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Adama Science & Technology University

School of Civil Engineering and Architecture

Department of civil Engineering

**Assessment of the Relationship between Contractors and their
Subcontractors and its Impact on Project Performance of Building
Construction projects in Addis Ababa**

**A Thesis submitted in partial fulfillment of the requirements for
the Degree of Master of Science in Civil Engineering
(Construction Management)**

By:- Mandefro Fikir

March, 2017

ASTU, Ethiopia

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Advisor- Girmay kahssay (PhD)

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Declaration

I, the undersigned, declare that this thesis entitled "Assessment of the Relationship between Contractors and their Subcontractors and its Impact on Project Performance of Building Construction projects in Addis Ababa" is my own work. I have undertaken the research work independently with the guidance and support of the research advisor. This study has not been submitted for any degree or diploma program in this or any other institutions and that all sources of materials used for the thesis have been duly acknowledged.

Declared by- Mandefro Fikir

Mandefro Fikir_____

Date_____

Adama Science and Technology University

School of Graduate Studies

This is to certify that the thesis prepared by Mandefro Fikir, entitled: *Assessment of the Relationship between Contractors and their Subcontractors and its Impact on Project Performance of Building Construction projects in Addis Ababa* and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Civil Engineering (Construction Management) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the Examining Committee:

_____ Signature _____ Date _____

Chair person of DGC

_____ Signature _____ Date _____

Advisor

_____ Signature _____ Date _____

External Examiner

_____ Signature _____ Date _____

Internal Examiner

ABSTRACT

Construction projects have become complex, hence, most projects are subcontracted to allow for specialization and to minimize the work load of the main contractor. This study aimed to investigate the relationship between the main and subcontractors in the Ethiopian context. Selection criteria of main contractors to select suitable subcontractors, Factors leading to the contractor- subcontractor interface problems, contractual relationship between main contractors and subcontractors and the impact of their relationship on construction project performance specifically on time, cost and quality are the main topics addressed in this study.

The information is collected through questionnaire from a sample of randomly selected 81 class 1, 2, 3 main contractors and 101 their subcontractors which are currently working in Addis Ababa on building construction projects. The response of respondents' organized and statistical analysis like computing relative importance index, frequencies, percentiles, graphs and charts is carried out by using Excel and SPSS software. The factors used by main contractors to select suitable subcontractors, interface problems and factors affecting time, cost and quality of a construction project ranked based on their relative importance index value. In addition to this to compare the difference in opinion of main contractors respondents and subcontractors respondents independent sample t-test was conducted for each factor and in group. The comparison presented in table format in a way of indicating the existence of significant difference or not.

The study found out important selection criteria, factors causing interface problems between main contractors and subcontractor and factors affecting the most important criteria of construction project performance (Time, cost and quality). Moreover contractual related problems like absence of standard form of contract, absence of safety guide lines in the contracts and payment issues identified. Based on the findings recommendations for main contractors, subcontractors, government bodies and future researchers are forwarded.

Key Words:- Main contractors, Subcontractors, Selection criteria, Interface problems, project performance, standard form of contract.

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ACRONYMS

MUDHo- Ministry of Urban Development and Housing

AAIHDP- Addis Ababa Integrated Housing Development Project

AAHDPO- Addis Ababa Housing Development Project Office

GCs- General Contractors

BCs-Building Contractors

PPA- Public Procurement Agency

MoWUD- Ministry of Works and Urban Development

RII- Relative Importance Index

Fig. - Figure

MC- Main contractor

SC- Subcontractor

CHAPTER 1. INTRODUCTION

1.1 Background of The Study

The construction sector in Ethiopia, generally in the world, contributes to the realization of about fifty percent of the total capital. It is one of the three sectors of the economy identified by the Ethiopia Government for special consideration to foster the country's economic development. However, the general state of the domestic construction industry in Ethiopia is still characterized by inadequate capital base, old and limited numbers of equipment, low levels of equipment availability and utilization, deficiencies in technical, managerial, financial and entrepreneurial skills, limited experience and participation of the private sectors in construction and consultation works, and insufficient and ineffective use of labor-based road construction and maintenance technology. It opens the door for the growth of many additional industries. The industry policy of the Federal Democratic Republic of Ethiopia has sought to pay special attention to the construction industry of the country (Tecle and Mahlet, 2012).

There are different parties which participate in a construction contract. The major contract is the one that deals with the project as a whole, is mostly signed between the employer and the consultant, being a main contractor.

A main contractor may engage a sub-contractor to undertake a specific part of the main contractor's works. While this concept is not new, it has become more prevalent in the modern construction industry. This is due to the complexity and specialized nature of modern construction and the increased flexibility afforded to main contractors who may expand or reduce their construction capabilities depending upon their workload (Gould, 2011).

Contractually, main contractors are responsible for the construction of projects, but they rely on subcontractors and/or specialist contractors and suppliers to execute the works (Obafemi et al, 2013). major portion of all construction projects in the building industry handled by subcontractors (Mbachu, 2008).

Arditi and Chotibhongs (2005) also explained that subcontractors are very important to the successful completion of most construction projects. According to them in the usual

case, the main contractor will perform the basic operations and subcontract the remainder to various specialty contractors.

But strain in the relationships and interface problems between the main contractor and subcontractor may develop due to poor communication, lack of information on site, poor supervision, master and slave syndrome, and lack of management systems. Inevitably, this will lead to poor overall management of the projects, poor quality products, late project delivery and create dissatisfaction between the main contractor and subcontractor as well as clients (Othman, 2007). Moreover main contractors financial problem, assigning part of the works to new sub-contractor without the main contractor is informing the original sub-contractor, delay in contract progress payments and delay by main contractor in providing necessary materials to the sub-contractors are the key interface problems between the main contractor and the sub- contractor emanating from the main contractor (Okunlola, 2015).

According to other researcher's view relations between subcontractors and general contractors (GCs) (main contractors in this study context) are often strained and prone to disputes due to a poor sense of fairness and a misunderstanding of each others' needs. More often however, disagreements arise due to a lack of knowledge of the GCs' general and special conditions for their planned construction method and schedule (Joseph and Proctor, 1996). If these problems ignored can cause an immense impact to the construction project, and can extend into the operation of the general contractor's organization (Lian and Lewyoke, 2012).

The performance of parties to the projects is critical to the success of any construction project as they are responsible for the conversion of the client's brief to practical reality. Project performance can be assessed under four fundamental aspects of performance, namely construction cost, construction time, construction quality and sustainable development (Hong and David, 2003)

Although subcontracting practices are extensively in use In the Ethiopian construction projects many issues arising due to subcontracting systems are not acknowledged and addressed in view of completion of construction projects.

So far, little or no research has been done in the country related to subcontracting practices. This thesis is thus will be conducted to fill the gap between required and current main contractors' and subcontractors' relations by investigating main factors affecting their relationships.

1.2 Statement of the Problem

As it was stated above due to the absence of similar studies and reinforcing organized documents in the country, problem of the study comes from practical observations, discussions with accessed main contractors and international research findings.

From the discussion and preliminary observation main contractors are subletting majority of their work to subcontractors in Ethiopia. Researches conducted in the international level on the other hand revealed the relationship between the main contractors and their subcontractors affected by different factors such as delay in payment to the subcontractor, Lack of skilled labor and Lack of construction work quality (Al-Hazmi, 1987). Loss of life and properties due to lack of safety, interference to resolve schedule conflicts and delays in execution of scheduled construction activities (Al-Hammad, 1993). Amount of money retained during payment, unclear details in the drawing, incomplete contract and design change are other sources of conflict which affect the relationship between the two parties (Hinze and Tracy, 1994). Poor communication, lack of information on site, poor supervision(Othman, 2007).

In addition to these the duties and responsibilities of main contractors and their subcontractors are subjected to misunderstanding, so the construction field has witnessed several problems and conflict between them. Also, there are no specific criteria for selecting the subcontractors by the main contractors (Moore et al, 1992). More over no standard condition of contract prepared for sub contracting regime in Ethiopia.

1.3 Objective of the study

1.3.1 General objective

The major objective of this research is to assess the relationship between main contractors and sub contractors and its impact on building construction projects performance in Addis Ababa.

1.3.2 Specific objectives

1. To identify the most common factors used by main contractors in the selection of suitable subcontractors in Addis Ababa.
2. To identify the common factors that cause conflicts and interface problems between the contractors and their subcontractors.
3. To assess the contractual relationship between main contractors and subcontractors.
4. To identify the factors which affect project performance especially on quality, cost and time performance related with main contractor-subcontractor relationship.
5. To recommend possible solutions to improve the contractor-subcontractor relationship with respect to selection of subcontractors, solving interface problems and contracts for successful project performance.

1.4 Significance of the study

The major significances of this research are:

- Helps to initiate Ministry of Construction to prepare legal framework for the contractual relationship between main contractors and subcontractors.
- Helps To create healthy contractual relationship and protect both main contractors and sub contractors not to invest unnecessary costs due to interface problems.
- Will have significant contribution in helping the project owners to complete their projects within scheduled period of time, reasonable cost and required quality.
- It will help future researchers as a reference as little or no research has been done in this regard.

1.5 Scope of the study

The scope of this research is limited to the followings:

- The study included contractors and their subcontractors only working on public building projects in Addis Ababa.
- Only currently working contractors of the 1st, 2nd and 3rd class categories and their subcontractors participated in this research.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

In the construction industry there are different parties which have their own responsibilities such as government, developers, consultants, architects, contractors, subcontractors, suppliers, etc. Subcontractors, who are hired to perform specific tasks on a project play a vital role in the industry (Moore et al, 1992).

General contractors may be able to complete specialty tasks on their own, but this may result in more risks and costlier fees. Subcontractors perform specialized duties, which enable them to cut costs and possess a higher level of efficiency (Tayeh, 2009). However in the construction industry the adversarial tendencies always show up in the construction stages where the main contractor and sub-contractor feature prominently. The main contractor and sub-contractor relationship needs to be maintained throughout procurement, contract and construction to enable strong interface within the project team, which signifies a positive move away from the traditional adverse relationship (Okunlola, 2015). According to Hinze and Tracy (1994) Contracting problems will appear in the execution stage.

2.2 Contract

A contract is an agreement whereby two or more persons as between themselves create, vary or extinguish obligations of a proprietary nature. (GoE, 1960)

Construction contract is a term found in the housing grants, construction and regeneration. It is defined in as an agreement for carrying out, arranging for the carrying out, or providing labour for carrying out construction operations. It is expressly stated to include agreements for architectural design or surveying work or for providing advice on building, engineering, interior or exterior decoration or the laying out of landscape. (Chappell et al, 2001).

2.3 Subcontracting

Various definitions of the concept of subcontracting are used;

According to Concise Oxford Dictionary (2008), it is a contract to do work for another company as part of a larger project. According to Encarta Dictionary (2004) it is a

secondary contract in which the person or company originally hired in turn hires somebody else to do all or part of the work.

Ethiopian civil code Art.3201(2) also defines subcontract as a contract whereby the party having contracted with the administrative authorities substitutes a third party for himself for the performance by the latter of a part only or of an item of the contract (GoE, 1960).

Generally Subcontracting is a business strategy that is used by main contractors to deal with uncertainties in the construction market and to transfer risks, such as financial risks, completion risks and responsibility for employees. It reduces direct costs and overheads, and allows main contractors to use more competitive local firms with their lower overhead costs and better knowledge of the local market conditions, practices and procedures (WorldBank, 2009) .

Subcontracting further facilitates the production of quality work through the use of specialist subcontractors with the necessary knowledge and skills in specialized trades. Overall, subcontracting allows the main contractor to reduce operating costs and thereby enhance competitiveness.

Subcontractors could be different types. Mbachu (2008) categorized from a contractual point of view as follows:

- Domestic subcontractors - those hired by the contractor to perform specific tasks;
- Selected subcontractors - subcontractors solicited from a recommended list of potential subcontractors in the tender documents; and
- Nominated subcontractors - nominated by the client or client's agent to undertake specified aspects of the main contract. Nomination is the practice by which an employer, through the contract administrator, selects persons who then enter into sub-contracts with the main contractor (Murdoch & Hughes, 2000).

2.3.1 Needs for Subcontracting

The followings may serve as the ground or reasons for subcontracting

- The need to subcontract portions of the works to increase the contracting capacity of the Main Contractor. This is true in case of domestic subcontract. It has the effect of reducing the work load of the Main Contractor.

- It is not possible for companies to own, operate, control, and maintain specialized plants and equipment as these generally receive limited usage on a typical project. (John, 1991) .This is true in case of nominated subcontract.
- The average prime contractor is not able to afford the cost of the full-time employment of skilled workers in each of the several specialized trades needed to complete construction projects. (John, 1991)
- The need to satisfy the Employers requirements or expectations relating to the engagement of small & micro enterprises or local enterprises in a contract. This issue is related to the issue of the broader concept of local capacity building.

2.3.2 Subcontractors Selection Process

The main objectives of the contractor selection process are to reduce project risk, maximize the quality and maintain strong relationships between project parties. The same concept is applied to the sub-contractor selection process. Selection of the best sub-contractor is a vital process in construction projects (Marzouk et al, 2013).

Several approaches exist for subcontractor selection in the construction industry, studies on the subject reported that one main factor to consider in the selection of the subcontractor is based on lowest tender (Hartmann et al, 2009).

Further studies added that performance of relevant previous projects, financial capacity, completion of job within time, prompt payment to labour, quality of production, standard of workmanship, quality of materials used, compliance with site safety requirements, compliance with contract and collaboration with other subcontractors are also principal factors to be considered in the selection of subcontractors (Mbachu, 2008).

Shash (1998) identified as the most important characteristics were the firm's experience in the field of work, the current work load of the subcontractor, number of labors, the financial capacity, types and modernization of equipment and advised the general contractors to concentrate on attracting qualified and professional subcontractors who will produce quality work, which will ultimately have a significant impact on improving the contractors' business reputation. Subcontractors advised to seek as much information as needed to produce quotations with reasonable and acceptable accuracy and to

concentrate on improving characteristics that are of interest to general contractors and will increase the chances of being awarded the sublet work (Shash, 1998).

On the other hand other factors like right experience, including volume of work and average job size, subcontractor's supervisory structure, business Management history, history of litigation, activity processes, safety record, and reputation identified by Beck (2013) as a reference to select subcontractors

Turskis (2008) underlines using criteria like history of reasonable bid price submissions, a work history that indicates specialization and quality of workmanship in a particular construction skill, degree of quality control, decorum, conduct and non-disruptiveness of contractor staff and subcontractors, coordination of operations that will cause noise, vibrations, dust, odors, safety concerns and other activities, responsiveness to warranty issues, flexibility and cooperation when resolving delays and ability to meet project schedule leads to the right selection of the best alternative, which has many benefits for all parties in the construction project; such as high quality finishing, meeting deadlines based on the estimated time, as well as abiding by the estimated cost. (Turskis, 2008).

Flexibility and cooperation when resolving delays, Reputation, delay, failure to comply with the quality specifications, quality, Suppliers incompetency to deliver materials on time, failure to complete contract, Physical resources, tender price, contractor's difficulty in reimbursement, Flexibility in critical activities, and Safety consciousness on the job site are identified by another researcher as they are important criteria to select suitable subcontractor (Marzouk et al, 2013).

Although many researchers and industry practitioners have been proposing different methods and procedures for contractor selection, It was observed that most of them have shortcomings in drawing a clear link between the selection criteria and the project success leading to a win-win situation for all parties. (Doloi et al, 2011).

2.3.3 Problems Arising During Subcontractor Management

One of the major issues and obstacles for subcontractor management is organizing and coordinating various trades. Since subcontractors usually do not interact with one another for an extended period of time, there is little opportunity to develop relationships or trust; however, a project requires that subcontractors work together (Levitt and Samelson, 1993).

A current problem that exists when managing subcontractors is that, often, each party involved is only interested in their own well-being. Rather than focusing on the overall goal of the project, each subcontractor desires the most profitable approach, regardless of the adverse effects it may have on others (Thomas, 2005)

Not all subcontractors have the same perception of the main contractor-subcontractor relationship. In some instances the relationship borders on being a partnership or team arrangement while for others the relationship is more adversarial in nature with a greater amount of distrust and lack of communication. Many subcontracts are awarded without any formal discussion taking place between the main contractor and the subcontractor. This may increase the probability of a conflict after construction work has begun (Hinze and Tracy, 1994). A construction project involves so many parties, such as owners, designers, construction main contractors, subcontractors, maintenance contractors, and material suppliers, that some interface problems can arise, for example, the lack of cooperation, limited trust, and ineffective communication leading to an adversarial relationship among all these project stakeholders. This kind of relationship induces project delays, difficulty in resolving claims, cost overruns, litigations, and compromise project quality (Moore et al, 1992).

