality control	37	3.89	0.843
Improving follow up and monitoring of construction materials	37	4.27	0.652
Good dealings with suppliers	37	3.78	0.712
Decrease the waste amount	37	4.46	0.650
Minimum space for materials on site	37	4.30	1.077
Good price for the construction materials	37	3.51	1.070
Average Mean Value		4.25	0.737

Also, the mean values of 4.14, 3.89, 3.78 and 3.5 indicate that implementing construction materials management systems on construction projects have very good benefit of enhancing of labour productivity, improvement of quality control, good dealings with suppliers and good price for the construction materials respectively.

Generally, majority of the respondents believe that construction materials management systems on construction projects is very important with the average mean value of the variables 4.25.

4.4.2 Solved problems by implementing materials management system

Table 4.4.2 Problems Addressed Through Implementing Materials Management System

Variables	N	Mean	SD
Materials availability with right quantity	37	4.51	1.070
Materials delay to deliver on site	37	3.32	1.749
Late confirmation from consultant supervising engineer about submittals	37	3.38	1.139
Wrong materials delivery	37	3.14	1.566
Wrong dimension materials delivery	37	3.11	1.524
Wrong quantities of materials delivery	37	3.41	1.554
Unnecessary storage of materials	37	3.81	1.525
Theft and damage	37	3.30	1.543
Materials damage while delivering	37	2.76	1.300
Average Mean Value		3.42	1.44

Table 4.4.2 outlines the importance of implementing construction materials management systems on construction projects to overcome the listed challenges. According to opinions of professionals involved in the construction duty, most of the professionals with the mean value of (4.51) believe that implementing construction materials management systems on construction projects is very important to solve the problem of materials availability with right quantity; and most of the professionals with the mean value of (3.81 and 3.41) believe that it is fairly important to overcome the issue of unnecessary storage of materials and Wrong quantities of materials delivery respectively.

Also, majority of the professionals with the mean value of 3.32, 3.38, 3.14, 3.11, 3.3 and 2.76 believe that implementing construction materials management systems on construction projects is important to solve the issue of materials delay to deliver site, late confirmation from the consultant supervising engineer about submittals, wrong materials delivery, wrong dimensions of materials delivery, theft and damage of materials while delivering respectively.

Generally, majority of the respondents believe that construction materials management systems on construction projects is fairly important to overcome the listed issues with the average mean value of the variables 3.42.

4.5 Analysis of Labour resource management

4.5.1 Important factors influencing productivity of workers

Table 4.5.1 Factors Influencing Labour Productivity

Variables	N	Mean	SD
Excellent labors management	37	4.54	0.960
Health-and-safety conditions	37	4.14	0.887
Job satisfaction	37	4.32	0.747
Labors participation in decision making and good team work	37	3.78	0.750
Availability of material & equipment properly	37	4.32	0.669
Project complication	37	3.95	0.664
Late inspection	37	3.54	0.650
Conflict between workers	37	3.68	0.852
Nonattendance of labors	37	3.54	0.960
Construction capacity	37	3.78	0.854
Inaccurate estimate concerning the productivity of workers	37	3.59	0.686
Average Mean Value		3.93	0.789

Table 4.5.1 summarizes the evaluation of the factors that have effect on productivity of workers according to opinions of professionals involved on the construction duty and most of the professionals with the mean value of (4.54) believe that Excellent labors management have a very high effect on labors productivity and also most of the professional with the mean value of (4.32) believe that job satisfaction of the workers and availability of material and equipment properly have a very high effect on the productivity of workers. Additionally; the factors with a high effect on the labor productivity are health and safety conditions, labors participation in decision making and good team work, project complication, late inspection, conflict between workers, nonattendance of labors, construction capacity and inaccurate estimate concerning the productivity of workers with the mean value of 4.14, 3.78, 3.95, 3.54,3.68, 3.54, 3.78 and 3.59 respectively.

