Investigation of the Effect of Communication between Project Team Members on Construction Project Schedule. Case: Jimma Zone.

A Research Report Submitted to the School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements for the Award of Master of Arts Degree in Project Management and Finance (MPMF)

By: ***Bedaso Ahmed***

JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF ACCOUNTING AND FINANCE

July, 2020

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Under the guidance of

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DECLARATION

I, the undersigned, declare that this study entitled "***Investigation of the Effect of communication between project team members on construction project schedule. Case: Jimma Zone*****"** is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the study have been duly acknowledged.

Declared by:

Name: ***Bedaso Ahmed***

Signature: _____

Date: _____

CERTIFICATE

This is to certify that this study, "***Investigation of the Effect of communication between project team members on construction project schedule. Case: Jimma Zone***", undertaken by **Bedaso Ahmed** for the partial fulfillment of Master of Arts Degree in Project Management and Finance at Jimma University, is an original work and not submitted earlier for any degree either at this University or any other University.

Research Advisor:

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Signature: _____

Date: _____

Research Co-advisor:

Mr. Mohammed Sultan

Signature: _____

Date: _____

Abstract

This study is about investigating the effect of communication between construction project team members on the construction project schedule. Construction projects that involve all client, contractor, consultant were considered as population of the study. Since the population was very small, the census type of sampling technique was used. The questionnaire was used for data collection from the population. A total of 60 questionnaires in which 20 for each party were distributed and a total of 59 questionnaires were collected which gives us a response rate of 98.33%. The study shows that 74.6% of the total projects were delayed with an average percentage of 24.32% to the original duration. The five leading delay factors in the construction projects were poor communication and coordination by contractors with other parties, poor communication and coordination between consultant and other parties, ineffective planning and scheduling of the project by the contractor, poor communication and coordination between the client and other parties and change orders by the owners during construction with relative importance index (RII) of 0.692,0.651,0.647,0.637 and 0.614 respectively. Casting of concrete was also leading categorical activities which needs good communication between project team members with relative importance index (RII) of 0.81. This study also shows that the schedule of construction projects was strongly correlated with communication between each team member. But the highest correlation coefficient was with communication between consultant and contractor with a correlation coefficient of 0.795. This study recommends to integrate communication management in their day to day project management. Especially the communication between contractor and consultant should be carefully monitored.

Keywords: *Communication, project team members, schedule*

Acknowledgment

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Acronyms

CC	Correlation Coefficient
CSA	Central Statistics Agency
RII	Relative Importance Index
S2	Significance level (2 tailed).
SPSS	Statistical Package for Social Science

List of Notations

i-response category index

W_i-is the weight given by respondents

F_i-is the frequency of respondent for each weight

A-is the highest weight

N-is the total number of respondents.

D-difference in ranks

CHAPTER ONE

INTRODUCTION

1.1Background of the study

Construction project is conducted by three parties/companies such as contractor, client, and consultant (Chan W.M., 2002). The representatives from these companies form a team on one specific project to accomplish the objectives of that project (Albanese R., 1994). The Client provides a resource for the project throughout the construction of the project. Designer provides the design of the project and also consults the project so that the project will be constructed according to the design. But the contractor constructs the project by managing the resource which is provided by the client and also managing the design which is provided by the designer/consultant. The successful project involves a large number of specialized project teams (e.g. Owners, contractors, consultants, and designers) with specific core competencies. A project team is characterized by diversity, multi-disciplinary knowledge, with dynamics and temporary features, while the ultimate goal of the project team is to achieve project success. With common goals of achieving project success, project teams tend to be interdependent with each other, which may lead to conflicts (Wu G., Liu C., Zhao X. and Zuo J.,2017).

So the adversarial working relationship between these team members affects the project schedules, safety, and quality as well as cost. One significant factor that causes the adversarial relationship is the lack of communication between project team members (Albanese R., 1994). Shohet M., Wei H., Skibniewski M., Tak B. and Revivi M. (2019) also believe that the improvement of information and communication technology system for effective communication has great use in effectively promoting safety and quality of the project.

Communication affects most project activities and areas due to managing any aspect of the project involves communicating within the project team or with external stakeholders. As a result, communication management is taken as one of the most important knowledge areas in project management and a very complex one at the same time. Many studies have shown that there is a direct connection between communication and project outcome, which is determined by the design of the communication environment of the project. Project communication and

networking skills are regarded as the lifeblood of project management leadership (Muszynska K.,2017).

According to Zulch BG (2014) also communication is so important to project success that it has been referred to as the lifeblood of a project by more than one practitioner. Project team members need to collaborate, share, collate and integrate information and knowledge to realize project objectives. So, it is necessary to understand the process of communication. Poor communication during the construction has effect on the schedule, the cost, the safety of workers, and the project quality. Enhanced communication by the project manager may goes to less failure, innovation, and technical solutions, positively influencing the quality, and leading to better decision making.

So in this study, investigation of the effectiveness of project team member's communication in completing the project which is located in the Jimma zone within the schedule was done.

1.2 Statement of the problem

A construction project is considered as successful when it is completed on time, with a budget, according to the specifications, and stakeholder satisfaction. According to Sinesillase E.G. (2017) also construction project is commonly considered as successful when it is completed on time, without cost overrun and in accordance with specifications. Different researchers use these to measure project success. However, there is a delay for most of the projects. Construction projects experienced 70% of time overruns and 76% of contractors and 56% of consultants have indicated that they have been experiencing average time overrun of 10 to 30% from the originally specified time that causes 50% cost overrun (Gebrehiwot T. and Luo H., 2017).

This time overrun is also one of the most significant issues being faced by the Ethiopian construction industry today. To finish the project within the schedule, the successful execution of construction projects and keeping them within a prescribed schedule is very important (Sinesillase s., 2016). Dessa (2010) shows in his study that the performance of 15 completed public construction projects in different regions of Ethiopia and found that the cost increases in most projects are greater than 80% of their contractual sum. The Construction industry in Jimma zone is one of the construction industries that experience the same problem of time overrun and cost overrun. In a construction project, the team is formed from different companies and different areas of knowledge.

According to Ammeter A.P. and Janet D.M. (2002) Project teams, in which individuals from different organizations are brought together to perform complex or specialized tasks of a multidisciplinary nature, represent an important type of organization. As a temporary group, a project team is formed mainly for completing the assigned activities and then disband. Being temporary are key factors driving the differences in the ways temporary group member perceive their working relationship. As a result of the often temporary nature of teams, as well as the fact that individuals on the team are often drawn from different functional areas, project team members may have conflicting perspectives and loyalties. Construction project development involves extensive information exchange among members of multidisciplinary project teams. The nature of such information can be typically categorized as financial, technical, and administrative. Furthermore, the timely transfer of relevant information is critical for project performance in light of the mutually dependent nature of construction activities (Cheung S., et al.,2013).

So communication between project team members is critical and main factors. Communication is one of the factors that can delay the completion time of the construction project (Biggs M., 1997). Shohet et al. (2019) and Chan W.M (2002) share the same idea. According to Zulch (2014) communication is the process of acquiring all relevant information, interpreting this information, and effectively disseminating the information to persons who might need it. Communication is very important to everyone involved in and influenced by projects.

Desalegn M. et al (2017) believes that the communication system is one of the project success factors in Addis Ababa, Ethiopia. According to Tebeje Z. (2016), the lack of effective communication is one of the major delay factors in the Ethiopian construction sector. Koshe W. (2016) indicate in his study that the poor communication and coordination between project team members is one the delay factor in Ethiopian construction industry. Gebrehiwot T. (2017) also has shown in his study that poor communication between project team members is one of the delay factors in Ethiopian construction projects. According to Sinesillase S. (2017), adequate communication between project participants is one of the project success attributes.

But recognition and attention for communication are not given in the Jimma zone though it is one factor that could delay the construction project in the Jimma zone.

So, the researcher was motivated to determine the effect of communication between project team members in completing construction projects which are located in the Jimma zone. After this

study, the experts who are engaged in construction projects will determine the relationship between the communication between project teams and project success, the effect of means of communication on project success and the major delay factors in Jimma zone so that attention will be given in planning and design of communication management.

1.3 Basic research questions

- What is the percentage of number of construction projects which are delayed in Jimma zone and also its percentage of delay?
- What are the major factors that can delay the construction project in Jimma zone?
- What is the percentage of construction project which are delayed due to poor communication between project team members?
- What are the means of communication between construction project team members?
- What are the categories of construction activities which mainly needs communication between construction project team members?

1.4 Objectives of the study

1.4.1 General objective

The main objective of the study is to investigate the effect of project team member's communication on the completion date of the construction project.

1.4.2 Specific objectives

- To determine the percentage of the construction projects which are delayed in Jimma zone and its corresponding average percentage of delay.
- To determine major factors that can delay the construction project in Jimma zone.
- To determine the percentage of construction project which is delayed due to poor communication.
- To determine the means of communication between construction project team members?
- To determine categories of construction activities which needs mainly communication between construction project team members.

1.5 Significance of the study

All companies that are engaged in construction projects will be benefited from this study so that they will improve the completion time of their project. After this study, the construction company will verify the good means or channel of communication to prevent time overruns. And also, by recognizing and realizing the effect of communication between project team members, design and management of communication will be considered in the planning stage. All experts will understand the relationship between the project team and project success and keep the project within the schedule by improving this relationship.

1.6 Hypothesis

1.H_o: Around 50% of construction projects are delayed in Jimma zone.

H_a: The percentage of the delayed construction projects in Jimma zone is different from 50%.

2.H_o: The average percentage of the delay in the Jimma zone construction project is 20%.

H_a: The average percentage of the delay in the Jimma zone construction project is other than 20%.

3.H_o: Poor communication between project parties is one of the major five leading delay factor in Jimma zone construction projects.

H_a: Poor communication between project parties is not one of the five leading major delay factors in Jimma zone.

4.H_o: Masonry and carpentry are the first leading activities that need more communication compared to other construction project activities.

H_a: Masonry and carpentry categorical activity is not the leading activity that needs more communication compared to the other construction project categorical activities.

5.H_o: Schedule is strongly correlated with communication between consultant and contractor.

H_a: Schedule is weakly correlated with communication between consultant and contractor.

1.7 Scope of the study

In this research, the effect of communication between team members in completing a construction project was studied. Since communication between project team members is one of

the factors that can delay the construction project, this research was limited to factors that could delay the completion of a construction project in Jimma zone. It was limited to Jimma zone due to the availability of the information and accessibility of different construction project site due to the current political situation in the country. And also the movement from one place to another was not the same as before due to the international pandemic coronavirus (COVID19). Due to the mentioned factors, it is limited to the building construction project which is constructed within the Jimma zone and also involves the participation of all client, Contractor, and consultant.

Knowledge of project management such as project management information system, project communication management, project management control, project risk management, and also others. The construction projects that include all client, contractor, and consultant were selected due to the significance of the effect of communication. As per information from Jimma zone construction design bureau and Jimma university construction capital office, the total number of construction projects that involve all client, contractor and consultant are 20. So the source of information was limited to these 20 construction projects.

1.8 Limitations of the study

The main limitations of this study were coronavirus (COVID19) and also the current political situations of our country. This influences and imposes a limit on the method of data collection and gathering sufficient information about related studies. The mentioned factors also limit the movement from one place to the others which means far from Jimma zone. But by choosing the method of data collection which enables us to gather information, information was collected.

