KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA

A Framework for On-Site Communication Planning for Construction Managers in Ghana.

by

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MASTER OF PHILOSOPHY

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CERTIFICATION

I hereby declare that this submission is my own work towards the MPhil Construction Management and that, to the best of my knowledge, it contains no material previously published by another person, nor material which has been accepted for the award of any degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

In modern day construction, some of the important elements contributing to the poor performance of the construction industry that have been identified are ineffective communication practices, the organizational fragmentation and the lack of integration between design and construction processes. In an industry such as construction, interaction is mainly characterised by unfamiliar groups of people who come together in a purpose driven environment within short periods before they are divided into several groups to perform their various roles towards the achievement of a construction project. Accordingly, failure in project communication can lead to the failure of the project as whole. Communication does not only aim to keep members of the project team updated in terms of progress, but to as well enhance the ownership of project decisions. This study aimed at developing a framework for on site communication to aid the planning of communication during the construction phase. The study adopted the quantitative method of research; in congruence with similar construction communication studies conducted. The primary data collection tool used for the study was the questionnaire. Data were collected from construction managers of D1 and D2 firms operating in the Kumasi and Accra Metropolises in Ghana yielding a response rate of 86 percent. Statistical tools used in data analysis included the mean score; quadrant analysis, factor analysis and descriptive statistics. The key findings of the study led to the development of a framework aimed at enabling construction managers to plan communication during the construction stage. The developed framework serves as an aid to construction practitioners to plan communication and help in allocating responsibility for information management. It also serves as a reference point through the provision of sources for which information can be assessed. Theoretically, further study has been recommended to validate the proposed framework on real life projects.

Keywords: Communication, Construction industry, Communication Planning, Framework

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DEDICATION

This work is dedicated to the Almighty God and my Parents, Mr. Emmanuel Akunyumu and Mrs. Sylvia Akunyumu for their love, guidance and support.

CHAPTER ONE

INTRODUCTION TO RESEARCH

1.1 BACKGROUND

The uniqueness of the construction industry and the fragmented nature of its operations requires the participation of various construction professionals. A noteworthy difficulty presently confronting the construction industry include ill-timed and inaccurate communication amongst members of the project team. Consequently, this has undoubtedly resulted in expensive delays in the successful performance of construction projects (Weippert *et al*., 2003). The separation of design from construction in the traditional procurement creates a communication gap that requires attention to facilitate the construction process for successful project delivery. The construction site has led to challenge of information communication between the design team and the construction team, and the difficulty of project information access by the participants of the construction team (Chen and Kamara, 2008). There are several factors on which the success of projects is hinged. Yet among the various challenges that construction managers face, communication is one of the most important (Rahjans and Shah, 2012).

According to Ramsing (2009), there are several examples to support the assertion that communication is important in ensuring the success of construction projects. For instance, effective communication between the project team helps to maintain a good relationship between the participants to ensure the success of the construction project (Ceric, 2011). Baker (2007), cited in Ramsing (2009) intimated that 95 percent of all problems encountered in projects are caused by poor communication and that the relevance of being capable to handle the skills of communication during the presentation of facts, details, status, project requirements, etc should be prioritized in

construction management. Again, Zulch (2012) stated that the issue of communication in the construction industry is of maximum importance irrespective of the fact that projects are planned, organised and managed by experienced and qualified personnel. Accordingly, failure in project communication can lead to the failure of the project as whole. Communication does not only aim to keep members of the project team updated in terms of progress but to as well enhance the ownership of project decisions (Cornelius and Associates, 2010).

Chen *et al*. (2013) intimated that to accomplish the requirements of a project means communicating the important messages to the team that needs the information. Where this cannot be attained during the construction of the project, members of the project/construction team will certainly not be able to execute the tasks accordingly which will eventually result in project delay. This assertion is also supported by Koivula (2009). According to Koivula (2009), communication is one of the most crucial aspects of project and for that matter construction management. The success of projects is often defined by how well the task of communication is handled (*Ibid.).*

The completion of projects does not only depend on materials but also on both skilled an unskilled labour termed as the blue collar on site and the white collar that are in the offices. The workers on site provides the material aspect of construction product while the office workers produces informational conditions for the construction of the project. This gives an indication of the fact that construction productivity is correllated to the amount and superiority of information flows between the management and the people on site (Aiyewalehinmi, 2013). Che Ibrahim *et al*. (2011) citing Moore and Dainty (1999) stated that the delivery of project and the performance of the construction industry is hinged to a large extent on the methodology of how the knowledge and the experience of the many people involved in the construction process

can be integrated as a team. Accordingly, the development of effective communication systems throughout the construction process will ensure the flow of quality and reliable information (*Ibid.).* Indeed, Dainty *et al.* (2006) indicated that communication in an environment which is project driven presents several challenges. In an industry such as construction, interaction is mainly characterised by unfamiliar groups of people who come together in a purpose driven environment within short periods before they are divided into several groups to perform their various endeavours towards the achievement of a construction project. The construction industry is not only deemed to be resistant to change, but also the industry as a whole is lacking efficient communication (Landin and Kindahl, 2013). And in an industry where managing and monitoring projects demands collaboration and coordination between parties for successful delivery of projects, effective communication and communication practices of construction firms cannot therefore be downplayed (Gunhan *et al*., 2012).

1.2 PROBLEM STATEMENT

In modern day construction, some of the important elements contributing to the poor performance of the construction industry that have been identified are ineffective communication practices, the organizational fragmentation and the lack of integration between design and construction processes (Dainty *et al*., 2006; Ochieng and Price, 2009). Project team members have always listed communication as one of the integral areas required for improvement during post-project assessments (Cornelius and Associates, 2010). They additionally stated that often times, project team members regarded troubled projects to have run smoother had communication management practices been better.

Communication management forms part of the nine knowledege areas that are advanced in the Project Management Body of Knowledge (PMBOK) of the Project

Management Institute (PMI). Indeed the PMI have developed a Communication Management Overview with clear guidelines regarding inputs, tools and techniques, and outputs towards effective communication management on projects. However, construction today has become more technologically complex, structures are bigger, higher, built in more crowded places, combine more advanced systems in an increasingly dynamic environment (Laufer *et al*., 2008).

Subsequently, there is increased flow of information between many people at any specific time. This is an obvious upgrade in the demand for communication (Laufer *et al*., 2008). There is therefore the need for the continuous development of frameworks that integrates the ever changing features and characteristics of a project.

According to the Professional Project Management Education (2010), the construction industry is suffering from project communication management issues such as; the inability to determine project stakeholders' needs for information; inability to determine communication channels, insufficient interaction between team members and inappropriate communication media. Also, Bandulahewa (2015), stated that the practice of communication requires, communication planning; information distribution; performance reporting; and managing stakeholders. However, these activities are not given the needed attention by construction managers partly because construction industries seem not to be aware of these practices; thus, communication is not given much attention among professionals and hence the use of communication plans are relatively rare (Bandulahewa, 2015).

1.3 RESEARCH QUESTIONS

The following research questions beckons the need for this research.

1. What are the predominantly used media of communication on construction sites?
2. What are the problems of communication encountered on site?
3. What are the key information requirements for the successful planning of communication on site?
4. How can a framework be developed to enable construction managers plan site communication?

1.4 AIM OF THE STUDY

The aim of the study is to develop a framework to guide professional construction managers in the development of on-site communication plan to drive their projects.

1.5 OBJECTIVES

To achieve the aim, the following objectives are advanced;

1. To identify the predominantly utilised media of communication and the effectiveness of these media as used on site;
2. To identify and prioritize the critical problems of communication encountered on construction project sites;
3. To identify the key information requirements and the sources of these information requirements; and
4. To propose a Framework for On-Site Communication Planning for Construction Managers.

1.6 JUSTIFICATION OF RESEARCH

As stated earlier the importance of communication in construction projects cannot be downplayed. Whereas the performance of most projects are measured on the basis of cost, time and quality, it is important to note that communication practices are needed to effectively communicate these success factors. Infact Zulch (2014), stated that "Communication is the function that integrates cost, scope and time to achieve a quality product and may be seen as having a foundation function". The cost component of the effect of communication on construction projects can also be significant. The Project Management Institute's (PMI) *Pulse of the Profession* reported that for every US$ 1 billion spent on a project, US$ 135million is at risk. It further revealed that a staggering 56 percent (US$ 75 million of that US$ 135 million) is at risk due to poor communication practices by firms (Project Management Institute, 2013). The Project Management Institute (2013), further stated that construction companies with effective and efficient communication practices are likely to outperform their counterparts 1.7 times financially. Statisitics also show that 74 percent of projects are unsuccessful and that among the factors that contribute to these failures include poor or insufficient communication practices by construction professionals (Mehta, 2002).

To ensure that construction projects are completed to performance standards,it is important that parties on site have a complete understanding of what is required. Information therefore becomes an indispensable item for the project team which is ensured through communication planning (Zungu, 2014). Therefore a study to investigate the communication practices of construction firms and developing a framework to help in planning communication is not only prudent but also timely. Additionally this study will also contribute to the body of knowledge on the most essential communication challenges facing the Ghanaian construction industry to help

stakeholders stand in better position to confront such barriers when they arise for succesful construction project delivery.

1.7 METHODOLOGY

The study adopted quantitative method of data collection and analysis. To achieve the set objectives both secondary and primary data were collected. The secondary data was collected through the conduction of thorough literature to establish the theoretical aspects of communication in construction. Conducting literature review, Saunders *et al*. (2009) posited, helps to develop a major understanding of the insights of other researchers and the emerging trends from such studies. Literature sources such as textbooks, databases, and internet sources were consulted to establish the theoretical aspects of communication management practices. The primary data was collected through the empolyement of questionnaire. The collected data through the questionnaire survey was then analysed using several statistical analysis methods such as Mean Score ranking and Factor analysis with the help of the Statistical Package for Social Scientists (SPSS) software.

1.8 SCOPE OF THE STUDY

The study covered only the construction stage of a project to determine the communication practices used by construction managers. The term construction stage refers to the building or construction of the various parts of a building namely, substructures, superstructures and architectural elements (Agyekum, 2012). This was because the construction stage represents the phase where majority of construction information are exchanged (see for instance Dainty *et al*., 2006). Additionally, management of onsite activities is a critical component precedent for a successful project. The accurate appreciation of on-site information concerning work tasks is

critical to increasing productivity. Construction managers however face the challenge of collecting and sharing site information within real time as a result of the harsh construction conditions. Information concerning location of materials, labor, and equipment along with current status of progress, are difficult to be handled on the construction sites. Such challenges necessitate the development of strategies and plans integrated with adequate communication capabilities to be used for the acquisition and exchange of construction information accurately and timely (Kim *et al*., 2013)

Geographically, the study was limited to Construction Companies in the Ashanti and Greater Regions of Ghana. Information was obtained from construction professionals in D1 and D2 classified construction companies in Ghana. The decision to focus on these companies was premised on the fact that these companies are believed to be well organised, carry out massive construction projects, employ qualified professionals and have the financial and technical muscle to employ the various means of communication.

The study areas of Accra and Kumasi were selected because majority of the construction companies are based in these cities. Again since mostly, large construction projects are undertaken in the city capitals of these regions, a massive 70% of the registered construction companies in Ghana are located in these cities. The other eight regions account for the remaining 30% (Ayisi, 2000; Ahadzie, 2007).

1.9 ORGANISATION OF RESEARCH

The study will be organised into five chapters. The first chapter provides the background that neccesitated the study. It also presented the problem for the study as well as the aim and objectives of the study.

Chapter two will be dedicated to reviewing literature on the subject matter. Attention will be granted to the various aspects of construction communication practices to establish the theoretical opinions of other reserchers. In this chapter, construction communication will be defined and literature will be reviewed to answer the research questions posed.

The third chapter will be dedicated to the method to be adopted for the study. In this chapter, the adopted research methods will be elaborated and justified.

The fourth chapter will present the data as obtained and analysed. The analysis will be focused on answering the research questions and achieving the objectives set for the study.

The chapter five will conclude the study. Based on the findings from the study, recommendations will be proposed as well as the need to conduct further research.

CHAPTER TWO

COMMUNICATION AND COMMUNICATION MANAGEMENT

2.1 INTRODUCTION

Having established the bases for the conduction of the study, it is important that literature on construction communication is espoused. This chapter will therefore concentrate on the theories governing construction communication. It will consider the nature of the construction industry in an attempt to draw the line in respect of its significance and the need for research and development to improve the industry. To understand the concept of communication and how it is managed, it is important that the industry within which communication is practiced is understood.

2.2 ECONOMIC SIGNIFICANCE OF THE CONSTRUCTION INDUSTRY

According to Szymanski (2006), the construction industry can be divided into subsectors of three. These are, the construction of buildings; road, highway and other infrastructure construction; and specialty trades. The construction industry is large, dynamic, complex, have several stakeholders and plays important roles in the development of nations. It serves as an employment avenue in which its activities are performed by this workforce. Its work can include the construction of new structures and the performance of renovations, additions, alterations, or the maintenance and repair of structures (Behm, 2008; Gwaya *et al*., 2014). The national socio-economic development goals of countries can be supported by the activities of the construction industry. This is because the construction of hospitals, schools, townships and other infrastructure which are the core mandates of every government for its people is carried out by the construction industry (Osei, 2013). The relationship between governments of economies and the construction industry towards economic development can be

described as rather symbiotic – government provides the fund and the construction industry constructs the projects. The importance of the construction industry is not limited only to the fact that it provides the infrastructure of other industries but also that it is sizeable in its own rights (OECD, 2008). The construction industry is fundamental to the existence of other industries since the environment within which they operate is provided by the construction industry. The workers of the industry have the responsibility to construct the structures that serves as a safe environment for people working in other industries to work and provide services (Jimoh, 2012; Tipili *et al*., 2014). The construction industry is a major employer of many economies across the globe. In Europe, it accounts for about 7% of the workforce and in the EU. A total of 40 million people are employed by the construction industry in America and Japan combined (OECD, 2008). This employment rate has a link to the output generated by the construction industry in several countries.

According to the International Labour Organization, ILO, (2001), the output of the construction industry worldwide was estimated at a little over $ 3,000 billion in 1998. This output is hugely concentrated in the high income countries (Western Europe, North America, Japan and Australia). In Europe alone the High income countries contributed 30% of the total output. Japan and America contributed 22 and 21% respectively. Whereas china and India contributed 6% and 1.7% respectively. Africa contributed about 3% of the total output worldwide within the same period (ILO, 2001). Despite the contribution of the construction industry to several countries, it is not without challenges. The challenges that confronts the industry is that which emanates from several areas. From the economy of countries to the management of its own activities. In the quest to provide solutions to the several challenges that confronts that industry, several researches have been conducted. Notwithstanding though, these

challenges still persist and now borders on those whose interest is to see a vibrant industry to do something. It is in view of this that this study is being conducted to propose a framework to help construction practitioners plan their communication.

2.3 THE GHANAIAN CONSTRUCTION INDUSTRY

There are two main characteristics that makes a construction industry unique. The first characteristic is the peculiarity that makes the industry different from others. Secondly, the uniqueness of a country's construction industry as defined by its socio-economic level, technological level, culture, institutional and legal frameworks (Gyadu-Asiedu, 2009). These peculiarities also define the Ghanaian Construction Industry. The Ghanaian construction industry have contributed immensely to industrial output and the Gross Domestic Product in Ghana (Osei, 2013). In Ghana, the contribution of the construction industry to the country's GDP is estimated to be about 10% (GyaduAsiedu, 2009). With respect to statistics that covers the entire nation, the effect of the construction sector as a whole is greater and includes areas of manufacturing, mining, quarrying, electricity and water sectors (Osei, 2013). The construction industry in Ghana is dominated by several stakeholders. These stakeholders include, client, contractors, and consultants. The construction industry performs its functions mainly by the formation of contracts with the other party (Client). Projects are mostly secured through Competitive Procurement as stipulated in the Public Procurement Act, 2003 (Act, 663) and The Public Procurement (Amendment), Act 2003 (Act 914). The Government of Ghana through this procurement method engages the industry in the provision of infrastructure including schools and hospitals.

The Construction industry in Ghana is dominated by several contractors ranging from

Small scale contractors to large scale contractors. To help distinguish between these contractors, the Ministry of Water Resources, Works and Housing have classified them into eight categories (A, B, C, S, D, E, K, and G). In each category, there are further groupings of 1, 2, 3, and 4 in ascending order of financial capability. Building contractors are in category D. This class of contractors are also supported by other contractors in categories E (Electrical Works) and G (Plumbing Works) mainly through sub-contracting in the execution of projects. The upper classes of D1 and D2 are considered as more organised and are noted for executing large scale projects. The financial threshold to which these contractors can bid are illustrated in Table 2.10

Construction projects in Ghana with high contract sums are mostly awarded to contractors in the D1 and D2 categories. In most cases, these projects are undertaken through partnerships and sub-contracting. By sub-contracting, many unique type of contractor organizations who specialize in specific areas of the project are hired to build according to a set of plans and specifications (Aiyewalehinmi, 2013). The contractual arrangements provides for the establishment of lines of communication, responsibility for the provision of information and pattern of co-ordination within the parties among the organisations (Murray *et al.*, 2000). The aggregation of many organizations on a particular project site comes with its associated characteristics of the presence of several construction operatives. And as stated by Abugre (2013), it is effective communication between the workers that gives life to the organizational structure and hence the successful execution of the project. It is against this background that this study seeks to develop a framework to help in planning communication to help construction managers co-ordinate site operatives.

Table 2.1:Financial Thresholds of Contractors

Financial Class	Building Contractor Designation	Financial Limits of Projects
1	D_1	-
2	D_2	US $ 500 000
3	D_3	US $ 200 000
4	D_4	US $ 75 000

Source: Dansoh (2005)

2.4 CONSTRUCTION PROJECTS AND COMMUNICATION

Construction projects are complex and their performance is affected by several factors (Fallrø, 2013). And according to Laufer *et al*. (2008), the complexity of construction can be divided into Technological Complexity and Organizational Complexity. Current construction projects have become technologically complex; structures are bigger, higher, built in crowded places and uses the combination of advanced systems. Subsequently, there is increased flow of information between many people at any specific time. This is an obvious upgrade in the demand for communication. The organizational complexity is the rate at which complexity grows with the proportional increase in the number of sub-organizations and the way they depend on each other (Laufer *et al*., 2008).

Construction Projects have been defined by several authors of various research studies. According to Adeyemi (2013), a project consists of a group of tasks, duly executed within a defined period, with the utmost aim of achiving the set objectives of the project. A construction project is charactized by several features. These include the likelihood of it being a onetime programme, having a specific start and end date, performed within a determined budget and several resources albeit scarce and have to be shared among others. Another profound definition was offered in the BS 6079-1

(Guide to project management) which stated that a project is a unique set of coordinated activities, having defined starting and finishing times, undertaken by an individual or organization to achieve specific specific objectives within schedule, cost and performance parameters (Lester, 2007). The Project Management Body of Knowledge (PMBOK) of the Project Management Institute (PMI) defined a project as a 'temporary endeavour undertaken to create a unique product, service, or result' (Project Management Institute, 2008). For the said product to be realized several parties and stakeholders are involved which have been found to be a source of worry for the performance of the projejct. The performance of each party is linked and have an impact on the performance of the overall project (Sweis *et al*., 2014).

Construction projects are undertaken by contracting and sub-contracting and the building of alliances. Several stakeholders are invloved in the conception of projects and the process of designing, financing, building, managing, upgrading and replacement. This comes with the need for communication and cooperation (Aulich, 2013). Communication is said to have taken place when message sent is interpreted by the target recipient. Communication can therefore be said to be dependent on the recipient (Landin and Kindahl, 2013). The effective communication among the participants of a project have been identified to be critical and fundamental to the success of construction projects. In construction, communication have been complicated by a number of factors (Liu *et al*., 2006).

The stages of construction that involves design and project execution is a social act of collaboration that thrives on interaction between stakeholders. Professionals are gathered through projects at all levels of groups and individuals. The collaboration is enhanced by the use of several tools of communication and media. The success of the project is linked to their ability to interact effectively (Gorse and Emmitt, 2007).

According to Tai and Wang (2009), construction communication span time and space, and it is a multi-level, multi-faceted problem. In construction, the largest volume of communncation that takes place occurs during the construction phase. Communication is fundamental to project success and borders on construction professionals to implement (Eddie *et al*., 2001).

2.5 COMMUNICATION DEFINED

Dainty *et al*. (2006), outlined the difficulty of defining communication since it is multidimensional and an indefinable concept. It has various meanings, contexts, forms and impacts and therefore could have diffeerent meanings to different people in several situations. This is synomymous with the construction industry in which several information are communicated at the same time. Communication is regarded as a complex system and three elements that can be identified in every system includes, input, transformation of input and the output of the input in a new format (Gillard and Johansen, 2004).