Generally majority of the respondents believe that the factors listed have high effect on the productivity of workers with the average mean value of the variables 3.93.

4.6 Factors Related to Equipment Resource and Their Impact

Table 4.6.1 Factors related to Equipments & Their Impact

Variables	N	Mean	SD
Market availability of construction equipment	37	3.57	1.444
Construction equipment quality	37	3.97	1.040
Construction equipment life time	37	4.03	1.040
Construction equipment cost	37	4.30	.878
Size of equipment	37	3.81	.908
How to use of construction equipment	37	3.95	.815
Proper equipment planning and selection	37	3.81	1.175
Climatic condition	37	4.11	.994
Availability of space	37	3.76	.830
Average Mean Value		3.92	1.014

Table summarizes the Analysis of factors related to Equipment resource and their impact according to opinions of professionals involved on the construction duty and most of the professionals with the mean value of (4.3) believe that construction equipment cost have a very high impact on construction projects and also most of the professionals believe that weather

condition, market availability of construction equipment, construction equipment quality, construction equipment life time, size of equipment, how to use of construction equipment, proper equipment planning and availability of space have a high impact on the construction equipment and construction projects as well with a mean value of 4.11, 3.57, 3.97, 4.03, 4.3, 3.81, 3.95, 3.81, 3.76 and 3.92 respectively.

To generalize majority of the respondents, believe that the factors related to equipment resource listed have a high impact on construction projects with the average mean value of the variables 3.92.

4.7 Planning and Measures Taken to Improve Resource Management

When analysing the planning and measures taken by the contractor for resource on construction projects the questionnaire has included some questions requesting for the actions taken for the late arrival of materials to the work site, for the arrival of materials which didn't meet the specification and actions taken in case of sudden breakdown of construction equipment which has negative effect on maintain the schedule.

Table 4.7 Planning and Measures Taken to Improve Resource Management

No	Questions	Responses	
		N	%
1.	What actions will be taken for the late arrival of materials to the work site?		
	Change the supplier	28	57.1
	Rely on the equipment of the company	8	16.3
	Continue with the supplier	1	2
	Others	12	24.5
	Total	49	100
2.	What actions will be taken for the arrival of materials which didn't meet the specification?		
	Change the resource	36	76.6
	Continue using the resource		
	Others	11	23.4
	Total	47	100
3.	What actions would possibly be taken in case of sudden breakdown of the equipment which has negative effect on maintaining the schedule?		
	Purchase new equipment	17	32.1
	Change the time line	11	20.7
	Rely on subcontractor	8	15.1
	Others	17	32.1
	Total	53	100

Table 4.7 shows that according to the response of the professionals the contractor mostly will take an action of changing the supplier in case of the late arrival of materials to the work site since this will affect the schedule of the project. Also, they will consider some other options like relying on the equipment of the company.

Additionally, table proves that that the contractor mostly will take an action of changing the resource in case of the arrival of materials which didn't meet the specification.

At last, the above table proves that that the contractor mostly will take an action of purchasing new equipment in case of sudden breakdown of the equipment which has negative effect on maintaining the schedule; will also take the other measures listed as an option.

4.8 Analysis of Interview Questions

The researcher reviewed the current situation of construction resources management in Ethiopia by interviewing seven professionals with the title of project manager. And found out that the construction resources management practices are generally inadequate and in the first stages. In addition, concluded that construction resources management practices are not done in a systematic way.

4.8.1 Resource Management Techniques and Their Challenges

Most of the respondents believed that Resource management techniques adds so much strength to the construction company like utilizing or outsourcing of works to subcontractors, development and training of employees, Visibility, accountability, managing costs, allocation and utilization of material, manpower, money and equipment. Also, companies use resource management to ensure resource availability and exchange this resource from one project site to another project site.