2.3.4 Contractor-Subcontractor Interface Problems

Interface problems between main contractors and subcontractors will be developed due to various factors as described below:

❖ Delay of Payment

Timeliness of payments affects many subcontractors, for whom receiving delayed payments from their main contractors is a cause of friction between the two parties. (Arditi and Chotibhongs, 2005). A delayed payment has been cited as the most significant shortcoming in the subcontracting relationship (Abdullahi, 2014). The main contractor may face financial problems that could be due to non-performing cost estimate, poor management, delay of payment by owner (Al-Hammad, 1993). In such a case a conflict will develop between the two parties (Al-Hazmi, 1987). Payment problems often bother subcontractors. Final payments are often delayed considerably, often approaching or exceeding one year after project completion. Such practices of

general contractors permit them to finance their operations to a significant degree with the funds earned by but not returned to the subcontractors. (Hinze and Tracy, 1994).

❖ **Lack of Construction Work Quality**

If any one of the two parties performs substandard work in this part of the construction work, he may affect the work standard of the other party and thus create an interface problem between them. The more experienced the contractor, the fewer mistakes he may commit in the construction work. If either the contractor or any of his subcontractors makes a mistake in the execution of his construction work, it may affect the work of the other. Consequently, it will create problems between the two (Al-Hazmi, 1987).

❖ **Delay from the time schedule**

Once the construction project is awarded, its time duration is identified. The awarded contractor will schedule his construction activities and that of his subcontractor(s) to meet the identified project duration. If any party delays the execution of his scheduled construction activities, it will consequently delay the progress of the activities of the other party (Al-Hammad, 1993). For example delay in approving finished work, delay in approving shop drawings and sampled materials may cause confusion on site (Othman, 2007).

❖ **Lack of Proper Communication**

Proper communication between the contractor and his subcontractors is very important and crucial to the success of the project completion(Tayeh, 2009). The construction industry is characterized by inaccurate and untimely communication that often results in costly delays to the progress of the project (Mutesi, 2007). Inefficient communication, leading to an adversarial relationship among project stakeholders (Okunlola, 2015).

Interface problems between main contractor and subcontractor may develop due to poorly communicated information. Poorly communicated information exists when instructions or requirements from the clients are not explicitly transmitted to or shared with the subcontractor. These may be in the form of project objectives, milestones and urgency of the project. Sometimes information is communicated in the dying moments of its schedule. Poorly communicated information by the contractor to the subcontractor may lead to incorrect pricing. Pressure is regularly applied by the contractor on subcontractor to reduce

prices and at the same time essential information is held back, making it almost impossible to allow for proper pricing and working (Othman, 2007).

❖ **Scheduling Conflicts**

It is possible that during the project time schedule, there will be scheduling conflicts between the contractor and his subcontractor due to poor scheduling of construction activities interface. Also, the schedule conflicts can arise among the subcontractors. In this case, the contractor will interfere to resolve the conflict and this may cause problem between the two parties (Al-Hammad, 1993).

❖ **Shortage of Construction Materials**

Material shortage, affect productivity which leads main contractors and subcontractors to interface problems (Enshassi and Medoukh , 2007).

❖ **Shortage of Skilled Labour**

labour is a fundamental resource needed to complete the construction project. To complete the work professionally and in a good quality, one requires skilled labour. Shortage of this important resource will affect the quality of the finished work which might not be acceptable to the owner and thus create a conflict problem between the contractor and his subcontractor. Lack of labor experience affects productivity which leads to interface problem between main contractor and subcontractor. (Al-Hazmi, 1987).

❖ **Interruptions and Termination of Work**

If the subcontractor performs substandard construction work or violates the contract agreement between him and the contractor. The contractor may interrupt or terminate his subcontractor's work. If the subcontractor does not agree with the action of the contractor he may sue the contractor in court. Consequently, a lengthy litigation will develop and create a conflict between the two parties. (Al-Hammad, 1992).

❖ **Contractual Issues**

Contracting problems appearing in the contract execution, like “unclear details in the drawing”, “incomplete contract”, “design change”, and so on. These problems usually occur when the involved parties make or execute contracts. Many subcontracts are awarded without any formal discussion taking place between the contractor and the subcontractor. This may increase the probability of a conflict after construction work has begun. (Hinze and Tracy, 1994).

❖ **Lack of Safety**

If either the contractor or his subcontractor is not implementing safety regulations and standards on the work site, it is possible that there will be an injury or a loss of life for anyone of the laborers. The responsibility about this will not be clear (Al-Hammad, 1993).

Injury rate Increases among subcontractors and their workers on large and complex projects, particularly those which require a large number of subcontractors. (Enshassi et al, 2008)

2.4 Construction project Performance

Traditionally, a construction project is considered successful when it is completed on time, within budget, and of acceptable quality regardless of the complexity, size, and the environment within which it is constructed (Chan et al, 2002) and (Othman et al, 2006). However, construction performance is subject to many variables and unpredictable factors. The performance of parties, resource availability, environmental conditions, and contractual relations contribute to construction performance.

CHAPTER 3. RESEARCH METHODS AND PROCEDURES

3.1 Introduction

This chapter discusses the methodology used in this research. The methodology includes the research design, sources of data, population of the research, sample size, data collection instruments, data collection procedures and the method of data processing and analysis.

3.2 Research Design

The choice of a research approach is determined by many variables such as the nature of the study, the objectives that the study seeks to achieve, resource availability and time constraints.(John et al, 2007).

The types of research employed under this study were descriptive and qualitative research. The major purpose of descriptive research is description of the state of affairs as it exists at present. Then this study describes and critically assesses the factors used by main contractors to select suitable subcontractors, factors which cause interface problems between main contractors and sub contractors which could come from different perspective and the impact of the relationship between main contractors and subcontractors on project performance specifically emphasized on negative effects on the traditional project performance measurement criteria called time, cost and quality more over contractual relationship between main contractor and sub contractor described. Second, the study employs qualitative approach in that the difference in opinion between main contractors and subcontractors on the dependent variables is tested using t-test and respective decision was made.

In this research, the questionnaire approach was used to collect the factual, perceptive and attitudes of the respondents. The followings are the reasons to choose questioner approach:

- ❖ The questionnaire approach helps the researcher to obtain both, qualitative data which is related to the perspectives and attitudes of the respondents in addition to the quantitative data which present the facts and actual cases in the works.
- ❖ The critical importance of the questionnaire approach in the development and collection of all necessary data for the practical and researching benefits for

quantitative and qualitative methods is recommended by many researchers (Fellows and Liu, 2015)

- ❖ Using the questionnaire approach is considered an easy, rapid and efficient approach to collect the data, facts and attitudes of the contractors and subcontractors.

3.3 Sources of Data and Information

The samples were drawn from Contractors of Class 1, 2 and 3 contractors currently working in Addis Ababa and their subcontractors. The study used questionnaire as best instrument. The respondents in the study were both men and women, who represent contracting and subcontracting firms.

3.4 Questionnaire Design

Two types of questions (Likert scale questions and multiple choice questions) included in the questionnaire. In the Likert scale questions respondents asked to give their perceptions from a scale of 1 to 5 points. 1 indicates not important to 5 indicates very important. The variety in these questions aims first to meet the research objectives, and to collect all the necessary data that can support the discussion, results and recommendations in the research. The questionnaire aims to study the relationship between the main contractor and their subcontractors and to identify its impact on project performance. The questionnaire comprised of six sections to accomplish the aim of the research.

The literature in the study was used as a guideline for the development of the questions in the questionnaire. Besides, questions in the questionnaire were adopted from previous researchers (Al-Hammad, 1993), (Okunlola, 2015) and (Tayeh, 2009). For each section, all related factors found in the literature and previous studies were collected and reviewed. Detail description of the questioner contents is illustrated as follows:

Part One: contains general information about the population (contractors and their subcontractors).

Part Two: is about factors used by main contractors for selection of suitable subcontractors. To identify and rank the most common factors used by main contractors in the selection of suitable subcontractors in Ethiopia, and to propose recommendations to improve the selection of suitable subcontractors.

Part Three: is about factors leading the contractor- subcontractor interface problems. To highlight the common factors that cause conflicts and interface problems between the contractors and subcontractor and to identify the most common problems and their relative importance, and to propose recommendations for solving these problems.

Part Four: is about the impact of relationship between the main contractor and the subcontractor on project performance especially on the most important methods of project performance measurement criteria (time, cost and quality).

Part Five: is about contractual relationship between the main contractor and the subcontractor. To investigate the contractor-subcontractor relationship with respect to legal contracts and to propose recommendations to improve contractual relationship.

3.5 Research Population

This research targeted two populations. The first population is Ethiopian class 1, 2 and 3 contractors that have valid registration and working in Addis Ababa on building projects. These categories considered in this study as the aim of this research is to assess the relationship between the main contractors and their subcontractors and its impact on project performance in Ethiopia. The small categories below 3 neglected due to the low practical and administrative experience of their companies in construction works and the low experience of their subcontractors seen during preliminary observation. The main contractors were drawn from the list of registered contractors from Hamlie 01/2007 to Miazia 03/2008 E.C obtained from ministry of construction, construction industry development and regulatory bureau the size of population for the 1st, 2nd, 3rd, General Contractors (GCs) and Building Contractors (BCs) categories in Addis Ababa is 281 (MUDHo, 2008).

The second populations are subcontractors in the various types of work fields like (plastering, tiling, painting, sanitary, electrical, concrete, masonry, carpentry and metalwork). Unfortunately, there are no official reports or organized documents showing the exact number of subcontractors in Ethiopia. However, from preliminary discussion with main contractors from class1, 2 and 3 about the number of their subcontractors, on the average 4 subcontractor firms participate with each main contractor and their total number estimated to be 1124.

3.6 Sample Size

The correct sample size in a study is dependent on the nature of the population and the purpose of the study (Dawson, 2009). Although there are no general rules, the sample size usually depends on the population to be sampled. In this study to select sample size the population specified in the research population section is used.

There are several approaches to determine the sample size. These include using a census for small populations, imitating a sample size of similar studies, using published tables, and applying formulas to calculate a sample size (Tayeh, 2009).

To determine the sample size for each population of main contractors and subcontractors, in this research Kish equation is used.

$$n = \frac{n'}{1 + \frac{n'}{N}} \quad (\text{Kish, 1965})$$

Where:

n' is the sample size from infinite population, which can be calculated from this formula

$[n' = S^2/V^2]$. The definitions of all variable can be defined as the following:

n : sample size from finite population.

N : Total population (281 main contractors and 1124 subcontractors)

V : Standard error of sample population equal 0.05 for the confidence level 95%,

$t = 1.96$.

S^2 : Standard error variance of population elements, $S^2 = P(1-P)$; maximum at $P = 0.5$

The sample size for main contractors' and subcontractors' population can be calculated from the previous equations as follows:

$$n' = S^2/V^2 = (0.5)^2/(0.05)^2 = 100$$

$$n(\text{Main contractors}) = \frac{100}{1 + 100/281} = 74$$

$$n(\text{subcontractors}) = \frac{100}{1 + 100/1124} = 92$$

To overcome the risk of not responding from the respondents and to reflect higher reliability and benefits for the study 10% sample size added from the calculated value as shown in table 3.1 below.

Table 3.1 Sample size and response rate of the populations

S.N	Population Category	Total Population	Calculated sample size	Distributed Questionnaire with 10% contingency	Correctly filled and returned questioners	Response Rate
1	Main contractors	281	74	81	69	85.19%
2	Subcontractors	1124	92	101	83	82.18%

3.7 Data Processing and Analysis

3.8.1 Data processing

The collected raw data was edited to detect errors and omissions in responses and checked that the questions are answered accurately and uniformly. The collected raw data was then coded and entered into computer software. SPSS and Excel software were used. Appropriate graphical representations like pie charts and bar graphs were used to summarize the raw data and displayed in the form of tabulation for further analysis.

3.8.2 Data Analysis

This is the further transformation of the processed data to look for patterns and relationship between and/or among data groups by using descriptive and inferential (statistical) analysis. SPSS version 20 was used to analyze the data collected through questionnaire from main contractors and sub contractors. Specifically, descriptive statistics (RII, frequencies, percentiles and pie charts) were used in the analysis accordingly based on the distribution of the data. More over in order to check whether there is a significant difference in the opinion between the two groups (main contractors and subcontractors) inferential statistics (independent samples t-test) was conducted.

3.9 Validity and Reliability test

content validity is made before administering the final phase. This was done in two ways primarily questionnaires were shown for senior academic colleagues and professional experts in the field then tested by sample respondents selected from the construction industry to make their objective relevant and suitable to the problem as guided by the

advisor. There were minor comments, which were mainly related to some contextual interpretations of few questions and almost all of the respondents' feedback was positive and their contributions brought some significant improvement. Issues raised by respondents were corrected and questionnaires were refined. Finally, the improved version of the questionnaires were printed, duplicated and dispatched.

Reliability indicates the degree of consistency data collection techniques or analysis procedures yield consistent findings (Creswell, 2009). Questionnaires reliability of this study was checked and its coefficient was calculated using Cronbach's alpha (α) test. The cronbach's alpha value for group of respondents calculated using SPSS version20 and the values were 0.72, 0.704 and 0.735 for factors used by main contractors for selection of suitable Subcontractors, causes of the contractor- subcontractor interface problems and impacts of the relationship between contractors and their subcontractors on project performance (Time, cost and quality) respectively as shown in table 3.2 which indicates an acceptable measure of questionnaire reliability by all respondents because the ideal cronbach alpha coefficient of a scale is accepted if it is above 0.7 (Pallant, 2001).

Table 3.2 Reliability Statistics

No	Tasted items	No. of Items	Cronbach's Alpha
1	Factors used by main contractors for selection of suitable	24	0.720
2	Causes of the contractor- subcontractor interface problems	48	0.704
3	Impacts of the relationship between contractors and their subcontractors on project performance (Time, cost and quality)	18	0.735

3.10 Ethical Consideration

All participants who participated in this study were appropriately informed about the purpose of the research and their willingness and consent were secured before the commencement of distributing questionnaire. Regarding the right to privacy of the respondents, the study maintained the confidentiality of the identity of each participant. In all cases, names kept confidential thus collective names like 'respondents' were used.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

This chapter introduces the survey results and the discussion of the questionnaires parts for the contractors and subcontractors. In part one main contractors' and subcontractors' profile and all necessary information about the respondents presented. Part two in the questionnaire was designed to achieve the first and fifth objectives that intend to identify and rank the most common factors used by general contractors in the selection of suitable subcontractors in Addis Ababa, and to propose recommendations to improve the selection of suitable subcontractors. Part three in the questionnaire was designed to achieve the second and fifth objectives that intended to highlight the common factors that cause conflicts and interface problems between the contractors and subcontractor, and to identify the most common problems and to propose recommendations for solving these problems. Part four in the questionnaire was designed to achieve the fourth objective that intended to identify the impact of relationship between contractors and sub contractors on project performance specifically on time, cost and quality of projects.

Part five was designed to achieve the third and fifth objective that intended to investigate the contractual relationship between contractors and subcontractors and to propose recommendations to improve contractual relationship.

Eighty one and one hundred one questionnaires were distributed to contractors and sub contractors respectively across the construction sites in Addis Ababa, out of which 69 from contractors and 83 from sub-contractors were completed and retrieved successfully, representing a response rate of 85.19% and 82.18% respectively.

Generally, this section is organized in the following manner: First, the general information about main contractors and sub contractors were presented and analyzed. Second, data collected through questionnaires were analyzed and ranked in their level of importance. Moreover, one of the statistical techniques, independent samples t- test is conducted to compare the responses of the research questions by main contractors and subcontractors.

4.2 General characteristics of main contractors and subcontractors

4.2.1 General Information about the Main Contractors

This section includes five (5) questions about the nature of the Company; Name (Optional), class of the Company, Years of Experience of the company, Position of the person filling the questionnaire and Years of Experience of the respondent.

4.2.1.1 Classification of contractors

As shown in figure 4.1 below from the companies sample 50.72% (35) are first class, 15.94% (11) second class and 33.33% (23) are third class.