Bandulahewa (2015), indicated that communication is an important skill and a managerial tool for success in the construction industry.

According to Vasanthi and Abu (2011), communication can be defined as the process through which a message is encrypted and imparted by a sender to a reciever using a channel or medium. This process of transmissions may either occur between individuals or between oganizations in the construction industry (Gunhan *et al*., 2012). The concept of communication is seen as a two information exchange. The sending of information to another party alone does not constitute communication. But communication is established when the recipient of the information responds to the information (Goh *et al*., 2014).

According to Liu (2009), communication have also been defined according to the context of application. Communication is said to occur only when there exists two associated information production procedures and the output of one process is the functional inverse of the other process's output (Losee, 1999). The intrinsic characterstics of communication has been made bear by some researchers who described communication as a process (Velentzas and Broni, 2014).

2.6 THE ELEMENTS OF THE COMMUNICATION PROCESS

Communication is the process of exchanging information, thoughts and feelings between people via interaction, writing or body language (Velentzas and Broni, 2014; Lunenburg, 2010). The definition reiterates the fact that without an understanding of the information transmitted, communication cannot be said to have occurred (Lunenburg, 2010a). Communication can take many forms. However, irrespective of the form in which information is communicated, the elements of sender, reciever, channel or medium and the message are always present (Velentzas and Broni, 2014). In the communication process, the message being communicated flows from the sender who encodes the message and transmits through a medium/channel by either a verbal or non-verbal method, to the reciever who decodes the encoded message (Zulch, 2014). In the process of communcation, noise and barriers acts to make the transmission difficult. This process is illustrated in the figure below.

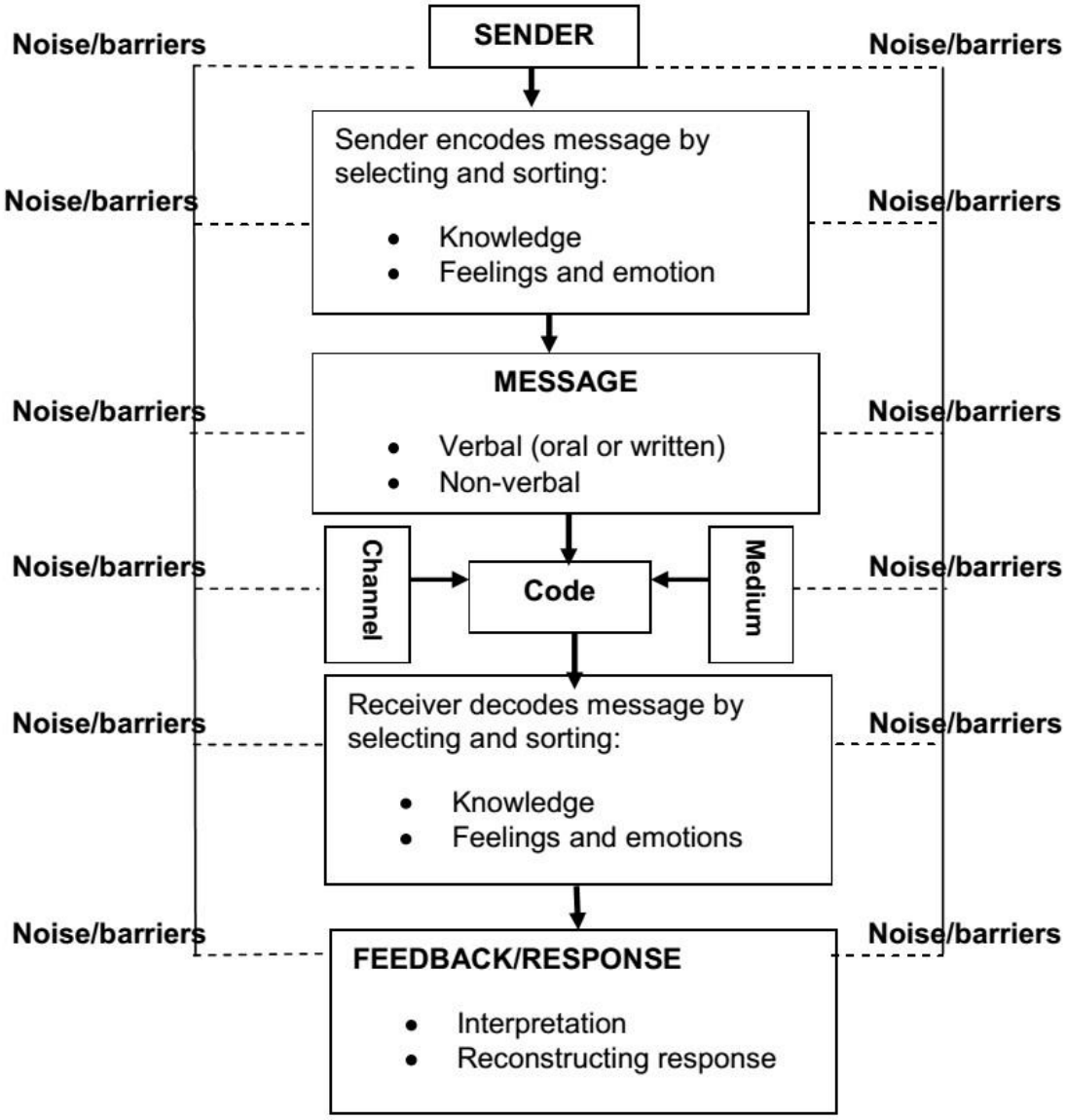

Figure 2.1: The Communication process

Source: Zulch (2014)

The process of communication and the transmission of information begins with the *sender*. The sender acts as the sending party and sends the message. This message can include ideas, thoughts, pictures and emotions (Alatalo, 2012; Pfeiffer, 1998). The sender *encodes* the message which may take any form (verbal or non-verbal). Encoding invloves the conversion of feelings, ideas, and thoughts, numbers or phrases to express oneself (Burke, 2007) emphsised (Zulch, 2014). Stated in other words,

encoding means that the intended message is embedded in a linguistic code (word, sign or both) to form the message. Hence it is important that the act of encoding is done in a language that conveys or communicates (Khattak *et al*., 2003). Once encoded, the message is transmitted through a *medium/channel*. *Medium* refers to the means of communication used (eg. Spoken, written, graphic etc.). The *channel* refers to the conduit through which the message is conveyed (Dainty *et al*., 2006). This channel can take many forms: during face-to-face interaction, on the telephone, through printed materials or visuals (televisions, photographs) (Pfeiffer, 1998). The communicated information is then received by the target recipient. The reciever decodes the message to understand what is communicated. Decoding is impacted by the prior experience of the reciever and the frames of reference (Guo and Sanchez, 2005). Decoding a message requires communication skills such as the ability to read and comprehend (written), and ability to listen carfully or ask questions when needed (MTD Training, 2010). Comprehension of the message by the recipient depends on the amount of prior information the recipient knows about the topic, the relationship between the recipient and the sender, the recipient's understanding and perception of the conveyed information (Thomas *et al*., 1998). The communication process is said to be complete when the reciever have received the message and offers a response (feedback) to the sender of the information. When the reciever decodes the message as intended by the sender, there is the matching of ideas of both parties and the likelihood of the reciever sending a response to the sender (Pfeiffer, 1998). Communication is said to be one-way when there is no feedback from the reciever. Two-way communication is when the feedback is offered. A feedback is not a mere acknowledgement of the message as it must contain as much content as desireable for the comprehension of the reciever. It is difficult to know if the message communicated is received and understood without

feedback (Xie, 2002; Lunenburg, 2010a; Dainty, *et al*., 2006). However, at each stage within the communication process are barriers/noise. Noise is described as anything that obstructs or distorts the message. Noise in the communication process is inevitable (Lunenburg, 2010a;Wood, 2010). Wood, (2010), stated that four kinds of noise exists in communication. They are classified into Physiological Noise (distortion by hunger, fatigue, headaches, medications and other factors that impacts the thinking process of the physical being),

Physical Noise (noise made by others, extreme temperatures, crowded conditions), Psychological Noise (qualities that impact communication and interpretation of others), and Semantic Noise (jargons, when words are not understood) (Wood, 2010).

2.7 TYPES OF COMMUNICATION IN AN ORGANISATION

Understanding communication on construction sites requires an understanding of organisational behaviour of a team. Earlier researchers have studied communication within organisations and classified them into various type. Kreps (1989) cited in Liu (2009), divided communication into four types: intrapersonal communication, interpersonal communication, small group communications and Multi-group communication. Details of these communication types are summarised in the table below.

Table 2.2: Types of Human Communication (Emmit and Gorse, 2003 Cited in Liu, 2009)

Process	**Number of people invloved**
Intrapersonal Communication The process of communication within oneself (cognition) which invloves the manisfestation of thoughts in the brain. It also includes the knowledge of the capability of another person to process the information which serves as the bases for the originator of the communication with the knowledge that he can communicate with the other person.	It invloves only one person. It is mainly the thought of one person either when they are alone or communicate with others. It is usually used when a unilateral decision is made. Since communication is said to be succesfull only when two people are involved, most authors does not consider intrapersonal communication as a communication process.
Interpersonal communication This type of communication occurs directly between two people which helps to establish and maintain relationships. Interpersonal communication involves the transmission of messages and signals between the parties. Both intrapersonal and interpersonal communication helps information to be processed in order for mutual decisions to be taken.	This generally involves two people- where there are more than two people, it is mostly considered to be group. Interpersonal communication is differentiated from group communication by the fact that in interpersonal communication, the information is intended for only one reciever. Some scholars though do not differentiate between the two base on one-to-one interactions. There can however be differences in the nature of the interactions.
Group Communication This invloves mainly groups (more than two people). The message may be conveyed in a way that addresses the entire group or persons within the group in different ways. The terms and language used may also be specific to the group.	Involves more than two people but restricted to a single group of people. Individuals or the whole group may be addressed by the communicator. And where individuals are addressed, the information will eventually be communicated to the entire group.
Multi-group communication In multi-group communication, the message is communicated to a number of groups or subgroups by either a person or a group. Different responses may be given to the message based on the culture and norms of the groups.	Though the message is targeted towards a number of groups or sub-groups, there is an element that the messages are largely contained within the specific groups, e.g. departments of an organisation.

The PMI have also classified communication within project management as having several dimensions including:Internal (within the project) and External (costumer, other projects, the media, the public); Formal and informal; Vertical and horizontal; Official and unofficial; Written and oral; and Verbal and non-verbal (Project Management Institute, 2008).

Organisational communication within construction projects is considered to happen in three different forms. The first refers to communication within a company or an organisation, example, communication in the main contractor's outfit. Secondly, communication with other participants, example, communication between main contractors and architects. The third is communication with all stakeholders, example, main contractors communication with government departments (Liu, 2009). This study concentrates on communication within the the project team at the construction stage and not to other external stakeholders such as the governement and the public.

2.8 PROJECT TEAM COMMUNICATION

Communication has an impact in all aspects of the work and plays a crucial role in construction (Emuze and James, 2013). Projects are executed with several participants who work in diverse ways towards the realization of the project. Each project requires the services of different people with their professionalism, knowledge, and experience and needs them to work and coordinate with others (Azmy, 2012). Communication between the project team is therefore essential to maintain a good relationship between the participants to ensure the success of the construction project (Ceric, 2011). On construction projects information is shared between the team in order to achieve the goals of the project (Ceric, 2011). Members of the project team require proper and timely information concerning the various aspects of the project in order to help in

contributing to the successful implementation of the project (Liu *et al*., 2006). Liu (2009), defined communication between project teams as the transmission and the exchange of project related information among the participants of the project mainly for the coordination and accomplishment of construction work towards the achievement of the project goals. Communication between project team members relate mainly to the exchange of information between the participants of the team (i.e. clients, architects, construction managers etc.) (Anumba and Evbuomwan, 1999).

2.9 THE CONSTRUCTION SITE AND COMMUNICATION

Construction sites are characterised by complexity and involves the participation of many practitioners and factors that can contibute to the failure of the construction process. Construction projects are executed by a range of participants having separate or conflicting aims and interests. On a typical construction site, the organization can include one or many designers, several contractors and subcontractors, many consultants as well as suppliers (Sheng and Hanbin, 2014). Thus collaboration and cordination of the stakeholders coupled with effective communication is noted to be important for successful project delivery (Yang *et al*., 2007; Sheng and Hanbin , 2014). The construction site is noted for the generation of several informations ranging from drawings produced during the design stage to reports generated on site (Garcia Garcia *et al*., 2014). Some aspects of the project may not be understood if the information available is inadequate (Olaniran, 2015). It can be explained that lower productivity on site can be partly blamed on the needs of information and communication not being adequately met (Garcia Garcia *et al*., 2014). There are stages within the construction period of a project where various activities are executed concurrently which require effective coordination and communication (Shohet and Frydman, 2003).

Communication on construction sites are hindered by nature of the construction sites in which senders and recievers of information are dispersed and circulating around in a congested and “noisy” site (Lee and Bernold, 2008).

Owing to the rugged nature of construction projects sites, and the participants involved, there are various channels of communication that are established during the construction period. The next section identifies the various channels of communication that are established during the execution of projects.

2.10 CHANNELS OF COMMUNICATION

There are several mediums of communication that can be used at any point in time to depending on choice and the characteristics of both the sender and the receiver of the information communicated. According to Mamuli *et al*. (2013), the channel of communication selected for the transmission of a particular information depends on the time available, expenditure involved, the urgency associated with the information, intellectual and emotional state of both the sender and recipient. It also depends on the stage of the project or the activity undertaken (Emmitt and Gorse, 2003). The various channels of communication are different in their ability to transmit information. It can be likened to the pipeline used for the carriage of liquid. The amount of liquid carried through the pipe is dependent on its physical properties. The physical properties of the medium can limit the volume and type of information to be conveyed (Lengel and Daft, 1989). The parties involved in the communication chain also influences the medium to be selected. Parties may require information at different times. Some participants are able to understand aspects of the project with little information provided. Others on the other hand, other aspects can only be understood when the information is conveyed in such a manner that enhances comprehension. The selection

of the appropriate channel is therefore important in communication (Gorse *et al*., 1999). Lengel and Daft (1989), stated that an effective communication medium should possess the following features.

- Capacity to handle several information cues simultaneously.
- Capacity to facilitate rapid feedback.
- Capacity to establish a personal focus.

The channels of communication usually used on construction projects can be classified into formal and informal (Posea, 2012; Dainty *et al*., 2006).

2.10.1 Formal Channels of Communication

Mamuli *et al*. (2013) defined a formal channel of communication as communication that is defined in the formal structure of an organization mainly for the transmission of goals, policies, procedures and directions. The formal channels of communication explains the relationship that exists in the nature of organisation between the team members (Posea, 2012). Majority of information that is communicated during the construction period usually flows either through the architect or contractor. Mostly design informations are communicated through the architect whereas building and assembly information are obtained through the contractor (Barakat, 2009). The procurement route and the contractual arrangements are thought to be the determinants in the rate at which formal communication channels are formed on construction projects. Formal communication channels are thought to be pre-designed and imposed on the project team rather than evolving. Nonetheless, there is the likelihood of project participants introducing their ideas when they communicate (Emmitt and Gorse, 2003; Dainty *et al*., 2006). The formal communication are usually complicated by the adoption of informal communication channels mainly to overcome the complicated

and bureaucratic nature of the formal communication routes (Emmitt and Gorse, 2003).

According to Tubbs and Moss (2008) c.f Zulch (2014), there are four directions in which formal communication flows. This include downward communication, upward communication, Horizontal Communication and Diagonal.

2.10.1.1 Downward Communication

This communication can also be described as vertical communication as information flows from higher levels to lower levels mainly for issuing orders, broadening of ideas and communicational knowledge (Turkalj and Fosić, 2007). This downward information communication refers to several issues. It includes directives, instructions, policy procedures mainly for the implementation of goals and objectives (Verma, 2013; Zulch, 2012). This form of communication has the likelihood to be filtered, modified or halted at each levels in the quest for managers to decide what information should pass to the employees (Zulch, 2012).

2.10.1.2 Upward Communication

The kind of communication that flows from the lower levels to the upper levels within an organization is known as upward communication. It is utilised to bring to the attention of managers of what the subordinates are feeling (Wang , 2011). Its use can also include the relay of information mainly related to the proposals system, employees' opinion, work insight and issues relating to employees' problems (Turkalj and Fosić, 2007). According to Tariszka- Semegine (2005), upward communication has not been utilised fully because of employees' fear of reprisal, employees have the

feeling that their concerns are filtered/modified when they communicate and managers lack of time to listen to the concern of employees.

2.10.1.3 Horizontal Communication

Horizontal or lateral communication is the communication that takes place among employees/supervisors at the same level in an organization (Tariszka-Semegine, 2005). Horizontal communication enhances coordination. Horizontal communication enables one employee to work with another without having to follow the rigidly setup procedures (Verma, 2013). By the nature of horizontal communication, activities that borders on common objectives can be easily synchronised without the intervention of managers of the higher ranks (Posea, 2012).

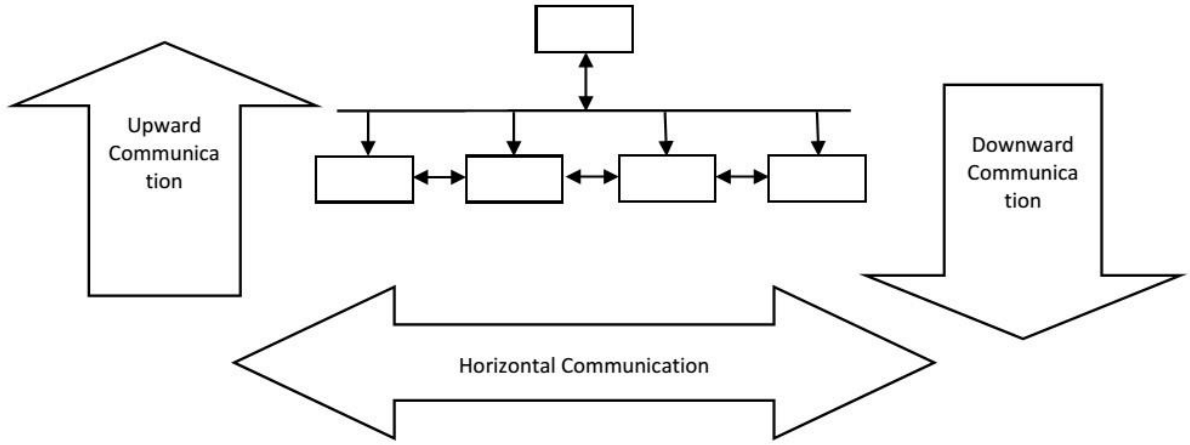

Figure 2.2: Directions of Communication
Source: Lunenburg (2010)

2.10.1.4 Diagonal Communication

Diagonal communication takes place between superiors and workers not located on the same hierarchy/level (Tariszka-Semegine, 2005). This communication is achieved

when members of the organization cannot communicate through the other channels. By utilising this communication route, there are savings in time and cost and the added advantage of utilising informal relationships (Posea, 2012).

2.10.2 Informal channels of communication

Communication is considered informal when the rules and hierarchies and the cordinating activities are ignored. Such communications are considered to be spontaneous, interactive and rich (Kraut *et al*., 2002). For coordination to be properly done, there is the need for informal communication as it is dependent on for human necessities: (a) physical presence, (b) the need to communicate, (c) the sense of belongingness to the group and (d) the hierarchy (Ergen, 2011). The informal channels of communication are deemed unofficial and the data transmitted is not verified. The informal means of communication has increased speed, fills organizational gaps, maintains linkages, handles one-time-situations and efficient even though the data it may carry may be of the 'gossip' type (Posea, 2012; Mamuli *et al*., 2013).

Ergen (2011) stated the characteristics of informal communication as;

- Having no permanent structure
- Suggests how communication networks actually work
- It can route around to damage formal communication networks
- Its situational and spontaneous
- It can creates its own organizational structure.

Figure 2.4 provides a pictorial representation of the the formal and informal channels of communication in construction. It depicts how organisation chart is not a good representation of communication among people and who may posses power in an organisation. Communication between people may not follow a particular parttern and

can move through parts of the structure and side-stepping others, thereby defeating established formal communication protocols (Dainty *et al*., 2006).