1.9 Organization of the paper

This paper has five chapters in which from introduction to finding of the study were discussed. The first chapter discussed the background of the study, statement of the problem, objectives of the study, significance of the study, hypothesis, scope of the study, limitation of the study and the organization of the paper. In the second chapter, the related literature review was done to show the study focuses on hot and critical issues in which different scholars did many researches. And also shows the area of this study and what was done in this research area. It presents about the introduction of construction projects, project team organization, factors affect construction project, project team communication, and also different empirical studies.

In the third chapter, the research methodology was presented. Under this chapter research location, research period, research design, dependent and independent variables, population, sampling technique and sample size, source and method of data collection, and method of data analysis were presented. In the fourth chapter, the finding of this study was presented and the last chapter summarizes the study and also recommends what should be improved in the future.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Overview of construction project

The construction industry is a way or a tool for satisfying societal needs (Ibrahim M., 2013). It is a collaborative venture that involves a variety of various organizations brought together to form the construction project team. It has been widely criticized for failure in forming an effective construction project team (Baiden B.K., et al., 2006). According to Chan (2002) construction project is conducted by a team formed from three parties/companies such as contractor, client, and consultant. The representatives from these companies form a team on one specific project to accomplish the objectives of that project. Ammeter et al. (2002) also shares the same idea.

2.1.2 Project team organization

Teams are a social organizations of two or more people that are included in an organization(context), whose members perceive themselves as such and are perceived as members by others (identity) and who collaborated on a common task (Baiden B. K,2011). It is used in an organization in most sectors and industries which need different experts and skills because of the team performance which is better than the individual acting alone (Baiden B.K, 2006). According to Albanese (1994), there are two organizational project teams such as the intra-organizational project team and the inter-organizational project team. Intra-organizational project team is about enhancing organizational effectiveness but also focus on contributing to project effectiveness. It consists of members of one organization either the owner, designer, or contractor organization. But inter-organizational project team focuses directly on project effectiveness by solving issues that concern owner/client, designer/consultant, and contractor working relationship. This effective inter-organizational project teams do not just happen. They have to be formed, developed and initiated by an effective team-building process. (Albanese R.,1994).

Albanese (1994) believes that a team-building process is a project-focused process that engages key stakeholders in the project's outcome usually the representatives of the project owner,

designer, and contractor. Its purpose is to improve project results by developing a common mission statement of shared goals, building and developing trust and commitment, resolving differences, removing roadblocks, creating interdependence, and accountability among the team members and developing problem-solving skills. Baiden (2011) also thinks that in construction, integration often refers to collaborative working practices, methods, and behaviors in which various parties share information. The Client provides a resource for the project throughout the construction of the project. Designer provides the design of the project and also consults the project so that the project will be constructed according to the design. But the contractor constructs the project by managing the resource which is provided by the client and also managing the design which is provided by the designer/consultant.

Project team, in which individuals of a different expert in an organization are brought together to perform complex or specialized tasks of multidisciplinary nature, represent an important type of a group in an organization (Cohen and Bailey, 1997). As a temporary group, the main purpose of the project team is to complete the given task by certain dates and disband. Like a temporary group, it has a definite life span. Specifying this time frame and assured impermanence are key factors driving the difference in the ways temporary group members perceive their working relationship with the group (Bryman, et al, 1987).

As a result of the temporary nature of teams as well as the fact that individuals on the teams often drawn from different functional areas, project team members may have conflicting perspectives and loyalties. The aim of using the project team in an organization is to ensure not only acceptable but also exceptional levels of performance. (A.P.Ammeter and Janet M.,2002).

According to Ammeter and Janet (2002), the following factors are associated with high performance in the project team.

1. Team orientation; the sense of belongingness to a team, working well together.

This represents a considering themselves as a part of the team and enjoys being part of the team. Being working together will enable them to be energetic, excited, hard-driving, task committed, enthusiastic and the team approach is good and led to a synergy in which things get done better and things don’t fall through the crack.

Synergy due to this orientation is an indication of factors related to well-functioning groups: interpersonal interactions, and liking.Having less feeling of team orientation in a big team may be the results of the bigger team being harder to cognitively identify as a “team”.

2.Critical project manager/Leader behavior

The main role of the project team leader is to communicate the desired goals and values of the team. A secondary role of the team leader, but still critical, is to share the information about the status of the project. Due to the size of some projects, team members in some projects often can only see or cognitively identify the entire project based on the information provided by the team leader.

3.Team communication; Frequent team meeting

This refers to the number and the extent to which the project team member and external parties were held meeting. These meetings generally were used to share information and solve problems of technical nature, but also served to provide a forum in which the team members interact socially with each other.

4.Ownership

The sense that personal success related to project success. These factors generally were expressed as asense of being with the project from beginning to end (sense of ownership) and a sense of considering project goals as the goals of each individual in the organization.

5.Location; collocation and/or physical isolation of team.

The study shows that working together in the same office or near to each other is a contributing factor to the success of the team. Many reasons were given, ranging from a need to facilitate communication necessary for project execution and restricting functional managers ability to take them temporarily of the project.

6.Performed team building

This refers to a grouping of teams that may be formal or informal. Formal team building includes organized seminars, offsite or onsite. But informal team-building includes group events, lunches, casual days.

7.Competition

Competing with other or previous projects. This study shows that competition which is done frequently concerning another project was important for at least two reasons. First, several project teams were being evaluated against the performance of the past teams or teams running parallel to them. Competitive comparisons thus provide a practical check as to how they were doing relative to their benchmarks. A second reason was the teams were generally doing well compared to their competitors.

8.Rewards or bonuses for excellence; Use of team perks.

Rewards often were made in the form of a certificate or in the organization's common area, or were given in the form of cash bonuses. Rewards were usually reserved for performance at the critical stage or particular point in the project and not for overall final project success;i.e the rewards were given during the project, thus serving as a motivator for the future performance on the project.

9.Level support or sponsorship/high profile/high visibility of the project.

According to this study, a project with high visibility and level of support could get greater access to resources and was more carefully planned.

Using effective teamwork helps to improve many aspects of a team such as coordination, innovation, horizontal communication, and flexibility(Baiden B.K,2011).In investigating the complex nature of team members working together, Hoegl explains that the standard of teamwork can comprehensively be assessed by considering six facts of the collaborative work process; communication, coordination, balance of member contribution, mutual support, effort, and cohesion. The size of a team has great effects on several aspects of teamwork quality. First, the sharing of technical and coordinative information within the team becomes significantly more difficult as the number of team members increases. As team size grows, the complexity of the communication structure between all members increases dramatically. While the communication between all members become increasingly difficult, larger team size also creates a stronger need to coordinate the contribution from the different team members. The combination of these two effects highlights how teamwork becomes increasingly resource and time consuming as the team adds members (M.Hoegl, 2005).

2.1.3 Factors that affect the success of the construction project

According to Chan et al. (2002), construction project may be regarded as successful if the projects is completed on time, within budget, without any accidents to the specified quality standards and overall client specification. Besides, quality can be defined as fulfilling the legal, aesthetic, and functional requirements of a project. Requirements may be simple or complex, or expressed as end result required or as a detailed description of what is to be done. But, however, expressed, quality is attained if the stated requirements are adequate, and if the completed project conforms to the requirements (David A. and H Murat, 1997).

In the construction industry, quality can be defined as fulfilling or attaining the requirements of the designer, contractor, and regulatory agencies as well as the owner. According to Ferguson et al. (1988) study can be characterized as follows:

- ✓ Fulfilling the requirements of the owner as to functional adequacy; completion on time and within budget; life-cycle costs; and operation and maintenance.
- ✓ Fulfilling the requirements of the design professional as to the provision of the well-defined scope of work; budget to assemble and use a qualified, trained and experienced staff; budget to obtain sufficient field information before design; giving on decisions by the owner and design professional and contract to perform important work at a fair fee with adequate time allowance.
- ✓ Fulfilling the requirements of the contractor like giving contract plans, specifications and other documents prepared in sufficient detail to permit the contractor to prepare priced proposal or competitive bid; on-time decisions by the owner and design expert on legalizing and processing of change orders; fair and timely interpretation of contract specification from field design and inspection staff; and contract for performance of work on a reasonable schedule which allows a reasonable profit.
- ✓ Fulfilling the requirements of regulatory agencies (the public) like public safety and health; environmental considerations; protection of public property including utilities; and conformance with applicable laws, regulations, codes, and policies.

Realistic construction time is now very important because it often functions as a crucial benchmark for evaluating the performance of the project and the efficiency of the project organization. A review of literature has found that time overrun which is one of poor performance is commonplace in the construction industry over the last three decades. For example, there were specified 50-80% delays on the 1627 World Bank sponsor project between1974-1988. Besides with an average of 23.2% time overrun on UK government construction project from 1993-1994. In Hong Kong, public building projects, private building projects, and civil engineering works were the project in which there were average time overruns in 1994 and were found to be 9,17and 14% respectively (Chan W.M.,2002).

Time and cost overrun are commonplace and far too many resources are used to correct or improve defects. So the failure of the project participant to work together effectively lead to this poor performance (Baiden, 2006). Ammeter and Janet (2002) shares also the same idea.

In construction, the delay might be defined as a failure of completing the project within contract specified time, or beyond the date that the parties prescribed for delivery of a project. It is a project slipping over its planned schedule and is regarded as a common problem in construction projects. To the owner, the delay means the failure of getting revenue due to lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, a delay means an increment of overhead costs due to a longer work period, an increment of material costs through inflation, and due to the rise of labor cost. Completing projects on time shows efficiency, but the construction process is exposed to several variables and unexpected factors, which result from many sources (Assaf, S.A and Al-Hejji, S., 2006).

But Baker et al. (1983) suggested that instead of using time, cost, and performance as measures for project success, perceived performance should be the measures.

Hughes (1986) conducted a survey to investigate the factors that affect project performance. He found that projects fail due to unsuitable basic managerial principles, such as the improper focus of the management system, by rewarding the inappropriate actions, and the lack of communication of goals.

Martin (1976) studied and identified the next listed factors which is critical for project success. Define goals, select project organizational philosophy, General management support, Organize and delegate authority, select project team, allocated sufficient resources, provide for control and information mechanisms, and Require planning and review.

Locke (1984) suggests the following factors as critical factors for project success. Make project commitments known, project authority from the top, appoint a competent project manager, set up communication and procedures, set up control mechanisms (schedules, etc.), progress meeting

Cleland and king (1983) believe that the following listed factors are critical factors for project success. Such as: Project summary, operational concept, top management support, financial support, logistic requirement, facility support, market intelligence (Who is client), project schedule, executive development and training, manpower and organization, acquisition, information and communication channels and project review.

Sayles and chandlers (1971) identified the following factors as critical success factors in a project. Such as: Project manager's competence, scheduling, control system and responsibilities, monitoring and feedback, and continuing involvement in the project

Baker et al. (1983) state the following listed factors as factors which is crucial for the success of the project. Such as: Clear goals, goal commitment of the project team, on-site project manager, adequate funding to completion, adequate project team capability, accurate initial cost estimate, minimum startup difficulties, planning and control technique, ask (vs. Social orientation), and absence of bureaucracy.

Pinto and Slavin (1989) suggested the following listed critical factors which is used for project success. Top management support, client consultation, personnel recruitment, technical tasks, client acceptance, monitoring and feedback, communication, trouble-shooting, characteristic of project team leader, power and politics and environment event urgency

Successful intervention to enhance the safety of work conditions on construction sites should focus on stimulating site management involvement, and on effective communication and control of safety. Improved communications and shared information between relevant parties as factors that could enhance construction quality (Shohet M., et al., 2019). Chan W.M. (2002) also thinks that project delays can lead to cost overruns as well, for example through additional overheads and potential claims between client and contractor. To enhance the construction time performance of the project, it is necessary to identify the significant factors that affect construction duration and contribute to delays. One of the factors that affect construction duration is communication management for decision making and construction team management attributes. Love and Edwards (2004) also believe that Lack of quality management focus, poor communications, and poor supervision were major factors contributing to rework.