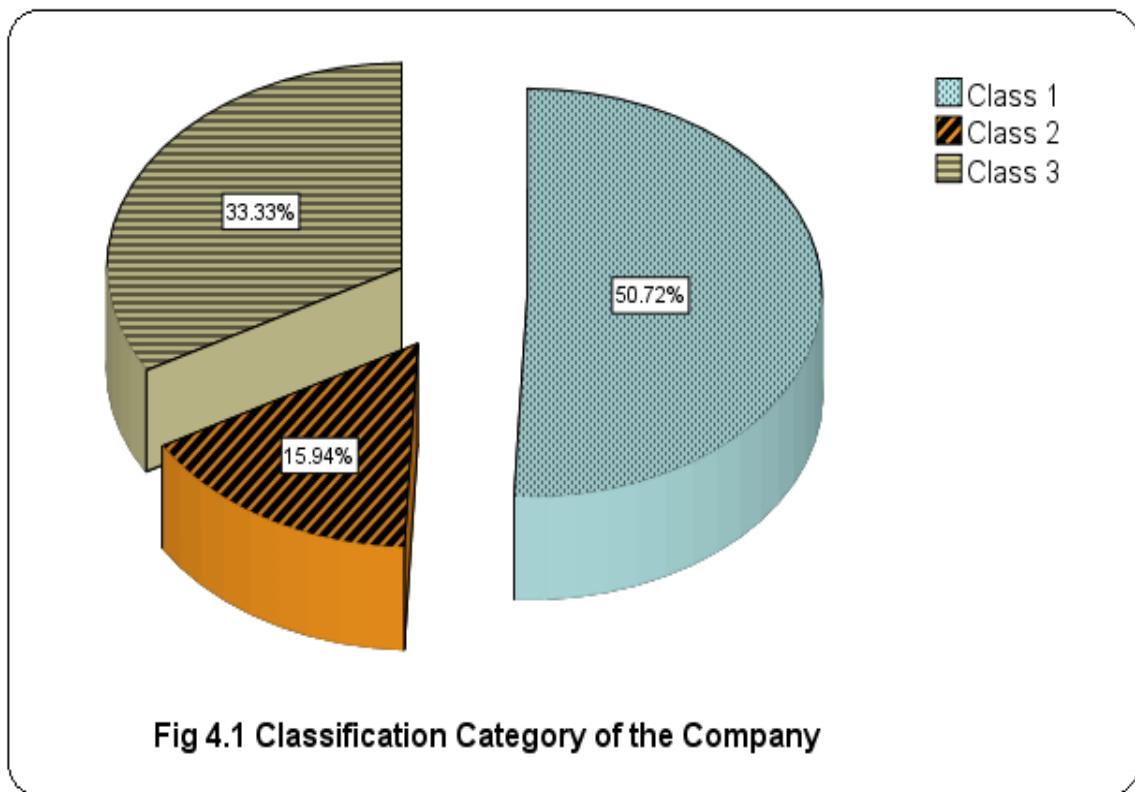
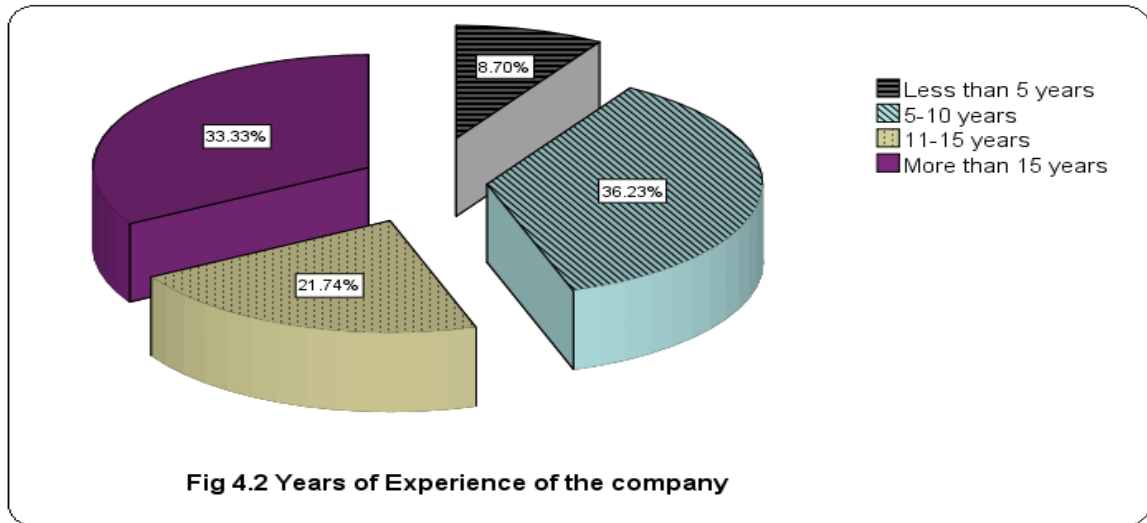


Fig 4.1 Classification Category of the Company

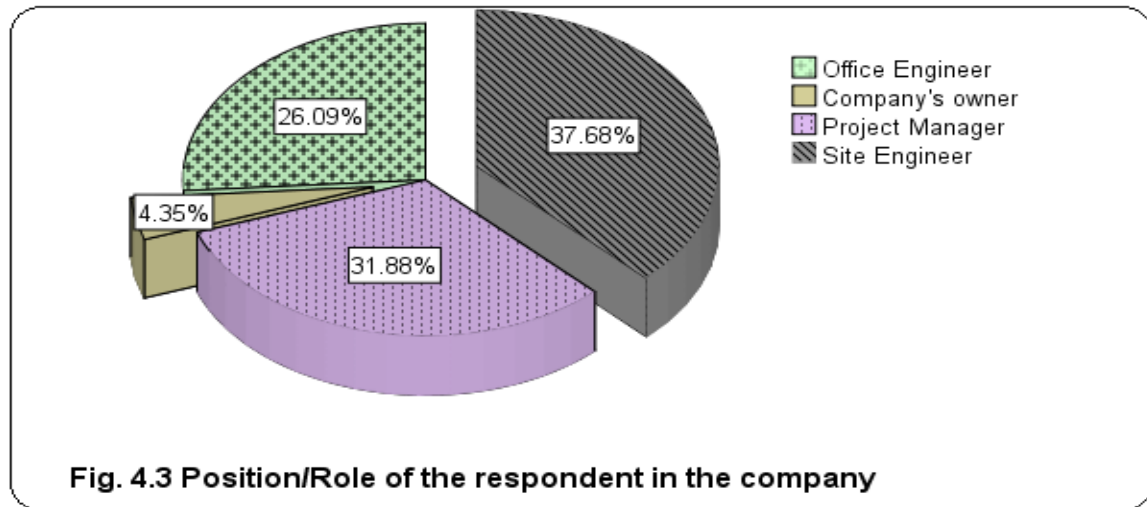
4.2.1.2 Years of Experience of the companies

In figure 4.2 It is shown that 8.7% (6) from the sample have experience less than 5 Years, 36.23% (25) from the sample have experience between 5-10 years, 21.74% (15) from the sample have experience between 11-15 years and 33.33% (23) from the sample have experience more than 15 years.



4.2.1.3 Position/role of the person filling the questionnaire in the company

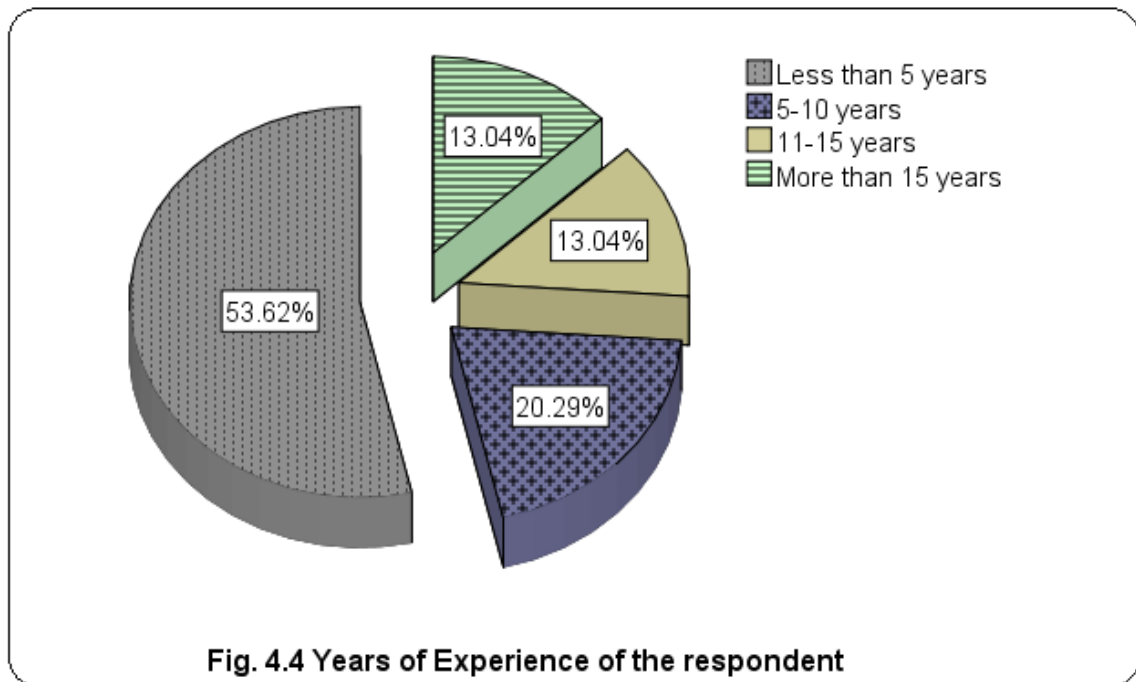
Percentage of respondents based on the position of the person filling the questionnaire is 31.8% (22) from the sample Project manager , 26.09% (18) from the sample Office engineer, 37.68% (26) from the sample "Site engineer" , and 4.35% (3) from the sample Company's owner.(see fig4.3)



4.2.1.4 Years of Experience of the respondent

As shown in fig 4.4 the number and percentage of respondents according to the years of experience of the persons filling the questionnaire is that 53.62% (37) from the sample has experience less than 5 years, and 20.29% (14) from the sample has experience

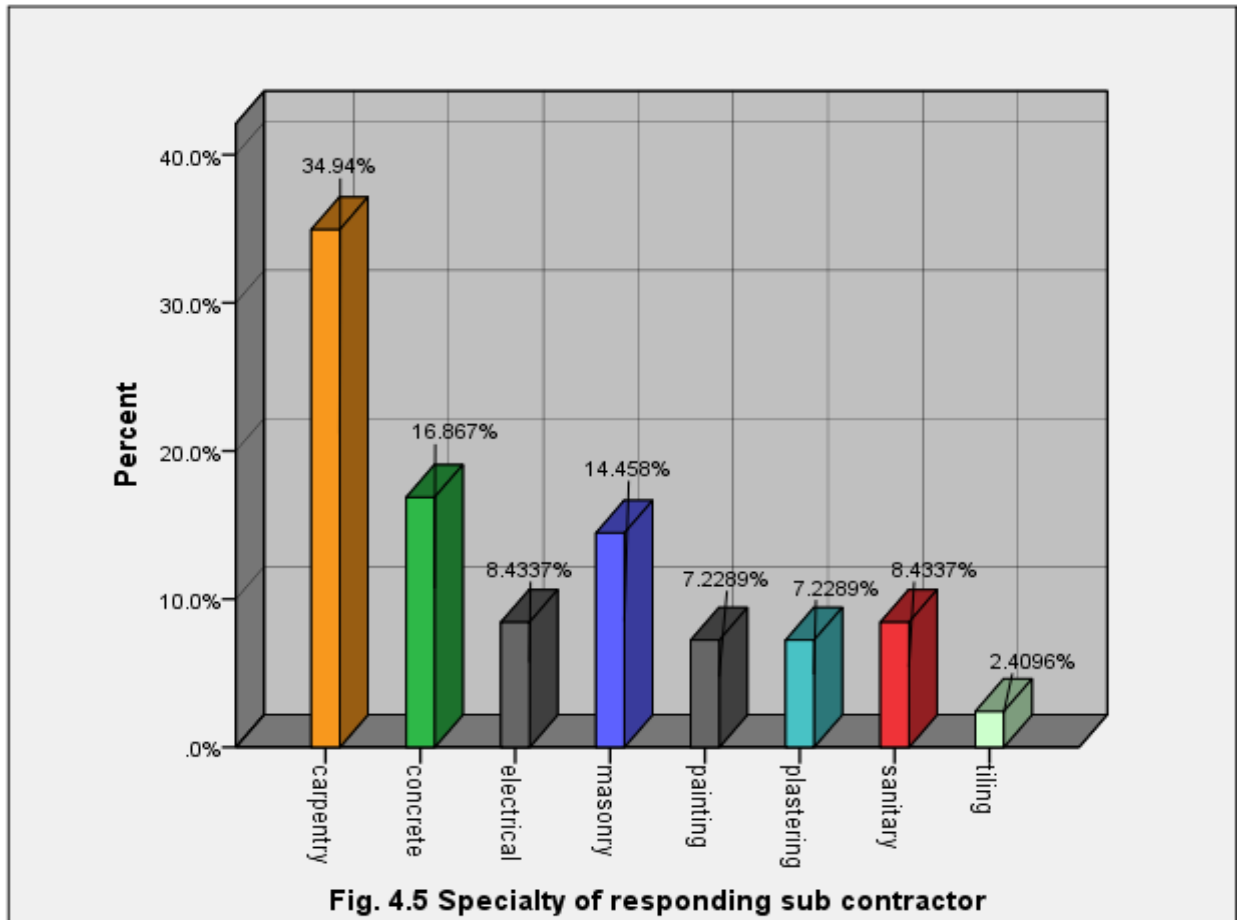
between 5-10 years, 13.04% (9) from the sample has Experience between 11-15 years, and 13.04% (9) from the sample has experience more than 15 years.



4.2.2 General Information about the subcontractors

4.2.2.1 Specialty of Subcontractor

From the sample, based on specialty of subcontractor the number and percentage of subcontractors respondents is 34.94% (29) Carpentry work subcontractors 16.87% (14) Concrete work subcontractors 7.23% (6) Plastering work subcontractors, 2.41% (2) Tiling work subcontractors, 7.23% (6) Painting work subcontractors , 14.46% (12) Masonry work subcontractors 8.43% (7) Electrical work subcontractors, 8.43% (7) Sanitary work subcontractors (see fig4.5)



4.2.2.2 Years of experience of the subcontractor

Figure 4.6 shows the number and percentage of subcontractors respondents according to their experience. It is shown that 15.66% (13) from the responding subcontractors has experience less than 5 years 53.01% (44) from the responding subcontractors has experience between 5-10 years, and 24.10%(20) from the responding subcontractors has experience between 11-15 years, and 7.23%(6) from the responding subcontractors has experience more than 15 years.

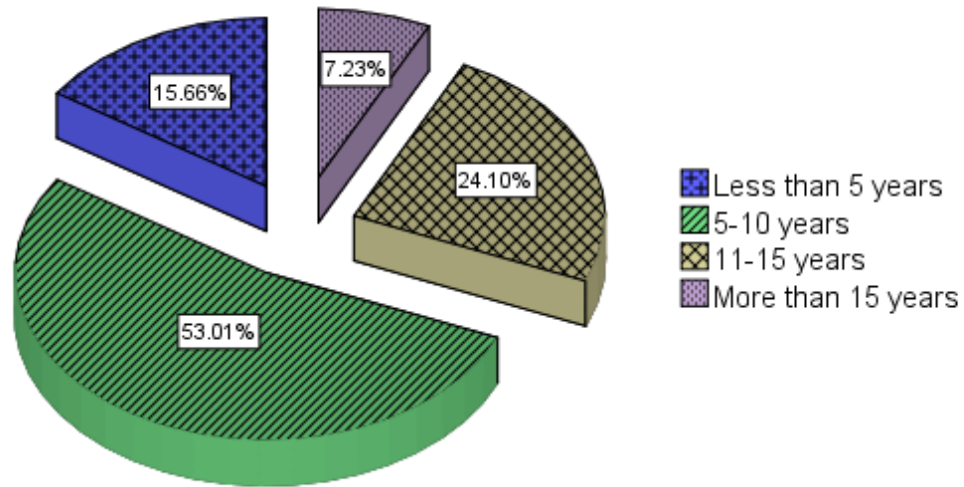


Fig 4.6 Years of Experience of the Sub contractor

4.2.2.3 Staff of the Sub contractor

From the responding subcontractors 15.66% (13) have staff less than 5 persons, 51.81%(43) have staff between 5-10 persons, 21.69% (18) have staff between 11-15 persons, and 10.84% (9) have staff more than 15 persons.

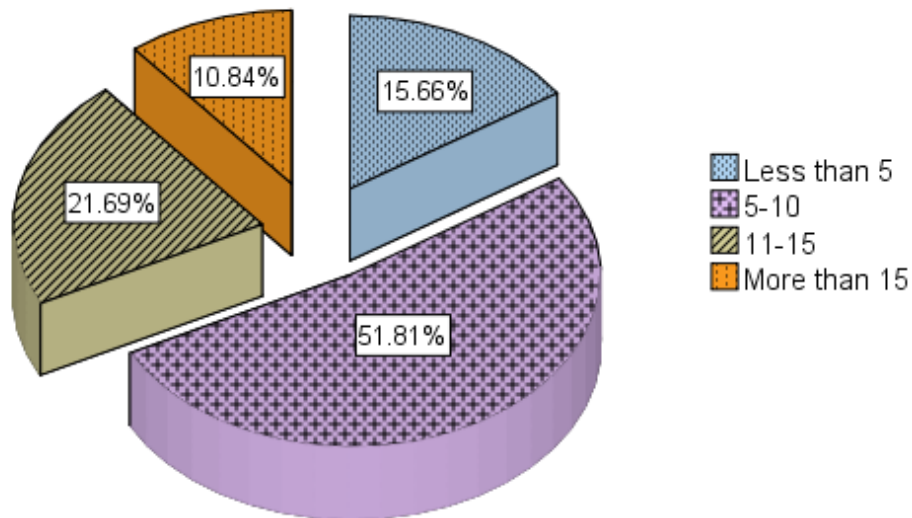


Fig 4.7 Staff of the Sub contractor

4.3 Factors used by main contractors for selection of suitable Subcontractors

Respondents were asked different questions regarding the factors used by main contractors for selection of suitable Subcontractors. Their responses are organized based on RII as shown in table 4.1.