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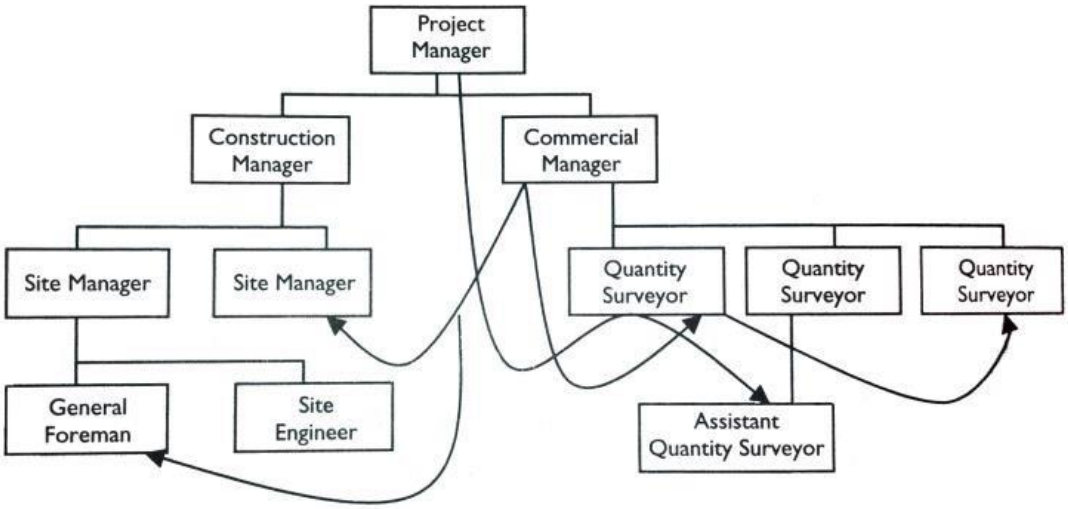

Figure 2.3: Formal and Informal communication routes in a project

Source: Dainty *et al*. (2006)

The advantages and disadvantages as well as the usage periods of formal and informal communication routes have been offered by Barakat (2009) and summarised below in the table.

Table 2.3: Formal and Informal routes of communication

Communication Route	Advantages	Disadvantages	When Used
Formal	1. Provides project historical records. 2. Provides control for the project. 3. Provides contractually obligatory process	○ The movement of information is slow. ○ Bureaucratic as there are several steps in the transmission of documents. ○ The gap between the needed information and the information available can lead to errors and changes. ○ Difficult to use in all situations as it may prove ineffective in providing solutions in urgent situations. ○ Iterations concerning approval of submittals and changes cannot be handled effectively with formal channels of communication. ○ The exchange of information is vertical and only horizontal at the top making distance documents travel long. ○ In the formal route small pieces of informations is not provided (i.e. only completed submittals travel through the formal process.	○ When records of historical nature are required. ○ When obligations that are contractual are to be fulfilled ○ When there is the need for approvals. ○ When there is the luxury of time (i.e. no urgency for information. ○ When the transfer of small pieces of information are not required. ○ When uncertainty is low.
Informal	○ The process of communication is very fast ○ Iterations of information is reduced. ○ Small pieces of information can be transferred or communicated ○ Time for communication is reduced as this nature if communication takes place in a horizontal pattern. ○ Direct communication with decision makers. ○ Time for review is reduced as discussions result in understandings and decisions made. ○ Action may be undertaken based on informal agreement. ○ Provides grounds for resolution of conflicts before formalization and getting entrenched in position. ○ Different perspectives are allowed under informal communication routes.	○ It is usually not recorded. ○ Not recognized contractually ○ The loss of information is possible. ○ Misunderstandings may arise. ○ It is “Chaotic” in nature ○ Initiated by individuals and therefore subject to various perspectives. ○ It is not well established (based on how individuals find suitable) ○ Requires trustworthiness to be established	○ When solutions are needed in urgent situations. ○ When pieces of information is required. ○ When there is interdependency between the tasks and the personnel involved requires communication. ○ When uncertainty of information is present and requires communication to reduce uncertainty ○ When reduction of iterations of information is required ○ When preparation time of works is required to be reduced (e.g. submittals)

Source**:** Barakat (2009)

2.11 METHODS OF ON-SITE COMMUNICATON

There are several means of communication used on construction sites used by both top management communication and communication amongst the various participants and these methods have been identified in earlier studies. Barakat (2009), conducted a case study into two mega projects in Dubai. The methods of communication used on those projects included face-to-face, meetings, email, correspondence and phone. Other researchers have also classified these methods of communication. Vasanthi and Abu (2011) and Mehta (2002) classified the means of communication under verbal communication and written communication. Billström and Cederqvist (2012), also conducted a study and sought the perspective of consultants on the channels of communication used in construction projects. They stated face-to-face communication, video conference systems, project planning documents, meetings, project portal, email and telephone as the tools or channels of communication. At the project level, the Project Management Institute also classified the methods of communication into Interactive communication (e.g. meetings,phone calls, video conferencing), Push Communication (letters, memos, reports, emails, faxes, voice mails, press releases etc.) and Pull communication (intranet sites, e-learning, and knowledge repositories) (Project Management Institute, 2008). Ergen (2011) also in his study into the shared knowledge within the informal communication network also classified the channels of communication into verbal, non-verbal and technology aided communication. From the literature these methods are summarised in Table 2.4 below:

Table 2.4: Means of Communication

COMMUNICATION METHOD	AUTHOR(S)
Face-to-face	Barakat (2009); Billström and Cederqvist, (2012); Mehta, (2002); Vasanthi and Abu, (2011); Gorse, *et al*., (1999)
Phone	PMI (2008),
Correspondence	Barakat (2009); PMI (2008)
Meetings	Billström and Cederqvis, (2012), Mehta (2002)
Memos	PMI (2008)
Faxes	PMI (2008)
Videoconference	PMI (2008); Billström and Cederqvist (2012)
Email	PMI (2008); Mehta (2002); Barakat (2009); Ergen (2011)
Project Intranet	PMI (2008)

Source: Author's Construct (2016)

2.11.1 Face to Face Meetings

Face to face communication is the personal means of communication where parties have the capability to respond to signals of the counterpart (Arndt, 2011). This communication method enables the recipient of the information to hear and see the nonverbal cues conveyed by the communicator for immediate feedback (Ean, 2010). In face to face discussions, the conversation between the parties are more personalized and the distinction between superiors and subordinates appears to be rather unrecognized. Subsequently the parties to the communication feel comfortable with the sense of "ownership" of the issues communicated (Abugre, 2013). Face to face communication have been found to be effective under uncertain conditions. According to Murray *et al*., (2000) organisations use face to face communication in situations

where there is high frequency of uncertainty. Within the project team, members use face to face communication to obtain construction information to remove uncertainty. The situations and construction drawings may be complex. Face to face communication has been noted to be the most effective way of interpreting those complexities to remove the uncertainties (Liu, 2009). Face to face communication have been found to be an effective way of communication and information transfer in the construction industry (Cheung *et al*., 2013; Gorse *et al*., 1999). Face to face communication provides the grounds for immediate recognition of whether the information is understood. For instance, in a situation where a specialist is explaining a problem, he or she is immediately capable of detecting whether the other party understands as a result of their facial expression (Gorse *et al*., 1999). In face to face communication, information is sent and received almost at the same time in such a manner that the ability to resolve issues is increased substantially (Emmitt and Gorse, 2006).

2.11.2 Telephone

In the construction industry, time is a always an important commodity. Indeed time is an factor for measuring the performance of construction projects. In the past communication was difficult unless the construction/project manager or site supervisor is in transit. However, the introduction new cellular phones and other technology devices has changed that (Shaban, 2008; Sivert, 1986). The use of such advanced commnucation tool has contributed to sufficent time savings during project execution. Constant communication can be maintained between the construction manager and the workers who also have a telephone (Sivert, 1986). Additional advantages of telephone communication is its information richness and the fact that the telephone is usable from anywhere on the site (Howard and Pertersen, 2001; Bauer

and Erdogan, 2012). The project manager is able to exchange information with the other participants at a faster rate. However, complex technical issues cannot be communicated effectively with telephone. The professional language gap between the construction manager and the other team members becomes difficult when they communicate between themselves through the telephone (Liu, 2009). The use of telephones for communication have not only revolutionised the construction industry but have also changed the manner in which people interact, thereby reducing face to face communication (Dainty *et al*.,
2006).

2.11.3 Faxes

According to Gorse *et al*. (1999) faxes are used to confirm details, provide instructions and correct details or instructions. They are fast and especially effective for communicating textural or information of graphical nature. Though the usage of faxes for information is quicker relative to other methods, an important problem is that the fax information is only delivered in A4 width (Gorse *et al*., 1999) and it cannot be edited (Howard and Pertersen, 2001). Though using fax to communicate is faster, it is rather difficult to update all other related project documents and distribute to relevant parties within the same time frame (Gorse *et al*., 1999).

2.11.4 E-Mails

Where a communication requires explanation, emails are a preferable choice (Barakat, 2009). Emails also are useful for reporting, informing and transmitting project information to the participants. Mostly such information is sent as an attachment. Email messages can be delivered by to the receivers in different locations (Liu, 2009).

The use of emails has provided a means of rapid transfer of both textual and graphical information and has enhanced decision making and problem solving during the construction process (Dainty *et al*., 2006). The *sine qua non* for the use of emails is access to the internet (Liu, 2009). Gorse *et al*. (1999) discorevered that a major challenge is that most construction sites do not have internet access, and owing to the late adoption of information technology by the industry, most professionals are not experienced in the use of emails. But in recent times, the use of the emails have become easy due to its accessibility on desktop computers, laptops, ipads, tablets and smartphones (Heady, 2014). Due to this, there is the likelihood of frequent use of mails than the other means of communication (Heady, 2014).

A summary of the various methods employed in the construction industry and their respective merits and demerits have been provided by (Barakat, 2009) as follows:

Table 2.5: Advantages and Disadvantages of the means of communication

Method	Use Of Communication Method	Advantages	Disadvantages
Face to face	• To solve problems • To reflect on ideas • To transfer information • To negotiate	Ability to use all of the senses Resolve problems before it is contractual May convince others of difference views before taking entrenched positions.	May stop ideas from developing prematurely Misunderstandings are likely if each participants understands differently.
Correspondence	• To establish historical records and fulfil contractual obligations • To maintain control	Documents establish rights and obligations Records of projects are kept	Slow Gaps may exist between information required and information provided Small pieces of information cannot be passed
Email	• Explore options • Reporting on issues • Passing information	Provides a traceable "feel" Instant Documents can be attached for clarification	Is instant and may cause misunderstandings May become "stuck" in response and counter response without resolution Keeps people glued to their seats and not use other communication methods.
Telephone (mobile phone)	Provides mobile communication	Ability to resolve ongoing problems immediately May initiate resolution to problems on site	Limited to verbal understandings

Source: Barakat (2009)

2.12 CONSTRUCTION COMMUNICATION PROBLEMS

Communication problems encountered in a construction project are considered to be critical especially when time is wasted and is accompanied by cost leading to reworks (Goh *et al*., 2014). Communication problems or barriers are the elements or factors that hinders or distorts information from being sent or received (Mailabari, 2008). Given the complexity of the task of communication, it is easy to accept that challenges may be present (Mehta, 2002). This could be due to the fragmented nature of the construction site and the number of participants involved. Since these parties represent different professions, these multidisciplinary skills limit the extent of their cooperation (Cheng *et al*., 2001). Communication problems are easily detected in an organisational environment, where information centralisation problems and issues of different interpretations are present (Monteiro de Carvalho, 2013). There are several communication challenges that are faced by the construction manager, who communicates with an array of people on the construction site (Gillard, 2005). These however are not unsurmountable and the successful construction manager will recognize and develop strategies to overcome them (Gillard, 2005). The lack of accuracy in communication is a communication problem that arise on daily basis (Monteiro de Carvalho, 2013). Critical communication problems that construction managers must overcome include the management of the individuals and groups who may be having different degrees of technical expertise (Gillard, 2005). Communicating with onsite employees have become difficult due to the extent of work site change, information overload and the diversity of the work force (French, 2002).

The construction manager can also become a barrier to the workers because of their power and influence on what employees sees and hears (Gillard, 2005). On projects,

as the construction process continues, members join and leave the team, disputes arise, and the barriers to effective communication evolve (Mead, 1999). Several researchers have identified the problems encountered in the construction industry. For instance, Guevara and Boyer, (1981); Liu (2009) identified the communication problems encountered on construction projects to include information underload, overload, distortion, gatekeeping, Barriers, Misunderstandings, inaccuracy, and untimeliness. These variables are explained below:

2.12.1 Information Underload

Where the information required is not available, or not enough, the problem of information underload emerges (Liu, 2009). The problem of information underload can stifle timely decision making (Xie, 2002).

2.12.2 Information overload

Overload occurs when there is more information at the disposal of an individual than they can utilise it. Information overload can lead to a breakdown where the receiver cannot send feedback to the sender (Xie, 2002; Mead, 1999). The effectiveness of communication can be compromised when there is overload because messages can be ignored or missing (Preece and Stocking, 1999).

2.12.3 Distortion

Distortion in information communication implies that the information sent or received is changed in meaning or some of its content is lost during dissemination (Murray, et al., 2000). Hunter (1993) cited in Xie (2002), also agreed with this assertion stated that when the content of an information is changed during transformation, distortion is present. Distortion normally occurs during the transmission of information and the

longer the chain of transmission the greater the distortion (Dainty *et al*., 2006; Cheung *et al*., 2013).

2.12.4 Gatekeeping

Gatekeeping is when an individual intentionally or unconciously withholds an information from others (Mead, 1999). The problem of gatekeeping can frequently occur on construction sites where the chain of communication is long. Liu (2009) in his study found that the problem of gatekeeping is prevalent in Beijing building projects.

2.12.5 Barriers

This is the presence of barriers that makes communication difficult. This can be interpersonal, logistical, accessibility among others (Xie, 2002). Shen (1992) cited in Liu (2009) stated information inaccessibility was caused by poor presentation or hierarchical barriers. According to Thomas *et al*., (1998), language is the most critical barrier to effective communication.

2.12.6 Misunderstanding

Misunerstanding occurs when there is a misunderstanding of the expectation (sender) and the requirement between the parties (Liu, 2009). Xie *et al*. (2000) indicated that misunderstanding was a major problem in multi-team design processes.

2.12.7 Inaccuracy

The problem of inaccuracy according to Liu, (2009) includes aspects of conflicting instructions and poor communication. This problem is also often caused by lack of coordination (Xie *et al*., 2000).

2.12.8 Untimeliness

Untimeliness occurs when information regarding changes are not delivered on time (Liu, 2009). Communication is only effective when information is provided in its right format, and at the right time (Project Management Institute, 2008). Xie *et al.* (2000) indicated the causes of information delay includes administration, information distribution, information prioritisation, communication channel, communication line, organisation structure, and the knowledge about the period of information flow.

Other earlier researchers have also identified some communication problems that are encountered on construction projects. Mehta (2002) highlighted some communication problems to include information overload, hidden agendas, power games, bias towards certain people. Preece and Stocking (1999) in their study into safety communication management in construction contracting stated some communication problems to include absence of feedback, selective listening, sender credibility, the use of technical language and jargons, filtering, status differences, time pressures and information overload. Mailabari (2008) also stated differing perception, poor listenting and premature evaluation, distrust, badly expressed messages, difference in background, information overload, inconsistent verbal and non verbal communication, emotional evaluation, and noise/distraction as the communication problems that are encountered in construction projects.

2.13 CONSTRUCTION INFORMATION

Construction relies mainly on the generation of large amounts of information, its transmission, interpretation, maintenance, reuse and eventual recycling (Barakat, 2009). In developing a framework that can enhance construction communication requires an identification and categorization of on-site information needs (Chen and

Kamara, 2008b). From the start of the project through construction to the end, ideas are developed, decisions are made and several information are generated and shared among the participants of the project (Chin, 2008). During the Pre-Project phase, majority of information is communicated between the owner or owner's representatives, Contractor's Project Manager and the design team (Ballan and ElDiraby, 2011). This pattern of communication changes during the construction stage where majority of exchange of information are between Construction Manager, Site Superintendents, Foreman and design consultants. Depending on the nature of the organization, most communication during the construction phase are handled by the construction manager. On the construction site, the construction manager with the help of other site engineers produces several reports which are disseminated to the various departments of concern (Gyampoh-Vidogah *et al*., 2003). Several site personnel require large volume of information that ranges from design drawings to personal diaries to enhance decision making (Chen and Kamara, 2008b). Control of the information generated depends to a larger extent on the one who has created the information. This can range from the architect to the client or to the contractor (Craig and Sommerville, 2006). Garcia Garcia *et al*. (2014) argued that low productivity on construction projects can be attributed partly to the fact that the information needs during construction are not adequately met.

The Project Management Institute (2008), indicated that in planning communication, it is important to first identify the information needs and the methods of distribution of these information. Construction site information needs have been categorized by several research studies. For instance, Chen and Kamara, (2008) grouped site information needs into 12 groups which includes drawings, material, Equipment, Contract, progress, safety, sub-contractor, design clarifications, construction method,

specification, labour, and quality. Nourbakhsh *et al*. (2012) cited De La Garza and Howitt (1998) also grouped construction information into 10 groups which are requests for information, material management, equipment management, cost management, schedule means and methods, jobsite record keeping, submittals, safety, quality control/ quality assurance, and future trends. Ballan and El-Diraby (2011) further provided various categories of information based on the study of De La Garza and Howitt (1998) into several sub-categories and are shown in the table below:

Table 2.6: Construction Information needs and requirements

Category	Information Need and Requirement
Request For Information	Design Intent and Clarification
	Change Orders / Contemplated Change
	Domestic Sub-Contractor Information
	Nominated Sub-Contractor Information
	Contract Specifications
	Contract Drawings
	Means and Methods
	Site Instructions
Materials Management	Place Request/Order Material
	Access to material management
	Material Order Status
	Material Location
	Special Material Handling/Delivery
Equipment Management	Equipment Rentals
	Equipment Allocation
	Hiring firm information
Cost Management	Budget Pricing
	Field Labour Costs/ labour Sheets
	Material Cost Accounting
	Purchase Orders and Extras
Site, Schedule and Construction Information	Schedules Updates
	Subcontract Performance Reports
	Update Drawings and As-Builts
	Labour Time Sheets
	Progress Reports
	Visitor Log
	Daily Site Diary
Quality Control/ Quality Assurance Management	Quality Assurance/ Control Reports
	Soil reports / Inspection and Test Results
Safety	Accidents Reports
	Reporting Safety Violations
	Safety meetings
	Sub-Contractor Health and Safety Packages

Source: Modified from Ballan and El-Diraby (2011)

2.14 PROJECT STAKEHOLDERS

As noted by Mailabari (2008), communication is considered to be effective among the project team when the information communicated achieves their desired action or reaction, since the construction process involves several parties including the client, Construction manager, quantity surveyors, architects, consulting engineers, specialists and the organization of the contractor. Whereas the composition of a project team invloves these aforementioned members, the composition can vary depending on several factors. Some of these factors include the size and type of project, attributes of the project, the mehtod of delivery, the management approach adopted, the nature and type of client, the complexity of the project and the nature and types of activities invloved (Baiden *et al*., 2006; Liu, 2009; Senescu *et al*., 2010).

The composition of a project team may vary according to the aforementioned factors. An example of such a team may consists of the Project Manager, Structural Engineer, Architect, Quantity Surveyor, and the Construction (Resident) Engineer (Mailabari, 2008). Liu (2009), identified a typical project team for a public project to include the client, design team, Main Contractor, Specialized Sub-Contractors, Specialis Consultant, Governement Representative, Suppliers and any third party guarantor. This evidently show that the composition of a project may vary based on the project and the other factors already mentioned. For the purposes of this study, the project team considered composed of the following depicted in Figure 2.5. The figure is a representatation of the position of the construction manager in the communication

process within a construction organisation. The construction manager is in the contractor's organisation within the entire project management team. He exercises authority on the construction site and reports to the project manager. The immediate parties on the site on which he exercises his authority include the architect, structural Engineer, services Engineer, Quantity Surveyor and general forman as shown in the figure.