Fatemeh N. (2017) believes that proper scheduling of the construction project enables us to finish the project at a specified time. But the following factors are identified by Sinesillase et al. (2016) as the critical success factor of scheduling public construction projects in Ethiopia.

i) Project manager's knowledge and experience: a clear understanding of project scope, well planning and organizing of project execution at the site facilitates monitoring, controlling the project progress easily, and expecting any sudden problems before their occurring.

ii) Coordination and communication between project parties enable to complete the project within a specified time.

iii) Site engineers and project managers enhance the project progress by monitoring and feedback with each other.

iv) A clear assignment of each party involved in the construction process prevents any conflict in the future.

v) Change orders during construction and maintenance could be reduced by providing a clear plan and specification which indirectly prevent delay.

vi) Giving attention to weather conditions in planning helps to organize the work at the site without any delay and improve resource management.

2.1.4 Project Team Communication

Communication influences most project activities and areas because every activity needs communication between the project team and external stakeholders. That's why communication management is taken as one of the most important knowledge areas in project management and a very complex one at the same time. It is affected by various factors like characteristic of project stakeholders, project environment, and project communication structure, and communication property, physical and psychological barriers. There is a direct relationship between communication and the project's outcome, which could be known by designing the communication environment of the project. Project communication and networking skills should be taken as the lifeblood of the project management leadership and awareness of the potential offered by efficient communication is an essential prerequisite for success in the business world. (Muszynska, K.,2017).

Communication is very important for the efficient performance of any team especially on construction projects because of various skill requirements (Baiden B.K., 2011). Chan et al. (2004) also believe that adequate communication is one of the factors which contribute to the success of the project.

Design/Construction process is described by adversarial working relationships among owners, designers, and contractors. Various factors contribute to adversarial relationships among owners, designers, and contractors. But according to Albanese, it is categorized as follows (Albanese R.,1994):

- The scope of the construction process was poorly designed.
- Excessive changes

- Changes not properly managed
- Others like lack of communication, lack of common project mission, perceived ethics violations, litigation contingency positioning, lack of team spirit, incomplete documentation and etc…

And also, Albanese (1994) believes that any of the above-mentioned interrelated causes of adversarial relationship may undermine the project result. Adversarial working relations could affect schedules, safety, and quality as well as costs; and they could make experiential history detrimental to future working relations. Team characteristics that made project teams succeed or fail are open communication, sharing goals, interdependency, and trust each other and soon.

Parties depend on contracts to bind others together for a construction project. However, they are known to be self-seeking and thus conflict of interest is obvious. This particularly results in the suspicion of motives and actions between clients and contractors. While clients used contracts to command the contractors to work according to any changed preferences (e.g., adjustment in design or schedule), contractors fight back by taking advantage of loopholes in the contract to their benefits and increasing self-assertion by withholding or manipulating information. As a result, they always face each other with such problems as ineffective communication, litigation, or event disputes (Cheng, E.W.L. and Li, H.,2002).

Chan (2002) also thinks that the effectiveness of communications and speed of decision making among the contracting parties should be incorporated in modeling the duration of the project. For example, Speed of decision making involving all project teams within the client team, within the consultant team, and within the contractor's team and information flows between clients, consultant, and contractor. This kind of communication management variables are seen to have a significant influence on the duration of the primary work packages and the whole project. It is expected that greater emphasis should be placed on both communications among the different groups of project participants and pre-construction planning.

According to Rico et al. (2009) also, communication is at the core of any virtual team process and is a key antecedent of trust-building in virtual teams.

Communication might not need meeting face to face. Andrew G. (2007) believes that continuous enhancement of electronic communication for more than 20 years has enabled individuals to cooperate over distance with greater effectiveness due to the increasing ability to send a greater

amount of data, at a faster rate of the transmission. No longer is it compulsory for teams to be collocated for the members to exchange ideas on time toward group tasks. Teams are minimizing the frequency of physical meeting, sometimes not meeting face to face at all, cooperating via electronic methods, which is widely called as working virtually formatting, cooperating virtually, or virtual teams considered as a normal part of doing business, either as a formal structure within existing organizations or an ad hoc task-dependent basis with varied success. A main contributor to effective virtual team processes, both at individual and at the team level is communication.

Pollaphat N. and Miroslaw J.S. (2004) state that the problem related to communication between the project team and information processing have a great contributor to the low productivity of the construction project.

According to Pitts V.E. et al. (2012) effective project communication ensures that the right information reaches the right person at the right time and in a cost-effective manner and it is a critical element of team effectiveness, both in traditional and virtual teams. The quality of decision and implementation depends on the effectiveness of project team communication.

Without a rigid communication plan, strategy, and tools, it is impossible to keep everyone up to date and informed. More than 50% of the management problem is due to poor communication (Memon S., et al., 2017). These may create differences in expectations, people not knowing the status of the project and what is expected from them. Therefore, communication is an important part, which has to be used effectively throughout the project's life cycle (Muszynska, K.,2017).

2.1.5 Communication means or media in design teams

Design team communication could be described as the interaction between a group of senders and receivers by a web of communication flows and available communication means. Communication means can be delineated as face to face means and electronic tools. The most commonly used means in the design teams for face to face communication are dialogues and meetings and at a distance by using telephones, cellphones, tele and video conferencing, and instant messaging (Kvan et al.,1998).

According to Ad den otter and Stephen Emmitt (2007) communication media comprised: Face to face communication through formal team meetings, design dialogues, discussion sessions, informal meetings, telephone, fax, post mail, e-mail, outlook agenda, computer network, project website.

2.1.6 Lack of adequate communication in construction project

The improper information and delay of information to the concerned body are some of the factors which lead to reworking. This is due to the inconsistent flow of information between various teams participated in a construction projects. For example, Architect/clients make changes to design quite frequently but contractors and subcontractors may not be informed about these changes on time to implement efficiently, resulting in rework. This makes a lot of strain in the client's budget and completion of the construction project. Most of construction site experience this kind of rework (Alshawi M., 2003).

Chinowsky et al. (2008) also believe that Similar to product development groups, project teams, and quality groups, construction teams are required to interact effectively to produce desired results quickly and efficiently. The current ordering, purchasing, and invoicing practices have a lot of gaps in terms of delays in supplies being received, less cooperation with producer and suppliers, and low integration with accounts software. For example, the current material procurement system, which does not fit well with project plans and schedules results delay. The failure of using a fully integrated procurement system tends to influence stock control policies (carrying a high quantity of stock) of construction firms due to a lack of accurate estimation of resource requirements for the project. The main reason for this is the poor communication and coordination between the supply chain partners and the overall lack of an integrated system to fulfill this need (Alshawi M., 2003).

Biggs (1997) also consider communication as the root cause of most project failures. She explains that the latest web-based solution which can be work with email or collaboration software can minimize the incidence of people related issues and total communication problems which create project failures.

2.1.7 Critical communication variables.

According to Stephen R.T. et al. (1998), relevant information must be identified and disseminated among the team members throughout the project. Project performance can be improved by implementing effective project communications and conversely, poor communication could lead to project failure. Thus, project team communications are one of the significant challenges to a project's success. Identification and measurement of critical communication variables are very important in enhancing team communications.

Stephen R.T et al. (1998) categorize the critical variable as follows:

i) Accuracy

The accuracy of data received as it is shown by the frequency of conflicting instructions, poor communication, and lack of coordination.

ii) Procedures

The presence, use, and effectiveness of formally defined procedures reviewing scope, methods, etc.

iii) Barriers

The existence of barriers (interpersonal, accessibility, logistics or other) involving communications between supervisors or other groups.

iv) Understanding

An understanding of data expectations with supervisors and other groups.

v) Timeliness

The timeliness of data received including design and schedule changes.

vi) Completeness

The amount of proper data received.

2.2 Empirical Literature

The project may be taken as successful if it is completed within a planned or specified budget, with a specified time frame, and fulfill the required quality or the required client specification (Chan W.M., 2002). Gebrehiwot (2017) also shares the same idea. If one of these requirements is not satisfied the project will not be considered as successful. The following researchers did different researches on the above mentioned three factors in different countries.

Vidhyasri and Sivagamasundari (2017) made a wide literature review on the significant factors, which should be taken into account when planning and scheduling any construction project. These factors are constraints on resource availability, weather conditions, government regulations, level of monitoring and controlling project execution, price escalation of materials, and labors and equipment especially for long projects.

According to Upadhyay et al. (2016), the following described factors are critical factors that are required for successful completion of the project at Gwailor in India. Effective planning and scheduling by a clear understanding of project scope and specifications, detailed preparation of

contract, design documents, and drawings before starting the work at the site, owner's commitment to pay the contractor on time, clear definition of responsibility of each party, availability of labors and equipment necessary for the project, on-time delivery of required materials, selecting qualified contractors, selecting qualified sub-contractors, and selecting qualified project manager and site engineer.

Mahamid (2016) studied the performance of construction projects in Saudi Arabia to determine the contributors to poor performance and their severity according to public owners, contractors, and consultants using a questionnaire survey. The results of this study show that owners rank 'poor communication between project participants' as the top major factor affecting the performance of construction projects, followed by 'poor labor productivity' and 'poor planning and scheduling', respectively. But contractors indicate that the most critical factors are payments delay, escalation of material prices, and poor labor productivity, respectively. Besides, consultants also mention the top three affecting factors that are poor planning, and scheduling, poor site management and payment delay respectively.

Aziz and Abdel-Hakim (2016) believe that the top factors affecting the scheduling of the road project in Egypt as follows:

- The financial ability of the owner (in road projects the Egyptian government is the owner of the project), any delays in progress payment to the contractor leads to project suspension which results in serious delays in project delivery.
- On-time, delivering the material and equipment required to commence the work.
- Strong site management and supervision of the contractor.
- Level of the coordination between different parties of the construction process.
- Change orders made by the owner.
- Government regulation and bureaucracy in obtaining permit and payment progress.
- Quality of material and equipment used in the project.
- Lack of experience of consultants in dealing with extraordinary situations and weather conditions.

Naveen Kumar (2016) determines the following causes of cost overrun in India construction project. These are delay in preliminary handing over of the project, wrong or inappropriate choice of site, inadequate project preparation, increment of material prices, resource constraint,

unpredictable weather conditions, fluctuations in the cost of materials, equipment allocation problems, and lack of cost reports and design changes.

Patil and Pankaj (2016) also add the following cause of cost overrun in India construction project. These are high transportation cost, change in material specification, escalation of material price and frequent break down of construction plants and equipment.

According to Wambui et al. (2015), the following factors are the main factors that should be considered in urban road construction projects in Nairobi, which include: Project management experience, project information technology used to control the progress of the project, which includes the database and software used by the management team, availability of funds for the project, quality of equipment used in road construction projects, and availability of skilled labors.

Tejale et al. (2015) studied the causes of cost overrun in India construction project and list as follows: Material shortage, shortage of labor, unavailability of competent staff, late delivery of material and equipment, low productivity level of labor and quality of equipment and raw material.

Subramani et al. (2014) also add these two causes of cost overrun those are slow decision making and poor design or delay in design.