Table 4.1: Ranking and RII of factors used by main contractors for selection of subcontractors

	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Quality performance in previous projects	0.890	1	0.855	3	0.871	1
2	Experience in similar projects	0.861	4	0.858	2	0.859	2
3	Regular and effective communication with main contractor	0.872	3	0.819	6	0.843	3
4	Efficient resource management and waste minimization	0.846	7	0.822	5	0.833	4
5	Financial capacity	0.829	10	0.831	4	0.830	5
6	Commitment to do remedial works (correcting defects)	0.849	5	0.812	8	0.829	6
7	Competitiveness of the tender price	0.841	8	0.814	7	0.826	7
8	Owner's acceptance of the subcontractor	0.771	15	0.872	1	0.826	7
9	Possession of qualified, skilled and strong workmanship	0.875	2	0.754	10	0.809	9
10	Leadership qualities and ability to manage own workmanship	0.849	5	0.745	12	0.792	10
11	Current workload and commitment	0.832	9	0.730	14	0.776	11
12	Regular payments for his employees	0.733	18	0.805	9	0.772	12
13	Reference from previous employers	0.786	12	0.749	11	0.766	13
14	Efficient programming of subcontract work and proper fit with main contractor's master work program	0.786	12	0.742	13	0.762	14
15	Evidence of adequate resources/ materials, equipment and machinery	0.780	14	0.725	15	0.750	15
16	Ability to work efficiently with other subcontractors	0.762	16	0.723	17	0.741	16
17	History of contract completion	0.751	17	0.704	18	0.725	17
18	Existence of proper organizational structure	0.725	19	0.725	15	0.725	17

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	Factors	Main Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
20	Commitment to the provided prices after awarding	0.699	20	0.675	20	0.686	20
21	Care to works done by others subcontractors	0.699	20	0.641	22	0.667	21
22	Health and safety records	0.559	23	0.694	19	0.633	22
23	Site proximity (living distance from the site)	0.586	22	0.593	23	0.589	23
24	Not partnering the works to another subcontractor	0.528	24	0.549	24	0.539	24
Total factors Average		0.771		0.745		0.757	

The results of the survey of the factors used by main contractors for selection of suitable subcontractors are tabulated in table 4.1 according to relative importance index. As revealed in the table, quality performance in previous projects was rated in first position by main contractors. The sub-contractors saw this factor as the third most important factor for selection of suitable subcontractors; both groups however rated this factor as the most important factor used by main contractor for selection of suitable subcontractors. The respondents in this research agree with the research conducted by (Marzouk et al, 2013) and identified as the third important factor by (Tayeh, 2009).

Experience in similar projects was rated by main contractors respondents as the fourth position but this factor was rated second by subcontractors and both groups rated this factor as second position. This result also agrees with the results obtained by (polat & Atilla, 2014). Regular and effective communication with main contractor was rated in third position by the main contractors and sixth position by sub-contractors and third most important criteria for selection of subcontractors by both groups. Efficient resource management and waste minimization was rated in seventh position by main contractors and fifth position by subcontractors. Both groups rated this factor in the fourth position. But it was rated as an intermediate factor for selection of subcontractors (polat & Atilla, 2014). It is also agreed by both groups as financial capacity of the sub contractors is the fifth important factor for selection of subcontractors.

As it is observed in the RII table commitment to do remedial works, competitiveness of the

tender price, owner's acceptance of the subcontractor, possession of qualified, skilled and strong workmanship, leadership qualities and ability to manage own workmanship, current workload and commitment, regular payments for his employees, reference from previous employers, Efficient programming of subcontract work and proper fit with main contractor's master work program, evidence of adequate resources/ materials, equipment and machinery are rated as intermediate factors used by main contractors for selection of suitable subcontractors in this study. Other criteria like ability to work efficiently with other subcontractors, history of contract completion, existence of proper organizational structure, specialty in certain type of work, commitment to the provided prices after awarding, care to works done by others subcontractors, health and safety records, site proximity and not partnering the works to another subcontractor are identified as less important factors by both groups.

Independent Samples t-test

Independent Samples *t* test is a parametric test compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different. (Pallant, 2001).

To interpret the *t*-table if sig. value greater than 0.05 we use the first line of the *t*-test table which refers equal variances assumed but if it is less than or equal to 0.05 the second line will be used which refers equal variances not assumed. Based on this the sig. 2-tailed value indicates the existence or not existence of significant difference between the mean scores such that if the value greater than 0.05 there is no significant difference, if the value less than or equal to 0.05 there is significant difference between the mean score of the two groups (Pallant, 2001). The aim of this aspect of the study is to test the difference in viewpoints (opinion) between main contractors and subcontractors. Based on this the *t*-test result of this research is interpreted next to RII analysis in each section.

The table of group statistics SPSS output for the factors used by main contractors to select suitable subcontractors shown in appendix B table 1 indicates as there is no missed respondent because the numbers of main contractors and subcontractors who correctly filled and returned the questioner were 69 and 83 respectively for each factor these numbers exactly displayed on the output. The mean response of respondents of the two groups (main contractors and subcontractors) of each factor compared and the SPSS output shown in Appendix B table 1 and 2

is summarized and the respective decision is tabulated below in table 4.2

Table 4.2 Comparison of mean score of respondents between the two groups for the factors used by main contractors to select suitable subcontractors and respective decision for each factor

No	Factors used by main contractors to select suitable subcontractors	Main contractors		sub-contractors		Sig. (2-tailed)	Respective decision
		Mean	Std. Deviation	Mean	Std. Deviation		
1	Experience in similar projects	4.30	.990	4.29	.690	.915	There is no significant difference
2	Quality performance in previous projects	4.45	.814	4.28	.611	.150	There is no significant difference
3	Possession of qualified, skilled and strong workmanship	4.38	.859	3.77	.902	.000	There is significant difference
4	Efficient programming of subcontract work and proper fit with main contractor's master work program	3.93	1.075	3.71	.982	.197	There is no significant difference
5	Evidence of adequate resources/ materials, equipment and machinery	3.90	.894	3.63	1.145	.102	There is no significant difference
6	Leadership qualities and ability to manage own workmanship	4.25	.755	3.72	1.300	.002	There is significant difference
7	Reference from previous employers	3.93	.828	3.75	1.198	.276	There is no significant difference
8	Health and safety records	2.80	1.267	3.47	1.328	.002	There is significant difference
9	Competitiveness of the tender price	4.20	.933	4.07	.745	.339	There is no significant difference
10	Financial capacity	4.14	.862	4.16	.773	.930	There is no significant difference
11	Current workload and commitment	4.16	.760	3.65	1.017	.001	There is significant difference
12	Owner's acceptance of the subcontractor	3.86	1.019	4.36	.932	.002	There is significant difference
13	Regular payments for his employees	3.67	1.390	4.02	.584	.049	There is significant difference

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No	Factors used by main contractors to select suitable subcontractors	Main contractors		sub-contractors		Sig. (2-tailed)	Respective decision
		Mean	Std. Deviation	Mean	Std. Deviation		
14	Efficient resource management and waste minimization	4.23	.894	4.11	.963	.418	There is no significant difference
15	Ability to work efficiently with other subcontractors	3.81	.928	3.61	1.333	.286	There is no significant difference
16	Regular and effective communication with main contractor	4.36	.641	4.10	.995	.058	There is no significant difference
17	Site proximity (living distance from the site)	2.93	1.252	2.96	1.383	.867	There is no significant difference
18	History of contract completion	3.75	.961	3.52	1.016	.147	There is no significant difference
19	Specialty in certain type of work	3.96	1.130	3.25	1.022	.000	There is significant difference
20	Care to works done by others subcontractors	3.49	1.066	3.20	1.332	.141	There is no significant difference
21	Commitment to do remedial works (correcting defects)	4.25	.736	4.06	1.004	.203	There is no significant difference
22	Existence of proper organizational structure	3.62	1.059	3.63	1.237	.986	There is no significant difference
23	Commitment to the provided prices after awarding	3.49	1.024	3.37	1.207	.511	There is no significant difference
24	Not partnering the works to another subcontractor	2.64	1.098	2.75	1.208	.564	There is no significant difference

From the table of group statistics of SPSS output (Table 4.3) below it is shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

As shown in table 4.3 and 4.4 below of all factors used by main contractors to select suitable subcontractors, the value of (Sig.2-tailed) = 0.025 is less than 0.05. So there is a significant difference between main contractors and subcontractors viewpoints in this group.

Table 4.3 Group Statistics for all factors used by main contractors to select suitable subcontractors

Factors used by main contractors for selection of suitable subcontractors		N	Mean	Std. Deviation	Std. Error
Factors used by main contractors for selection of suitable subcontractors	Main contractors	69	3.88	0.358	0.043
	Subcontractors	83	3.75	0.346	0.038

Table 4.4 Independent Samples Test for the group of all factors used by main contractors to select suitable subcontractors

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Factors used by main contractors for selection of suitable subcontractors	Equal variances assumed	1.31	0.255	2.262	150	0.025	0.13	0.057	0.016	0.243
	Equal variances not assumed			2.255	143.09	0.026	0.13	0.057	0.016	0.243

4.4.1 Factors causing interface problem between main contractor and subcontractor caused by main contractors

The results of the data collected from both groups for the factors leading to interface problems caused by main contractors is organized. By calculating the RII of respondents'

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response the factors are arranged and displayed in their order of importance as tabulated in table 4.5

Table 4.5 Ranking and RII of factors leading to contractor-subcontractor interface problems caused by main contractors

	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Delay in valuation, measurement and progress payments	0.812	1	0.872	1	0.845	1
2	Delay by the main contractor in providing the necessary materials to the subcontractor	0.754	2	0.802	2	0.780	2
3	Delay in necessary clarifications of design and sample material approval	0.690	4	0.793	3	0.746	3
4	Interruptions and termination of work by the contractor	0.710	3	0.761	5	0.738	4
5	Mistrust relationship of the contractor with the subcontractor	0.684	5	0.778	6	0.736	5
6	Providing low-quality materials that result in low-quality workmanship	0.667	6	0.764	4	0.720	6
7	Scheduling conflicts among the subcontractor	0.652	9	0.720	8	0.689	7
8	Delay of the main contractor in submitting the formal documents to the supervision staff, which leads to delay in implementing the	0.629	12	0.737	7	0.688	8
9	Failure to provide the subcontractor with essential services such as electricity, water,	0.667	6	0.704	10	0.687	9
10	Assigning part of the works to another sub contractor, without informing the original sub	0.632	11	0.711	9	0.675	10
11	Using distant location for storage of materials	0.658	8	0.653	14	0.655	11
12	Incomplete understanding of the main contractor to the contract documents	0.641	10	0.665	13	0.654	12
13	Low experience and low capability of the main contractor	0.623	14	0.672	12	0.650	13
14	Involvement of the main contractor in several projects at the same time	0.554	18	0.682	11	0.624	14
15	Failure to provide proper security for the site and equipments	0.629	12	0.617	16	0.622	15
16	Frequent absence of the main contractor from the site	0.597	17	0.629	15	0.614	16
17	Asking the subcontractors to reduce the agreed costs in the tendering stage.	0.609	16	0.605	17	0.607	17
18	Failure of the main contractor to use the insurance in case of injury of subcontractor's labor	0.623	14	0.549	18	0.583	18
All Factors Average		0.657		0.706		0.684	

As it is indicated in the table delay in valuation, measurement and progress payments was rated in first position by both main contractors and sub-contractors. This study respondents agreed with (Al-Hammad, 1993), (Tayeh, et al, 2012) and (Okunlola, 2015)

who were identified as the most important factor causing interface problem. Delay by the main contractor in providing the necessary materials to the subcontractor was rated as the second position by both groups, hence in this study the factor is considered as a major cause next to delay in valuation, measurement and progress payments which leads main contractors and subcontractors to interface problems between them. This factor was identified as the fourth factor which cause interface problem between the two parties in previous studies (Okunlola, 2015) and (Tayeh, 2009). Delay in necessary clarifications of design and sample material approval was rated by the main contractors as fourth important factor. This factor was rated third by subcontractors both groups however rated this factor as the third important factor which will cause problem between main contractors and subcontractors. In previous studies researchers also gave highest rank for this factor (Al-Hammad, 1993)

The table of group statistics SPSS output For the factors leading main contractor-subcontractor interface problem caused by the main contractor shown in appendix B table 3 indicates as there is no missed respondent because the numbers of main contractors and subcontractors who correctly filled and returned the questioner were 69 and 83 respectively for each factor these numbers exactly displayed on the output. The mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in Appendix B table 3 and 4 is summarized and the respective decision is tabulated below in table 4.6

Table 4.6 Comparison of mean score of respondents between the two groups for the factors leading to contractor-subcontractor interface problems caused by main contractors and respective decision for each factor

No	factors leading to contractor-subcontractor interface problems caused by main contractors	Main Contractor		Subcontractor		Sig. (2-tailed)	Respective decision
		Mean	Std. Deviation	Mean	Std. Deviation		
1	Delay in valuation, measurement and progress payments	4.06	1.097	4.36	0.983	0.074	There is no significant difference
2	Interruptions and termination of work by the contractor	3.55	1.119	3.81	1.264	0.191	There is no significant difference
3	Delay in necessary clarifications of design and sample material approval	3.45	1.119	3.96	0.862	0.002	There is significant difference
4	Delay by the main contractor in providing the necessary materials to the subcontractor	3.77	1.319	4.01	1.174	0.23	There is no significant difference
5	Providing low-quality materials that result in low-quality workmanship	3.33	1.28	3.82	1.28	0.021	There is significant difference
6	Delay of the main contractor in submitting the formal documents to the supervision staff, which leads to delay in implementing the works	3.14	1.047	3.69	0.962	0.001	There is significant difference

No	factors leading to contractor-subcontractor interface problems caused by main contractors	Main Contractor		Subcontractor		Sig. (2-tailed)	Respective decision
		Mean	Std. Deviation	Mean	Std. Deviation		
7	Assigning part of the works to another sub contractor, without informing the original sub contractor	3.16	1.302	3.55	1.271	0.061	There is no significant difference
8	Failure of the main contractor to use the insurance in case of injury of subcontractor's labor	3.12	1.278	2.75	1.387	0.093	There is no significant difference
9	Failure to provide the subcontractor with essential services such as electricity, water, etc.	3.33	1.28	3.52	1.223	0.365	There is no significant difference
10	Failure to provide proper security for the site and equipments	3.14	1.407	3.08	1.579	0.805	There is no significant difference
11	Using distant location for storage of materials	3.29	1.226	3.27	1.593	0.914	There is no significant difference
12	Frequent absence of the main contractor from the site	2.99	1.367	3.14	1.231	0.452	There is no significant difference

No	factors leading to contractor-subcontractor interface problems caused by main contractors	Main Contractor		Subcontractor		Sig. (2-tailed)	Respective decision
		Mean	Std. Deviation	Mean	Std. Deviation		
13	Involvement of the main contractor in several projects at the same time	2.77	1.374	3.41	1.423	0.006	There is significant difference
14	Scheduling conflicts among the subcontractors	3.26	1.146	3.6	0.826	0.041	There is significant difference
15	Low experience and low capability of the main contractor	3.12	1.323	3.36	1.358	0.263	There is no significant difference
16	Incomplete understanding of the main contractor to the contract documents	3.2	1.558	3.33	1.094	0.584	There is no significant difference
17	Mistrust relationship of the contractor with the subcontractor	3.42	1.366	3.89	1.059	0.021	There is significant difference
18	Asking the subcontractors to reduce the agreed costs in the tendering stage.	3.04	1.377	3.02	1.506	0.935	There is no significant difference

From the table of group statistics for all factors of SPSS output (Table 4.7) below it is shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

As shown in table 4.7 and 4.8 below of all factors leading to contractor-subcontractor interface problems caused by main contractors, the value of (Sig.2-tailed) = 0.024 is less than 0.05. So there is a significant difference in the opinion between main contractors and subcontractors in this group.