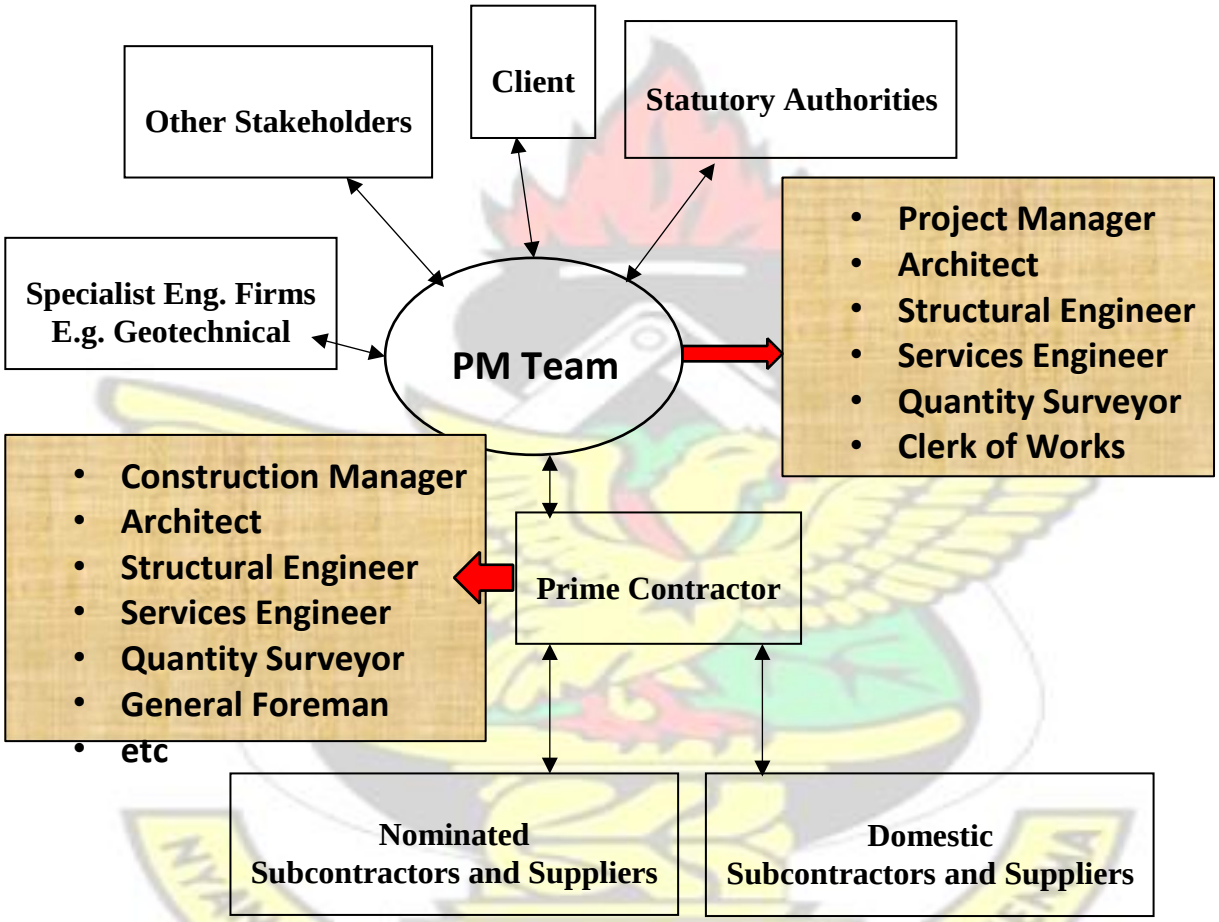

Figure 2.4: The project Team

Source: Author's Construct (2016)

2.15 CHAPTER SUMMARY

The chapter espoused the critical aspects of communication as stated by earlier studies. The review brought to the fore, areas that have been researched and emerging theories from those studies. It discussed the concept of communication on site, the construction site and

communication and also the types of communication within organisations. This chapter provided the literature that served as the bases for the development of the research instrument for the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The previous chapter reviewed literature and set the pace for the development of a survey from which the opinion of respondents were sought. This chapter encompasses the research design adopted for this study. Kothari (2004), stated that research design provides the conceptual structure for the research study and it constitutes the blueprint for the collection, measurement and analysis of data. As such this chapter details the philosophical standpoint of the study, the research design, the data collection methods and methods of data analysis.

3.2 PHILOSOPHICAL STANDPOINT OF THE STUDY

Saunders *et al*. (2009) intimated that the philosophical standpoint of a research study relates to the development of knowledge and the nature of that knowledge. Indeed, it has been argued that research should not be preceeded by methodology but rather the choice of methodology should be dictated by the philosophical consideration of the research (Holden and Lynch, 2004). Thus, it is imprudent to conduct a study without a consideration of the philosophical assumptions for the study (Pathirage *et al*., 2005). It is therefore important to define the philosophies that underpin a resaerch study in order that the appropriate methodology is adopted. Research philosophy explains the epistemological, ontological and axiological assumptions upon which research is undertaken (Pathirage *et al*., 2008).

Epistomology is concerned with how knowledge can be created, acquired and communicated, thus *what it means to know* (Scotland, 2012). It makes the claim of

what is acceptable and valid knowledge thereby cutting research into what is acceptable and unacceptable (Tennis, 2008). Epistemology is related to the ontology and methodology philosophies. Whereas ontology involves the philosophy of reality, epistomology provides how the reality can be known while methodology identifies itself with the practices that can be used to attain knowledge of the reality (Krauss, 2005). Epistemology poses the questions of: What Counts as Knowledge? What is the relationship between what is known and the enquirer? How do we know what we know? (*ibid.*). According to Saunders *et al*. (2009), positivism and interpretivism are the two main epistemogical considerations in research.

According to Krauss (2005), in the positivist paradigm, the researcher is independent of the object being studied. The discovery of knowledge is achieved by either direct observation or the measurement of phenomena. In the positivism philosophy, only phenomena that can be observed can lead to the production of credible data and the research strategy adopted for data collection of these data is most likely existing theory to develop hypothesis (Saunders *et al*., 2009). The emphasis of positivism is that genuine, real and factual occurences can be studied and observed scientifically and empirically and could also be expounded by comprehensive and rational investigation and subsequent analysis (Aliyu *et al*., 2014). Another essential feature of the positivist position is that the research is undertaken in value-free way (Saunders *et al*., 2009). Thus, the decision of what to study, and how to study it can be determined by an objective criteria instead of human beliefs and interests (Holden and Lynch, 2004). The interpretivist position of research is that phenomenon is based on the interpretation of peoples' conviction (Walliman, 2003) cited in (Ahadzie, 2007). It is one of subjectivism which is based on the real world phenomena (Scotland, 2012). Thus, meaning is not there to be discovered; it is constructed via the interaction between

conciousness and the real world. In interpretive research the enquirer has to be part of the research process (Ahadzie, 2007). Perhaps the position of the interpretivist is made clearer in the statement made by Scotland, (2012) saying that '*A tree is not a tree without someone to call it a tree'.* Interpretive methods provide insight into understanding behaviour and explains actions from the perspective of the participant (Scotland, 2012). Thus human interest is largely the dominating driver of the science (Ahadzie, 2007). This study seeks to develop a framework for communication on site. It resorted to collecting data from sites to help draw conclusions. In effect the researcher sought to 'discover' how communication is done onsite and develop this into an integrated framework for construction managers. This line of action follows the positivist epistemological philosophy and was thus adopted.

Ontology is concerned with the nature of reality (Saunders *et al*., 2009). It explains 'what' knowlegde is and the underlying assumptions about reality (Pathirage *et al*., 2008). Whereas ontology is concerned with the understanding of 'what is', espistemology is concerned with the understanding of 'what it means to know' (Gray, 2014). Objectivism and Subjectivism are the two aspects of ontology according to Saunders *et al*. (2009). The objectivist posits that reality exist external to the social actors whereas the subjectivist posits that social phenomena are created from the actions and perceptions of the social actors (*Ibid.)*. From the foregoing, it can be deduced that the objectivists view leans towards the positivist philosophy whereas the subjectivist view leans towards the interpretivist philosophy. At the ontological level, the objectivist philosophy was adopted. This is because the practices of communication on construction sites are real and not borne from the construction of the researcher.

Axiology is that component of research philosophy that studies judgement about values (Saunders *et al*., 2009). Axiology classifies the reality into value free and value laden (Pathirage *et al*., 2008). When the research is value neutral, the choice of what to study and how to study is determined by an objective criteria whereas value laden research is determermined by human beliefs and experience (Easterby-Smith *et al*., 2002). The Study selected the Value free axiological philosophy position since the study was determined by an objective position. Again, the value free axiological philosophy is accommodated within the the epistemological positivist and the ontological objectivist philosophies already advanced and selected for the study (see Figure 3.1).

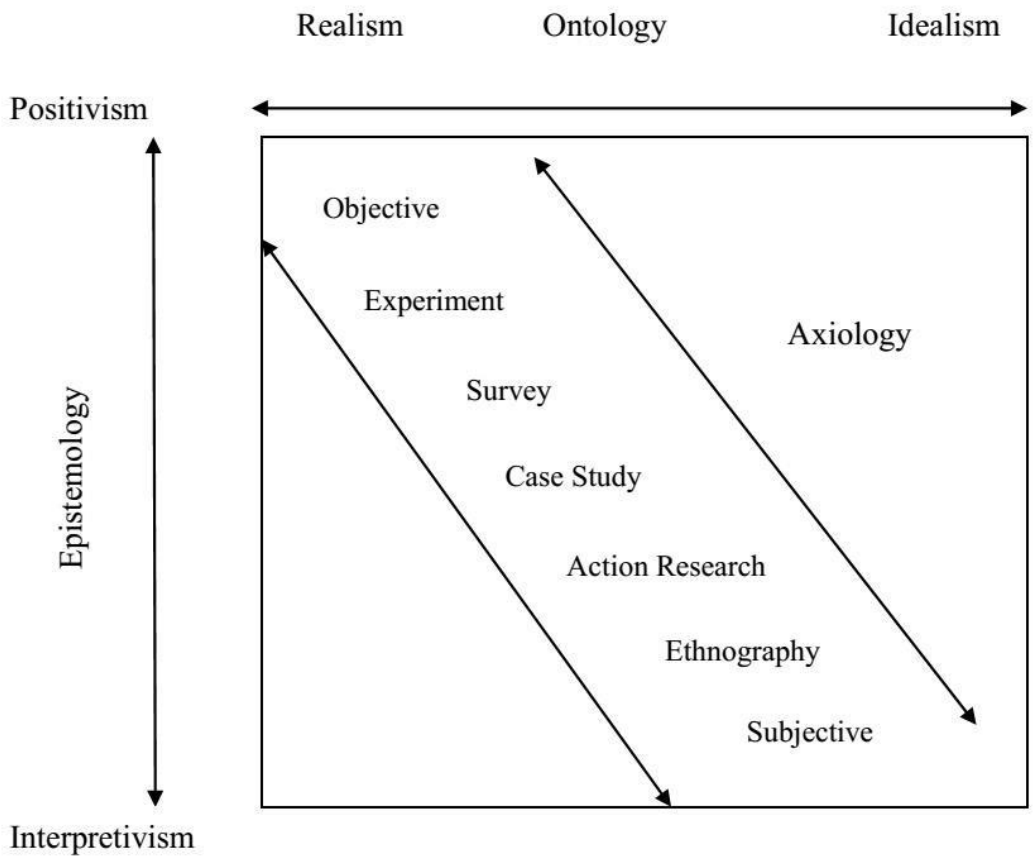

Figure 3.1: Research Philosophical Assumptions

Source: Pathirage *et al*. (2005)

3.3 RESEARCH APPROACH

Fellows and Liu, (2008) opined that in determining a research approach for a study, the critical contemplation is the logic that provides the links for the collection and analysis of data to produce results and the subsequent conclusion to the question being investigated. Approaches to research have multiplied and given researchers (Pathirage *et al*., 2005) the flexibility of choices (Creswell, 2003). Creswell, (2003) suggested the approaches of research to include quantitative, qualitative and Mixed Methods. The over-arching principle in quantitaive research is the collection of numerical data and carrying out analysis that is dominated by mathematically-based methods (Sukamolson, 2010). The ultimate aim is to classify features, count them and construct models that explains the phenomena observed (McCusker and Gunaydin, 2015). Studies that adopt the quantitative approach are well structured and have gained credibility for its validity and reliability (Kumar, 2011). The use of quantitative research for a study begins with data collection premised on theory or hypothesis and is followed with the application of descriptive or inferential statistics methods (Rajasekar *et al*., 2013). The aim is to infer a characteristic or establish relationship between the variables to a parent population (Brannen, 2005). Statistics dominates the analysis of quantitative data. This fact is evident in the characteristics of the quantitative approach (Rajasekar *et al*., 2013):

- It is numerical, non-descriptive, applies statistics or mathematics and uses numbers.
- The process is iterative where evidence is evaluated.
- Tables and graphs are often used to display the results.
- It is conclusive.
- It seeks to investigate the what, where and when of decision making.

The qualitative approach on the other hand is concerned with providing explanations of social phenomena (Hancock *et al*., 2007). It seeks to obtain the understanding of people about how they percieve 'the world' either as groups or individuals (Fellows and Liu, 2008). It focuses on undestanding, explaining, exploring, discovering and clarifying situations, feelings, perceptions, beliefs and experiences of the group of people being studied (Kumar, 2011). Qualitative research is a function of the researcher's insights and impressions. The result generated from qualitative studies are non-quantitative and therefore not subjected to analyses that are quantitatively based (Kothari, 2004). Effective qualitative studies are characterised by correspondence between the perspectives that occasioned the research questions and the research methods used (Fossey *et al*., 2002).

The mixed method approach combines the relative strengths of both quantitative and qualitative research. Adopting this method helps in reducing or eliminating the flaws of each qualitative and quantitative research whilst achieving the advantages of both methods and obtaining a multidimensional view of the subject (Fellows and Liu, 2008). The mixed method can provide pragmatic advantages when adressing complex resaerch questions (McCusker and Gunaydin, 2015). The use of the mixed approach has been identified as a means of validating the claims or outcome of an initial study (Olsen, 2004).

This study seeks to develop a framework for communication by gathering information on how construction managers communicate with their operatives on site. The quantitative approach have been adopted for the study against the backround advanced.

3.4 RESEARCH STRATEGY

The strategy for a research study suggests the overall direction and the process by which the research is conducted (Wedawatta *et al*., 2011). The choice of strategy adopted for a study should be guided by the objectives, the research questions to be answered, the extent of existing knowledge, the time available, and the philosophical considerations that underpinnes the study (Saunders *et al*., 2009). According to Yin (2003) cited in Wedawatta *et al*. (2011), the selection of a strategy for a research study should satisfy three conditions of the type of research question, the extent of control that the researcher exercises over actual behavioural events, and the degree of attention on existing or past events. Fellows and Liu (2008) stated that, principaly, the adopted strategy should help in maximizing the probability of achieving the objectives for the study. Case study, experiment, survey, action research, grounded theory, ethnography and archival research are examples of research strategies (Fellows and Liu, 2008; Saunders *et al*., 2009; Wedawatta *et al*., 2011). However, studies on communication have relied on Case studies, surveys, and experiments to elicit suitable results that sufficed for the objectives advanced (*C.f* Mead, 1999; Xie, 2002; Liu, 2009; Kwofie, 2015).

3.4.1 Case Studies

Case studies are expected to provide results and capture the complexity of a single case. As such, such methodologies have been deisgned and applied across the sciences including social sciences and practice oriented areas such as environmental studies, social work, education and business studies (Johansson, 2003). Case studies are studies that places emphasis on a particular phenomenon with the ultimate goal of providing an in-depth account of events, experiences or processes occuring in that particular

instance (Denscombe, 2007). The case under consideration can vary from individuals to corporations (Zucker, 2009). An appropriately designed case study serves as an essential tool for a researcher to investigate and evaluate complex phenomena within their contexts (Baxter and Jack, 2008). The reason for focusing on a single case in the stead of many is that there could be insights gained from a single case that have general implications which may not have come to light when the scope is extended across a wider spectrum (Denscombe, 2007). Case studies are mostly applied in researches that seeks to provide answers to 'why?', 'what?' and 'how?' questions, although 'what?' and 'how?' questions lends themselves more to the survey strategy (Saunders *et al*., 2009).

3.4.2 Experiments

An experiment is an emperically undertaken investigtion to observe the properties of, an relationship between specific factors within controlled conditions (Denscombe, 2007). Experiments simply seek to ascertain whether there exist a link between variables (Saunders *et al*., 2009). In complex situations, experiments consider size of change and the relative importance of two or more independent variables (Saunders *et al*., 2009). Due to the degree of control exercised by the researcher, many argue that, 'Naturalism' which is considered to be an integral ingredient in generalization is reduced (Beaumont, 2009).

3.4.3 Surveys

Surveys aim to gather data that seeks to describe the nature of existing conditions, or establishing standards for which existing conditions can be compared, or defining the relationships between concepts and events (Cohen *et al*., 2005). In surveys, the

independent and dependent variables determines the scope of the study but are not subject to the control of the researcher (Glasow, 2005). This strategy is usually associated with the deductive approach and permits the collection of data from a sizeable population in a manner that is economical (Saunders *et al*., 2009). By collecting data from a sample of the population, this strategy determines relationships that are common and allows for the generalization of the outcome (Gable, 1994). Surveys also allows the establishment of relationships between variables and the production of models that depicts these relationships (Saunders *et al*., 2009).

3.4.5 Chosen Strategy

The selected strategy for the this study was the Survey Strategy. According to Saunders *et al*. (2009) the survey strategy is suitable for studies that seek to answer the 'what', 'who', 'how much', 'where' and 'how many' questions. Considering the research questions posed for this study and the reasons already advanced, the survey strategy was considered the most suitable for the study. Further reasons for which the survey strategy was selected were earlier highlighted by Asah-Kissiedu, (2009) as follows:

- Survey invloves the collection of data from a group and the generalization of the outcome to predict the attitude of the population of interest;
- It invloves questionnaire which may be structured to collect information from the population in a manner that is unbiased and systematic; and
- Surveys allows for analysing data statistically and generalization of findings, making them suitable for research in construction management.

3.5 RESEARCH INSTRUMENT

The research instruments refers to the tools used for the collection of data during a study. A range of data collection tools include questionnaire, interviews, and the

combination of these. The data collection method used for this study was the questionnaire. The questionnaire is the convenient tool often favoured for data collection for its ability to provide cheap and effective data collection in a manner that is structured and manageable (Wilkinson and Birmingham, 2003). The most significant point when designing a questionnaire is to ensure that it is valid, reliable and unbiased (Zohrabi, 2013). The questions posed may be structured or unstructured. Structured questions provide answers from which the respondents are asked to select whiles unstructured questions require respondents to provide responses in their own words (Bhattcherjee, 2012). The questions adopted in this research study were broadly structured. Respondents were requested to tick answers from the options provided. The questionnaire were structured into four sections with each section addressing the objectives put forward for the study, save the first section that gathered demoghraphic variables. The sections include, respondent background (section A), means of onsite communication (section B), project communication problems (section C), key information requirements (section D).

For the medium of communication, respondents were asked to provide scores for their frequency of usage and their respective effectiveness. For each problem of communication, respondents were requested to score on a likert scale of 1 -5, the frequency of occurrence where 1 = 'Not Often', 2 = 'Less Often', 3= 'Moderately often', 4 = 'Often', 5 = 'Very Often'.

One the key information requirements, it was requested of respondents to score the categorised information requirement on a scale 1-5, the frequency at which those informations are required on site. The full details of the questionnaire is attached as an appendix to this study (Appendix A).

3.6 POPULATION DEFINITION

The population for a study involves a group of individuals to which results, discussion of the results and the implication of the study are to be generalized (Sampson, 2012). It is important to define the population vividly; for it is not always that the target population will be human beings (Nenty, 2009). The sampling frame is determined by the structure of the population (Fellows and Liu, 2008) and unless the population is defined, it is impossible to authenticate the representativeness of the sample (Cohen *et al*., 2005). The population for this study included Construction firms in the D1 and D2K2 classified categories. Construction managers in these firms were selected for the study because they were deemed to be head of all activities as far as the construction site was concerned.

For the purpose of this study, the construction manager have been distinguished from the project manager. They are therefore not used interchangeably. In this study the construction manager is regarded as the person employed by the construction firm to manage the execution of works by managing the resources provided by the firm in an efficient manner. He exercises authority on the project site only. On the project, they usually report directly to the project manager employed by the client. The project manager is for the purposes of this study regarded to be at a higher authority employed by the client usually to manage the entire project from inception to completion (Kissi, 2013). The organizational structure of these professionals have been explained under Section 2.14 (Chapter Two).

The selected respondents were construction managers in D1 and D2 classified construction firms. The bases for the various categorisation have been advanced under section 2.3.The selected firms operated in the Kumasi and Accra of the Ashanti and Greater Accra Regions of Ghana respectively. Mostly, large construction projects are undertaken in the city capitals of these regions, a massive 70% of the registered construction companies in Ghana and have offices in these citiescities. The other eight regions account for the remaining 30% (Ayisi, 2000; Ahadzie, 2007). The decision to focus on D1 and D2 construction firms were made against the background that these firms were in good standing and have trained staff. They are also noted for executing projects with huge contract sums with a wide variety of on-site personnel. In addition, these firms have established offices making their location relatively easier.