Another interview question is related to the resource management techniques employed by their company; accordingly, the common answer shared by the respondents was that they use resource management technique of resource levelling of materials, human resource (labour) levelling, equipment and machine allocation, resource allocation, resource scheduling, resource forecasting, use excel and Ms project software to plan and schedule resources to purchase materials and deliver to site.

Mostly used technique by the professional on construction project for resource management is resource levelling. Resource levelling is a project management technique in which the demand for limited resources is accommodated by adjusting the project program. Resource levelling can be used to determine when the project will be completed with the available resources.

Project management software can be used for resource levelling, which automatically calculates resource availability and potential delays and updates tasks accordingly.

Common techniques that are used by project managers to assist with resource levelling, include: Critical path analysis, Fast-track construction, Project crashing.

Respondents answered the question regarding if they use computer in their company, they all use and they share the program they use almost all answered the same. The programs they used are Ms-Project, Excel, AUTOCAD and PRIMAVERA. From the listed MS-Project and PRIMAVERA are used for planning and scheduling of resources. They use Excel program to prepare bill of quantity and take off sheet. The last program is AUTOCAD it is used for designing floor plans, elevations and sections of a building. They all agreed on the importance of using computer in resource management and mentioned some benefits as it's best tool in project planning and follow up, it reduces the time for preparing project planning, it shows the critical activity and resource, it shows cause and effect of delay, it's best for automated results, to try and test different data with short time, it will minimize consumption of paper, it's easy to calculate and re- evaluate data, it improves efficiency, it's time saving, it helps for quantifying the resource and ordering the necessary material on time.

Some of the challenges shared by the respondents about using computer in resource management are lack of trained professionals on specific resource management software, lack of training institutions for the software, the emphasis the companies give to project planning, the formalities the companies don't follow as per the master schedule and the computer program shortage for resource management they tell only two applications are practiced in Ethiopia.

Another interview question asked to the interviewee was related with the challenge of resource management on construction projects. Accordingly, some of the interviewees mentioned some challenges in general country wise not being specific to their company; its challenges are the lack of timely request, lack of purchase and delivery of resource with the right quality and

quantity on site, contractors managing multiple projects with limited resource, assigning of limited work force by contractors for a complex project to increase the profit of the company by decreasing the expense for professionals, local materials availability and cost of materials, poor scheduling and materials not delivering on time.

Whereas all of the respondent agreed that qualified personnel are not assigned in the area of resource management.

4.8.2 Relationship Between Resource Management Techniques and Construction Project

Almost all of the respondents tell about the relationship between resource management and construction projects as they both are directly related in order to achieve a project goal or objective of a construction project one should employ a very good resource management technique. They also say that without proper resource management, projects will result in cost and schedule overrun. The objective is to ensure the adequate and timely provision of resources, at the same time employing proper utilization of resources.

Most of the interviewee explain that when a company implement a proper resource management technique the project will be completed within budget, on schedule and reasonable profit margin. It will also reduce the overhead cost caused by poor planning and increase revenue. Last but no list they mentioned that with excellent resource management technique will solve the issue of schedule and cost overrun.

Along with this answer the interviewee recommended in order to improve the resource management techniques on construction projects construction companies should take measures like training and creating awareness about the resource management techniques, implementing proper planning improving performance measurement and updating the resource management technique every year.

4.9 Discussion

From the analysed data through distributed questionnaires and conducted interview the researcher believed that almost all of the respondent professionals understand the impact of resource management on construction projects, also estimate resources by classifying as

material resource, labour resource and equipment resource. They believe that implementing resource management techniques on construction projects have plenty of benefits and it will overcome a lot of issues from happening on construction projects. The researcher observed through interview with experienced project managers most of Ethiopian construction projects are not properly practicing the techniques to manage resources. This have many reasons like the company not giving more attention, lack of training on how to techniques, lack of skilled professional on specific duty, materials delivery delay on site, poor planning and scheduling of the contractor, contractors managing multiple projects with limited resources and companies not assigning a specific professional for the resource management responsibility.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION & RECOMMENDATION