Table 4.7 Group Statistics for all factors leading to contractor-subcontractor interface problems caused by main contractors

		N	Mean	Std. Deviation	Std. Error Mean
Factors causing interface problems between main contractors and subcontractors caused by main contractors	Main contractor	69	3.2858	.81829	.09851
	Subcontractor	83	3.5321	.38315	.04206

Table 4.8 Independent Samples Test for all factors leading to contractor-subcontractor interface problems caused by main contractors

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Factors causing interface problems between main contractors and subcontractors caused by main contractors	Equal variances assumed	46.84	.00	-2.440	150	0.016	-0.246	0.101	-0.446	-0.047
	Equal variances not assumed			-2.299	92.5	0.024	-0.246	0.107	-0.459	-0.034

4.4.2 Factors leading to contractor-subcontractor interface problems caused by subcontractors

The results of the data collected from both groups for the factors leading to interface problems caused by subcontractors is organized. By calculating the RII of respondents' response the factors are arranged and displayed in their order of importance as tabulated in table 4.9

Table 4.9 Ranking and RII of factors leading to contractor-subcontractor interface problems caused by subcontractors

	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Delay of the works behind the time schedule	0.901	1	0.945	1	0.925	1
2	Failure to preserve and take care of the materials	0.864	4	0.908	2	0.888	2
3	Lack of construction quality work	0.878	2	0.800	5	0.836	3
4	Shortage of skilled labor with the sub contractor	0.870	3	0.798	6	0.830	4
5	Neglecting the instructions of the main contractor	0.843	5	0.807	3	0.824	5
6	Exhausting equipments and other resources of the main contractor	0.786	7	0.805	4	0.796	6
7	Involvement of the sub contractor in several projects at the same time	0.788	6	0.773	7	0.780	7
8	Non-adherence to the conditions of the contract	0.742	9	0.745	8	0.743	8
9	Shortage of equipment or machinery at the sub contractor	0.739	10	0.708	9	0.722	9
10	Absence of the sub contractor from the site	0.751	8	0.694	10	0.720	10
11	Partnering the works to another sub contractor without getting approval of the main contractor	0.710	11	0.648	11	0.676	11
12	Neglecting the safety measures	0.667	12	0.559	12	0.608	12
All Factors Average		0.785		0.766		0.779	

As shown in table 4.9 above the responses of both groups indicated that delay of the works behind the time schedule was ranked in the first position. The result of this study agreed with the result of previous foreign researchers which identified this factor as the most important cause of interface problem between main contractors and sub contractors caused by subcontractors (Okunlola, 2015). If the work of subcontractors delayed it may affect the entire project of the main contractor and leads to financial penalties. That is why it is identified as the most important factor which will bring interface problem between main contractors and subcontractors. Failure to preserve and take care of the materials was rated in the second position which was rated in the intermediate position by other researchers (Okunlola, 2015). The other factor identified as the third important factor which leads to interface problem between main contractor and subcontractor caused by subcontractor in this study was lack of construction quality work which agreed with the work of previous researchers (Al-Hammad, 1993) and (Tayeh, 2009) which rated the same in highest position. Shortage of skilled labor with the sub contractor and neglecting the instructions of the main contractor are ranked as the fourth and fifth important factors which cause interface problem between main contractors and subcontractors.

On the other hand Absence of the sub contractor from the site, partnering the works to another sub contractor without getting approval of the main contractor and neglecting the safety measures ranked in the lowest position.

The table of group statistics SPSS output For the factors leading main contractor-subcontractor interface problem caused by the sub contractor shown in appendix B table 5 indicates as there is no missed respondent because the numbers of main contractors and subcontractors who correctly filled and returned the questioner were 69 and 83 respectively for each factor these numbers exactly displayed on the output. The mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in Appendix table 5 and 6 is summarized and the respective decision is tabulated in table 4.10 below.

Table 4.10 Comparison of mean score of respondents between the two groups for the factors leading to contractor-subcontractor interface problems caused by sub contractors and respective decision for each factor

N o		Main Contractor		Subcontractors		Sig. (2-tailed)	Respective decision
		Mean	Std. Deviation	Mean	Std. Deviation		
1	Delay of the works behind the time schedule	4.51	0.720	4.72	0.450	0.033	There is significant difference
2	Failure to preserve and take care of the materials	4.32	0.866	4.54	1.063	0.163	There is no significant difference
3	Exhausting equipments and other resources of the main contractor	3.93	1.048	4.02	.826	0.526	There is no significant difference
4	Partnering the works to another sub contractor without getting approval of	3.55	1.219	3.24	1.340	0.142	There is no significant difference
5	Absence of the sub contractor from the site	3.75	1.277	3.47	1.549	0.218	There is no significant difference
6	Involvement of the sub contractor in several projects at the same time	3.94	0.983	3.87	1.057	0.656	There is no significant difference
7	Neglecting the instructions of the main contractor	4.22	0.953	4.04	0.956	0.246	There is no significant difference
8	Shortage of skilled labor with the sub contractor	4.35	0.682	3.99	0.862	0.005	There is significant difference
9	Non-adherence to the conditions of the contract	3.71	1.113	3.72	1.108	0.944	There is no significant difference
10	Lack of construction quality work	4.39	0.771	4.00	0.826	0.003	There is significant difference
11	Shortage of equipment or machinery at the sub contractor	3.70	0.960	3.54	1.319	0.409	There is no significant difference
12	Neglecting the safety measures	3.33	1.080	2.80	1.575	0.014	There is significant difference

From the table of group statistics of all factors leading to contractor-subcontractor interface problems caused by sub contractors SPSS output (Table 4.11) below it is shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

On the other hand as shown in table 4.11and 4.12 below group of all factors leading to contractor subcontractor interface problems caused by subcontractors, the value (Sig.2-tailed) = 0.023 is less than 0.05. Therefore there is a significant difference in opinion between main contractors and subcontractors in this group.

Table 4.11 Group Statistics for the group of factors leading to contractor-subcontractor interface problems caused by subcontractors

Factors causing interface problems between main contractors and		N	Mean	Std. Deviation	Std. Error
Factors causing interface problems between main contractors and subcontractors caused by subcontractors	Main contractor	69	3.9746	.35248	.04243
	Subcontractor	83	3.8293	.41461	.04551

Table 4.12 Independent Samples Test for the group of factors leading to contractor-subcontractor interface problems caused by subcontractors

		Levene's Test for		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence	
									Lower	Upper
Factors causing interface problems between main contractors and subcontractors caused by subcontractors	Equal variances assumed	3.23	.074	2.301	150	0.023	0.145	0.063	0.021	0.270
	Equal variances not assumed			2.335	149.92	0.021	0.145	0.062	0.022	0.268

4.4.2 Factors leading to interface problems caused by the owner

The results of the data collected from both groups for the factors leading to interface problems caused by the owner is organized and by calculating the RII of respondents' response the factors are arranged and displayed in their order of importance as tabulated in table 4.13 below.

Table 4.13 Ranking and RII of factors leading to contractor-subcontractor interface problems caused by the owner

	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Delay in releasing payments to the main contractor	0.896	1	0.892	1	0.893	1
2	Delay in providing information such as additional drawings,	0.846	2	0.848	3	0.847	2
3	Short period allowed for implementing the project	0.774	4	0.870	2	0.826	3
4	Awarding the tender to the contractor with lowest price	0.826	3	0.781	4	0.801	4
5	Using several variation orders	0.696	6	0.718	5	0.708	5
6	Giving instructions to the subcontractor directly without	0.699	5	0.646	7	0.670	6
7	Objection of the owner on the implementation method used by the sub contractor	0.626	7	0.672	6	0.651	7
All Factors Average		0.766		0.775		0.771	

As it is shown in table 4.13 Delay in releasing payments to the main contractor rated in the first position by both groups (main contractors and subcontractors) because lately releasing payment for the contractor will force the contractor not to pay timely for his subcontractor consequently the subcontractor will not pay on time for his workers which will bring conflict. This result agrees with the findings of previous researchers (Al-Hammad, 1993). Delay in providing information such as additional drawings ranked in second position delay in drawings and necessary information may affect the project duration which will expose both the contractor and subcontractor for extra cost for overhead and other expenses which leads to interface problem between them. Short period allowed for implementing the projects ranked in third position by both groups. On the other hand objection of the owner on the implementation

method used by the sub contractor is ranked in the final position because there is a trend of working method adjustment based on client interest.

The table of group statistics SPSS output For the factors leading main contractor-subcontractor interface problem caused by the owner shown in appendix B table 7 indicates as there is no missed respondent because the numbers of main contractors and subcontractors who correctly filled and returned the questioner were 69 and 83 respectively for each factor these numbers exactly displayed on the output. The mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in Appendix B table 7 and 8 is summarized and the respective decision is tabulated in table 4.14 below.

Table 4.14 Comparison of mean score of respondents between the two groups for the factors leading to contractor-subcontractor interface problems caused by the owner and respective decision for each factor

N o		Main contractors		subcontractors		Sig. (2-tailed)	Respective decision
		Mean	Std. Deviation	Mean	Std. Deviation		
1	Awarding the tender to the contractor with lowest price	4.13	0.999	3.9	0.821	0.126	There is no significant difference
2	Delay in providing information	4.23	0.825	4.24	0.892	0.948	There is no significant difference
3	Giving instructions to the subcontractor directly without consulting the main contractor	3.49	1.335	3.23	1.509	0.255	There is no significant difference
4	Objection of the owner on the implementation method used by the sub contractor	3.13	1.083	3.36	1.089	0.194	There is no significant difference
5	Using several variation orders	3.48	1.335	3.59	1.288	0.600	There is no significant difference
6	Delay in releasing payments to the main contractor	4.48	0.885	4.46	0.915	0.890	There is no significant difference
7	Short period allowed for implementing the project	3.87	0.969	4.35	0.772	0.001	There is significant difference

From the table of group statistics of all factors leading to contractor-subcontractor interface problems caused by the owner SPSS output (Table 4.15) below it is shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

On the other hand as shown in table 4.15 and 4.16 below group of all factors leading to contractor subcontractor interface problems caused by the owner, the value (Sig.2-tailed) = 0.522 is greater than 0.05. Therefore there is no significant difference in the opinion between main contractors and subcontractors in this group.

Table 4.15 Group Statistics for the group of factors leading to contractor-subcontractor interface problems caused by the owner

		N	Mean	Std. Deviation	Std. Error Mean
Factors causing interface problems between main contractors and subcontractors caused by owners	Main contractor	69	3.8302	.39677	.04777
	Subcontractor	83	3.8761	.47105	.05170

Table 4.16 Independent Samples Test for the group of factors leading to contractor- subcontractor interface problems caused by the owner

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Factors causing interface problems between main contractors and subcontractors caused by owners	Equal variances assumed	1.7	.19	-.641	150	.522	-.046	.072	-.187	.095
	Equal variances not assumed			-.651	149.99	.516	-.046	.070	-.185	.093

4.4.3 Factors leading to interface problems caused by the consulting firm

The results of the data collected from both groups for the factors leading to interface problems caused by the consulting firm is organized and by calculating the RII of respondents' response the factors are arranged and displayed in their order of importance as tabulated in table 4.17 below.

Table 4.17 Ranking and RII of factors leading to contractor-subcontractor interface problems caused by the consulting firm

No	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Delay in approving payment documents of the main contractor	0.797	1	0.865	2	0.834	1
2	Delay in approving materials samples and shop drawings	0.774	3	0.870	1	0.826	2
3	Ambiguity of the drawings and technical specifications	0.777	2	0.805	3	0.792	3
4	Contradiction among the tender documents	0.713	4	0.786	4	0.753	4
5	Delay in hand-over of sub contractor's works	0.701	5	0.781	5	0.745	5
6	Low experience of the consultant's team	0.690	6	0.728	6	0.711	6
All Factors Average		0.742		0.806		0.777	

As it is shown in the relative importance index table 4.17 delay in approving payment documents of the main contractor is ranked first by main contractors and ranked second by sub contractors the cumulative value by both groups shows as it is ranked first because delay of payment approval will make the payment of the main contractor to be delayed consequently the main contractor will not pay timely for the subcontractor and create interface problem between the two parties. Even though delay in approving materials samples and shop drawings rated in the third position by main contractors the sub contractors ranked it in first position, so the result of both groups placed in the second position so respondents in this research identified this factor as one of the important

factors which leads main contractors and sub contractors to interface problems because delay in approving material samples and shop drawings will delay subcontractors' works so that friction could be created between the two parties.

The table of group statistics SPSS output For the factors leading main contractor-subcontractor interface problem caused by the consulting firm shown in appendix B table 9 indicates as there is no missed respondent because the numbers of main contractors and subcontractors who correctly filled and returned the questioner were 69 and 83 respectively for each factor these numbers exactly displayed on the output. The mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in Appendix B table 9 and 10 is summarized and the respective decision is tabulated in table 4.18 below.

Table 4.18 Comparison of mean score of respondents between the two groups for the factors leading to contractor-subcontractor interface problems caused by the consulting firm and respective decision for each factor

	Main contractors		subcontractors		Sig. (2-tailed)	Respective decision
	Mean	Std. Deviation	Mean	Std. Deviation		
Contradiction among the tender documents	3.57	1.289	3.93	1.368	0.097	There is no significant difference
Ambiguity of the drawings and technical specifications	3.88	0.978	4.02	1.168	0.423	There is no significant difference
Delay in approving materials samples and shop drawings	3.87	0.906	4.35	0.652	0.000	There is significant difference
Delay in hand-over of sub contractor's works	3.51	0.1.208	3.90	1.236	0.049	There is significant difference
Low experience of the consultant's team	3.45	1.334	3.64	1.154	0.356	There is no significant difference
Delay in approving payment documents of the main contractor	3.99	1.105	4.33	0.912	0.039	There is significant difference

From the table of group statistics of all factors leading to contractor-subcontractor interface problems caused by the consulting firm SPSS output (Table 4.19) below it is shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

On the other hand as shown in table 4.19and 4.20 below group of all factors leading to contractor subcontractor interface problems caused by the owner, the value (Sig.2-tailed) = 0.00 is less than 0.05. Therefore there is a significant difference in the opinion between main contractors and subcontractors in this group.

Table 4.19 Group Statistics for the group of factors leading to contractor-subcontractor interface problems caused by the consulting firm

Factors causing interface problems between main contractors and subcontractors caused by consultants		N	Mean	Std. Deviation	Std. Error Mean
Factors causing interface problems between main contractors and subcontractors caused by consultants	Main contractor	69	3.7101	.48140	.05795
	Subcontractor	83	4.0281	.47486	.05212

Table 4.20 Independent Samples Test for the group of factors leading to contractor-subcontractor interface problems caused by the consulting firm

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Factors causing interface problems between main contractors and subcontractors caused by consultants	Equal variances assumed	.006	.938	-4.085	150	.000	-.318	.078	-.4718	-.1642
	Equal variances not assumed			-4.079	144.2	.000	-.318	.078	-.4720	-.1639

4.4.4 Factors leading to interface problems caused by the external factors

The results of the data collected from both groups for the factors leading to interface problems caused by external factors is organized and by calculating the RII of respondents' response the factors are arranged and displayed in their order of importance as tabulated in table 4.21 below.

Table 4.21 Ranking and RII of factors leading to contractor-subcontractor interface problems caused by external factors

	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Shortage of construction materials in the market	0.794	1	0.829	1	0.813	1
2	Non existence of standard condition of contract	0.670	3	0.795	2	0.738	2
3	Changes in material and labor	0.771	2	0.677	5	0.720	3
4	Weather conditions	0.638	4	0.689	4	0.666	4
5	Underground condition of the site	0.600	5	0.701	3	0.655	5

The result of RII shown in table 4.21 above revealed that shortage of construction material is the most important external factor causing interface problem between main contractor and sub contractor which has got first rank by both groups. Previous researchers also identified this factor similar to this finding (Al-Hammad, 1993) and (Tayeh, 2009) because shortage of construction materials in the market will inhibit the subcontractors to perform their duty according to their terms of contract and may be project delay which could be fundamental breach of contract. Non existence of standard condition of contract is ranked second position by subcontractors and third position by main contractors. It is ranked in second position by the average of the two groups. Even though the researcher could not get similar findings specified by previous researchers for this factor due to the absence of standard condition for subcontracting agreements made unfairly based on the main contractor interest only. This is one basic source of conflict between the two parties. On the other hand underground condition of the site ranked in third position by sub contractors, main contractors rated this factor in the final position the average result indicates as it is ranked in the final position. This result seems to agree with the findings of previous researcher (Al-Hammad, 1993) who ranked in the last position as a cause for interface problem between the two parties.

The table of group statistics SPSS output For the factors leading main contractor-subcontractor interface problem caused by the external factors shown in appendix B

table 11 indicates as there is no missed respondent because the numbers of main contractors and subcontractors who correctly filled and returned the questioner were 69 and 83 respectively for each factor these numbers exactly displayed on the output. The mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in Appendix B table 11 and 12 is summarized and the respective decision is tabulated in table 4.22 below.