3.7 SAMPLING TECHNIQUES AND SAMPLE SIZE

Sampling has been employed in research and have been regarded as an indispensable technique without which a research cannot be undertaken (Singh, 2006). Sampling provides the means by which data is collected from a sub-group rather than the entire population (Saunders *et al*., 2009). There are several sampling techniques but depending on the specific research problem, specific sampling techniques are employed since one technique may not be appropriate for all problems (Singh and Masuku, 2014). The purpose of sampling is to obtain a manageable size of the population for the study. Sampling is important as it aids the researcher to utilize resources adequately and provides for the completion of the study within time (Kothari, 2004). The outcome of the sampling process is the selection of a sample. A sample is a subgroup of the population. This selected sample should be representative of the entire population from which they are drawn (Latham, 2007). A too small sample

size may fail to detect the important relationships. Invariably, a too large sample size may increase complexity and inaccuracy in the results (Singh and Masuku, 2014).

The sampling techniques are divided into probability sampling and Non-probability sampling. For the probability sampling each unit has an equal chance of being drawn from the population. Probability sampling is considered the best because it mitigates the possibility of an unrepresentative sample. In the non-probability sampling techniques however, the likelihood of each case being selected is largely unknown. The decision to select a probability or a non-probability sampling technique is dependent on the choice of the researcher and the goal of the research. Probability sampling is most often used when the researcher wants to achieve a certain level of confidence in the data collected (Latham, 2007; Fellows and Liu, 2008; Saunders *et al*., 2009).

This study adopted the purposive sampling technique which is an example of nonprobability sampling techniques. Purposive sampling is where sampling units are selected based on purpose (Singh and Masuku, 2014). In this method, respondents are selected to answer questions concerning a "certain matter or product"(MacNealy, 1999 cited in Latham, 2007). In other words, samples are selected by the researcher in a manner that aids in answering the research questions and goals (Saunders *et al*., 2009) and his choice concerning the samples remains final (Kothari, 2004). An added reason for which the purposive sampling was selected was as a result of the lack of accurate data on construction firms. A list obtained from the Association of Building and Civil Engineering Companies in Ghana (ABCEG) containing a number of firms purported to be in good standing had some of the listed firms without an appropriate designation of their classified class (i.e D1-D4). Moreover, after conducting a cursory examination of the list, it was noted that the most active firms known, at the time of the study, to be

the “big guns” in the construction industry were not part of the list (eg. Michelleti, Consar etc).

Owing to the above, the sample size for the study could not be statistically determined. The sample size of the study was therefore conveniently selected to be 100. The selection was done in a manner to account for non-response. This number is also in tandem with other studies conducted in the area of construction communication (see for instance, Xie, 2002; Liu, 2009). The convenient sample size was also selected in order to avoid the possibility of not locating all the firms contained in the list obtained. This is because some of these firms are actually not active on the grounds. Similar challenge was reported by Ahadzie (2007).

3.8 DATA COLLECTION PROCESS

Before the fieldwork was conducted, the developed questionnare was given to other researchers to solicit their views on the questionnaire. This was done to ensure that the final questionnaire for the feildwork was accurate and would aid in achieving the purpose for which it was designed. All responses that arrived from the pilot process were incorporated paving the way for the actual feildwork.

The fieldwork began by visiting sites in Kumasi. Since the purposive sampling technique was employed, some known sites close to the institution where this study was conducted were first visited. Information on their knowlegde about other construction sites were obtained and visited accordingly. A digital copy of the questionnaire was developed and sent by mail to respondents who requested for same. This process was replicated in Accra until the required number of questionnaire were distributed.

3.9 DATA ANALYSIS

The collected data were edited for completeness consistency and readability. The edited data was then analysed using the SPSS analysis tool. The statistical techniques employed for the analysis are explained under the following headings.

3.9.1 Means of Communication

The modes of communication on site were identified from literature. The respondents were then asked to rate the mode of communication with respect to their frequency of usage on a scale of 1-5. The mean score ranking and standard deviation were adopted for analysing this information. Thus on the scale of likert scale, a factor with a mean value of 3.00, consistent with Liu (2009) and Agyekum (2012) was selected to be important and ranked predominant. Where two factors had the same mean score, the factor with the least standard deviation was ranked higher (Field, 2005 cited in AntwiAfari, 2015).

3.9.2 Project Communication Problems

The communication problems identified from literature were put forward for respondents to rate their frequency of occurrence on the project. These problems were analysed using the factor analysis statistical module. Factor analysis examines how underlying constructs relates to the responses on a number of measured variables (DeCoster, 1998). The basic purpose of factor analysis is the summarization of collected data in a manner that allows for drawing patterns and relationships to enhance interpretation and comprehension (Yong and Pearce, 2013). It assumes that the underlying factors can be used to explain complex phenomena (Lingard and

Rowlinson, 2006). It essentially measures which variables might be measuring the same underlying constructs (Kwofie, 2015). In short, it assembles variables into descriptive categories and determines which variables can 'go together' (DeCoster, 1998; Yong and Pearce, 2013).

The Principal Component Analysis (PCA) is the mostly used method for extracting the factors (Lingard and Rowlinson, 2006). The PCA utilizes underlying mathematical principles to generate a number of variables into smaller components mostly refered to as principal components (Richardson, 2009). The present study utilized the Principal Component Analysis to extract the variables (communication problems) into manageable number of components. This strategy is in agreement with earlier studies conducted by Liu (2009); Agyekum (2012); Kissi (2013); Antwi-Afari (2015); and Kwofie (2015).

Prior to the conduction of factor analysis, the tests are conducted to ascertain the appropriateness of the factor analysis. These tests include Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy and Barlett's test of Sphericity (Williams *et al*., 2010).

3.9.2.1 Kaiser-Mayer-Olkin (KMO) Measure of Sampling Adequacy

The Kaiser-Mayer-Olkin (KMO) Measure of Sampling Adequacy measures the shared variance in the variables (Beavers *et al*., 2013). The researcher is provided with information with regards to the grouping of the survey variables (Taherdoost *et al*., 2014). Grouping variables into sets of understandable and interpretable factors help to explain the constructs under investigation (*Ibid.).* Beavers *et al*. (2013) cited Friel (n.d) indicated the guidelines for the KMO test shown in the table below.

Table 3.1: Interpretation Guidelines for the Kaiser-Meyer-Olkin Test

KMO Value	Degree of Common Variance
0.90 to 1.00	Marvelous
0.80 to 0.89	Meritorious
0.70 to 0.79	Middling
0.60 to 0.69	Midiocre
0.50 to 0.59	Miserable
0.00 to 0.49	Don't Factor

Source: Adopted from Beavers *et al*. (2013)

In the field of construction management research, KMO values more than 0.50 have been considered desirable and recommended.

3.9.2.2 Barlett's test of Sphericity

The Barlett test of Sphericity tests whether there are potential correlations that clusters do exists in the factors (Ahadzie, 2007). It provides evidence that the correlation matrix observed is statistically different from a singular matrix, confirming that linear combinations exits (Beavers *et al*., 2013). The Barlett's test has the null hypothesis that the correlation matrix observed is equal to the identity matrix, thus the observed matrix is not factorable (Pett *et al*., 2003; Beavers *et al*., 2013).

3.9.3 Key Information Requirements

There were categories and subcategories of information requirements for on-site communication. The respondents were required to rate how this information was often communicated on the site. To obtain the RII, Mean, and Standard Deviation were used to select which category of information requirement was important to be included in the Framework.

3.10 RELIABILITY OF RESEARCH INSTRUMENT

Saunders *et al*. (2009) stated that reliabilty is ensuring that the data collection techniques or analysis provides consistent findings. Obtaining a good degree of reliability implies that the research instrument produces the same data repeatedly on each occasion it is used, thus any variation encountered through repetition using the instrument is as a result of the thing being measured (Denscombe, 2007). The testretest and Cronbach's *alpha* for internal consistency have been identified as some the tests used in measuring reliability (see for instance Denscombe, 2007; Gaur and Gaur, 2006). Gaur and Gaur, (2006) however stated that the test-retest is particularly difficult. They contended that once a subject has been through some test, it will no longer be neutral to the test. The Cronbach's *alpha*, which is mostly used for testing for internal consistency was therefore used in this study.

Vadility ensures that the research measuring instrument measures the property it is intended to measure (Gaur and Gaur, 2006). To ensure content validity of the research instrument, a pilot study was conducted. This was done to ensure that the final questionnaire for the feildwork was accurate and would aid in achieving the purpose for which it was designed. All responses that arrived from the pilot process were incorporated paving the way for the actual feildwork.

Further to this, recommendations have been proferred that provides for the validation of the proposed framework on construction projects.

3.11 ETHICAL CONSIDERATIONS

According to Saunders *et al*. (2009), ethics in research relates to issues about the entire research in respect of topic formulation, research design, data collection and access to data, data analysis and the write up of the research findings in a way that is considered moral and responsible. They posited that, in terms of ethics, every research study must pay attention to the following ethical considerations;

- the privacy of both possible and actual participants;
- the voluntary right of participants to withdraw partially or completely from the process;
- consent of the participants;
- maintaining the privacy of participants and keeping the data provided in confidence;
- the effect of study on participants; and
- the behaviuor and objectivity of the researcher.

The research followed steps to ensure that all protocols in respect of ethics were respected. The questionnaire used for the collection of data had a cover letter assuring participants of their privacy and how the opinions expressed were going to be used for the exact purpose for which the data were collected, ensuring confidentiality. While on the field, some the participants before accepting the questionnaire read through to ensure that there were no questions that were sensitive. Participants were also given sufficient time to answer the questions. In fact, some of them called the researcher in person to inform him of the completion of the questionnaire for collection.

3.12 CHAPTER SUMMARY

This chapter introduced the pressing issues surrending the conduct of this research study. The philosophical standpoint of the study were espoused. The positivism research paradigm was selected for the study. The various research methods were reviewed and the survey method was selected for the study in tandem with the positivism research philosophy. The method of data collection adopted included the mean score ranking, relative importance index and factor analysis. Data were obtained from construction managers working in D1 and D2 companies in the Greater Accra and Ashanti Regions of Ghana. The questionnaire were then entered in the SPSS software for analysis. The next chapter now provides the analysis of the data and the discussion of the findings.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 INTRODUCTION

This chapter is dedicated to the analysis of the data obtained from the field. The first section describes information obtained on the respondents that gives credibility to the study. The second section provides information on the data analysis with respect to the objectives set for the study.

4.2 DATA COLLECTION AND RESPONSE RATE

The data was collected using a questionnaire in the central businness enclaves of Kumasi and Accra. The target respondents were construction managers of D1 and D2 firms. Due to the lack of accurate data on the respondents, the purposive sampling technique which is an example of non-probability sampling technique was used for identifying the respondents. In this process, the researcher selects the respondents that meets a certain criteria that is relevant for the purpose of the study, thus respondents must be a worker in a D1 and D2 classified firm.

Respondents were given ample time to answer the questions to express their professional opinion about construction communication. During the collection of the issued questionnaire, only 62 were retrieved representing 86% of the total questionnaire issued (i.e 72). This rate of response was deemed adequate for data analysis as it was in congruence with similar studies

4.3 DEMOGRAPHIC VARIABLES

The reliability of any research is partly dependent on the source of data and the rigorousness of the analysis employed. To provide reliabilty and impose confidence of the findings, qustions were posed in the questionnaire that aimed at gathering information about the background of the respondents. The questions posed sought to gather information in respect of respondents' years of experince in the construction industry, types of construction projects undertaken, academic qualification, professional body of membership and the number of projects undertaken in the last five years. The results from these information are presented in descriptive statistics in the form of frequencies and percentages and are presented in Table 4.1 below.

Table 4.1: Respondents' Profile

Profile	Frequency n = 62	Percentage
Period of work in the Construction Industry		
1-5 years	6	10.00%
6-10 years	29	47.00%
11-15 years	16	26.00%
15-20 years	5	8.00%
Above 20 years	6	10.00%
Type of Construction		
Building	15	24.00%
Civil and Building	47	76.00%
Academic Qualification		
Higher National Diploma (HND)	15	24.00%
Bachelor's Degree (BSc.)	32	52.00%
Masters Degree (MSc)	15	24.00%
Doctorate Degree (PhD)	0	0.00%
Professional Body of Membership		
Ghana Institute of Construction (GIOC)	41	66.00%
Ghana Institution of Surveyors (GhIS)	9	15.00%
Project Management Institute (PMI)	12	19.00%
Number of Projects Undertaken		
1-5 projects	39	63.00%
6-10 projects	23	37.00%

Source: Author's Construct (2016)

It can be deduced from the table that out of the 62 respondents surveyed, 10% have worked in the construction industry for a period ranging between One (1) to Five (5) years. From Table 4.1, majority of the respondents surveyed have worked in the industry for 6-10 years with a percentage of 47. Another 26% of the respondents have also worked in the industry for 11 to 15 years. Additionlly, only 8% have worked in the construction industry for 16 to 20 years. It can also be seen from the table that 10%

of the respondents surveyed have also worked in the construction industry for over 20 years. This is a clear indication that the respondents have enough experience in construction and as such the information obtained from them can be regarded as one gathered as a result of extensive experience in construction. It gives credence to the findings that the information provided are as a result of a relatively long particpation in construction projects.

Information was also sought from the respondents on the type of construction projects they have handled. The type of projects handled gives the reflection of the number of people they have worked with and an idea about the amount of information they have handled. From the table, a total of 15 respondents, constituting 24% have worked on building projects whereas 47 respondents, constituting 76% have worked on both Building and Civil engineering projects. It is clear that the participants in the survey have enormous experience as far as construction projects are concerned.

To further provide reliability and credibility to the data collected, respondents were asked to provide information on their academic qualification. Apart from the practical experience a respondent may have, provision of accurate data is partly dependent on the ability to interpret and understand the questions posed and this depends on the educational training obtained. It can be deduced from the table that 15 respondents constituting 24% of the data collected have obtained the Higher National Diploma education. Majority of the respondents (52%) surveyed have also obtained University Bachelors Degree. Additionally 15 respondents, representing 24% of the respondents have also obtained Masters Degree. It can be seen from the above analysis that, majority of the respondents have obtained at least a first degree. The spread of educational qualification of the respondents surveyed can be said to be enough to

provide the information required from them and that the information provided was borne out of their understanding of the issues posed.

The professional body of affiliation was also asked of respondents. From the table above it can be deduced that, 44% (41 persons) were members of the Ghana Institute of Construction (GIOC), 15% (9 persons) were members of the Ghana Institution of Surveyors (GhIS), and 19% (12 persons) were members of the Project Management Institute- Ghana Chapter. It is important to point out that membership to professional bodies are based on annual subscription and to remain an active member is solely dependent on ones engagement in the activities of the body and payment of professional dues. Membership to these bodies also guarantee to the larger extent that, one is active in the construction business. Following up on these arguments therefore means that the respondents surveyed are active in construction and that the data provided were based on both present and past experience.

Respondents were also asked to provide information on the number of projects they have handled in the past five years. It can be seen from the table that 39 persons, representing 63% have worked on projects ranging between 1 to 5. Another set of 23 persons, representing 37% have also managed projects ranging between 6 to 10. This shows that the persons who responded to the questions have experience in construction activities.

It can be seen from the demographic variables collected that the respondents have expertise and experience in the construction industry. It is therefore plausible to conclude that the data provided are credible.

4.4 MEANS OF COMMUNICATION ON SITE

To communicate, there must be the means through which the information being communicated is sent. In this section the means of communication and the effectiveness of these media are examined.

4.4.1 The Usage frequency of media

The various means of communication used on site are examined based on their frequency of usage and are ranked from the most frequent to the least. It was deemed necessary to establish from the respondents (construction managers), the frequently used medium of communication on site. It was considered that, the medium used frequently on site will help in developing the framework that will be important for application on site. The respondents were therefore asked to rate the frequency of usage of the means of communication from 1 to 5 where, 1 represents Not often, 2 represents Less often, 3 represents Moderately Often, 4 represents Often and 5 represents very often.

In evaluating the results, the mean score and the standard deviation were used to rank the frequency of usage of the media of communication. In ascertaining the rank for each medium, the mean was considered predominant over the standard deviation. The standard deviation was used in instances where two media obtained the same mean. Thus, where two media obtained the same mean, the media with the least standard deviation was ranked higher. Table 4.2 provide the summary of the statistical mean score ranking of the frequently used means of communication on site based on the combination of the mean and standard deviation.

Table 4.2: Frequency of usage of media

Means of communication	Valid	Mean	Standard Deviation	Rank
Face to face	62	4.7742	0.58448	1
Meetings	62	3.8226	0.87823	2
Phone	62	3.6774	1.03661	3
Graphic	62	3.4355	1.52166	4
Email	62	3.2742	1.46175	5
Memo	62	2.8065	1.19889	6
Project Intranet	62	2.2903	1.31058	7
Fax	62	1.5645	0.66827	8

Source: Author's Construct (2016)

The results in the table above shows that *face to face* is the frequently used medium of communication on site. It was ranked first with a mean of 4.7742 and a standard deviation of 0.58448. The use of *Meetings* as a medium of communication was ranked second with a mean value of 3.8226 and a standard deviation of 0.87823. The use of the *phone* as medium of communication was also ranked third; obtaining a mean score of 3.6774 with a standard deviation of 1.03361. These were considered the most significant in this research study because they obtained more than the population mean selected as 3.50. Nevertheless, it can also be seen from the table that *graphic* and *email* were also used as media of communication on site albeit not frequently. The least used media according to the findings include *memo, project intranet and fax.* All of these media obtained a mean score of less than 3.00. The three frequently used media are discussed below;

4.4.1.1 Face to Face

Face to face communication is regarded as the best form of communication because of the advantages it presents. During face to face communication, the construction manager is able to explain all concepts about the project to the project team in a friendly environment. Because it takes place with everyone present, it is regarded as a powerful medium to convey information. During face to face conversation, complex concepts can be explained which may otherwise be difficult to achieve with other media/channels of communication. Again with face to face communication, the person being communicated to be able to hear and see both the verbal and non-verbal cues conveyed by the sender. It facilitates comprehension and the provision of immediate feedback (Ean, 2010). Particularly on construction sites where immediate feedback is required, face to face communication is the preferred choice. Also to ensure project coordination, face to face is a preferred choice for its richness in content and the associated savings in time. Face to face was also found to be among the most preferred media of communication in studies conducted by Liu (2009).

4.4.1.2 Meetings

Meetings are necessary on site for communicating pertinent issues and explaining complex concepts. Like face to face interactions, meetings require the presence of all the stakeholders involved in the project. Mostly, meetings are scheduled and minuted. The minutes are usually considered as an official document. Most construction firms begin the day's activities with a meeting where the task for the day is communicated to the site operatives. Meetings facilitate the provision of immediate feedback. During the data collection, a construction manager was questioned on how quickly he obtained feedback from the operatives and he indicated that he used meetings to obtain

feedback. Apart from scheduling a meeting, ad hoc meetings are usually held to resolve disputes and to address issues when they come up. The challenge with meetings was that most people considered meetings as a waste of time. This is especially true for ad hoc meetings meant to resolve conflicts. It is considered to be frustrating to listen to someone else's problems. This challenge, however can be resolved when such meetings are held with the immediate parties involved and not the entire site.

4.4.1.3 Phone

The phone is considered as an important medium of communication. Its importance is mostly evident in its ability to offer mobility to the user. The phone could either be used as the main communication tool or as a supporting tool to the other means of communication. For instance, the construction manager can call the head of the materials department to confirm if materials ordered have been supplied. The construction manager can also communicate with the head office through the use of the mobile phone. In a case study conducted by Barakat (2009) into communication in mega projects in Dubai, the phone was discovered as a dominant tool used for communication. The use of the phone is quick and saves time relative to the other means of communication. This is because the physical presence of the receiver is not required. Simple clarifications on construction documents and drawings can be achieved through the use of the phone from the project site. The phone however is not effective in discussing complex technical issues (Liu, 2009). It is also a challenge to use the phone when the site is located in areas where network coverage is limited. However though, Ballan and El-Diraby (2011) indicated that the phone can never be replaced as far as construction is concerned because it is heavily relied upon for peer

to peer relationships and immediate responses; thus the use of the phone will always be significant in construction.

4.4.2 Effectiveness of media

The effectiveness of the various means of communication were also explored. Communication is said to be effective when the receiver or listener understands the message sent by the sender or as put up by Čulo and Skendrović (2010), communication is said to be effective when the information is presented in the right format, at the right time and with the right impact. This is also to say that a medium of communication can be said to be effective when it is capable of transmitting the information communicated to the recipient in a manner that is understandable. The respondents were therefore requested to provide their opinion on how effective the various media identified were to them in transmitting information.