5.1 Summary of Findings

The result of the study provides important point on the impact of resource management on construction projects in case of Misac General construction plc. From the research finding to summarize the reliability values for all the questions is greater than 0.7 this makes it acceptable. The project resource management of Misac general construction plc implement all of those components of project resource management i.e. the professionals are aware of impact of materials management systems on construction projects (Mean=4.25 ,SD=0.737), solved problems by implementing materials management system on project site (Mean=3.42 ,SD=1.44), can evaluate important factors influencing labour productivity (Mean=3.93 ,SD=0.789) and they understand the impact of factors related to construction equipment(Mean=3.92,SD= 1.014).

Moreover, respondents all agreed with the company project resource management since all of the resource management questions had mean score in the range of (3.4 - 4.2).

The overall response of the respondents show that the resource management of Misac General Construction plc has a higher level. The company gives more attention for resource management and that is the reason for being an outstanding construction company in Ethiopia. That helps for the success of every project they take. They tell for every construction project success resource management plays a very critical role to finish the project within schedule, budget and with the requested specification. Since Misac General Construction is one of the outstanding constructions company in Ethiopia there is a lot to learn from their experience. Most of the respondents during the interview agreed that the challenges occurring in our country these days besides the economic situation of the country is mostly because of not focusing on resource management by the construction companies and understanding the impact it has on the project success of failure. It's very advantageous to use computerised resource planning and management technique and implement it properly. Since it saves time and is easy to recalculate and re-evaluate in case of variation.

5.2 Conclusion

From the research findings, the project resource management components implemented in Misac general construction plc considers and includes planning and managing resources by classifying as material resource, labour resource and equipment resource for the project. The professionals working in the company are fully aware of impact of materials management systems on construction projects, problems solved by implementing materials management system on project site, can evaluate important factors influencing labour productivity on their company and they understand the impact of equipment resource on construction projects. The company uses computerized resource planning technique and also resource levelling is another technique implemented in the company to manage resources.

When assessing the impact resource management techniques on construction projects in case of Misac general construction, managing all the resources on the project independently and by categorizing them as material resource, labour resource and equipment resource has a significant impact for the construction project success. Additionally, managing resource properly has a positive impact to construction projects while ignoring and not giving more attention to project resource management has a negative effect, it will cause project cost and schedule overrun.

This study encourages the idea that resource management has a positive impact for the success of a construction project. Effective resource management will improve labor productivity and a good work flow on project sites which leads to deliver construction projects on schedule, with the estimated cost and with the specification requested.

5.3 Recommendation

Based on the study results, the researcher gives the following recommendation; first, any project staffs involved on the construction project should focus on project resource management it shouldn't have to be the duty of the professionals or engineers. Specially, project material resource and equipment management should be done by all the workers involved in the construction project. The company must have a clear procedure on resource management techniques and all the project staffs should understand it clearly.

Using computerized resource management technique is the best option and training almost all of the professionals on computer software is recommended. Since it is time saving and more advanced.

Although in Ethiopia construction projects has so many challenges on projects resource management due to external factors like weather condition, political situation and economy of the country all construction companies should have a well understanding of resource management and implement it by giving more attention for project resource management since it has a negative effect when not implemented properly will cause cost and schedule overrun.

Construction companies need to invest in their employees to help them obtain the required knowledge and skills for resource management on advanced level since it is the critical thing for construction projects. Also, most failing construction companies should adopt advanced tools and techniques used by some other successful companies to enhance their project success.

The construction sector in Ethiopia is booming and still continuing to have a leading part in the industry. The fast growth of the construction industry resulted in increase in the number of contractors joining the industry. However, several defects are being noted in the sector that need immediate action. Recently projects are having the challenge of delivering projects with in a schedule and budget. Most known challenges faced by contractors are project complexity and understanding it, late delivery of materials, poor planning and scheduling, managing multiple projects with insufficient employees or work load on labors, shortage of resource and other much more challenges. Taking an immediate measure for this listed and other challenges is very crucial by the contractors in order to deliver construction projects without cost and schedule overrun which is mostly occurring nowadays.