Culfik et al. (2014) did a research on the delay of the construction project of turkey. The data were collected from all client, contractor, and consultant. The finding of this research shows that the following listed are causes of delay of construction project in turkey. These are suspension of the project by owner, delays in contractor's progress payment by owner, unrealistic project duration, slowness of the owner decision-making process, inadequate early planning of the project, financing by contractor during construction, shortage of labor, slow delivery of materials, obtaining permits from municipality and design changes by the owner or his agent during construction.

Ravisankar et al. (2014) did a research on the main causes of schedule delays in a construction project in India. A detailed questionnaire was prepared and distributed between contractors to collect the required data. The data analysis shows that the main reasons for delays are change orders made by the owners of the project, bad weather conditions such as floods and earthquakes, unforeseen problems during construction, shortage of skilled laborers which increase the reworking items due to errors, high changes in materials and equipment prices,

ineffective site management and supervision, high idle times for equipment maintenance, delays in paying the contractors, inaccurate time estimation and wrong selection of equipment.

According to Saraf (2013), the following listed factors are important causes of cost overrun in the construction industry of India. These are improper planning, improper designing, site management decision making, construction methods, shortage of labor and technical personnel, construction mistakes and defective work, quality and shortage of materials and labor productivity.

Wong and Vimonsatit (2012) believe that the schedule of construction projects in Australia is affected by many factors. These are:

- Availability of local skilled engineers: Rather than relying on foreigners the government focus on training and improving local site engineers that solve the problem for a short period of time.
- Financial resources of owners and contractors: The failure of the owners to pay the contractors for each progress in construction process prevent the contractors to continue working in the project and cause serious delays in the schedule and consequently cost overrun. Therefore, it is necessary for the contractors to have reliable financial resources to support themselves in case of any delay from the owners.
- Availability of skilled workers: this could be solved by providing training, good wage rates, incentives and bonuses to continue working effectively in the construction industry
- The accurate anticipation of project completion: estimating a realistic deadline to complete the project is the most important aspect of scheduling to prevent paying any liquidated damages. This necessitates including the risk and uncertainty in scheduling to prevent any critical conditions during construction.
- Well planned site investigation: will enable the contractors to put a better schedule and control any unforeseen ground problems.
- Accurate definition and organization of the construction process to reduce change orders, which result in a reliable schedule.
- Strong communication system among different parties participated in the project will support quick decision-making and adjust the schedule quickly without any delay.

Mahamid et al. (2012) studied the time performance of road construction projects in the West Bank in Palestine to determine the causes of delay and their severity according to contractors and

consultants through a questionnaire survey. The result of this study indicates that there are 52 causes of delay in road construction projects in Palestine. But the major and significant causes of delays are political situation, segmentation of the West Bank and limited movement between areas, award project to the lowest bid price, progress payment delay by owner and shortage of equipment, the Poor communication by owner with other, by the contractors with other and by consultant with other parties. The finding also shows that:

- ✓ Approximately 75% of the participating contractors shown that the average delay for the projects they have experienced is between 10 and 30% of the original project duration.
- ✓ Approximately 20% of the contractors shown a 30–50% delay compared with the origin specified duration.
- ✓ Approximately 70% of the participating consultants shown that the average delay for the projects they have experienced is between 10 and 30% of the original project duration.
- ✓ Approximately 25% of the consultants shown a 30–50% delay compared with the original specified duration.
- ✓ A total of 5% of the consultants shown a 50–100% delay.
- ✓ Neither consultants nor contractors shown any time delay greater than 100% of the original contract duration.

According to Sunday et al. (2012), the following listed factors are causes of cost overrun in Nigeria construction project. These are inflation increase in material cost, inaccurate material estimation, underestimating of project costs, and increase in project scope among others.

Chitkara (2011) states the following important cause of cost overrun in India. These are poor planning for implementation, inadequate project formulation, lack of proper contract planning and management, lack of project management during execution.

Ameh et al. (2010) state the following causes of cost overrun in Nigeria construction project. These are lack of experience of contractors, cost of material, fluctuation in the price of material, frequent design changes, economic stability, high-interest rates charged by banks on loan, mode of financing, bonds, and payments, and fraudulent practices and kickbacks.

Ali and Kamaruzzaman (2010) studied factors that contribute to cost overrun and potential measures to mitigate the problem with the focus given to construction projects within Klang Valley, Malaysia. Their finding indicates that inaccurate or poor estimation of original cost was the most serious factor that contributes to cost overrun and the factor affect most was a mistake

in design. They recommend that the most important method to manage construction costs is proper project costing and financing. On the other hand, the least important method was establishing a system in design.

Ochieng and Price (2010) studied managing cross-cultural communication in the multi-cultural project team in Kenya and the United Kingdom. The results indicate that communications within multicultural project environments can be effective when project managers explain an awareness of cultural variation. This finding shows that one of the important components of building multicultural project teams in the creation and development of effective cross-cultural collectivism, trust, communication, and empathy in leadership.

Assaf and Al-Hejji (2006) studied the cause of delays in large construction projects in Saudi Arabia. A data was gathered from the contractor, client, and consultant on-time performance of different types of construction project that are located in Saudi Arabia to identify the cause of delay. According to this finding, there are seventy-three causes of delay in which the most common cause of delay is a change order. The result also shows that 76% of the contractor and 56% of the consultant indicate that the average time overrun is between 10% and 30% of the original duration. Poor communication/coordination between the consultant and other parties, between the contractor and other parties between the client and other parties, are some of the seventy-three cause of delay of construction project in Saudi Arabia.

Iyer and Jha (2005) studied the important causes of cost overrun in India and listed as follows: Conflict among project participants, ignorance and lack of knowledge, presence of poor project-specific attributes and nonexistence of cooperation, hostile socio-economic and climatic conditions, reluctance in timely decision, aggressive completion at the tender stage and short bid preparation time.

The following review is the related literature which is done in our country.

Garomsa et al. (2019) did the study to assess the applicability of value engineering concepts and the current management practice of Ethiopian building construction projects. In this study, the understanding of Ethiopian building construction project experts on value engineering principles was studied and the current management practice was evaluated. The finding of this study shows major challenges in the project area were: delay in progress payment by owner, poor site management, weak follow up by consultant, and delay in material delivery from contractor side. Nearly all experts in the project do not know the principle of value engineering and have no

willingness to apply the principle. The evaluation made using value engineering principles indicates the current management practice was more conventional and the industry is still experiencing a delay of projects, cost overrun and poor quality while there are opportunities to reduce such problems.

Desalegn et al. (2017) studied major success factors on building construction projects management system in Addis Ababa, Ethiopia. According to this study, the main significant success factors from 68 identified major management success factors are project delivery system, decision-making effectiveness, timely decision by owner/owner's representative, contractor's cash flow, and leadership skills of project manager and adequacy of the fund. The finding also shows that the next factor is the communication system.

Koshe (2016) did research on Investigating Causes of Construction Delay in Ethiopian Construction Industries. The first 88 important factors that cause delay in Ethiopian construction industries were identified, and then the most common and important causes of construction delay were assessed by using both the data collected in a survey of construction managers, resident engineers, contractors, and clients, and interviews with senior expert. According to this finding, the main important factors that cause construction delays in Ethiopia are: Difficulties in financing project by a contractor, escalation of the materials price, infective project planning, scheduling or resource management, delay in progress payments for completed works, poor communication and coordinate with other parties, fluctuating labor availability season to season /Seasonal labor availability.

Sinesillase et al. (2016) studied the critical factors of scheduling public construction projects in Ethiopia and listed as follows:

- Project manager's knowledge and experience: a clear understanding of project scope, well-planning and organizing of project execution at site facilities monitoring, controlling the project progress easily, and anticipating any sudden problems before their occurring.
- Coordination and communication between project parties enhance completing the project within the estimated time.
- Regular monitoring and feedback between site engineers and project managers improve project progress.
- Defining the responsibility of each party involved in the construction process prevents any conflict in the future.

- Clear plans and specifications help reducing change orders during construction and maintenance of the prepared schedule without any delay.
- A good prediction of weather conditions helps to organize the work at the site without any delay and improve resource management.

Tebeje (2016) did study to access the level of techniques and software packages used for project time control; to identify factors affecting delay in Ethiopian construction projects and to recommend possible mitigation measures. The study revealed a low-level application of techniques and software packages for project planning and time control. It also identified the top five delay factors. Lack of effective communication is one of the factors of construction delay in Ethiopian.

Still now no one did the effect of project team communication in completing construction projects in the Jimma zone.

So in this research, investigation of the effect of project team communication in completing the project which is located in the Jimma zone within the specified schedule was done.

CHAPTER THREE

RESEARCH METHODOLOGY

Under this chapter, the method followed by this study is discussed briefly. Such as study location and period, research design, sampling technique and sampling size, dependent and independent variables, method of data collection, and method of data analysis.

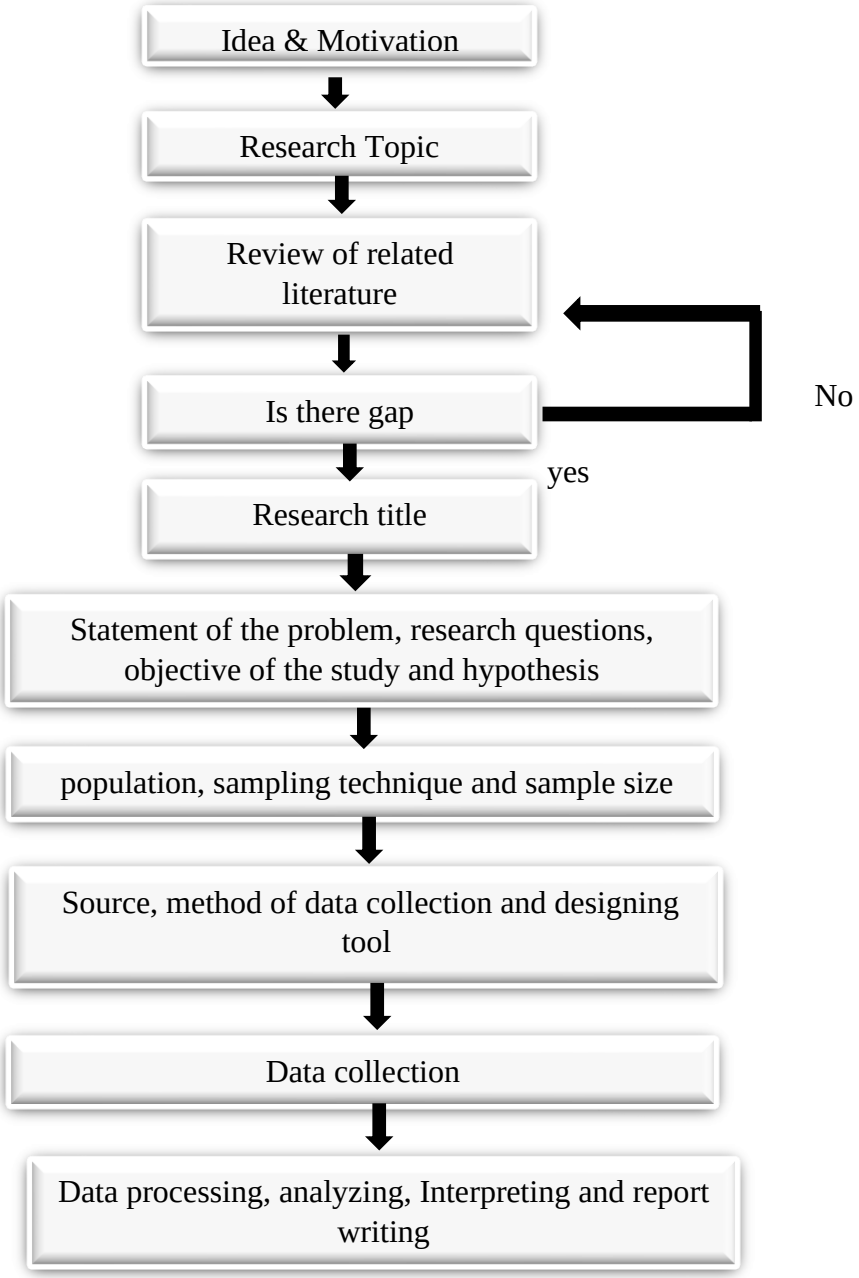
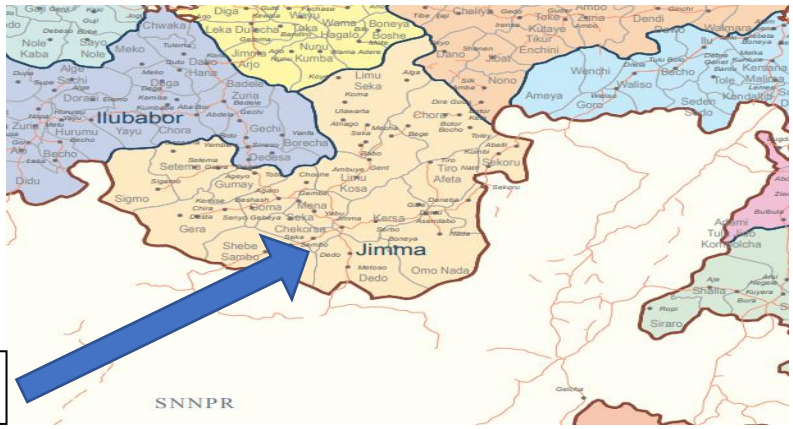