Table 4.3: Effectiveness of media

Media	Valid	Mean	Standard Deviation	Rank
Face to face	62	4.7258	0.57743	1
Meetings	62	4.5323	0.67064	2

Phone	62	3.7581	0.78271	3
Graphic	62	3.9839	1.53101	4
Email	62	3.6935	1.22258	5
Memo	62	3.6774	1.02067	6
Project Intranet	62	3.0323	1.22766	7
Fax	62	2.0968	1.19712	8

Source: Author's Construct (2016)

From Table 4.3 above, the most effective medium of communication used on site was *face to face* communication. Face to face communication was rated and ranked the highest medium with a mean of 4.73. This is not surprising as communication by face to face was rated as the most frequently used medium of communication on site. It is therefore plausible to deduce that this medium is often used as a consequence of its effectiveness. This effectiveness can be attributed to its capability to be used in communicating complex technical issues coupled with the added advantage of obtaining immediate feedback. *Meeting* was also rated and ranked as the second most effective medium of communication. Meetings on site are sometimes a daily activity. During site meetings, issues ranging from the activity of the day to anticipated milestone to be achieved are discussed. There are similarities between face to face and meetings as media of communication on site. They both require to presence of both the sender and recipient. Due to the requirement of 'presence', obtaining immediate feedback is also possible. The effectiveness of these media of communication is also inherent in the ability of the receiver to also understand what is being communicated through the interpretation of non-verbal cues. The *phone* has also been considered as an effective medium of site communication and was ranked third behind face to face and meeting. It is also similar to the preceding means of communication due to the

verbal nature of the communication. As stated earlier, the only limitation to the use of the phone for communication is where the project is located in areas where network coverage is limited. The limitation is however not widespread as there is massive improvement in the Ghanaian Telecommunication industry. The use of *graphics* as a means of communication have also been considered as significant and an effective communication on site. Usually on most construction sites, graphics are used to display safety signs and warnings. They are also used to display the outlook of the final project when completed usually in the site office. On entry to very organised sites, graphics are used to show the organogram of the site that shows the span of authority. *Email and memo* were also rated and ranked as effective media of communication on site as they all attained mean value of more than 3.00. The *Project intranet and fax* were ranked as the least effective means of communication on construction sites by the respondents. These media are probably deemed not effective since they are not mostly used at all on construction sites (see frequency of usage in Table 4.20). Some construction managers did not sue media as a result of the lack of facilities that supports these media.

4.4.3 Gap and Quadrant Analysis of the means of On-Site Communication

The gap analysis of the means of communication identified were determined. This gives an indication of the gap between frequency and effectiveness of the various modes of communication identified. The analysis was conducted using the means and standard deviation for each communication method. The percentage gap was obtained by dividing the mean by the standard deviation of each method of communication for the respective frequency and effectiveness of each method being measured.

Table 4.4: Gap Analysis

Code	Means of communication	Mean Score		Standard Deviation		% Gap		F-E Gap %
		F	E	F	E	F	E	
CM 1	Face to face	4.77	4.73	0.58	0.58	12	12	0
CM 2	Meetings	3.82	4.53	0.88	0.67	23	15	8
CM 3	Phone	3.68	3.76	1.04	0.78	28	21	7
CM 4	Graphic	3.44	3.98	1.52	1.53	44	38	6
CM 5	Email	3.27	3.69	1.46	1.22	45	33	12
CM 6	Memo	2.81	3.68	1.20	1.02	43	28	15
CM 7	Project Intranet	2.29	3.03	1.31	1.23	57	41	16
CM 8	Fax	1.56	2.10	0.69	1.20	43	57	-14

Source: Author's Construct (2016)

The quadrant analysis was used to integrate the frequency and effectiveness of usage of the methods of communication. It helps in providing an indication of the relationship between the methods of communication identified in terms of the frequency of usage and their effectiveness when used. As can be seen in the table above, memo and Project Intranet were not used frequently even though they were deemed to be effective (effectiveness mean more than 3.00). Fax was also not used frequently and was as well deemed not to be effective. As can also be seen from the table six of the communication means were said to be effective based on their usage. On the basis of this, CM 6 and CM 7 can be said to require immediate attention. This imply that the construction industry must increase their usage as they were deemed to be effective whenever used. The other methods including C1, CM 2, CM 3, CM4, and CM5 were frequently used and was also deemed to be effective. The construction industry must make conscious efforts to increase

their use for communication. CM 8 however was deemed not to be effective and hence not used frequently. This could be the result of the lack of the necessary logistics for its application since this method is a computer based method.

Frequency Rating	Above Average	Communication methods for further assessment and improvement.	Communication methods for continuous improvement CM 1, CM 2, CM 3, CM 4, CM 5.
	Below Average	Communication methods to Deemphasize CM 8	Communication methods requiring Immediate attention CM 6, CM 7
		Below Average	Above Average
		Effectiveness Rating	

Figure 4.1: Quadrant Analysis of means of on-site communication

Source: Author's own design, (2016)

4.5 On-Site Communication Problems

The factor analysis was adopted to analyse the communication problems that construction managers face on site. Due to the relatively large number of the variables used (18) it was deemed necessary to use factor analysis to group the variables measuring the same underlying construct. It is easier to concentrate on some significant factors instead of considering too many variables that may be trivial and thus factor analysis is preferred for categorising variables meaningfully (Yong and Pearce, 2013). The principal component factor analysis (PCFA) was selected as the means of data reduction. According to Baglin (2014) the PCFA is used in reducing relatively large

number of interrelated variables into a smaller set of "components" with limited loss of information. The aim of Principal Component Analysis is to produce a small number of derived variables that can be used in place of the larger original variables to provide a simplified interpretation of the data (Landau and Everitt,
2004).

The suitability of factor analysis have been a major issue of debate within academic circles.The debate in the literature revolves around the adequacy of the sample size
(see for instance, Yong and Pearce, 2013). However, Ahadzie (2007) cited Field (2005) who reported on the work of Guadagnoli and Velicer (1988) that the development of Simulation and Monte Carlo Test have provided enough empirical evidence to substantiate the argument that the suitability of factor analysis should not be limited to the absolute sample size but also the magnitude of the factor loadings. Consequently, Ahadzie (2007) reported on Guadagnoli and Velicer (1988) as stating that where a factor has four or more loadings greater than 0.60, it is adequate irrespective of the sample size. A factor loading for a variable measures the degree to which a variable contributes to the factor; thus, high factor loadings gives an indication that the dimesions of the factors are duly accounted for by the variables (Yong and Pearce, 2013).

To further give credibility to factor analysis, tests such as the Kaizer–Meyer–Olkin (KMO) and Bartlett test of sphericity were conducted. These tests are regarded as a requirement prior to the main factor analysis.

The measure of internal consistency of the research instrument have also been used to substantiate the credibility of the factor analysis (see for instance, Ahadzie, 2007;

Ameyaw, 2014; and Kwofie, 2015). This measure is to ensure that the scales measure what they are supposed to measure in the context of their application (Vehkalahti, 2000). The Cronbach's reliability test which is the commonly used method of testing reliability (Tavakol and Dennick, 2011) was adopted. The results from the factor analysis and the interpretation of the results are presented in the subsequent sub sections.

Table 4.5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.643
Bartlett's Test of Sphericity	Approx. Chi-Square	324.536
	Df	153
	Sig.	.000
Cronbach's Alpha	0.781	

Source: Author's Construct (2016)

From Table 4.5 above, the KMO test provided 0.643. According to Williams *et al.* (2010), a KMO test value of 0.50 can be considered adequate and thus confirms the adequacy of the sample size of the study. Also the Bartlett's Test of Sphericity produced a value of 324.536 and an associated significance of 0.000. This gives an indication that correlations exist in the factors and that the population matrix is not an identity matrix. An identity matrix is a matrix in which all the elements of the diagonals are one and all off diagonal elements are zero (Field, 2000). It can therefore be concluded that the communication problems identified have correlations and that relationships and clusters exists. Additionally, the results were also checked for reliability. The Cronbach's Alpha adopted for the reliability test yielded a value of 0.781. This suggests that there exist an acceptable level of internal consistency and therefore the results can be considered as reliable. Field (2000), suggested that a

Cronbach's Alpha of 0.70 is acceptable and hence, internal consistency of the research instrument.

4.5.1 Communalities

Having satisfied all the preliminary tests for factor analysis, the data was then analysed adopting the Pincipal Component Analysis and the Varimax rotation. Before then, the variables to be included for factor analysis were ascertained. This was achieved by deriving the communalities of the variables.

Table 4.6: Communalities

Communication Problems	Initial	Extraction

Receiving late information from others	1.000	.703
Handling more information than necessary in a particular period of time	1.000	.662
Information not available when needed	1.000	.582
Change in meaning of information communicated	1.000	.391*
Information sent not delivered to the recipient	1.000	.535
Directives not carried out according to instructions issued	1.000	.727
Receiving conflicting information	1.000	.702
Changes to the project are not communicated early	1.000	.508
Lack of access to information database	1.000	.646
Poor listening and premature evaluation	1.000	.591
Use of technical language and jargons	1.000	.667
Differing perception	1.000	.652
Lack of feedback	1.000	.648
Difficulty in building trust and relationship	1.000	.524
Bias towards certain people	1.000	.783
Power play	1.000	.697
Difference in background	1.000	.807
Cultural differences	1.000	.835

Extraction Method: Principal Component Analysis. *extraction less than 0.50

Source: Author's Construct (2016)

The table above shows the variables (communication problems) and the extracted communalities. The communality provides an explanation of the total amount of variance an original variable shares with all the other variables included in the anaylsis and are critical in deciding which variables to be extracted (Field, 2000). The average communality for the variables above was 0.648. Conventionally, where the average communality is greater than 0.60, the factor analysis is considered to be adequate (see

for instance, Ahadzie, 2007). Thus the average communality extracted supports the use of factor analysis.

Field (2005) stated that extraction values (eigenvalues) greater than 0.50 at the initial iteration is a manifestation that the variable is significant and should therefore be included for further analysis. Thus variables that obtain communalities less than 0.50 are removed. Hence the variable, *change in meaning of information communicated,* which obtained an eigenvalue of 0. 391 was dropped and was not included in the subsequent analysis done. A reason why a variable might have a low communality could be that the variable is unrelated in the domain of interest and thus shares little in common with the other variables being measured (Fabrigar *et al*., 1999).

Following the determination of which variables to include for factor analysis, the variables that obtained communality values more than the cut off point of 0.50 were then carried on for further analysis. The Principal Component factor analysis with varimax rotation with Kaiser Normalization was adopted for the extraction of components. In doing so the Kaiser criteria was used (eigenvalue > 1.00) where only factors accounting for variances greater than one were included in the extraction (see for instance Williams *et al*., 2010). Following this criteria and as seen from Table 4.7, Six components were extracted to represent the communication problems construction managers faced on site. This is also confirmed by the scree plot.

From the table, the total variance explained by the extracted components shows that principal component (1) accounted for 24.895% of the total variance; second principal component (2) accounted for 11.939% of the remaining variance unaccounted for by the first component; third principal component (3) accounted for 8.709% of the

remaining variance unaccounted for by the first and second principal components; principal component four (4) also accounts for 7.572% of the remaining variance unaccounted for by the preceeding three principal components. The fifth principal component (5) also accounted for 7.545% of the remaining variances unaccounted for by the first four principal components and the sixth and final principal component (6) also accounted for 6.671% of the remaining variance unaccounted for by the first five components. The six extracted prinicpal components collectively accounted for a cummulative variance of 67.330%. This implies that these components having obtained eigenvalues greater than one have been extracted to represent the problems of communication faced by construction managers on site. These components with high eigenvalues explained about 68% of the variables, thus the factors can be reduced to these components with loss of information of 32%.

Table 4.7: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.232	24.895	24.895	4.232	24.895	24.895	2.703	15.898	15.898
2	2.030	11.939	36.833	2.030	11.939	36.833	1.920	11.294	27.192
3	1.481	8.709	45.542	1.481	8.709	45.542	1.916	11.274	38.465
4	1.287	7.572	53.115	1.287	7.572	53.115	1.798	10.578	49.043
5	1.283	7.545	60.660	1.283	7.545	60.660	1.669	9.818	58.862
6	1.134	6.671	67.330	1.134	6.671	67.330	1.440	8.469	67.330
7	.910	5.355	72.686						
8	.767	4.514	77.200						
9	.744	4.374	81.573						
10	.672	3.953	85.526						
11	.496	2.919	88.446						
12	.475	2.792	91.238						
13	.434	2.551	93.789						
14	.340	2.000	95.789						
15	.326	1.915	97.704						
16	.229	1.348	99.052						
17	.161	.948	100.000						

Extraction Method: Principal Component Analysis.

Source: Author's Construct (2016)

Table 4.8: Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
Receiving conflicting information	.805					
Difficulty in building trust and relationship	.664					
Lack of access to information database	.647					
Changes to the project are not communicated early	.536					
Information not available when needed	.503					
Cultural differences		.885				
Difference in background		.815				
Receiving late information from others			.767			
Power play			.724			
Use of technical language and jargons				.738		
Handling more information than necessary in a particular period of time				.735		
Differing perception				.595		
Lack of feedback					.752	
Directives not carried out according to instructions issued					.578	
Bias towards certain people						.826
Poor listening and premature evaluation						.748

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 10 iterations.

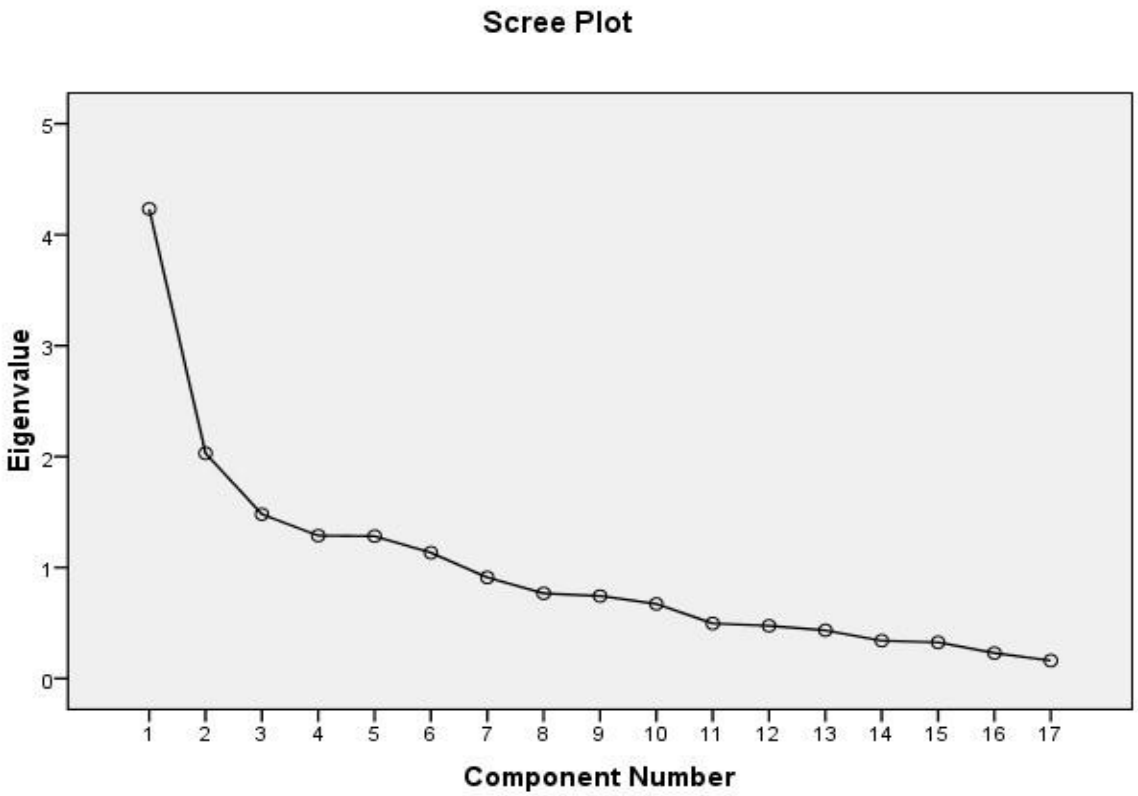

Figure 4.2: Scree Plot

Source: Author's Survey (2016)

The extracted components after rotation are shown in Table 4.8. As noted by Gaur and Gaur (2006), rotation is helpful in arriving at a simple pattern of factor loadings via the maximization of high correlations and the minimization of low correlations. Thus, it simplifies and clarifies the data structure (Costello and Osborne, 2005). It is desireable that each component has high loadings for few factors, helping to differentiate the factors from each other. As seen from the Table 4.8, all the extracted components had at least two variables on it, indicating that the results yielded are reasonable and easy to be interpreted since there were no complex structures (Field, 2009). These extracted components explains a cummulative variance of 67%.

Following the examination of the relationship shared by the variables under each components, the components have been named as follows: Component one (1) Lack

of access to information, component two (2) Cultural challenge of participants, component three (3) delay in information delivery, component four (4) Professional Challenge, component five (5) Lack of feedback, and component six (6) lack of teamwork.

4.6 Discussion Of Components

4.6.1 Component One: Lack of access to information

Component one accounted for 24.895% of the total variance. Five variables contributed to this variance. They included: Receiving conflicting information (0.805), difficulty in building relationship (0.664), lack of access to information database (0.647), changes to the project are not communicated early (0.536), and information not available when needed (0.503). The loadings in bracket are an indication of how the variables impact the component. The subjects that these variables represent from a close examination include untimeliness, barriers/inaccessibility, and distortion. These variables have been used to measure the effectiveness of communication in several communication studies (see for instance, Liu, 2009; Mead, 1999 and Xie, 2002).

Projects thrive on information, especially during the construction stage. A variable that this component also meassures includes the delay in communicating information in respect of changes to the design. This challenge becomes particularly worrying when the changes made to the design relates to aspects of the project that has been already constructed. The ripple effect of this problem in most instances is demolishing of the affected part leading to rework and associated cost to the client.

The lack of access to information is a major problem that can impact the success or otherwise of a project. This ccommunication problem was also identified by Xie

(2002) and Liu (2009).

4.6.2 Component Two (2): Cultural Challenge

This component accounted for 11.939% of the total variance. The variables that constituted this component were, cultural differeces with a factor loading of 0.885 and difference in background with a factor loading of 0.815. Construction industry employs the diverse range of occupational cultures and qualifications, ranging from skilled to unskilled labour and this could be a challenge in the communication process. This is particularly so in projects that involve the invlovement of international human resource (Waziri and Khalfan, 2014). In Ghana, the labour force that are employed on projects cuts across various cultures with different languages. Emuze and James (2013) indicated that though language helps in communicating among people of different backgrounds, cultural literacy is required to comprehend the information communicated through the language used. And where there is the lack of knowledge of the cultural implications for the information communicated, at best, the communication may be ineffective and at worst, the wrong message may be sent (Emuze and James, 2013).

Difference in background which also contributed to this component can also be a problem in the communication process. According to Mailabari (2008), this arises as a result of difference in social and educational background coupled with age and personality differences. Another factor capable of impacting communication as a result of difference in background is superior/inferior relationship between site workers and their supervisors. For instance, people with high educational background can appear to be intimidating to workers without same qualification. Valuable information that could be critical to the progress of the project can be held back by those in possesion of those information if they have the sense of being berated as a result of their

educational background. Rogers (1973) cited in Waziri and Khalfan (2014) held the view that information that is communicated in manner that is perceived to be greatly different from what is culturally common can lead to the lack of understanding or comprehension of the communicated information.

4.6.3 Component Three (3): Delay in information delivery

Component three consists of receiving late information (0.767) and power play (0.724). It was therefore named delay in information delivery and accounted for 8.709% of the variance. Untimely delivery of information has been identified as a major cause of delay of construction projects (Chen and Kamara, 2008). Weippert *et al*., (2003) also identified inaccurate and untimely communications as a major component that result in delaying projects. As contended by Čulo and Skendrović (2010), ensuring project succes means that project information including expectations, goals, needs, resources, reports needs to be communicated on regular basis. A breakdown or delay in the communication of same or any other significant project information can delay the project (Čulo and Skendrović, 2010). Delivery of informamtion in a timely manner is important for the progress of the project. Dainty *et al*. (2006), identified cost and time as a constraint that impacts a project. According to them, being aware of these problem demands that the constructon manager develops a communication strategy that delivers information in a rapid manner that ensure that time and cost bound decisions are taken throughout the project for success.

A characteristic of construction projects is the transient nature of its workforce; as the project proceeds new people are introduced. For the project to attain is objective, it is important that each party is aware of the project needs at every point in time. Failure to communicate timely information to new members of the team could impede its progress. Accordingly, Cervone (2014) indicated that one effective way of updating

people on new information on the project is through regular meetings. However discussions in these meetings should be limited to the issues that are impeding the progress of the project such that attention can be paid to them or information on issues that have put the project ahead of schedule such that they can be enhanced.