Table 4.22 Comparison of mean score of respondents between the two groups for the external factors leading to contractor-subcontractor interface problems

	Main contractors		subcontractors		Sig. (2-tailed)	Respective decision
	Mean	Std. Deviation	Mean	Std. Deviation		
Shortage of construction materials in the market	3.97	1.283	4.14	1.221	0.395	There is no significant difference
Changes in material and labor cost	3.86	1.019	3.39	1.267	0.012	There is significant difference
Weather conditions	3.19	1.004	3.45	1.232	0.166	There is no significant difference
Underground condition of the site	3.00	1.15	3.51	1.347	0.012	There is significant difference
Non existence of standard condition of contract	3.35	1.174	3.98	1.024	0.001	There is significant difference

From the table of group statistics of all factors leading to contractor-subcontractor interface problems caused by external factors SPSS output (Table 4.23) below it is shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

On the other hand as shown in table 4.23 and 4.24 below group of all factors leading to contractor subcontractor interface problems caused by external factors, the value (Sig.2-tailed) = 0.01 is less than 0.05. Therefore there is a significant difference in the opinion between main contractors and subcontractors in this group.

Table 4.23 Group Statistics for the group of factors leading to contractor-subcontractor interface problems caused by the external factor

Factors causing interface problems between main contractors and subcontractors caused by external factors		N	Mean	Std. Deviation	Std. Error Mean
Factors causing interface problems between main contractors and subcontractors caused by external factors	Main contractor	69	3.47	.423	.05090
	Subcontractor	83	3.69	.608	.06677

Table 4.24 Independent Samples Test for the group of factors leading to contractor- subcontractor interface problems caused by external factors

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Factors causing interface problems between main contractors and subcontractors caused by external factors	Equal variances assumed	5.815	.017	-2.53	150	.013	-.219	.0867	-.391	-.048
	Equal variances not assumed			-2.61	145.68	.010	-.219	.0839	-.385	-.053

The Relationship Between Contractors and Their Subcontractors and its impact on project performance in Addis Ababa

Table 4.25 Ranking and RII of all factors causing contractor-subcontractor interface problems

No	factors causing contractor-subcontractor interface problems	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Delay of the works behind the time schedule	0.901	1	0.95	1	0.925	1
2	Delay in releasing payments to the main contractor	0.896	2	0.89	3	0.893	2
3	Failure to preserve and take care of the materials	0.864	5	0.91	2	0.888	3
4	Delay in providing information such as additional drawings, benchmarks, etc.	0.846	6	0.85	8	0.847	4
5	Delay in valuation, measurement and progress payments	0.812	9	0.87	4	0.845	5
6	Lack of construction quality work	0.878	3	0.8	14	0.836	6
7	Delay in approving payment documents of the main contractor	0.797	10	0.87	7	0.834	7
8	Shortage of skilled labor with the sub contractor	0.87	4	0.8	15	0.830	8
9	Short period allowed for implementing the project	0.774	15	0.87	5	0.826	9
10	Delay in approving materials samples and shop drawings	0.774	15	0.87	5	0.826	9
11	Neglecting the instructions of the main contractor	0.843	7	0.81	10	0.824	11
12	Shortage of construction materials in the market	0.794	11	0.83	9	0.813	12
13	Awarding the tender to the contractor with lowest price	0.826	8	0.78	19	0.801	13
14	Exhausting equipments and other resources of the main contractor	0.786	13	0.81	11	0.796	14
15	Ambiguity of the drawings and technical specifications	0.777	14	0.81	11	0.792	15
16	Delay by the main contractor in providing the necessary materials to the subcontractor	0.754	18	0.8	13	0.780	16
17	Involvement of the sub contractor in several projects at the same time	0.788	12	0.77	22	0.780	16
18	Contradiction among the tender documents	0.713	22	0.79	18	0.753	18

The Relationship Between Contractors and Their Subcontractors and its impact on project performance in Addis Ababa

N o	factors causing contractor-subcontractor interface problems	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
19	Delay in necessary clarifications of design and sample material approval	0.69	28	0.79	17	0.746	19
	Delay in hand-over of sub contractor's works	0.701	25	0.78	19	0.745	20
21	Non-adherence to the conditions of the contract	0.742	20	0.75	25	0.743	21
22	Interruptions and termination of work by the contractor	0.71	31	0.76	16	0.738	22
23	Non existence of standard condition of contract	0.67	23	0.8	24	0.738	22
24	Mistrust relationship of the contractor with the subcontractor	0.684	30	0.78	21	0.736	24
25	Shortage of equipment or machinery at the sub contractor	0.739	21	0.71	31	0.722	25
26	Providing low-quality materials that result in low-quality workmanship	0.667	32	0.76	23	0.720	26
27	Absence of the sub contractor from the site	0.751	19	0.69	34	0.720	26
28	Changes in material and labor cost	0.771	17	0.68	37	0.720	26
29	Low experience of the consultant's team	0.69	28	0.73	27	0.711	29
30	Using several variation orders	0.696	27	0.72	29	0.708	30
31	Scheduling conflicts among the subcontractors	0.652	36	0.72	28	0.689	31
32	Delay of the main contractor in submitting the formal documents to the supervision staff, which leads to delay in implementing the works	0.629	40	0.74	26	0.688	32
33	Failure to provide the subcontractor with essential services such as electricity, water, etc.	0.667	32	0.7	32	0.687	33
34	Partnering the works to another sub contractor without getting approval of the main contractor	0.71	23	0.65	42	0.676	34
35	Assigning part of the works to another sub contractor, without informing the original sub contractor	0.632	39	0.71	30	0.675	35
36	Giving instructions to the subcontractor directly without consulting the main contractor	0.699	26	0.65	43	0.670	36
37	Weather conditions	0.638	38	0.69	35	0.666	37
38	Underground condition of the site	0.6	35	0.7	41	0.655	38

The Relationship Between Contractors and Their Subcontractors and its impact on project performance in Addis Ababa

No		Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
39	Using distant location for storage of materials	0.658	46	0.65	33	0.655	38
40	Incomplete understanding of the main contractor to the contract documents	0.641	37	0.67	40	0.654	40
41	Objection of the owner on the implementation method used by the sub contractor	0.626	42	0.67	38	0.651	41
42	Low experience and low capability of the main contractor	0.623	43	0.67	38	0.650	42
43	Involvement of the main contractor in several projects at the same time	0.554	48	0.68	36	0.624	43
44	Failure to provide proper security for the site and equipments	0.629	40	0.62	45	0.622	44
45	Frequent absence of the main contractor from the site	0.597	47	0.63	44	0.614	45
46	Neglecting the safety measures	0.667	32	0.56	47	0.608	46
47	Asking the subcontractors to reduce the agreed costs in the tendering stage.	0.609	45	0.61	46	0.607	47
48	Failure of the main contractor to use the insurance in case of injury of subcontractor's labor	48	14	0.55	46	0.583	48

4.5 Impacts of the relationship between contractors and their subcontractors on project performance

In section 4.4 above factors which cause interface problem between main contractors and sub contractors identified and ranked. These factors have their own negative impact on the healthy relationship between main contractors and sub contractors consequently on the overall project performance. Based on the criterion extracted from different literatures and previous researches the factors affecting project performance especially on the very important performance requirements such as time, cost and quality assessed and described in the following sections.

4.5.1 Aspects negatively affecting project performance in terms of time

From the factors causing interface problem between main contractors and sub contractors addressed in section 4.4 above those which have negative impact on project performance in terms of time identified from literatures and evaluated by respondents as tabulated in table 4.26 below

Table 4.26 Ranking and RII of factors negatively affecting project performance in terms of time

	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Delay in valuation, measurement and progress payments	0.826	1	0.961	1	0.900	1
2	Delay by the main contractor in providing the necessary materials	0.745	5	0.887	2	0.822	2
3	Delay in providing information such as necessary clarifications of design, benchmarks, etc.	0.762	3	0.757	3	0.759	3
4	Absence of good working relationship between different	0.739	6	0.740	4	0.739	4
5	Absence of the sub contractor from the site	0.774	2	0.708	6	0.738	5
6	Interruptions and termination of work by the contractor	0.751	4	0.725	5	0.737	6

The table of group statistics SPSS output For the factors negatively affecting project performance in terms of time shown in appendix B table 13 indicates as there is no missed respondent because the numbers of main contractors and subcontractors who correctly filled and returned the questioner were 69 and 83 respectively for each factor these numbers exactly displayed on the output. The mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in Appendix B table 13 and 14 is summarized and the respective decision is tabulated in table 4.27 below.

Table 4.27 Comparison of mean score of respondents between the two groups for the factors negatively affecting project performance in terms of time

Main contractors and subcontractors	Main contractors		sub-contractors		Sig. (2-tailed)	Respective decision
	Mean	Std. Deviation	Mean	Std. Deviation		
Delay in valuation, measurement and progress payments	4.13	1.162	4.81	0.551	0.000	There is significant difference
Interruptions and termination of work by the contractor	3.75	1.168	3.63	1.386	0.540	There is no significant difference
Delay by the main contractor in providing the necessary materials to the subcontractor	3.72	1.293	4.43	0.886	0.000	There is significant difference
Delay in providing information such as necessary clarifications of design, benchmarks, etc.	3.81	1.128	3.78	1.269	0.885	There is no significant difference
Absence of the sub contractor from the site	3.87	0.958	3.54	1.243	0.066	There is no significant difference
Absence of good working relationship between subcontractors	3.7	1.075	3.7	1.207	0.987	There is no significant difference

From the table of group statistics of all factors negatively affecting project performance in terms of time SPSS output (Table 4.28) below shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

On the other hand as shown in table 4.28 and 4.29 below group of all factors negatively affecting project performance in terms of time, the value (Sig.2-tailed) = 0.071 is greater than 0.05. Therefore there is no significant difference in the opinion between main contractors and subcontractors in this group.

Table 4.28 Group Statistics for the group of all factors negatively affecting project performance in terms of time

Aspects negatively affecting project performance in terms of time		N	Mean	Std. Deviation	Std. Error Mean
Aspects negatively affecting project performance in terms of time	Main contractor	69	3.831	.50203	.06044
	Subcontractor	83	3.982	.51732	.05678

Table 4.29 Independent Samples Test for the group of factors negatively affecting project performance in terms of time

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Aspects negatively affecting project performance in terms of time	Equal variances assumed	.008	.929	-1.816	150	.071	-.151	.083	-.3153	.01330
	Equal variances not assumed			-1.821	146.42	.071	-.151	.083	-.3149	.01288

4.5.2 Aspects negatively affecting project performance in terms of cost

Similar to time the factors which have negative impact on project cost performance identified from literatures evaluated by respondents and tabulated in table 4.30 below

Table 4.30 Ranking and RII of factors negatively affecting project performance in terms of cost

	Factors negatively affecting project performance in terms of cost	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Rank	RII	Rank	RII	Rank
1	Rework	0.728	3	0.814	1	0.775	1
2	Absence of clear working drawings and specifications	0.768	2	0.742	2	0.754	2
3	Late information such as on design changes	0.777	1	0.706	5	0.738	3
4	Lack of cooperation between personnel of main contractor	0.707	5	0.742	2	0.726	4
5	Absence of good working relationship between subcontractors	0.710	4	0.737	4	0.725	5

The result in table 4.30 above shows that rework ranked first among the factors that affect project cost performance. Other factors ranked in the order of severity are absence of clear working drawings and specifications, late information such as on design changes and lack of cooperation between personnel of main contractor and subcontractor. Absence of good working relationship between subcontractors ranked last.

For the factors negatively affecting project performance in terms of cost, the mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in the appendix B section table 15 and 16 is summarized and the respective decision is tabulated in table 4.30 below.

Table 4.31 Comparison of mean score of respondents between the two groups for the factors negatively affecting project performance in terms of cost

Factors	Main contractors		sub-contractors		Sig. (2-tailed)	Respective decision
	Mean	Std. Deviation	Mean	Std. Deviation		
Late information such as on design changes	3.88	1.323	3.53	1.648	0.144	There is no significant difference
Lack of cooperation between personnel of main contractor and subcontractor	3.54	1.065	3.71	1.099	0.324	There is no significant difference
Absence of good working relationship between subcontractors	3.55	0.963	3.69	1.361	0.487	There is no significant difference
Absence of clear working drawings and specifications	3.84	1.093	3.71	1.461	0.533	There is no significant difference
Rework	3.64	1.317	4.07	1.166	0.035	There is significant difference

From the table of group statistics of all factors negatively affecting project performance in terms of cost SPSS output (Table 4.32) below shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

On the other hand as shown in table 4.32 and 4.33 below group of all factors negatively affecting project performance in terms of cost, the value (Sig. 2-tailed) = 0.554 is greater than 0.05. Therefore there is no significant difference in the opinion between main contractors and subcontractors in this group.

Table 4.32 Group Statistics for the group of factors negatively affecting project performance in terms of cost

Aspects negatively affecting project performance in terms of cost		N	Mean	Std. Deviation	Std. Error Mean
Aspects negatively affecting project performance in terms of cost	Main contractor	69	3.6899	.52304	.06297
	Subcontractor	83	3.7422	.55658	.06109

Table 4.33 Independent Samples Test for the group of factors negatively affecting project performance in terms of cost

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Aspects negatively affecting project performance in terms of cost	Equal variances assumed	.856	.356	-.593	150	.554	-.0523	.088	-.227	.122
	Equal variances not assumed			-.596	147.726	.552	-.0523	.088	-.226	.121

4.5.3 Aspects negatively affecting project performance in terms of quality

The factors which have negative impact on project cost performance identified from literatures also evaluated by respondents and tabulated in table 4.34below

Table 4.34 Ranking and RII of factors negatively affecting project performance in terms quality

No	Factors	Contractors		Subcontractors		Both Contractors & Subcontractors	
		RII	Ran	RII	Rank	RII	Rank
1	Shortage of skilled labor with the sub contractor	0.794	1	0.824	1	0.811	1
2	Providing low-quality materials that result in low-quality	0.759	2	0.795	2	0.779	2
3	Failure of the subcontractor to preserve and take care of the materials	0.739	4	0.778	3	0.761	3
4	Poor supervision	0.733	5	0.737	5	0.736	4
5	Shortage of required equipment or machinery at the sub contractor	0.719	6	0.740	4	0.730	5
6	Absence of good working relationship between subcontractors	0.696	7	0.716	6	0.707	6
7	Absence of clear working drawings and specifications	0.742	3	0.655	7	0.695	7

The respondents' response shown in table 4.34 above shows that Shortage of skilled labor with the sub contractor ranked first among the factors that affect project performance in terms of quality. Other factors such as providing low-quality materials that result in low-quality workmanship, Failure of the subcontractor to preserve and take care of the materials Poor supervision ranked in the order of their severity. Absence of clear working drawings and specifications ranked in the last position.

For the factors negatively affecting project performance in terms of quality, the mean response of respondents of the two groups (main contractors and sub-contractors) of each factor compared and the SPSS output shown in appendix B table 17 and 18 is summarized and the respective decision is tabulated in table 4.35 below.

Table 4.35 Comparison of mean score of respondents between the two groups for the factors negatively affecting project performance in terms of quality

	Main contractors		subcontractors		Sig. (2-tailed)	Respective decision
	Mean	Std. Deviation	Mean	Std. Deviation		
Providing low-quality materials that result in low-quality workmanship	3.8	1.037	3.98	1.249	0.345	There is no significant difference
Shortage of required equipment or machinery at the sub contractor	3.59	1.276	3.7	1.496	0.647	There is no significant difference
Shortage of skilled labor with the sub contractor	3.97	0.939	4.12	1.098	0.367	There is no significant difference
Failure of the subcontractor to preserve and take care of the materials	3.7	0.880	3.89	1.148	0.247	There is no significant difference
Absence of good working relationship between subcontractors	3.48	1.038	3.58	1.191	0.586	There is no significant difference
Poor supervision	3.67	1.184	3.69	1.229	0.919	There is no significant
Absence of clear working drawings and specifications	3.71	0.972	3.28	1.633	.045	There is significant difference

From the table of group statistics of all factors negatively affecting project performance in terms of quality SPSS output (Table 4.36) below shown that there is no missed respondent because all 69 respondents of main contractors and all 83 respondents of subcontractors who correctly filled and returned the questionnaire were displayed on the output.