The success of any construction project highly depends on how proper and effective the management of construction resources flow. Resources are assets, such as people, equipment, physical facilities, or inventory that have limited availabilities, can be scheduled, or can be leased from an outside party.

Resource management is the process of planning the resources necessary to meet the objectives of the project. The aim of project resource management is to optimize the allocation of resource to projects, manage resource cost, balance the internal and external resource, develop staff capabilities, allocate staff to work with their skills, deliver more projects on schedule, increase resource utilization, identify skill and resource shortage earlier.

Without proper resource management, projects will result in cost and schedule overrun. The objective is to ensure the adequate and timely provision of resources, at the same time

employing proper utilization of resources. The main technique here is knowing what resources are needed, what resources are available, where resources are located, and the ability to reschedule those resources accordingly.

Mostly used technique by the professional on construction project for resource management is resource levelling. Resource levelling is a project management technique in which the demand for limited resources is accommodated by adjusting the project program. Resource levelling can be used to determine when the project will be completed with the available resources. In construction, resource levelling can be used to estimate the large variations in resource usage that can occur over time, and which can be inefficient and costly. Project management software can be used for resource levelling, which automatically calculates resource availability and potential delays and updates tasks accordingly. Common techniques that are used by project managers to assist with resource levelling, include: CPM, Fast-track construction and Project crashing.

5.4 Suggestion for Further Research

The present study discussed only one factor which affects the construction project in case of Misac general construction plc, further studies should consider discussing other factors which has an impact on construction projects. The research tries to cover the perspective of contractor's professionals about the impact of resource management techniques on construction projects more investigation should be done to find the view of consultants, clients and other stakeholders about the impact of resource management. Moreover, the impact of resource management on various projects different of similar industry can be conducted using this project work.

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Appendix 1

Questionnaire

Title of Research: Impact of Resource Management Techniques on Ethiopian Construction Project.

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Addis Ababa University, College of Business and Economics, School of Commerce, Department of Project Management

My name is Hirut Kebede MA candidate in Project Management at Addis Ababa University, College of Business and Economics, School of Commerce. At present, I am engaged in conducting MA thesis research entitled 'Impact of Resource Management Techniques on Ethiopian Construction Projects'. The research aims at examining the resource management techniques of organizations from different dimensions including efficiency, effectiveness, challenges and opportunities. I am hoping that the findings of the research will be an input to improve the resource management practice of organizations involved in management of construction projects.

For the purpose of the above research, I am collecting primary data from selected organizations that implement or active in construction projects. The respondents are site engineers, project managers, office engineers and other professionals who involve in the construction projects. Therefore, I kindly request you to fill in the questionnaire. The information you provide will be treated anonymously and kept confidential.

If you have further inquiry regarding the research and questions please don't hesitate to contact me through the contact details mentioned above.

Thank you for showing willingness and investing time.

SECTION A: GENERAL INFORMATION ON ORGANIZATION

1. Organization Name: _____

2. Year of company establishment:

- Five or below years
- 6-10 years
- 11-15 years
- 16 and more years

3. Major type of work involved:

- Buildings
- Roads
- Sanitary and Electrical Installation Work
- Electro Mechanical work
- Other (specify).....

4. Function (responsibility) of respondent:

- Project manager
- Site Engineer
- Office Engineer
- Other(specify).....