4.6.4 Component 4: Professional Challenge

This component accounted for 7.572% of the total variance and was constituted by variables such as; use of technical language and jargons (0.738), handling more information than necessary in a particular period of time (0.735) and differing perception (0.595). This component was therefore named professional challenge. The construction profession is one that deals with a lot of people along the production chain to the realisation of the construction product. Indeed, in order to achieve success in any construction project, good communication skills are required of the construction manager as the leader of the site activities. Construction professionals are mostly trained to gain expertise mainly to deliver their mandate, the construction product without any major training on effective communication. In a study conducted by Adinyira and Abankwa (2015) to determine the adequacy of the syllabus used by tertiary institutions in Ghana for Construction management training, communication was found to be indequately catered for in the current syllabus. As indicated by Zulch (2014b), for projects to be successful depends partly on the communication skills of the construction/project manager.

The use of technical language and jargons was one of the variables contributing to this component. As indicated by Dainty *et al*. (2006), when the terms used in communicating an information to inexperienced insiders are technical, they would be able to extract little or no meaning from the message being communicated. In such

circumstances, effective communication cannot be deemed to have taken place. Construction invloves a mix of various people with different background in terms of education. The professionals on a project are the most educated relative to the site operatives. It is a possibity that the professionals may use terms and jargons too technical to the understanding of these operatives. Additionally, as contended by Patoko and Yazdanifard (2014), even though the construction manager or any other professional may be aware of the calibre of people they are dealing with, they sometimes fail to recognize that the terms they understand well may prove to be difficult or meaningless to the site operatives.

Another variable that constituted this component included handling more information than necessary in a particular period of time. This variable have been measured by several other studies and termed information overload (see for instance, Mead, 1999; Xie, 2002; Liu, 2009). Information overload occurs when a person is required to process too much information at a particular point in time than necessary. This is particularly possible in the construction industry due to the amount of information that are exchanged during the execution of a project.

Defering perception occurs when people percieve an idea from different perspectives as a result of difference in background, knowledge and experience (Mailabari, 2008). For instance, complimenting a worker for working hard may be miscontrued by others workers to be divisive.

4.6.5 Component 5: Lack of feedback

The variables that constituted this component included lack of feedback (0.752) and directives not carried out according to instructions issued (0.578). This component accounted for 7.455% of the total variance. It was named Lack of feedback. Feedback

is an important ingredient in communication that completes the process. It may include an instruction for a task to be undertaken for which feedback is required. It may also be as subtle as a stare, nod or failure to ask a question after a set of complicated instructions have been issued (Erven, 2002). Lack of feedback was also reported by Mehta (2002) as a major communication problem. Another variable that contributed to this component is the failure to carry out instructions issued. It follows that workers are likely to avoid providing feedback on an instruction they have not executed. This can deprive the team of vital project information and delay the project.

4.6.6 Component 6: **Lack of teamwork**

The variables that constituted this component included, bias towards certain people (0.826) and poor listening and premature evaluation (0.748). It was therefore named lack of teamwork. This component also accounted for 6.671% of the total variance. As noted by Dainty *et al*. (2006), construction projects are a collectivist endeavour involving the combination of the skills and knowledge of different people working together for the attainement of the final product. However, failure of the team members to work together and contact each other appears to be a major cause of effective communication in the construction industry (Goh *et al*., 2014). It is expected that as the project progresses, teams will naturally develop and synergies will emerge, thus they will work effectively as a unit. In reality though, teams often fail with some members of the team failing to contribute effectively leading to a breakdown in communication (Dainty *et al*., 2006). It is important that team members become aware of the impact of communication on the project and that each member has a role to play in ensuring that success is achieved.

Poor listening and premature evaluation was a variable that contributed to this component. Communication invloves attentive listening and the tendency of not drawing conclusion during the communication process. A common possiblity is the tendency to either approve or disapprove of what is being communicated. Consequently, people draw premature conclusion based on a decision of hearing what they prefered to hear instead of what is actually being communicated.

4.7 KEY INFORMATION REQUIREMENT

In order to evaluate the information that is mostly communicated on site for inclusion in the framework, the information requirements were ranked. At the initial stages of the project, information is mostly exchanged between the owner or representatives of the owner and the contractors company or firm. This is quite different from the construction phase where the bulk of information is communicated to and managed by the construction manager. Because the construction manager often operates during the construction stage and is mostly resident on site, the bulk of information communicated emanates from him/her to the other parties on the project. From literature, a list of information requirements was used as a starting point to develop the conceptual framework. It is important to state here that the categories and subcategories of information requirements used here are not exhaustive but only a representation of the most important categories of information that every construction project is likely to use.

In order to arrive at which category to include in the framework, the mean score and the standard deviation were used. To be included in the framework, a variable (category) must obtain a mean value of 3.00. The standard deviation was used where two categories obtained the same mean value. The mean values of the categories were

obtained by finding an average of the means obtained by the sub-variables under each category. This was done to ensure that the mean value of each category is consistent with the number of sub-variables under each category relative to the other categories. From Table 4.9, it can be seen that all the categories of information needs obtained an average mean values of more than 3.00. These categories were therefore used in the development of the framework. These categories are briefly described subsequently.

Table 4.9: Mean Score of Information Requirements

Information Requirements	Total	∑W	Mean	Standard Deviation	RII
Request for Information			**4.00**	**0.899**	**0.80**
Design Clarification	62	251	4.05	0.542	0.81
Change orders	62	244	3.94	0.746	0.79
Sub-Contractor Information	62	248	4.00	0.839	0.80
Contract Specification	62	276	4.45	1.124	0.89
Contract Drawings	62	273	4.40	0.948	0.88
Means and Methods	62	225	3.63	0.818	0.73
Implementation problems	62	198	3.19	1.193	0.64
Site instructions	62	267	4.31	0.987	0.86
Materials Management			**4.15**	**1.535**	**0.82**
Place Request/ Order Material	62	286	4.61	1.657	0.92
Material Order Status	62	259	4.18	1.379	0.84

Location of supplier	62	250	4.03	1.442	0.81
Special Material Handling	62	233	3.76	1.625	0.75
Equipment Management			**3.13**	**1.339**	**0.63**
Equipment rentals	62	191	3.08	1.475	0.62
Equipment allocation	62	194	3.13	0.788	0.63
Location of Hiring firm	62	198	3.19	1.753	0.64
Cost Management			**3.73**	**1.197**	**0.77**
Budget Pricing	62	210	3.39	0.967	0.70
Field labour costs	62	227	3.66	1.234	0.76
Material Cost	62	237	3.82	1.437	0.79
Purchase orders	62	250	4.03	1.149	0.83
Site, Schedule and Construction Information			**3.75**	**1.048**	**0.78**
Schedule updates	62	243	3.92	0.799	0.81
Update drawings and As-Built	62	232	3.74	1.249	0.77
Time sheets	62	252	4.06	1.001	0.84
Progress reports	62	256	4.13	1.351	0.85
Visitor Log	62	210	3.39	0.487	0.70
Daily site diary	62	202	3.26	1.398	0.67
Quality Control/ Assurance			**3.55**	**0.899**	**0.74**
Quality Control/ Assurance reports	62	228	3.68	1.227	0.76
Soil reports/ Inspection and Test results	62	212	3.42	0.571	0.71
Safety			**3.50**	**1.498**	**0.72**
Accident Reports	62	203	3.27	1.733	0.68
Reporting Safety Violations	62	205	3.31	1.587	0.68
Safety Meetings	62	237	3.82	1.551	0.79
Sub- Contractor Health and Safety Packages	62	214	3.45	1.124	0.71
Human Resource Management			**3.10**	**1.371**	**0.64**
Recruitment of labour	62	204	3.29	1.395	0.68
Training of labour	62	193	3.11	1.316	0.64
Dispute Resolution Mechanism	62	181	2.92	1.403	0.60

Source: Author's Construct (2016)

4.7.1 Request for Information

During the design and construction phases, a number of questions arise that include but not limited to the interpretation of drawings and specification. These field reports are termed as Request for Information or Request for Clarification (Shahid and Froese, 1998). Request for Information are the most communicated information throughout the construction lifecycle (Ballan and El-Diraby , 2011). Request for Information obtained a mean value of 4.00, thus its inclusion in the framework is affirmed. This category of information requirements that was used in the study included, design clarification, change orders, sub-contractor information, contract specification, contract drawings, means and methods, problems of implementation and site instructions. The proper use of Request for Information can serve as a reliable, orderly and documented way of resolving issues that borders on the construction project. The delay in the provision of clarification can provide the grounds for claims (Shahid and Froese, 1998). Nonetheless, Request for Information are communicated throughout the lifecycle of the project (Ballan and El-Diraby , 2011).

4.7.2 Materials Management

Every construction project is achieved through the use of large quantity of materials. It is therefore the duty of the construction manager and to organize and coordinate with the Materials Management department to ensure that the necessary materials are available on the project at the time required. This category of the information requirement therefore pertains to the documents of all the materials needed to complete the project (Ballan and El-Diraby , 2011; Shabnam and Abdelnaser, 2013). Information on the availability of materials is always helpful in ensuring that the project runs smoothly. The Materials Management category obtained a mean value of 4.15 and thus shall be included in the framework to be developed.

4.7.3 Equipment Management

This category pertains to all document and information exchanged as far as the use of equipment is concerned. This category includes information on equipment rentals, allocation and its location. Equipment Management is crucial to the success of projects given the nature of projects that are undertaken. The possession of equipment is a prerequisite for tendering for projects in Ghana due to their importance.

4.7.4 Cost Management

Information exchanged in respect of the cost of the project are included in this category. Indeed, cost is a key component in every construction projects. It is a key determinant in the determination of the success or otherwise of a project. The information captured under this category include budget pricing, field labour costs, material cost and purchase orders.

4.7.5 Site, Schedule and Construction Information

Construction projects generally use schedule in the execution of the projects. This schedule is the representation of the phasing of activities leading to the completion of the project. The availability of Schedules forms the basis of project monitoring and controlling activities together with other project plans and budget. Additionally, in construction projects, the project participants are payed based on the amount of work done. The information on the amount of work done is often communicated by the weekly/monthly progress report which is covered under this category. As stated by Shahid and Froese (1998), the progress report provides a means of itemizing the amount of work completed to-date as per the bill of quantities which also includes additional columns providing information on the current month's progress (quantity or percentage), and progress to-date. The information under this category represents

information exchanged between site and the office. Schedule updates, updated drawings, progress reports, visitors long and daily site diary are the information under this category.

4.7.6 Quality Control/Assurance

Quality assurance and control measures are undertaken to ensure that the project meets its quality requirement. Some of the information that are exchanged as far as quality is concerned include quality control/quality assurance reports, soil reports and other inspections that are undertaken.

4.7.7 Safety

Ensuring safety in every construction project is mostly required in construction projects. The documentation that contains information on all safety issues are covered under this category. Some of these include accidents reports, safety violations and information on safety meetings. These safety documentations usually required of the contract.

4.7.8 Human Resource Management

The human resource is an inevitable resource required for the accomplishment of any project. From the operation of equipment on site to the provision of the various reports require human resource. The real progress of any construction project is mostly incumbent on whether the human resource is proactive of the human resource. Normally, at the beginning of every construction project the necessary human resource are recruited and allocated. During the progress of the project there may be the need to either reduce or increase the size of the human resource on site depending on the circumstances. Information regarding the recruitment of labour, training of labour and dispute resolution are covered under this category.

4.8 Sources of Information

The sources of the information were also ascertained. The respondents were asked to indicate the sources of the information communicated on projects. The sources from which respondents were required to indicate included; Organisational Policy, Terms of contract, externally published databases, Personal Experience, and Legal requirement. The results from the survey as indicated by respondents are shown in the Table 4.7.

Table 4.7: Sources of Information Requirements

Information Requirements	**Organisational Policy**		**Terms of Contract**		**Externally Published Databases**		**Personal Experience**		**Legal Requirement**	
Request for Information	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Design Clarification	8	12.90%	44	71.00%	0	0.00%	10	16.10%	0	0.00%
Change orders	10	16.10%	46	74.20%	0	0.00%	6	9.70%	0	0.00%
Domestic Sub-Contractor information	37	59.70%	15	24.20%	4	6.50%	6	9.70%	0	0.00%
Nominated Sub- Contractor information	18	29.03%	42	67.74%	0	0.00%	2	3.23%	0	0.00%
Contract Specification	11	17.70%	30	48.40%	9	14.50%	6	9.70%	0	0.00%
Contract Drawings	4	6.50%	52	83.90%	0	0.00%	6	9.70%	0	0.00%
Means and Methods	5	8.10%	36	58.10%	4	6.50%	17	27.40%	0	0.00%
Site Instructions	27	43.50%	31	50.00%	0	0.00%	4	6.50%	0	0.00%
Materials Management										
Place Request/ Order Material	31	50.00%	6	9.70%	0	0.00%	15	24.20%	10	16.10%
Material Order Status	40	64.50%	0	0.00%	4	6.50%	18	29.00%	0	0.00%
Suppliers information	31	50.00%	0	0.00%	6	9.70%	25	40.30%	0	0.00%
Special Material Handling/ Delivery	23	37.10%	0	0.00%	6	9.70%	21	33.90%	0	0.00%
Equipment Management										
Equipment rentals	50	80.60%	0	0.00%	0	0.00%	4	6.50%	0	0.00%
Equipment allocation	35	56.50%	0	0.00%	0	0.00%	15	24.20%	0	0.00%
Hiring firm information	35	56.50%	0	0.00%	0	0.00%	15	24.20%	12	19.40%
Cost Management										
Budget Pricing	20	32.30%	29	46.80%	5	8.10%	8	12.90%	0	0.00%

Material Cost	24	38.70%	8	12.90%	5	8.10%	17	27.40%	8	12.90%

Purchase orders	32	51.60%	14	22.60%	5	8.10%	11	17.70%	0	0.00%
Site, Schedule and Construction Information										
Schedule updates	20	32.30%	34	54.80%	4	6.50%	4	6.50%	0	0.00%
Update drawings and As-Built	10	16.10%	38	61.30%	6	9.70%	8	12.90%	0	0.00%
Labour Time sheets	31	50.00%	4	6.50%	0	0.00%	27	43.50%	0	0.00%
Visitor Log	39	62.90%	0	0.00%	0	0.00%	23	37.10%	0	0.00%
Daily Site diary	25	40.30%	0	0.00%	0	0.00%	33	53.20%	0	0.00%
Quality Control/ Assurance										
Quality Control/Assurance reports	14	22.60%	33	53.20%	0	0.00%	10	16.10%	5	8.10%
Soil reports/Inspection and Test Results	20	32.30%	38	61.30%	4	6.50%	0	0.00%	0	0.00%
Safety										
Accident Reports	24	38.70%	18	29.00%	0	0.00%	0	0.00%	20	32.30%
Reporting Safety Violations	30	48.40%	12	19.40%	0	0.00%	10	16.10%	10	16.10%
Safety Meetings	24	38.70%	0	0.00%	6	9.70%	14	22.60%	0	0.00%
Sub- Contractor Health and Safety Packages	32	51.60%	21	33.90%	0	0.00%	0	0.00%	5	8.10%
Human Resource Management										
Recruitment of labour	27	43.50%	4	6.50%	16	25.80%	10	16.10%	5	8.10%
Training of labour	41	66.10%	6	9.70%	6	9.70%	4	6.50%	5	8.10%
Dispute Resolution Mechanism	37	59.70%	6	9.70%	6	9.70%	8	12.90%	5	8.10%

Source: Author's Construct (2016)

Under **the request for information** category, Organisational Policy and Terms of contract were the predominant sources for the information in this category. These served as the source for the various information under the category. For instance, 44 of the respondents representing 71% of the total respondents indicated Terms of contract as the source for design clarification. Personal experience (16.10%) and organisational policy (12.90%) were also indicated by the respondents as the other sources of information for design clarification.

Following to the **materials management** category, it can be seen that information on placing request/ ordering material can be obtained from an organisational policy (50.00%). Thus information on ordering for is provided for in the organisational policy. Personal experience (24.20%) was the next point of call when it came to placing material orders.

A look at the **equipment management** category also revealed organisaional policy as the main source of information concerning equipment rentals, equipment allocation and information about equipment hiring firms. The respondents also indicated the use of their personal experience about issues concerning equipment management. Also the **cost management** category showed a hybrid of Organisational Policy, Terms of Contract and personal experience as the sources of information for the variables under that category. For Budget pricing 46.80% of the respondents indicated terms of contract as the source for this information. Another 32.30% of the respondents indicated organisation policy as the source for this information. Majority of the respondents also indicated organisational policy as the source for information concerning field labour costs. The source of information for material cost and purchase orders was organisational Policy. These information as given by the respondents were generally not different from what is usually done in practice.

The **Site, Schedule and Construction Information** category also had combination of organisational policy, terms of contract and personal experience being the dominating sources for the information listed in the category.

In the category of **Quality Control/Assurance**, organisational policy, terms of contract and personal experience. Information on Quality control/assurance reports was indicated by majority of the respondents (53.20%) to be sourced from the terms of the contract. Another 22.60% of the respondents also indicated Organisational policy as the source of information concerning quality control and assurance. Within the same category, 61.30% of the respondents indicated terms of contract as the source for information concerning soil reports/inspection and test results. For the same variable, 32.30% of the respondents also indicated organisational policy as the source for information on soil reports/Inspection and test results. Thus in the unlikely event where the contract fails to provide information on this variable, the organisational policy of the company becomes the next point of call for information concerning these reports.

Organisational policy, terms of contract, and legal requirement were the sources indicated by respondents as base for obtaining information on **safety**. According to the findings, 38.70% of the respondents opined that, information regarding reporting accidents were provided in their organisational policy. A significant 32.30% also indicated accidents reporting as a legal requirement. According to Section 120 of the Labour Act (Act 651, 2003) an employer is required to report an accident to the appropriate governmental agency any accident that occurs in the workplace. It is also important to note that firms are also vigilant in ensuring they prevent the occurrence of accidents on sites. A firm with high record of accident occurrence may be at the risk

of being at a competitive disadvantage within the competitive environment in which they operate.

Information concerning **Human Resource Management** was also indicated to be provided for in the organisational policy, externally published data and also a legal requirement. Information concerning the recruitment of labour, training of labour and dispute resolution mechanism were indicated by majority of respondents as provided in their organisational policies. It is also prudent to state at this point that issues of labour are also provided in the legal document that regulate matters of employeremployee relationships. For instance, on dispute resolution mechanism, whereas 59.70% of the respondents indicated of its provision in their organisational policies,

12.90% (second highest) also indicated that this mechanism is provided for in the law.

4.9 PROPOSED FRAMEWORK

The framework proposed in this study resulted from the analysis of data on the variables that constituted the framework. It comprises of the stakeholders (Construction Manager), the information, source of information and the means of communicating the information. The framework is aimed at aiding construction firms in planning communication during the construction stage.

The proposed framework is shown in Figure 4.3.The framework is seen as a set of boxes linked with arrows to draw ‘relationships’. The process to the development of framework and its usage are as follows:

- The process begins with the construction Manager Preparing a register of Stakeholders. These stakeholders includes the Project Manager, the Contractor, and the community.
- State the Stakeholder Management Strategy. This strategy includes the analysis of each stakeholder's interest to determine what to communicate. It is also important to ensure that the strategy makes provision for an escalation process that allows for resolving any communication-based conflicts or issues.
- Determine the information to be communicated. In this framework these information have been labeled as Information requirements. The information requirements were grouped into eight categories of Request for Information, Materials Management, Cost Management, Equipment Management, Site, Schedule and Construction Information, Quality Control/Assurance, Safety and Human Resource Management. According to the PMI, (2008), determining the information and identifying the means of communicating same are important variables for the success of the project. As such, the construction manager must determine the information to be communicated.
- Another component of this framework is the inclusion of the sources of the information to be communicated. The sources included organisational policy, terms of contract, personal experience, externally published databases and whether the task is a legal requirement. These sources acts as a repository of information for the categories of information stated. For instance information concerning the order of material or placing material requisition can be found in the organisational policy of a firm as indicated by the respondents.

- Having established what to communicate and the source of the information, the construction manager/communicator should decide on how to communicate this information to the recipients. To have the maximum impact, it is important that the right medium is selected. This framework recognises that deciding the medium to use to communicate a particular information depends of the type of information and the recipient of the information. As such the framework allowed for communicators to select the medium suitable for communicating an information. This was enabled by the provision of dotted lines seperating the identified media (Figure 4.3). The appropriate selection of the media for communication eventually leads to its inclusion in the final communication plan as shown in Figure 4.3.