Table 4.36 Group Statistics for the group of factors negatively affecting project performance in terms of quality

Aspects negatively affecting project performance in terms of quality		N	Mean	Std. Deviation	Std. Error Mean
Aspects negatively affecting project performance in terms of quality	Main contractor	69	3.7019	.58530	.07046
	Subcontractor	83	3.7470	.62363	.06845

Table 4.37 Independent Samples Test for the group of factors negatively affecting project performance in terms of cost

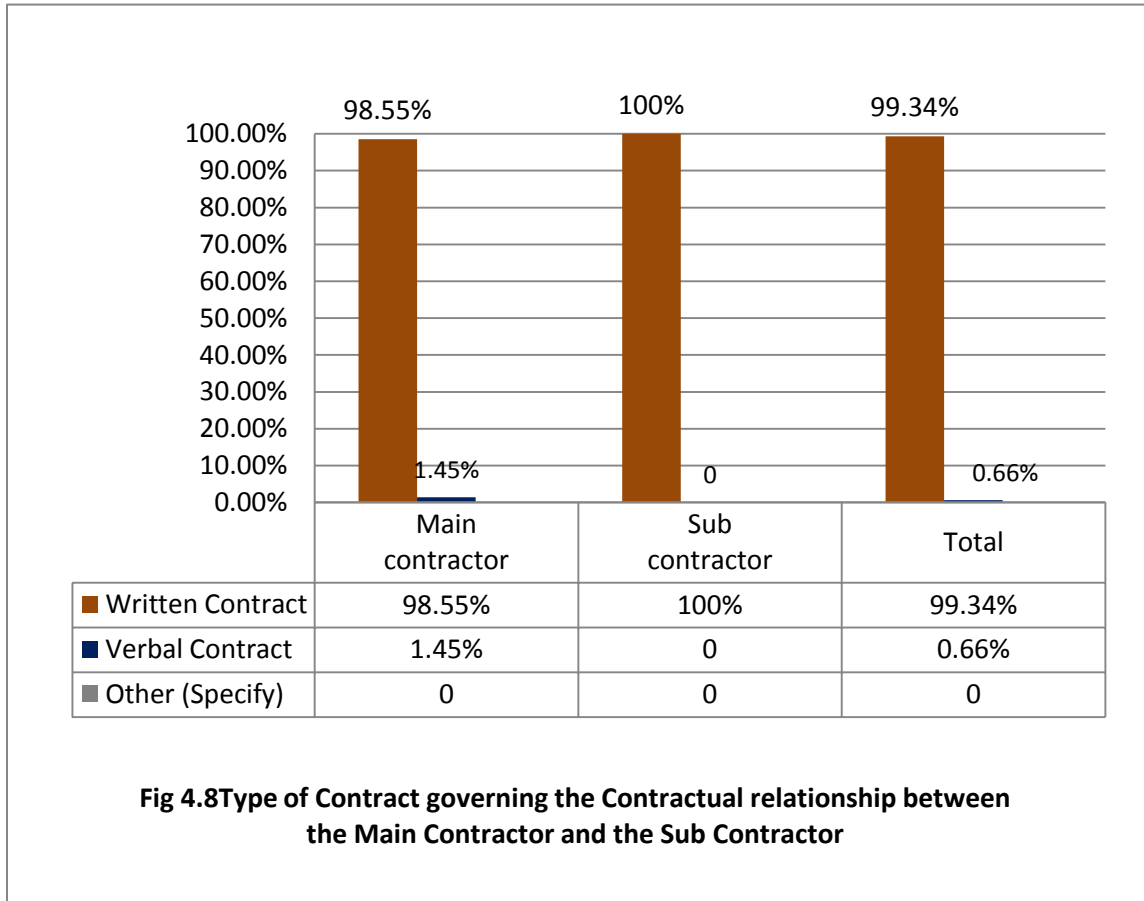
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. 2-tailed	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Aspects negatively affecting project performance in terms of quality	Equal variances assumed	.017	.898	-.457	150	.649	-.045	.099	-.240	.150
	Equal variances not assumed			-.459	147.8	.647	-.045	.098	-.239	.149

4.6 Contractual relationship between the main contractor and the subcontractor

In order to assess the contractual relationship between main contractor and subcontractor the researcher organized 8 questions retrieved from different literatures and previous researchers in the subject. Based on this, respondents were allowed to give their opinion and their response for each question presented by bar graph in the following section.

4.6.1 Type of Contract governing the Contractual relationship between the Main Contractor and the Sub Contractor

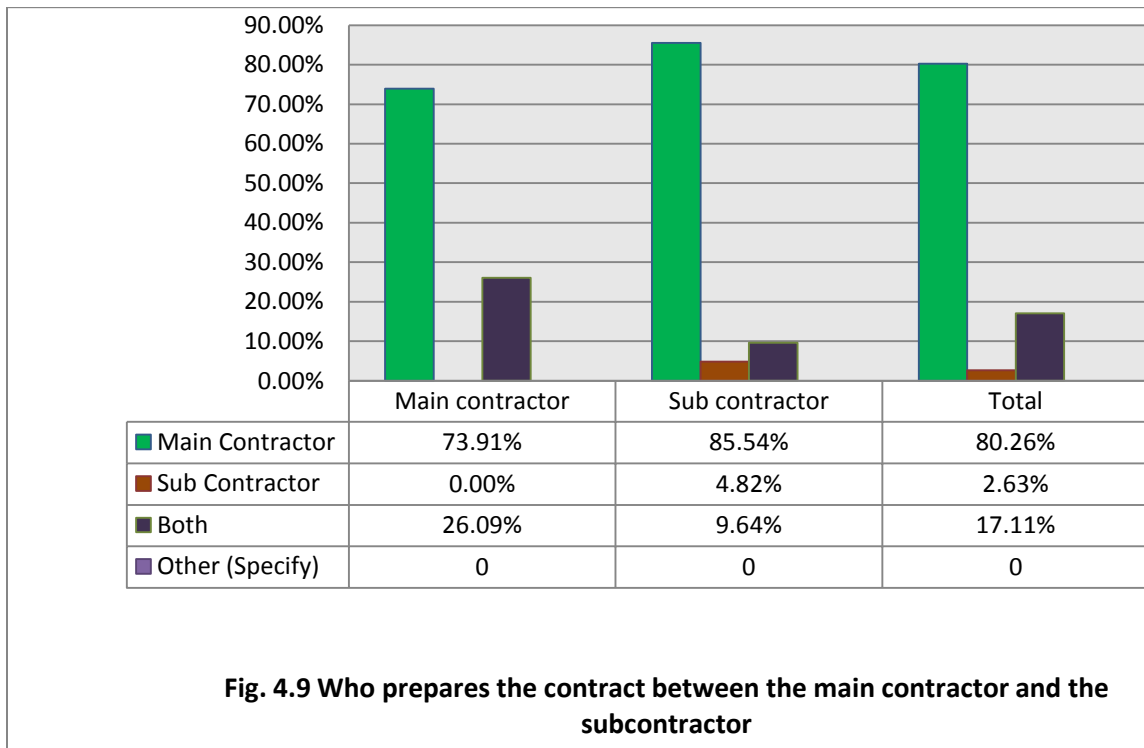
The percentage of respondents' response regarding the type of contract between the main contractor and the subcontractor described graphically in figure 4.8 below.



As it is indicated in the bar graph (Fig.4.8) 98.55%, 100% and 99.34% from main contractors, subcontractors and total respectively agreed as the type of contract is written contract.

Only 1.45% from respondents of main contractors responded as the type of contract is verbal which is 0.66 % of the total respondents.

4.6.2 Who prepares the Contract between the Main Contractor and the Sub Contractor?



From the bar graph shown in fig. 4.9 above 73.91% of main contractors' respondents, 85.54% of subcontractors' respondents and 80.26 % of total respondents agreed as the contract is prepared by the main contractor. 4.82% of subcontractors' respondents agreed as the contract is prepared by subcontractor but there was no respondent from main contractors who said the contract is prepared by subcontractor. From the total respondents only 2.63% were agreed as the contract is prepared by subcontractor. 26.09 % and 9.64 % of main contractors' and subcontractors' respondents respectively agreed as the contract prepared by both parties which made 17.11% of the total respondents.

The above data indicates there is dominance of main contractors in the preparation of contract. Even the percentage of preparation by both parties is very little which means the possibility of reviewing the document prepared by the main contractor is not common. This means Subcontractors enter in to a contract without knowing the necessary conditions.

4.6.3 Is the contract prepared based on known conditions of contract?

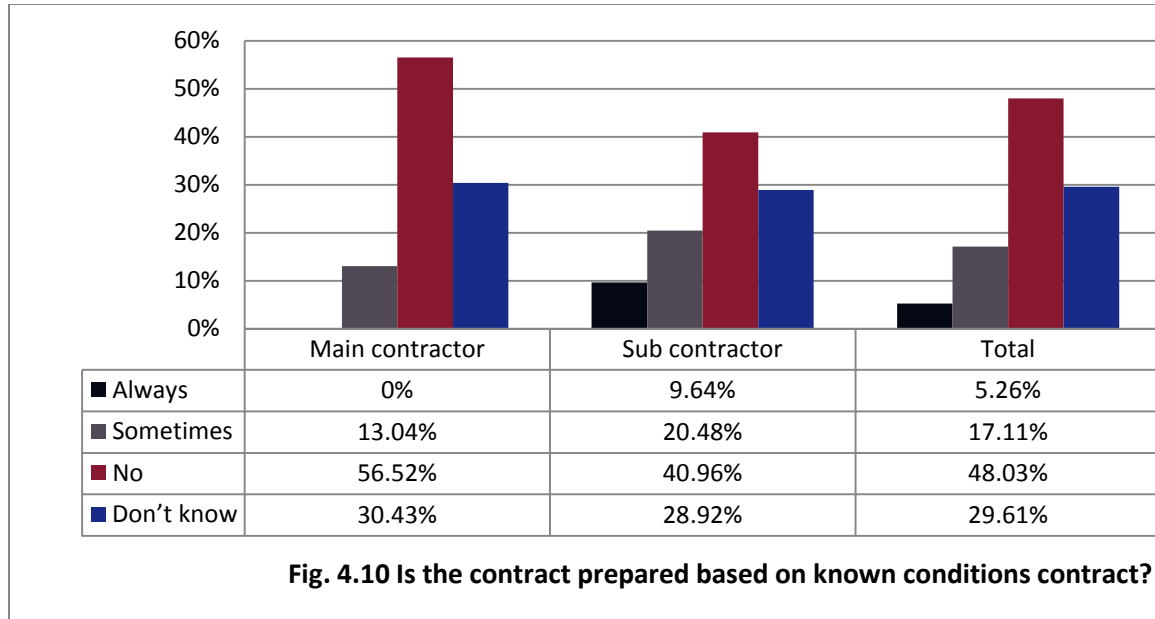


Fig. 4.10 shows that 9.64% of responding subcontractors responded always the contract prepared based on known conditions of contract but there is no respondent who said always from main contractor respondents. From total respondents 5.26% agreed as the contract is prepared always with known condition of contract. 13.04% from main contractor respondents, 20.48% from subcontractors' respondents and 17.11% of the total respondents agreed as the contract prepared with known conditions of contract. Majority of the respondents that is 56.25% from main contractors respondents, 40.96% from subcontractors' respondents and a total of 48.03 % agreed as the contract is not prepared with known conditions of contract. The remaining 30.43% from main contractors respondents, 28.92% from subcontractors respondents and 29.61% from the total respondents do not know whether a contract is prepared based on known conditions or not. The obtained result indicates majority of the respondents that is 48.03% responded that there is no standard condition of contract in contract preparation.

4.6.4 Is there a penalty condition in the contract, in case that one of the parties doesn't comply?

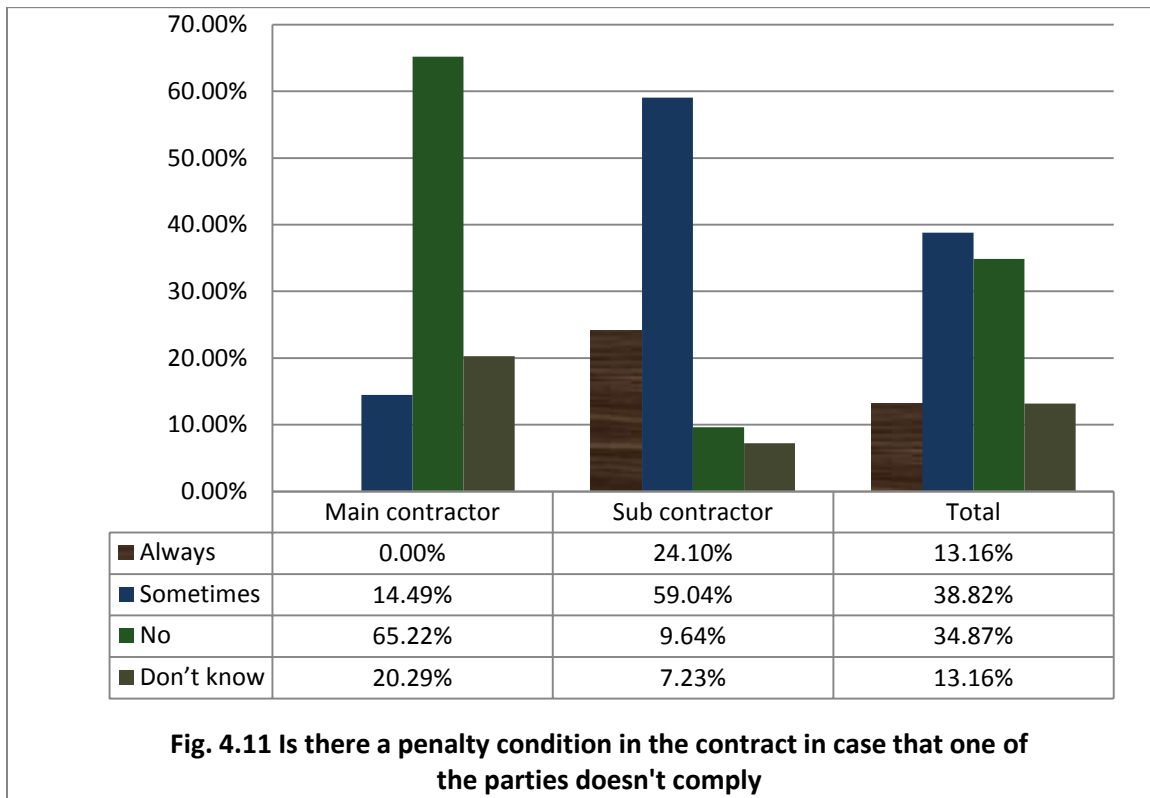


Fig. 4.11 shows that 24.1 % of subcontractor respondents agreed as there is always penalty condition in the contract but no one respondent in this case from respondents of the main contractor. 14.49% from main contractors' respondents, 59.04% from subcontractors' respondents a total of 38.82% agreed as there is sometimes penalty condition in the contract. 65.22 % respondents from the main contractor, 9.64% from subcontractors and a total of 34.87% agreed as there is no penalty condition in the contract for the party which does not comply. On the other hand 20.29% from respondents of main contractor, 7.23% from respondents of sub contractor totally 13.16% agreed as they don't know whether is a penalty condition or not.

The result indicates 38.82% sometimes existence of penalty where as 34.87% non existence of penalty condition. In case one of the parties doesn't comply it could be difficult to force both parties.