Figure 3. 1: Research methods flow chart

3.1 Study Location

This research will be conducted in Jimma zone. Jimma is one of the zones of the Ethiopian Region of Oromia. It has a latitude and longitude of 7°40′N 36°50′E. Based on the 2007 Census conducted by the central statistics agency (CSA), this Zone has a total population of 2,486,155, an increase of 26.76% over the 1994 census, of whom 1,250,527 are men and 1,235,628 women; with an area of 15,568.58 square kilometers, Jimma has a population density of 159.69. While 137,668 or 11.31% are urban inhabitants, a further 858 or 0.03% are pastoralists. A total of 521,506 households were counted in this Zone, which results in an average of 4.77 persons to a household, and 500,374 housing units. The three largest ethnic groups reported in Jimma were the Oromo (87.6%), the Amhara (4.05%), and the Yem (3.12%); all other ethnic groups made up 5.23% of the population. Afaan Oromo was spoken as a first language by 90.43% and 5.33% spoke Amharic; the remaining 4.24% spoke all other primary languages reported. The majority of the inhabitants were Muslim, with 85.65% of the population having reported they practiced that belief, while 11.18% of the population practiced Ethiopian Orthodox Christianity and 2.97% professed Protestant.



Jimma Zone

Figure 3. 2: Map of Jimma zone

3.2 Study Period

The research is conducted for months starting from November to June. Within the specified time data was collected, analyzed, and report writing which include data collected and interpreted.

3.3 Research design

The descriptive study concerns in stating something about the size, form, distribution, or existence of a variable, and in bivariate it also states the interrelationship between each variable.

since it does not show the casual relationship it descriptive studies (Donald R. Cooper and Pamela S. Schindler,2014). This study was about describing the existence of delay of the project, the existence of poor communication between project team members, and the relationship between the communication between project team members and the project schedule. So, it is descriptive studies.

Quantitative data often consists of participant responses that are coded, categorized, and reduced to numbers so that these data may be manipulated for statistical analysis. But qualitative data are all about texts. Detailed descriptions of events, situations, and interactions, either verbal or visual, constitute the data (Donald R. Cooper and Pamela S. Schindler,2014). In this study information that could be coded, categorized, and reduced to number including information directly expressed quantitatively was used. And also there is a data that was described by texts in detail. So, a combination of both qualitative and quantitative data was used which indicates that it is both qualitative and quantitative studies.

3.4 Population of the study

All building construction project which is located in Jimma zone and also involve all parties of construction project which client, contractor, and consultant. Small construction which is carried out by the agreement of the owner and skilled laborers are not included because of its small chain, lack of clear structure, lack of clear means of communication, and scope of the work.

Muszynska, K. (2017) believe that communication is affected by various factors like characteristic of project stakeholders, project environment, and project communication structure, and communication property, physical and psychological barriers. Project communication and networking skills should be taken as the lifeblood of the project management leadership and awareness of the potential offered by efficient communication is an essential prerequisite for success in the business world. According to Hoegl (2005) also as the team size increases the effect and the complex nature of the communication also increase.

So, according to the information collected from the Jimma zone design bureau and Jimma university capital office, the total building construction projects that involve all client, contractor and consultant are 20. Hence all client, contractor, and consultant that participate in these building construction project were the total population.

3.5 Sampling technique and sampling size

The importance of using sampling over census studies is less compelling when the population is small and the variability within the population is high. Two conditions are appropriate for a census study: a census is (1) feasible when the population is small and (2) necessary when the elements are quite different from each other (Donald R. Cooper and Pamela S. Schindler,2014).

As it is indicated in the scope and limitation of the study, the building structures which were constructed in Jimma zone that involves all client, contractor, and consultant were considered. The time and energy required to collect information from these projects were not high and it was possible to gather information from all populations. So census type of sampling technique was appropriate and suitable. Hence the information was collected from the total population which was 60.

3.6 Source and method of data collection

The sources of data for this research are primary sources. The primary data was collected using questionnaires. Due to the coronavirus (COVID 19), the respondents were not ready and allow to make an interview. But the questionnaire could be filled or answered at any place and at any time. Due to this, a structured survey questionnaire was used for data collection.

3.6.1 Questionnaire

In designing questionnaire five steps were used. First, the problem was clearly defined, then planning for the administration of the questionnaire was done then the questionnaire was written and finally, desk check and piloting was done.

Most of the questions in the questionnaire were close-ended and also there is open-ended question. Mainly closed-ended with five-point Likert-scale questions were used except basic information about the respondent and question related to the status of the project.

The questionnaire has four parts. The first part was designed to gather the basic and demographic data about the respondents. The second part was designed to collect general information about the status of the project. The third part was designed to have information about factors affecting construction scheduling. Here the factors selected were chosen from different literature which frequently occurs in different countries including our country. The last part was designed to

gather information related to the communication of project team members. Two open-ended question was included in the last part.

The questionnaire was prepared and distributed for the collection of data in English and it is attached in appendix A.

3.7 Method of data analysis

After the data were collected from the intended sources, then data processing and analysis were followed to make the raw data meaningful for the interpretation and report writing. So great attention was given for data processing and analyzing.

3.7.1 Data processing

Before proceeding to the analysis of the data, Editing, numbering, coding, classification, and tabulation were done. The first editing was done if there is error and omission in collected data. Then numbering of the questionnaire was done so that it is simple for correcting the error while inputting the data to the statistical package for social science (SPSS). Finally, coding, classification, and tabulation were done.

3.7.2 Data Analysis method

The method of data analysis used in this study was descriptive statistics. Descriptive statistics includes frequency, percentage, mean and standard deviation. And also relative importance index and correlational analysis.

3.8 Dependent and independent variables of the study

3.8.1 Dependent variables of the study

Schedule of the construction project is a dependent variable in this study. Scheduling in construction management means to identify the milestones, activities, and deliverables of a certain project together with the timing and dependency relationships between the different activities. So successful scheduling is important to deliver the project without any delays this causes many benefits to all participants (Fatemeh N. and Nivin G.,2017):

For contractors:

- ✓ Good reputation for the contractor's business, which enables him to bid on more projects.
- ✓ Reducing the direct costs especially labor, and equipment costs.
- ✓ Gaining more incentives and bonuses, when finishing early or within the estimated time.
- ✓ Reducing overhead costs, liquidated damages and other liabilities.

For owners:

- ✓ Receiving return on investment as soon as possible.
- ✓ Good marketing impacts.
- ✓ Avoiding problems in cash flow.
- ✓ Commitment to client promises.

According to Sinesillase et al. (2016), lack of coordination and communication between project parties is one major factor which affects construction project scheduling.

3.8.2 Independent variable of the study

Communication between parties that participate in the construction projects is the independent variable of this study. It influences most project activities and areas because managing any aspect of the project involves communicating within the project team or with external stakeholders (Muszynska, K.,2017). Effective team communication for the design of buildings is becoming increasingly important due to the growing technical and organizational complexity of construction projects (Ad den otter and Stephen Emmit,2007). Construction project development involves extensive information exchange among members of multidisciplinary project teams. The nature of such information can be typically categorized as financial, technical, and administrative (Cheung,2013). Scanlin (1998) shows in his study that ineffective communication is a root cause of most project failures.

CHAPTER FOUR

RESULT AND DISCUSSION

Under this chapter, the result of the study was presented. The data collected, processed, and analyzed data is presented in such a way that the analyzed data answers the research question and also achieves the objective of the study.

Response rate

A total of 60 questionnaires were distributed to the construction projects that involve all three parties. Such as client contractor and consultant. Equal 20 questionnaires were distributed to each of them. But 59 questionnaires were collected which gives us a response rate of 98.33 percent. One questionnaire was not collected because of the availability of the respondent.

4.1 Descriptive statistics of analysis

4.1.1 Characteristics and profiles of respondents

Table 4. 1:Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	53	89.8	89.8	89.8
	Female	6	10.2	10.2	100.0
	Total	59	100.0	100.0	

Most of the respondents were male which constituents 89.8 percent. The remaining 10.2 percent were female. This indicates that male was involved in the construction project as an engineering expert than female.

Table 4. 2:Respondents position in the firm

		Frequency	Percent	Valid Percent	Cumulative Percent
Respondent position	Contractor	20	33.9	33.9	33.9
	Consultant	20	33.9	33.9	67.8
	Client	19	32.2	32.2	100.0
	Total	59	100.0	100.0	

Almost equal respondents have participated in this study from all parties that were client, contractor, and consultant. Both contractor and consultant constituents around 67.8 percent which each of them is 33.9 percent. But client constituents around 32.2 percent.