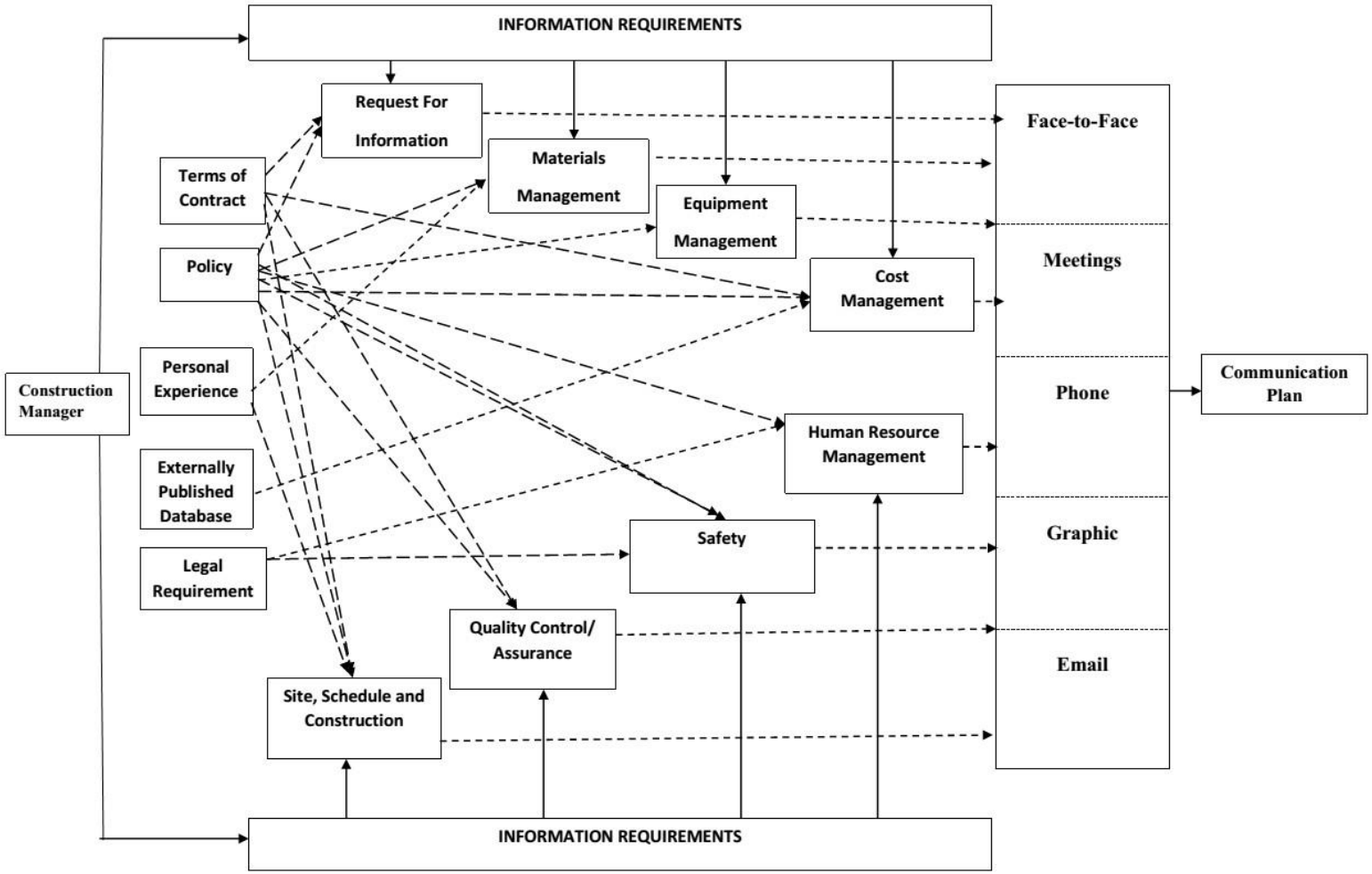

Figure 4.3: Proposed framework

Source: Author's Survey, (2016)

4.10 SUMMARY OF FINDINGS

Towards the development of a framework for communication on site, this chapter analysed data on the variables that eventually led to the development of the framework proposed. The quantittaive data collected through the questionnaire survey were analysed quantitatively to identify the most used media of communication on site. Using the mean score ranking and pegging the significant mean at 3.00, face to face, meetings, telephones, graphic and email emerged as the most frequently used means of communication. The study also identified some communication problems that are encountered on site. Applying the factor analysis, the identified variables (problems) were grouped into six components named as: Component 1: Lack pf access to information; Component 2: Cultural Challenge; Component 3: Delay in information delivery; Component 4: Professional Challenge; Component 5: Lack of feedback; and Component 6: Lack of teamwork. Subsequently, the most communicated information as well as the sources of these information were identified and analysed. The information needs were grouped into Eight categories of request for information; materials management; cost management; schedule, site and construction information; equipment management; safety; quality control/assurance; and human resource management. These information required and their respective sources were included in the development of the framework for on-site communication.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The main focus of this study was to develop a framework for on site communication for Construction site Managers. As a result, the study identified the modes of communication used most frequently for the exchange of information on site. The effectiveness of these media were also ascerteined relative to their usage. The process of communication encompasses the exchange of information from a sender to a receiver. The information to be communicated were then identified and classified in their order of relative importance. This chapter, the entire study is concluded by providing a summary of the findings through a review of the objectives advanced for the study. The chapter concludes with recoomendations and direction for future research while highlighting the limitations of the research as a guide to the extent of generalization of the findings.

5.2 REVIEW OF THE STUDY OBJECTIVES

The aim of the study led to the formulation of objectives that enabled the development of the ultimate framework. The achievement of these objectives are reviewed in this section.

5.2.1 Objective One: To identify the predominantly utilised media of communication and the effectiveness of these media as used on site.

Exchange of information is always conducted through a medium whether voluntarily or involuntarily chosen. The selection of a communication medium is mostly influenced by the type of information to be communicated and the reciepient of the

message. As such, in achieving this objective literature search was conducted to establish the available media for site communication. From the review, several media of communication were identified as the modes used in communicating information on-site. These identified media were then included in the developed questionnaire for the respondents to indicate their frequency of usage as well as their effectiveness relative to their usage.

The data from the field survey were then analysed using the mean score ranking to rank the frequency of usage and their effectiveness (See Sections 4.4.1 and 4.4.2). Setting the significant mean value to 3.00, face-to-face communication emerged as the most used medium of communication on site. Meetings, phone, the use of graphic and email also emerged as used on site. Finally, gap analysis of these media of communication was conducted to draw the attention of industry to harness the use of these identified communication media.

5.2.2 Objective Two: To identify and prioritize the critical problems of communication encountered on construction project sites.

This objective was to identify the problems of communication that are faced within the construction environment. This objective was achieved by conducting literature search on the problems of communication encountered on construction sites. Following similar studies conducted by Mead (1999), Xie (2002), and Liu (2009), eighteen (18) variables representing the problems were identified and adopted as the communication problems that are encountered on construction sites.

These variables were then developed as part of the questionnaire survey for construction managers to indicate based on their experience the problems they encounter. The aim of this was to highlight the main communication problems that are

encountered and draw attention of the industry to them. These variables were analysed using the factor analysis to identify which factors were measuring the same construct (see Section 4.5). From the factor analysis conducted, Six Principal Components were extracted. There were no complex situations as no factor measured more than one component.

5.2.3 Objective three: To identify the key information requirements and the sources of these information requirements.

This objective was attained by conducting literature on the main information that are communicated on site. This were identified to be included in the final framework for communication planning. Through the literature search, eight categories of information required were identified. It is important to note that the identified information requirement was only selected to represent the myriad of information that are exchanged during the construction phase of a project. Thus the identified information requirement was not exhaustive. The categories identified included, Request for information, Materials Management, Cost Management, Equipment Management, Schedule and Site Construction Information, Safety and Human Resource Management. These information requirements were then developed into a questionnaire for the respondents to indicate which ones were most communicated on site. The findings for the most communicated information on site were discussed under Section 4.7. Another component of the sources of the information were included for analysis. Outcome of the analysis were presented in Chapter Three (Section 4.8).

5.2.4 Objective Four: To propose a Framework for On-Site Communication Planning for Construction Managers.

The main aim of this study was to develop a framework that encompasses communication on site. This objective was achieved by drawing and combining the findings from the first and third objectives. It included findings from data analysis using statistical tools as the mean score ranking and descriptive statistics. The framework as explained in chapter three (see Section 4.9) contained components such as the communicator, the information, the source of the information, and the means of communicating this information.

5.3 FINDINGS OF THE RESEARCH

Following the analysis of data for the various objectives applying statistical tools such as mean score ranking, gap analysis, factor analysis, and descriptive statistics leading to the development of the proposed framework, a summary of the findings are provided below;

- The main medium of communication on construction sites were identified to include Face-to-face, meeting, telephone, graphic and email. From the analysis of their effectiveness, these media of communication were also indicated as effective based on their usage.
- The gap and quadrant analysis showed that Face-to-face, meeting, telephone, graphic and email were deemed to be effective based on their usage and therefore they need to be maintained and continuously improved. Memo and Project intranet were also deemed to be effective but not in use. It is therefore important that the industry pays more attention to these media and increase their usage for adequate results. Fax was not deemed effective as it was not in frequent use.

- The main information most exchange during construction as revealed by the study included the set of categories as grouped under request for information, materials management, equipment management, cost management, site schedule and construction information, safety and human resource management.
- The source of these information requirements were identified to include organisational policy, terms of contract, personal experience, externally published databases and legal regulations.

5.4 CONCLUSION

The fundamental aim of this study was develop a framework that aids construction managers in planning communication on site. This led to the development of objectives aimed at achieving this fundamental aim. The importance of planning communication has been established in literature as a key variable to the success of projects. Construction projects involves several stakeholders and communication is required to coordinate the project to a successful end. To this end, it became necessary that a clear path of communication is developed to help supervisors of projects to manage communication effectively.

The framework was developed following the review of literature to identify the key variables necessary for developing the framework. The findings impact the management of communication that encompasses planning. Problems in communication can serve as a barrier to the progress of works on site. Communication problems in the construction industry are one major aspect to consider when handling or managing projects. The factor analysis provided six components named as lack of

access to information, cultural challenge, delay in information delivery, professional challenge, lack of feedback and lack of teamwork as the main communication problems facing the Ghanaian Construction Industry.

Applying the developed framework, industry stands in a pole position to benefit from the weaknesses of the lack of planning communication.

5.5 CONTRIBUTION TO KNOWLEDGE

Antwi-Afari (2015) citing Gray (2011) indicated the criteria for contribution of research to knowledge to include the following:

- Review of relevant literature that aims at identifying the gaps in research in the area of study whiles establishing the already existing knowledge in the area of the study;
- Developing frameworks and models;
- Publications;
- Contribution to methodology; and
- Developing new Formulae

This study adopted the deductive approach to research relying on established knowledge to develop new knowledge. Whereas several studies have been conducted in the area of construction communication mostly in developed countries, very little work have been done in the Ghanaian Construction Industry. Besides most of these studies focused on the other stages of construction without particular attention to the practices on site. In an attempt to fill the gap, this study was conducted to develop a framework aimed at enabling construction managers plan communication for their projects.

This study fulfilled the aforementioned criteria for contribution to knowledge, albeit not entirely. The over-arching aim of this research was to develop a framework.

Whereas, the study adopted did not propound new methodologies and formulae, it developed a framework as a contribution to knowledge. The proposed framework is expected help industry plan communication which is critical to the success of the project. Additionally, the idientification of the on-site communication problems is a significant contribution given the paucity of studies in this area in Ghana thus far.

5.6 RECOMMENDATIONS

The following recommendations have been made based on the findings of the study. The study developed a framework to aid the construction industry and particularly, construction managers, to plan their communication during the construction period. Further from the findings of the study, the following recommendations were put forward.

- Following the identification of the frequently used media for communication, it became clear that the computer based media were not in use as much as the other means identified. Given the rate at which these computer based media can be used to communicate and store relevant information as well as the amount of construction information communicated during the construction stage, industry must focus on developing and shifting attention to utilising them while benefitting from the their relative strengths. Subsequently, there must be sufficient training of industry personnel on how these technologies can be harnessed for ultimate benefit.
- The proposed framework requires the commitment of industry players for its successful implementation. It was observed during the study, most construction firms did not prioritise planning communication although research have provided evidence on its importance to the success of projects. It is therefore

recommended that the attention of industry players be drawn to the importance of planning communication through seminars and continuous professional development programs.

5.7 LIMITATIONS OF THE STUDY

The study though signicant to the development of the industry had limitations that could serve the gorunds for future studies. As with all research studies, the limitations of this study include the following:

- The respondents for the study were determined using non-probability methods as there was no data on the respondents. As such, the representativeness of the sample used for the study cannot be ascertained. This has an impact on the extent to which the findings of the study can be generalized.
- The study measured the effectiveness of the media used in communicating information. It has however been established that the effectiveness of a medium of communication can effectively be determined by the type of information it is communicating. This study only focused on the general effectivenes of the media relative to their use without recourse to the specific information being communicated.
- The framework proposed was purely based on the inputs from the industry players (construction managers). It has not been tested on real projects yet, notwithstanding its potential significance to construction communication planning.

5.8 DIRECTIONS FOR FUTURE RESEARCH

As a continuation of the contribution of knowledge on the subject of construction communication against the background of the stated limitations of this study, the following recommendations are advanced for future research;

- Future studies should attempt to validate the framework by applying it on real life projects. The current study did not test the viability of the framework on real life projects.
- Given the advancement of technology in the industry, further studies should be conducted on how such a framework can be integrated into a computer software.
- This study also focused on communication within the construction site. It is recommended that a similar study should be conducted but extended to include communication between the site and office with the aim of developing an integrated framework that encompasses all communication during the construction stage.

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APPENDIX: SURVEY QUESTIONNAIRE

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND BUILT ENVIRONMENT

DEPARTMENT OF BUILDING TECHNOLOGY

Dear Sir/ Madam,

SURVEY QUESTIONNAIRE - A FRAMEWORK FOR ON-SITE COMMUNICATION PLANNING FOR CONSTRUCTION MANAGERS IN GHANA

I am a research student developing a framework for on-site communication for construction managers in Ghana.

As part of the research study, this questionnaire survey is conducted to solicit your opinion on the subject of site communication. It is aimed:

1. To identify the predominantly utilised media of communication and the effectiveness of these media as used on site.
2. To identify and prioritize the critical problems of communication encountered on construction project sites.
3. To identify the key information requirements and the sources of these information requirements.
4. To propose a Framework for On-Site Communication Planning for Construction Managers.

The findings from the study is expected to help construction managers manage their operatives on site in terms of communication. It is my belief that you will provide answers to the questions below to enable me present a good report. I am by this writing promising you that this is strictly for academic purposes and that it will not be used in any way as a competitive edge against you or your company. Thank you in advance for your contribution to this research study.

Yours Sincerely

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SECTION A: RESPONDENT BACKGROUND

1. How long have you been working in the construction industry?
   a) 1 – 5 years ☐
   b) 6 – 10 years ☐
   c) 11 – 15 years ☐
   d) 16 – 20 years ☐

e) Above 20 years ☐

2. In what type of construction is your company generally involved?
   a) Civil Engineering ☐
   b) Building ☐
   c) Civil and Building ☐
   d) Others (please specify)
   ……

3. Which of the following academic qualifications do you hold?
   a) Higher National Diploma (HND) [ ]
   b) Bachelors Degree [ ]
   c) Masters Degree [ ]
   d) Doctorate Degree [ ]
   e) Others, please specify……

4. Which of the following professional bodies do you holds membership?
   a) Ghana Institute of Construction (GIOC) [ ]
   b) Ghana Institution of Surveyors (GhIS) [ ]
   c) Project Management Institute (PMI) [ ]
   d) Chattered Institute of Construction (CIOC) [ ]
   e) Others, please specify……

5. How many projects have you handled in the past five years?

a) 1 – 5 projects [ ]
b) 6 – 10 projects [ ]
c) 11 – 15 projects [ ]
d) Above 16 project [ ]

SECTION B: MEANS OF ONSITE COMMUNICATION

Please indicate how often you use the following means of communication with other parties on site and indicate their level of effectiveness in communicating information.

Please rank using the frequency key: **1=Not Often; 2=Less Often; 3=Moderately Often; 4=Often; 5= Very often** Effectiveness of media: **1=Not effective; 2=Less effective; 3=Moderately effective; 4=Effective; 5 = Very effective**

No.	Means of Communication	Frequency					Effectiveness				
		1	2	3	4	5	1	2	3	4	5
1	Face to face										
2	Phone										
3	Meetings										
4	Project Intranet										
5	Memo										
6	Email										
7	Correspondence										
8	Graphic e.g Safety signs photographs										
9	Fax										
10	Post										
	Please specify other means not stated above and rank them accordingly										
9											
10											
11											
12											
13											

SECTION C: PROJECT COMMUNICATION PROBLEMS

Below are a number of communication problems encountered in construction projects. From your experience please indicate the frequency of occurrence of these problems in your communication with site operatives. Please rank using the key: **1=Not Often; 2=Less Often; 3=Moderately Often; 4=Often; 5= Very often**

S/No	Communication Problems	1	2	3	4	5
1	Receiving late information from others					
2	Handling more information than necessary in a particular period of time					
3	Information not available when needed					
4	Change in meaning of information communicated					
5	Information sent not delivered to the recipient					
6	Directives not carried out according to the instructions issued					
7	Receiving conflicting information from others					
8	Changes to the project are not communicated on time					
9	Lack of adequate access to information database					
10	Poor listening and premature evaluation					
11	Use of technical language and jargons					
12	Differing perception					
13	Lack of feedback					
14	Difficulty in building trust and relationship					
15	Bias towards certain people					
16	Power play					
17	Difference in background					
18	Cultural differences					

SECTION D: KEY INFORMATION REQUIREMENTS

1. In the list below are categories and subcategories of information communicated on site. In your experience kindly indicate by ticking on the scale provided, the rate at which these information are communicated. Rate using the following scale

1. Never 2. Rarely 3. Occasionally 4. Frequently 5. Very Frequently

S/N	Information Requirements	1	2	3	4	5	6
	Request for information						
1	Design clarification						
2	Change orders						
3	Sub-Contractor Information						
4	Contract Specification						
5	Contract Drawings						
6	Means and Methods						
7	Implementation problems						
8	Site instructions						
	Materials Management						
9	Place Request/ Order Material						
10	Access to material Management						
11	Material Order Status						
12	Material Location						
13	Special Material Handling						
	Equipment Handling						
14	Equipment rentals						
15	Equipment allocation						
16	Equipment Location						
	Cost Management						
17	Budget Pricing						
18	Field labour costs						
19	Material Cost						
20	Purchase orders and Extras						
	Site, Schedule and Construction Information						
21	Schedule updates						
22	Update drawings and As-Built						
23	Time sheets						
24	Progress reports						
25	Visitor Log						
26	Daily site diary						
	Quality Control/ Assurance						
27	Quality Control/ Assurance reports						

28	Soil reports/ Inspection and Test results						
	Safety						
29	Accident Reports						
30	Reporting Safety Violations						
31	Safety Meetings						
32	Sub- Contractor Health and Safety Packages						
	Human Resource Management						
33	Recruitment of labour						
34	Training of labour						
35	Dispute Resolution Mechanism						

2. Kindly indicate from your experience which of the following provides the timing for the communication of the following information requirements (multiple responses allowed).

1. Organisational Policy 2- Terms of contract 3- Externally Published Databases 4- Personal Experience 5 – Legal regulations 6 - Others

S/N	Information Requirements	1	2	3	4	5	6
	Request for information						
1	Design clarification						
2	Change orders						
3	Sub-Contractor Information						
4	Contract Specification						
5	Contract Drawings						
6	Means and Methods						
7	Implementation problems						
8	Site instructions						
	Materials Management						
9	Place Request/ Order Material						
10	Access to material Management						
11	Material Order Status						
12	Material Location						
13	Special Material Handling						
	Equipment Handling						
14	Equipment rentals						
15	Equipment allocation						
16	Equipment Location						
	Cost Management						
17	Budget Pricing						
18	Field labour costs						
19	Material Cost						
20	Purchase orders and Extras						
	Site, Schedule and Construction Information						
21	Schedule updates						
22	Update drawings and As-Built						
23	Time sheets						

24	Progress reports						
25	Visitor Log						
26	Daily site diary						
	Quality Control/ Assurance						
27	Quality Control/ Assurance reports						
28	Soil reports/ Inspection and Test results						
	Safety						
29	Accident Reports						
30	Reporting Safety Violations						
31	Safety Meetings						
32	Sub- Contractor Health and Safety Packages						
	Human Resource Management						
33	Recruitment of labour						
34	Training of labour						
35	Dispute Resolution Mechanism						