5. Relevant working experience (Years):

- 1-4 Yrs.
- 4-6 Yrs.
- 6-10 Yrs.
- >10.1Yrs

6. Company grade classification according to Ethiopian authority (ministry) responsible for construction:

- Grade 1-3
- Grade 4-6
- Below Grade 7
- I don't know

7. No. of permanent employees:

- Less than 5
- 5-10
- 10-15

- More than 15

SECTION B: MATERIALS

The impact of materials management systems on construction projects

8. Please assess the impact of implementing construction materials management system.

No	Benefits	Excellent	Very good	Good	Fair	Poor
1	Minimizing material cost					
2	Proper management of materials					
3	Decrease repetition of materials orders					
4	Ontime availability of materials with the right quantity					
5	Enhances labour productivity					
6	Project running on schedule					
7	improvement of quality control					
8	Improving follow up and monitoring of construction materials					
9	Good dealings with suppliers					
10	Decreasing the waste amount					
11	Minimum space for materials on site					
12	Good price for the construction materials					

9. What is your evaluation on the solved problems by implementing materials management system on project site?

No	Issues	Very important	Fairly important	Important	Slightly important	Not at all important
1	Materials availability with right quantity					
2	Materials delay to deliver on site					

3	Late confirmation from the consultant supervising engineer about submittals					
4	Receiving of wrong materials					
5	Wrong dimensions materials delivery					
6	Wrong quantities of materials delivery					
7	Unnecessary storage of materials					
8	Theft and damage					
9	Materials damage while delivering					

SECTION C: LABOR

Important factors influencing labour productivity

10. Evaluate the factors that have influence on labour productivity.

No	Factors affecting productivity of workers	Very high	high	Medium	Low	Very low
1	Excellent labours management					
2	Health-and-safety conditions					
3	Job satisfaction					
4	Labours participation in decision making and good team work.					
5	Availability of resources (material & equipment) properly					
6	Project complication					
7	Late Inspection					
8	Conflict between workers					
9	Absenteeism of labours					
10	Construction capacity					
11	Inaccurate estimate concerning the productivity of workers					

SECTION D: EQUIPMENT

Factors related to equipment and their impact on construction projects

11. To what degree impact the availability of equipment in construction project?

No	Factors increasing duration and cost of the project	Very high	High	Medium	Low	Very low
1	Market availability of construction equipment					
2	Construction equipment quality					
3	Construction equipment lifetime					
4	Construction equipment cost					
5	Size of equipment					
6	How to use of construction equipment					
7	Proper equipment planning and selection					
8	Climatic condition					
9	Availability of space					

SECTION E: Planning and measures taken

12. What actions will be taken for the late arrival of materials to the work site?

- Change the supplier
- Rely on the equipment of the company
- Continue with the supplier
- I don't know
- Other (specify).....

13. What actions will be taken for the arrival of materials which didn't meet the specification?

- Change the resource
- Continue using the resource
- I don't know
- Other (specify).....

14. What actions would possibly be taken in case of sudden breakdown of the equipment which has negative effect on maintaining the schedule?

- Purchase new equipment
- Change the time line
- Rely on subcontractor

- I don't know
- Other (specify).....

THANK YOU!!!

Appendix 2

Interview questions

1. Depending on your experience on construction projects; what are the major strengths and challenges in resource management of construction projects in Ethiopia?

Summarize your opinion in bullet points.

1.1) Strengths:

1.2) Challenges:

2. To what extent construction companies give attention to resource management?

3. Do you use computer system in your company?

- Yes
- No

4. If your answer for Q# 3 is yes, please answer the following question otherwise go to Q#22. Which computer programs are used by your company?

- MS-PROJECT
- EXCEL
- AUTO CAD
- PRIMAVERA
- OTHER (specify).....

5. From your experience, please list the important aspects of using computer and its application in resource management.

6. From your observation, what are the challenges in use of computers in resources management? If so, mention a few.

7. What resource management techniques does your company employ for construction project sites?

8. Please shortly describe about the relationship between resource management techniques and construction project delay?

9. Explain about the impact of resource management techniques on construction project?

10. What recommendations can you make to improve the resource management techniques on construction project sites?

THANK YOU!!!