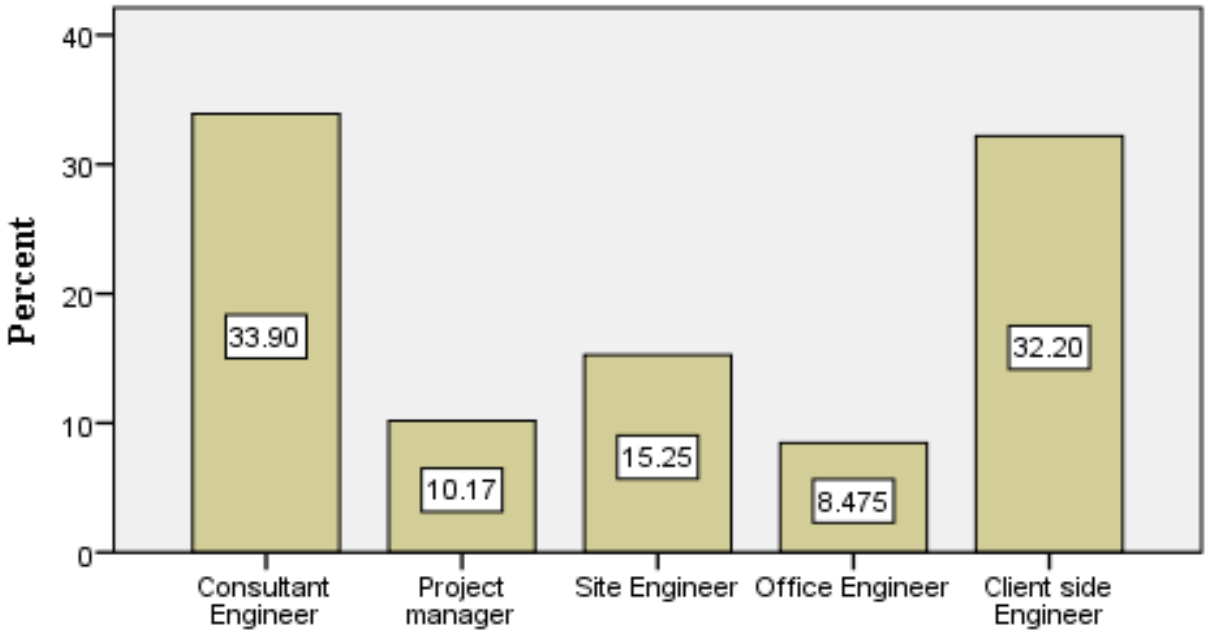


Figure 4. 1: Responsibility in the organization

From the chart on fig.4.1 around 33.9 percent of the respondents were consultant engineers and 32.2 percent were client-side engineers. But the remaining were from contractor side in which 10.17 percent were project manager,15.25 percent were site engineer and 8.475 percent were office engineers.

Table 4. 3:Origin of the company

	Frequency	Percent	Valid Percent	Cumulative Percent
Outside the country	5	8.5	8.5	8.5
Within country	54	91.5	91.5	100.0
Total	59	100.0	100.0	

The respondents have participated from companies which its origin was within the country and also outside of the country. Around 91.5 percent were within the country and the remaining 8.5 percent were outside of the country. Except for 1 respondent who was not a citizen of Ethiopia, the remaining respondents were Ethiopian.

Table 4. 4: Age, Work experience and level of education of the respondent

Characteristics		Frequency	Percent	Valid Percent	Cumulative Percent
Age	20-29	18	30.5	30.5	30.5
	30-39	38	64.4	64.4	94.9
	40-49	3	5.1	5.1	100.0
	Total	59	100.0	100.0	
Work experience	Less than 5 years	10	16.9	16.9	16.9
	5-10	34	57.6	57.6	74.6
	10-15	12	20.3	20.3	94.9
	15-20	3	5.1	5.1	100.0
	Total	59	100.0	100.0	
Level of Education	Diploma	1	1.7	1.7	1.7
	Bachler's degree	34	57.6	57.6	59.3
	Masters	24	40.7	40.7	100.0
	Total	59	100.0	100.0	

Most of the respondents ages were within 30-39 which constituents 64.4% (38) of the respondents. Those within 20-29 were 30.5%(18) and 40-49 were 5.1%(3) of respondents. Around 57.6%(34) which is more than half of respondents had 5-10 years of work experience. But 20.3%(12) of respondents had 10-15 years of work experience and 5.1% (3) respondents had 15-20 years of work experience. The remaining respondents had less than 5 years of work experience.

The level of education of more than half of the respondents in which constituents 57.6%(34) of respondents had bachelor's degrees. The master's holder's constituents 40.7%(24) of respondents and diploma was 1.7%(1).

4.1.2 Status of the project

Most of the projects were delayed as it is shown in table 4.5. 74.6% of the construction projects were behind schedule. The remaining which are 25.4%(15) were within the schedule. (H_{a1} alternative hypothesis is accepted).

Table 4. 5: Status of project

		Frequency	Percent	Valid Percent	Cumulative Percent
Status of project	Behind schedule	44	74.6	74.6	74.6
	Within schedule	15	25.4	25.4	100.0
	Total	59	100.0	100.0	

As it is shown in fig.4.2, from delayed construction projects, 31.82% were delayed by less than 10% of the original duration of the project. About 40.91% of the construction projects were delayed by 10-20% of the original duration. Construction project in which constituents 6.818% and 20.45% were delayed by 30-40% and 40-50% respectively.

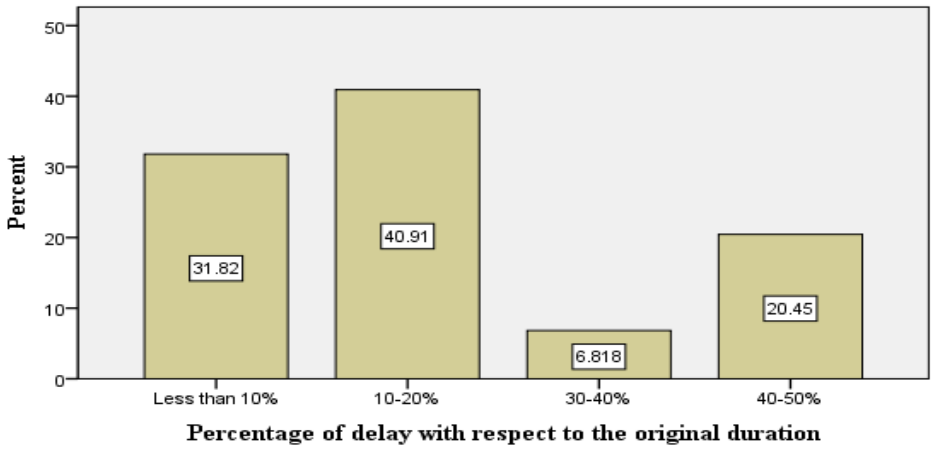


Figure 4. 2: Percentage of delay concerning the original duration for the delayed project.

Approximately the average percentage of delay for the total project is 24.32% (Ha_2 alternative hypothesis was accepted).

According to Chan et al. (2002), there was an announced 50-80% delays on 1627 world bank sponsored projects, together with an average of 23.2% time overrun on United Kingdom, UK government construction projects. The time overrun for Hong Kong in 1994 for public building, private building, and other civil engineering works was 9%,17%, and 14% respectively.

Table 4. 6:Means of communication in construction projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Means of communication	Letter	7	11.9	11.9	11.9
	All	42	71.2	71.2	83.1
	Other	10	16.9	16.9	100.0
	Total	59	100.0	100.0	

Means of communication in which constituents 71.2% (42) of construction projects were using a combination of letter, e-mail, Telephone, meeting, and verbal. Around 11.9% (7) of construction projects were used letters as a means of communication. But 16.9% (10) of the construction projects were using other means of communication which indicate other than the listed or combination of the listed means of communication. From those who use other means of communication 1.7% of total projects were using email and telephone,3.4% of total projects were using email, telephone, and meeting, 5.1% of total projects were using the letter, and telephone, 1.7% of total projects were using a letter, telephone, and meeting,3.4% of the total project were using the letter, telephone; and verbal and 1.7% of total projects were using the letter, telephone, meeting, and verbal. The table which shows other means of communication were presented in table C.3, appendix C. Around 93.2% (55) of respondents believe that the means of communication which was used by construction projects were appropriate to keep the schedule with in the specified time. But the remaining 6.8% percent of the respondents suggest the combination of different means of communication to keep the schedule within the specified time. From this, 1.7% of the total suggests to use all means of communication, 3.4% suggest letter, telephone, and meeting,1.7% suggest meeting and letter.

According to Zulch B.G. (2014), the communication method which is used in the construction industry with the highest ranking is written communication and the second is an electronic communication. Oral, visual, and non-verbal communication are 3rd, fourth, and fifth respectively.

4.1.3 Ranking of delay factors

After related literature was reviewed carefully, the frequent delay factors were selected and included in the questionnaire. By using relative importance index (RII) the delay factors were

ranked as it is shown in table 4.8 based on the response of the respondents. Reliability analysis was also done to show the degree of internal consistency of this delay factor.

Reliability Analysis

As a general rule, a Cronbach's alpha value of 0.7 is the threshold for acceptance. An inter-item correlation measures the relationships among all items for assessing consistency. To assess the internal consistency reliability, the proportion of the item with a correlation coefficient with other items within the range of 0.2-0.7 is considered. Besides, item-total correlation measures the relationships between an item and the total score from the collection of items. The item-total correlation should achieve a value>0.3 (the acceptance threshold) for inclusion in the analysis (Cheung, S.O., et al.,2013).

The result from the SPSS output for Cronbach's alpha is tabulated below in table 4.7. All delay factors which is 25 in number was analyzed.

Table 4. 7: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.949	.948	25

Since Cronbach's alpha greater than 0.7, it is accepted. And also the inter-item correlation matrix is between 0.2 and 0.7 for all factors except for the delay in sub-contractor's work. The item-total correlations for all factors were greater than 0.3 which is acceptable.

Case processing summary, Item-total statistics were attached in Appendix-B.

Relative importance index (RII): used to determine the relative importance of various causes and effects of delay using five-point Likert scale. The higher value relative importance index (RII) represents the important cause or effect of delay and vice versa (Gebrehiwot T. and Luo H.,2017). Computed by Equation:

$$RII=\frac{\sum W_iF_i}{A*N}=\frac{1*F_1+2*F_2+3*F_3+4*F_4+5*F_5}{5*N}$$

Where: i-response category index, W_i-is the weight given by respondents, F_i-is the frequency of respondent for each weight, A-is the highest weight and N-is the total number of respondents. The relative importance index (RII) ranges from 0 to 1 (not inclusive).

According to table 4.8, the five major delay factors of construction projects in Jimma zone are poor communication and coordination by the contractors with other parties, poor communication and coordination between consultant and other parties, ineffective planning and scheduling of

project by the contractor, poor communication and coordination by the owner and other parties and change orders by owners during construction with relative importance index (RII) of 0.692,0.651,0.647,0.637 and 0.614 respectively. (Ho_3 null hypothesis is accepted).

The frequency table was attached for all factors in appendix C.

Table 4. 8: Ranking of delay factors of construction projects

Delay factors of construction project	RII	Rank
Poor communication and coordination by contractors with other parties	0.692	1
Poor communication and coordination between consultant and other parties.	0.651	2
Ineffective planning and scheduling of project by contractor	0.647	3
Poor communication and coordination by owner and other parties	0.637	4
Change orders by owner during construction	0.614	5
Low productivity and efficiency of equipment, labor	0.59	6
Slowness of the owner decision making process	0.586	7
Difficulties in financing project by contractor	0.573	8
Slowness in decision making by consultant	0.566	9
Slowness in decision making by contractors	0.556	10
Delay in performing inspection and testing by consultant	0.536	11
Delay in sub-contractors work	0.532	12
Delay in progress payments by owner	0.529	13
Poor qualification of the contractors technical staff	0.515	14
Late confirmation from client	0.508	15
Original contract duration is too short	0.505	16
Late in reviewing and approving design documents by consultant	0.505	16
Suspension of the project by owner	0.498	17
Inflexibility (Rigidity) of consultant	0.488	18
Delay in commencement	0.468	19
Inadequate experience of consultant	0.448	20
Frequent change of sub-contractors because of their inefficient work	0.441	21
Other factors related to client	0.39	22
Other factors related to contractor	0.383	23
Other factors related to consultant	0.353	24

According to Sinesillase et al. (2017), adequate communication among all project participants was one of the major factors in Ethiopia which is considered as top-five success attributes when cost criterion is of prime importance in gauging project performance. Gebrehiwot T. and Luo H.

(2017) states the relative importance index of poor communication and coordination between project participant parties was 0.55,0.55 and 0.59 for client, contractor, and consultant respectively. Alshawi M. and Ingrige B. (2003) also believe that communication consumes about 75-90% of a project manager's time and information, therefore, needs to be current and available on-demand.

This study also shows 69.5% of respondents of total projects and 93.2% of respondents of total delayed projects also believe that poor communication between project team members was one of the major factors that delay the building construction project.

4.1.4 Ranking of construction activities

Activities in every construction building project involve some common category which is used most of the time whatever the type of building. So in this study, these common categories of activities were selected and rated with respect to the importance of communication between project parties in keeping the schedule of the project. By computing the relative importance index, the activities were ranked as it is shown in table 4.8.

Table 4. 9:Ranking of construction project activities

Construction activities	**RII**	**Rank**
Casting of concrete	0.81	1
Masonry works and carpentry	0.729	2
Plastering, painting and tiling	0.729	2
Office work	0.671	3
Plumbing and electrical installation	0.698	4
Formwork preparation	0.681	5
Site clearance and Excavation	0.559	6

As it is shown in table 4.9, Casting of concrete needs more communication and coordination between the construction project parties. Then masonry works and carpentry, plastering, painting and tiling are next to casting of concrete. But this does not indicate that the communication and coordination between project parties are not important/required for other activities rather it shows the extent of the importance of these factors for each activity. So, more attention should be given to the casting of concrete, masonry work and carpentry, plastering, painting, and tiling during construction of the project. H_{a4} alternative hypothesis is accepted.

4.2 Correlational analysis

Correlation is one of the most widely used measures of association between two or more variables. In its simplest form, it signifies the relationship between two variables, that is, whether an increase in one variable results in the increase of the other variable. In a way, measures of correlation are employed to explore the presence or absence of correlation, that is, whether or not there is a correlation between the variables in an equation. The correlation coefficient also describes the direction of the correlation, that is, whether it is positive or negative, and the strength of the correlation, that is, whether an existing correlation is strong or weak (Singh, 2007).

Spearman's rank correlations are used to assess the relationship between two variables. The value of rho ranged from -1 to 1 and indicated as if -1 or 1 perfect negative or positive correlation, between -1 to -0.5 or 1 to 0.5, strong negative or positive correlation, between -0.5 to 0 or 0 to 0.5, weak negative or positive correlation and 0 no correlation (Gebrehiwot T.,2017)

$$\text{rho}=\frac{1-6\sum D^2}{N\left(N^2-1\right)}$$

D, defined as the difference in ranks, and N is the number of ranks.

The end result of a correlation analysis is a correlation coefficient whose values range from -1 to +1. A correlation coefficient of +1 indicates that the two variables are perfectly related in a positive manner, a correlation coefficient of -1 indicates that two variables are perfectly related in a negative manner, while correlation coefficient of zero indicates that there is no linear relationship between the two variables being studied (Gogtay NJ. and Thatte UM.,2017).

From the collected data the relationship between the required variables was assessed using spearman's coefficient of correlation. The output which was correlational matrix from SPSS is presented in table 4.10. Due to the availability of space, the variables were presented in numbers.

Table 4. 10: Correlation matrix

			1	2	3	4	5	6	7	8	9	10	11	12
Spearman's rho	1	CC	1.000	.526**	.602**	.603**	.599**	.519**	.621**	.607**	.493**	.495**	.495**	.795**
		S2		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	2	CC	.526**	1.000	.515**	.421**	.530**	.395**	.385**	.380**	.450**	.470**	.546**	.654**
		S2	.000		.000	.001	.000	.002	.003	.003	.000	.000	.000	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	3	CC	.602**	.515**	1.000	.594**	.507**	.518**	.465**	.481**	.498**	.534**	.489**	.719**
		S2	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	4	CC	.603**	.421**	.594**	1.000	.711**	.586**	.590**	.485**	.465**	.572**	.568**	.734**
		S2	.000	.001	.000		.000	.000	.000	.000	.000	.000	.000	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	5	CC	.599**	.530**	.507**	.711**	1.000	.531**	.550**	.417**	.448**	.511**	.487**	.705**
		S2	.000	.000	.000	.000		.000	.000	.001	.000	.000	.000	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	6	CC	.519**	.395**	.518**	.586**	.531**	1.000	.700**	.530**	.412**	.391**	.368**	.678**
		S2	.000	.002	.000	.000	.000		.000	.000	.001	.002	.004	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	7	CC	.621**	.385**	.465**	.590**	.550**	.700**	1.000	.624**	.500**	.370**	.407**	.713**
		S2	.000	.003	.000	.000	.000	.000		.000	.000	.004	.001	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	8	CC	.607**	.380**	.481**	.485**	.417**	.530**	.624**	1.000	.578**	.466**	.379**	.729**
		S2	.000	.003	.000	.000	.001	.000	.000		.000	.000	.003	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	9	CC	.493**	.450**	.498**	.465**	.448**	.412**	.500**	.578**	1.000	.435**	.459**	.729**
		S2	.000	.000	.000	.000	.000	.001	.000	.000		.001	.000	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	10	CC	.495**	.470**	.534**	.572**	.511**	.391**	.370**	.466**	.435**	1.000	.563**	.668**
		S2	.000	.000	.000	.000	.000	.002	.004	.000	.001		.000	.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	11	CC	.495**	.546**	.489**	.568**	.487**	.368**	.407**	.379**	.459**	.563**	1.000	.686**
		S2	.000	.000	.000	.000	.000	.004	.001	.003	.000	.000		.000
		N	59	59	59	59	59	59	59	59	59	59	59	59
	12	CC	.795**	.654**	.719**	.734**	.705**	.678**	.713**	.729**	.729**	.668**	.686**	1.000
		S2	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
		N	59	59	59	59	59	59	59	59	59	59	59	59

**. Correlation is significant at the 0.01 level (2-tailed).
CC=Correlation coefficient.
S2=sig. (2 tailed).

So the representations of the numbers are 1=Consultant-Contractor,2=Contractor-Client,3=Consultant-Client,4=Project Manager-Office engineer,5=Project Manager-Site engineer,6=Site engineer -Office engineer, 7=Site engineer -Data collector,8=Site engineer -Foreman,9=Office engineer -Data collector,10=Foreman-Skilled laborers &daily laborers, 11=Communication between all teams and 12= Status of the project. Except status of the project all represent the nature of communication between participants in the project.

Table 4.10 shows that the relationship between the status of the project and Communication between Consultant-Contractor, Contractor-Client, Consultant-Client, Project Manager-Office Engineer, Project Manager-Site Engineer, Site Engineer-Office Engineer, Site Engineer-Data collector, Site Engineer-Foreman, Office Engineer-Data collector, Foreman-Skilled laborers and daily laborers, Communication between all teams was strongly correlated. This means when the communication between the above-listed participants moves from very poor to very good the status of the project moves from behind schedule to ahead of schedule. As the nature of the communication is improved and becomes very good, the status of the project will be kept within the schedule. The status of the project is highly correlated with the communication between consultant-contractor in which its correlation coefficient was 0.795. (H_{o5} null hypothesis is accepted).

Communication between consultant-contractor is weakly correlated with office engineer-data collector, foreman-daily laborers and skill laborers, and average communication between all team members with correlation coefficient of 0.493,0.495 and 0.495 respectively. But strongly correlated with the remaining other variables.

There is a weak correlation between communication between contractor-client and project-manager-office engineer, site engineer-office engineer, site engineer-data collector, site engineer-foreman, office engineer-data collector, foreman-skilled laborers &daily laborers with correlation coefficient of 0.421,0.395,0.385,0.38,0.45 and 0.47 respectively. This means when the communication between contractor and client approach to very good there is the improvement in communication between the listed participants but the extent of improvement is low. But the correlation between contractor-client with other remaining variables is strong.

Improvement in communication between consultant and client will improve the communication between each participant but the extent of improvement is low for communication between site

engineer-data collector, site engineer-foreman, office engineer-data collector, and average communication between all team members with a correlation coefficient of 0.465,0.481,0.498 and 0.489 respectively.

As it is shown in the table 4.10, enhancing the communication between project manager-office engineer from very poor to very good also enhances the communication between each participant in construction project but the extent of enhancement is low for communication between contractor-client, site engineer-foreman, and office engineer-data collector with a correlation coefficient of0.421, 0.485 and 0.465 respectively.

There is a strong relationship between project manager-site engineer and communication between each participant (all variables) except communication between site engineer-foreman, office engineer-data collector, and average communication between all team members with a correlation coefficient of 0.417,0.448 and 0.487 respectively.

In addition to contractor-client, the communication between site engineer and office engineer has a weak correlation with office Engineer-Data collector, Foreman-Skilled laborers and daily laborers, and average communication between all teams with correlation coefficient of 0.421,0.391 and 0.368 respectively. But site engineer-office engineer has a strong correlation with remaining communication between each participant.

As the progress for the improvement of communication of site engineer-data collector increases, the communication between the other participants also increases but the extent of increment is low for foreman -Skilled laborers and daily laborers, average communication between all team members in addition to the above mentioned communication with contractor-client and consultant-client.

Finally, adding on the above mentioned relationship on both Site engineer-foreman and office engineer-data collector, they have a weak correlation with foreman-skilled laborers and daily laborers, and average communication between all team members with a correlation coefficient of 0.466,0.379 for site engineer–foreman and 0.435,0.459 for office engineer-data collector respectively.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Summary of the thesis and main findings

The study reveals that the percentage of the construction projects which was not within the schedule was 74.6% and the remaining were within the schedule. The average percentage of delay of total construction projects were approximately 24.32%. The five leading major delay factors in construction projects of Jimma zone were poor communication and coordination by contractors with other parties, poor communication and coordination between consultant and other parties, ineffective planning and scheduling of project by the contractor, poor communication and coordination by the owner and other parties and change orders by owners during construction with relative importance index (RII) of 0.692,0.651,0.647,0.637, and 0.614 respectively. 69.5% of total construction projects and 93.2% of delayed construction projects were due to poor communication between construction project team members.

Casting of concrete needs more communication and coordination between the construction project parties. Then masonry works and carpentry categorical activity, was next to the casting of concrete. These two categories of activities were the leading categories of activities with relative importance index (RII) of 0.81 and 0.729 respectively. 71.2% of construction projects were using a combination of letters, e-mail, Telephone, and verbal. Around 11.9% of construction projects were used letters as a means of communication. But 16.9% of the construction projects were using other means of communication which means other than the listed or combination of the listed means of communication. There is a strong correlation between the status of the project (schedule) and communication between each member of a team of the construction project. But there is the highest correlation with communication between consultant and contractor with the coefficient of correlation 0.795.

5.2 Conclusion

Construction projects involve three parties which include different experts from different areas. These parties are consultant, client, and contractor. These experts from this party's form construction project team. So the performance of the project is based on the relationship, communication, and coordination between this team member. In order to make our project successful, it should be completed within the specified schedule, quality, and cost.

Currently, in our country, most of the projects are not completed with the specified schedule, cost, and quality due to different factors. So this study is about the effect of communication between project team members on the schedule of the construction project. Poor communication and coordination between project team members is recognized as one of the possible delay factor in construction projects.

The construction projects in Jimma zone which includes all parties such as client, contractor, and consultant were considered as a population of this study. Due to the number of this population, census type of sampling technique was used. The source of the information for this study was from all consultants, clients, and contractors who participate in the construction project of the Jimma zone. The questionnaire was used for the collection of data from the source of information. Around 60 questionnaires were prepared and distributed to the population/sample of the study in which there were 20 questionnaires for each party that participate in construction projects of Jimma zone. But 59 questionnaires were collected with a response rate of 98.33%.

The study reveals that:

- The percentage of the construction projects which was not within the schedule was 74.6% and the remaining were within the schedule.
- The average percentage of delay of total construction projects were approximately 24.32%.

- The five leading major delay factors in construction projects of Jimma zone were poor communication and coordination by contractors with other parties, poor communication and coordination between consultant and other parties, ineffective planning and scheduling of project by the contractor, poor communication and coordination by owner

and other parties, and change orders by the owners during construction with relative importance index (RII) of 0.692,0.651,0.647,0.637, and 0.614 respectively.

- 69.5% of total construction projects and 93.2% of delayed construction projects were due to poor communication between construction project team members.

- 71.2% of construction projects were using a combination of letters, e-mail, Telephone, and verbal. Around 11.9% of construction projects were used letters as a means of communication. But 16.9% of the construction projects were using other means of communication which means other than the listed or combination of the listed means of communication.

- Casting of concrete needs more communication and coordination between the construction project parties. Then masonry works and carpentry categorical activity, was next to the casting of concrete. These two categories of activities were the leading categories of activities with relative importance index (RII) of 0.81 and 0.729 respectively.

- There is a strong correlation between the status of the project (schedule) and communication between each member of a team of the construction project. But there is the highest correlation with communication between consultant and contractor with the coefficient of correlation 0.795.

5.3 Recommendation

- It is recommended to any construction projects especially around Jimma zone that they should plan or design communication management and also incorporate it into their management to keep the project within the schedule.
- By realizing the effect of poor communication on the construction project schedule in this study, it is better to manage the communication between each member of a team of construction projects.
- This study shows that there is strong correlation between project status (schedule) and communication between consultant and contractor. So great attention should be given to communication between consultant and contractor.

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APPENDIX-A

QUESTIONNAIRE

Thank you for agreeing to answer the following questions about your construction project. The information is collected purely for academic purpose and has no claim with any governmental or non-governmental organization. Your answer will be kept confidential and help us to determine the effect of communication on construction project schedule.

Name: Bedaso Ahmed, **Email:**bedasoahmed@gmail.com, **Phone:** +251915169557

Part-One: General or Basic information about respondent.

1. Kindly indicate your gender? Male ☐ ` Female ☐

2.Respondents' position in the firm: Contractor ☐ Consultant ☐ Client ☐ Other ☐

3. Company Name _____

4. Does your company is from outside of the country? Yes ☐ No ☐

5. What is your age interval? 20-29 ☐ 30-39 ☐ 40-49 ☐ above 50 years ☐

6.How long you have been involved in the construction project? Less than 5 years ☐ 5-10 ☐

10-15 ☐ 15-20 ☐ 20-25 ☐ above 25 ☐

7.Indicate the level of your education. Diploma ☐ Bachelor's degree ☐ Masters ☐

PHD ☐ Other ☐

8. What is your responsibility in your organization? Consultant Engineer ☐ Project manager ☐

Site Engineer ☐ Office Engineer ☐ Client side Engineer ☐

9. What is your citizen? Ethiopian ☐ Other ☐

Part-Two: General Information about construction project status

10. What is the status of your project? Behind the schedule ☐ with in schedule ☐

A head of schedule ☐

11. If it is behind schedule, what is the percentage of delay with respect to the original duration?

Less than 10% ☐ 11-20% ☐ 21-30% ☐ 31-40% ☐ 41-50% ☐ Above 50% ☐

Part-Three: Factors affecting the schedule of construction project.

12. To what extent do you rate the following factors that could delay the construction project in relation to your project? 5=Very high, 4=High, 3=Neutral, 2=Low, 1=Very low

Delay factors related to client	Rating scale				
	1	2	3	4	5
Delay in progress payments by owner					
Slowness of the owner decision making process,					
Poor communication and coordination by owner and other parties					
Change orders by owner during construction					
Suspension of the project by owner,					
Late confirmation from client					
Other factors					

Delay factors related to contractor	Rating scale				
	1	2	3	4	5
Poor communication and coordination by contractor with other parties					
Delays in sub-contractors work					
Ineffective planning and scheduling of project by contractor					
Difficulties in financing project by contractor					
Frequent change of sub-contractors because of their inefficient work					
Poor qualification of the contractors technical staff					
Slowness in decision making					
Original contract duration is too short					
Delay in commencement					
Low productivity and efficiency of equipment, labor					
Other factors					

Delay factors related to consultant	Rating scale				
	1	2	3	4	5
Delay in performing inspection and testing by consultant					
Slowness in decision making					
Poor communication/coordination between consultant and other parties					
Inadequate experience of consultant					
Inflexibility (rigidity) of consultant					
Late in reviewing and approving design documents by consultant					
Other factors					

13. If your project is delayed, then do you think poor communication between project team member is one of the major factor for the delay? Yes ☐ No ☐

Part-4: Information about communication of project team members.

14. To what extent do you rate the following communication between different team members? Where, 5=Very good, 4=good, 3=Fair, 2=Poor, 1=Very poor.

Project team members	Rating scale				
	1	2	3	4	5
Consultant-Contractor					
Contractor-Client					
Consultant- Client					
Project manager-Office engineer					
Project manager-Site engineer					
Site Engineer-Office Engineer					
Site Engineer-Data collector					
Site Engineer-Foreman					
Office Engineer-Data collector					
Foreman-Skilled laborer and daily laborers					
Overall communication between all teams					

15. What are means of communication in your construction project? Letter ☐ email ☐ Telephone ☐ Meeting ☐ Verbal ☐ All ☐ Other ☐

16. If your answer in question #15 is other, please state means of communication of your project_____

17. Do you think the means of communication in your construction project is not appropriate to keep the schedule within specified period? Yes ☐ No ☐

18. If your answer in the question 17 is yes, what means of communication do you suggest for your project? _____

19. To what extent do you rate the following category of activities of construction project in relation to importance of communication between team members? Where 5=Very high, 4=high, 3=neutral ,2=Low, 1=Very low.

Category of project activities	Rating scale				
	1	2	3	4	5
Site clearance and Excavation					
Formwork preparation					
Casting of concrete					
Masonry works and carpentry					
Plastering, painting and tiling					
Plumbing and electrical installation					
Office work					

20. What is the delay of the following category of activities in relation to their corresponding original duration due to poor communication?

Category of project activities	Less than 10%	11-20%	21-30%	31-40%	Above 40%
Site clearance and excavation works					
Formwork preparation					
Casting of concrete					
Masonry works and Carpentry					
Plastering, painting and tiling					
Plumbing and Electrical installation					
Office work					

Thank you for your time. You have helped to determine the effect of communication on construction project schedule.

APPENDIX-B

RELIABILITY ANALYSIS OUTPUT

B.1 Reliability analysis result of delay factors.

Table B. 1:Case processing summary

		N	%
Cases	Valid	59	100.0
	Excluded[a]	0	.0
	Total	59	100.0

a. List wise deletion based on all variables in the procedure.

Table B. 2:Item-total statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Delay in progress payments by owner	63.41	344.349	.570	.795	.947
Slowness of the owner decision making process	63.12	343.727	.675	.842	.946
Poor communication and coordination by owner and other parties	62.86	357.085	.344	.751	.949
Change orders by owner during construction	62.98	341.500	.621	.727	.947
Suspension of the project by owner	63.56	344.251	.568	.813	.947
Late confirmation from client	63.51	344.254	.644	.807	.947
Other factors related to client	64.10	348.058	.541	.792	.948
Poor communication and coordination by contractors with other parties	62.59	357.590	.385	.762	.949

Delay in sub-contractors work	63.39	351.173	.357	.875	.950
Ineffective planning and scheduling of project by contractor	62.81	323.396	.839	.941	.944
Difficulties in financing project by contractor	63.19	323.465	.802	.926	.945
Frequent change of sub-contractors because of their inefficient work	63.85	339.269	.618	.931	.947
Poor qualification of the contractors technical staff	63.47	331.736	.792	.930	.945
Slowness in decision making	63.27	336.167	.789	.867	.945
Original contract duration is too short	63.53	332.081	.774	.880	.945
Delay in commencement	63.71	332.519	.808	.884	.945
Low productivity and efficiency of equipment, labor	63.10	330.955	.749	.876	.945
Other factors related to contractor	64.14	341.602	.641	.778	.947
Delay in performing inspection and testing by consultant	63.37	345.617	.694	.828	.946
Slowness in decision making	63.22	346.002	.645	.834	.947
Poor communication and coordination between consultant and other parties.	62.80	353.854	.410	.794	.949
Inadequate experience of consultant	63.81	356.361	.483	.749	.948
Inflexibility (Rigidity) of consultant	63.61	333.380	.781	.883	.945

Late in reviewing and approving design documents by consultant	63.53	337.840	.694	.899	.946
Other factors related to consultant	64.29	350.312	.580	.753	.947

APPENDIX-C

DESCRIPTIVE STATISTICS RESULT.

Table C. 1: Frequency of delay factors

Delay factors of construction projects	1	2	3	4	5
Delay in progress payments by owner	10	20	13	13	3
Slowness of the owner decision making process	3	20	17	16	3
Poor communication and coordination by owner and other parties	2	12	21	21	3
Change orders by owner during construction	4	17	19	9	10
Suspension of the project by owner	12	22	13	8	4
Late confirmation from client	9	22	17	9	2
Other factors related to client	28	11	15	5	0
Poor communication and coordination by contractors with other parties	0	7	23	24	5
Delay in sub-contractors work	16	10	15	14	4
Ineffective planning and scheduling of project by contractor	13	5	10	17	14
Difficulties in financing project by contractor	16	12	8	10	13
Frequent change of sub-contractors because of their inefficient work	26	10	10	11	2
Poor qualification of the contractors technical staff	15	15	14	10	5
Slowness in decision making by contractors	7	20	15	13	4
Original contract duration is too short	20	6	18	12	3
Delay in commencement	22	9	15	12	1
Low productivity and efficiency of equipment, labor	12	10	16	11	10
Other factors related to contractor	33	6	12	8	0
Delay in performing inspection and testing by consultant	2	29	16	10	2
Slowness in decision making by consultant	4	19	21	13	2
Poor communication and coordination between consultant and other parties.	3	11	16	26	3
Inadequate experience of consultant	10	25	24	0	0
Inflexibility (Rigidity) of consultant	19	12	12	15	1
Late in reviewing and approving design documents by consultant	12	24	6	14	3
Other factors related to consultant	30	14	14	1	0

Where:1=very low,2=Low,3=Neutral,4=High and 5= Very high

Table C. 2: Frequency of construction activities

Construction activities	**1**	**2**	**3**	**4**	**5**	**Total**	RII
Site clearance and Excavation	12	13	17	9	8	59	0.559
Formwork preparation	1	7	25	19	7	59	0.681
Casting of concrete	2	1	12	21	23	59	0.81
Masonry works and carpentry	1	5	21	19	13	59	0.729
Plastering, painting and tiling	0	9	9	35	6	59	0.729
Plumbing and electrical installation	3	8	15	23	10	59	0.698
Office work	7	10	10	19	13	59	0.671

Where:1=very low,2=Low,3=Neutral,4=High and 5= Very high

Table C. 3:Other means of communication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		49	83.1	83.1	83.1
	e-mail and Telephone	1	1.7	1.7	84.7
	e-mail, telephone & meeting	2	3.4	3.4	88.1
	Letter and Telephone	3	5.1	5.1	93.2
	Letter, Telephone and meeting	1	1.7	1.7	94.9
	Letter, Telephone and verbal	2	3.4	3.4	98.3
	Letter, telephone, meeting and verbal	1	1.7	1.7	100.0
	Total	59	100.0	100.0	