4.6.5 When shall interim payments effective?

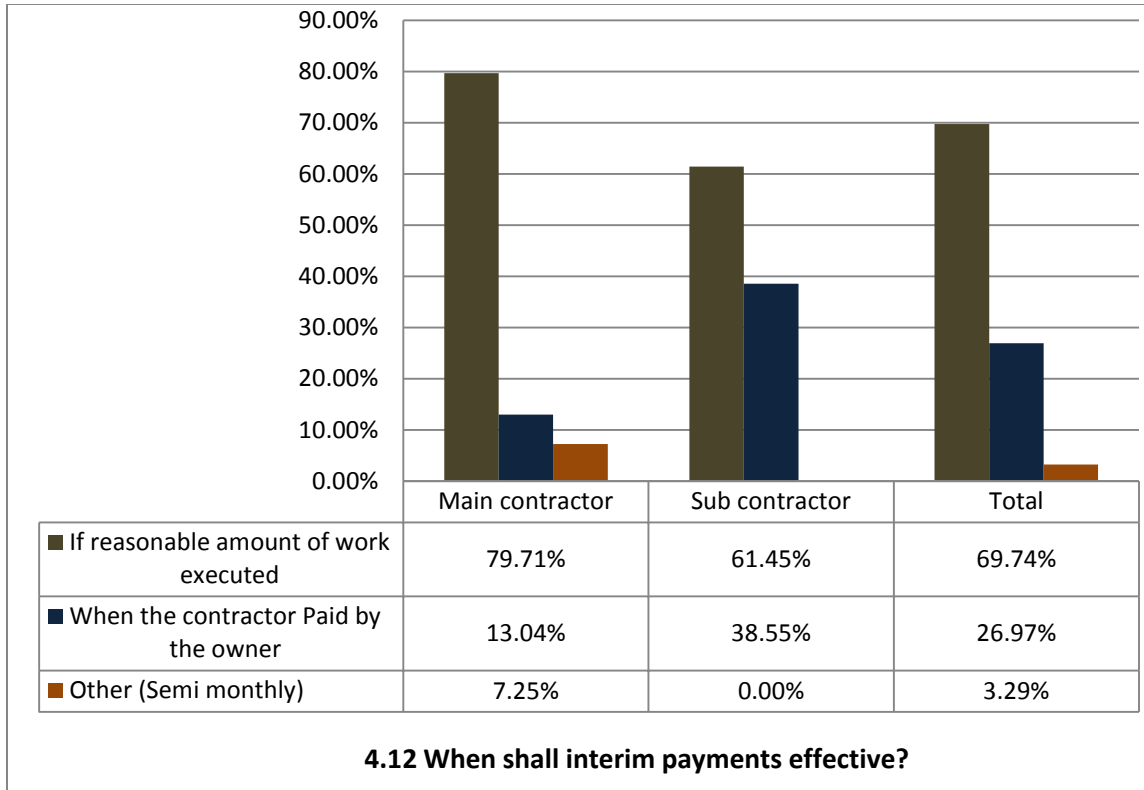
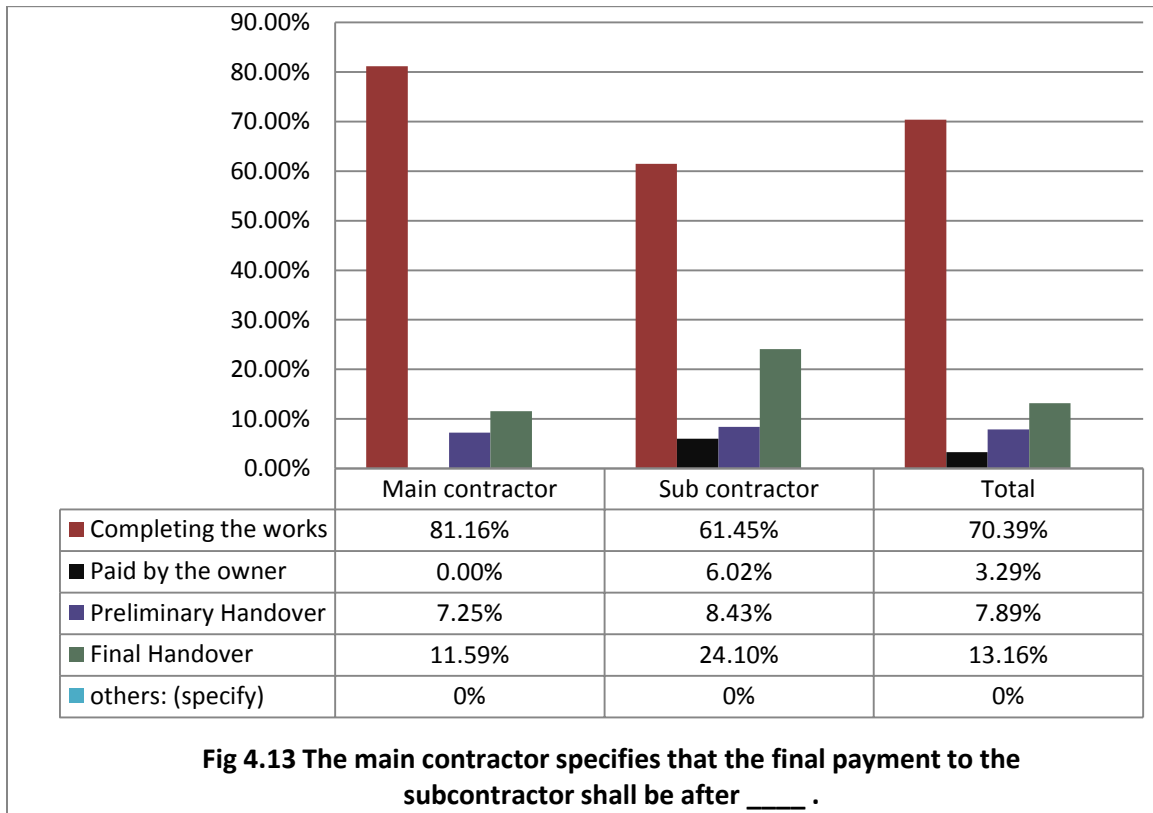


Fig. 4.12 shows that 79.71% of main contractors respondents, 61.45 % from subcontractors respondents and 69.74% of total respondents agreed as interim payment is paid if reasonable amount of work executed. 13.04 % from main contractor respondents, 38.55% from subcontractor respondents and 26.97% from total respondents agreed as interim payment is paid when the contractor paid by the owner. Only 7.25% of main contractor respondents replied as there is a trend of semi monthly interim payment.

From the result majority of respondents even subcontractors themselves agreed as interim payment is effective if reasonable amount of work is executed this condition should be encourage to maintain the healthy relationship between the parties. 26.97% respondents said when the contractor is paid by the owner. This number should get attention because it is considerable. Timeliness of payments affects many subcontractors, for whom receiving delayed payments from their general contractors is a cause of friction between the two parties (Arditi and Chotibhongs, 2005)

4.6.6 The Main Contractor specifies that the final payment to the sub contractor shall be after_____.

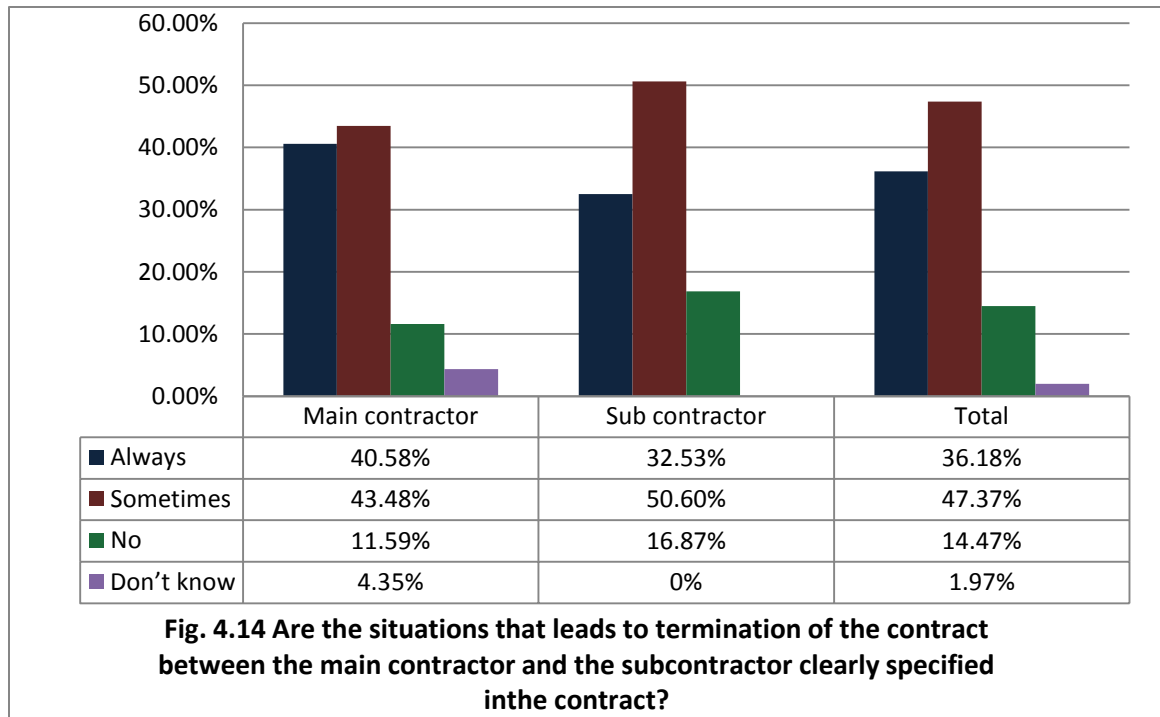


In Fig. 4.13 above it is shown that 81.16% from main contractor respondents, 61.45% from subcontractors' respondents and 70.39% from total respondents agreed as the main contractor specifies the final payment to be after completing the works. There is no one respondent from the main contractors respondents who said the main contractor specified final payment to be after paid by the owner but 6.02 % from subcontractor respondents replied the same which is 3.29% from total respondents. 7.25% from main contractors respondents, 8.43% from subcontractors' respondents and 7.89% from total respondents replied as the main contractor specifies the final payment to be after preliminary handover. 11.59% from main contractors, 24.1%from subcontractors' respondents and 13.16% from total respondents responded as the main contractor specifies the final payment to be after final handover.

The result indicates large number of respondents agreed as final payment is specified to be after completing the works. Of course this is good for subcontractors but it may bring

risk for the main contractor for unrevealed defects. On the other hand 13.6% of respondents agreed as the final payment is specified to be after final handover. This number should not be ignored, it tells us as there is this trend. Therefore subcontractors should due attention about the terms of payment during signing a contract.

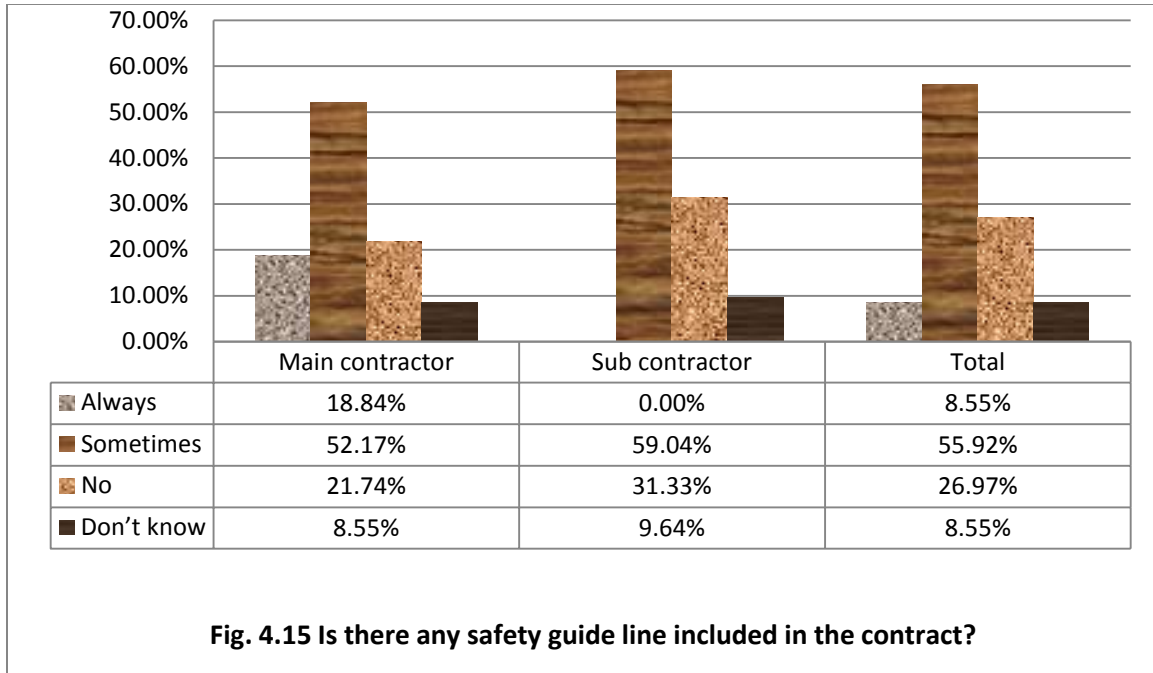
4.6.7 Are the situations that lead to termination of the contract between the main contractor and subcontractor clearly specified in the contract?



As shown in figure 4.14 above 40.58% from main contractors' respondents, 32.53% from subcontractors' respondents and 36.18% from total respondents replied as the situations that lead to termination always clearly specified. 43.48% from main contractors' respondents, 50.6% from subcontractors' respondents and 47.37% from the total respondents agreed as the situations that lead to termination sometimes clearly specified. 14.47% of respondents said that situations that lead to termination of contract are not clearly specified.

From the above data, 47.37% said sometimes, 36.18% said always and 14.47% no. Therefore it is possible to conclude to some extent there is a problem of lack of specifying the situations that lead to termination. This could be a source of dispute.

4.6.8 Is there any safety guideline included in the contract?



In the fig. 4.15 above Majority of the respondents that is 55.92% said sometimes safety guideline is included in the contract but next to this 26.97% from the total respondents agreed as there is no safety guide line included in the contract.

Construction industry on average has a higher rate of occupational injury and fatality than most other industries (Arditi and Chotibhongs, 2005). On the contrary the finding of this research indicates main contractors and subcontractors give little attention for safety which will be consequently one of the sources of interface problems between the parties.

Chapter- 5

Conclusion and Recommendation

5.1 Introduction

In this chapter the conclusions and recommendations are discussed. For the purpose of clarity the conclusions are based on the research objectives of the study. Based on the findings of the study recommendations are made to government bodies, to main contractors, subcontractors and for future researchers.

5.2 Conclusions

This research was conducted on contractors working in Addis Ababa with the prime intent of identifying the factors used by main contractors to select suitable subcontractors, factors causing interface problems, the impact of relationship between main contractors and subcontractors on project performance (Time, cost and quality performance) and to assess the contractual relationship between main contractors and their subcontractors. Based on the objectives and findings of the study, the following conclusions are worth drawn.

24 factors used by main contractors to select suitable subcontractors were collected from literatures and previous studies. Then by calculating the RII for each factor which was conducted by 69 main contractors' and 83 subcontractors' respondents all the 24 factors were ranked. Among them the first ten factors were Quality performance in previous projects, Experience in similar projects, Regular and effective communication with main contractor, Efficient resource management and waste minimization, Financial capacity, Commitment to do remedial works (correcting defects), Competitiveness of the tender price, Owner's acceptance of the subcontractor, Possession of qualified, skilled and strong workmanship, Leadership qualities and ability to manage own workmanship respectively. The difference in opinion of the two groups (Main contractors respondents and subcontractors respondents) was checked by independent samples t-test using SPSS software, the result shows except for the three factors, possession of qualified, skilled and strong workmanship, leadership qualities and ability to manage own workmanship and

owner's acceptance of the subcontractor there was no significant difference between them.

The factors leading main contractor-subcontractor interface problems caused by different parties also ranked. 48 factors were collected from literatures and previous studies to be assessed in this study. Then the identified first fifteen severe factors which cause interface problem between main contractor and subcontractor in this study are delay of the works behind the time schedule, delay in releasing payments to the main contractor, failure to preserve and take care of the materials, delay in providing information such as additional drawings, benchmarks, etc., delay in valuation, measurement and progress payments, lack of construction quality work, delay in approving payment documents of the main contractor, shortage of skilled labor with the sub contractor, short period allowed for implementing the project, delay in approving materials samples and shop drawings, neglecting the instructions of the main contractor, shortage of construction materials in the market, awarding the tender to the contractor with lowest price, exhausting equipments and other resources of the main contractor and ambiguity of the drawings and technical specifications

Regarding project performance this study emphasizes on the factors negatively affecting the three most important construction project performance criteria time, cost and quality. Based on this the study identified Delay in valuation, measurement and progress payments, Delay by the main contractor in providing the necessary materials to the subcontractor and Delay in providing information such as necessary clarifications of design, benchmarks, etc. critically affect project time performance. Project cost performance is also seriously affected by Rework, Absence of clear working drawings and specifications and Late information such as on design changes. Other factors such as Shortage of skilled labor with the sub contractor, Providing low-quality materials by main contractors that result in low-quality workmanship, Failure of the subcontractor to preserve and take care of the materials and Poor supervision are identified as critical problems for quality performance of construction projects.

In terms of contractual relationship this study found that the type of contract governing the two parties is written contract prepared by the main contractor but there is lack of

using standard forms of contract. One of the characteristics of construction contract is form (standard) requirement. But from this research it is identified as either the majority of contracting parties do not know about standard condition of subcontracting or there is no standard condition of contract. The researcher also tried to refer the PPA and MoWUD standard conditions of contract but could not get standard condition of subcontracting. The other important issue to be raised here is payment regulation under the contract. The finding of this research in this regard is better mostly interim payment is paid if reasonable amount of work executed and final payment will be effective after completing the works. However, in real life the researcher saw payment issue as critical problem.

The other important finding of this research is the absence or being little of safety guideline in the contract between main contractors and subcontractors. Main contractors may employ hundreds of workers and may use the services of several subcontractors on the contrary giving little attention for safety is really shocking.

5.3 Recommendations

According to the results obtained from this research, the relationship between contractors and subcontractors in different aspects has significant influence on the construction project performance. This will affect not only the contracting parties but the project owners as well and will have its own impact on the overall development of the country. Therefore every concerned body should due attention and work for the better relationship between main contractors and subcontractors. Based on the findings and conclusions of the study, the following recommendations are forwarded.

The existence of standard form of contract helps the contracting parties to reduce the conflict between them consequently it will have positive impact on project performance and helps the legal system to settle disputes easily. Therefore Ministry of construction should prepare standard form of contract for the subcontracting regime which includes enforcing of using safety guide lines.

Majority of the construction project activities executed by subcontractors. Therefore employers should consider subcontracting starting from the planning stage especially on

critical issues like payment. Payment delay is a basic source of friction between main contractors and sub contractors.

Adequate selection of project team is very important for good project performance. Since subcontractors are one of the team members which play vital role in a construction project main contractors should due attention for the selection criteria of subcontractors. Therefore main contractors should critically consider the parameters such as quality performance in previous projects, experience in similar projects, regular and effective communication with main contractor, efficient resource management and waste minimization, possession of qualified, skilled and strong workmanship, financial capacity of the subcontractor which indicate the commitment of the subcontractor to the contract conditions and ensure completing the works with the scheduled period by the allocated budget and the required quality.

On the other hand the capacity of main contractors and subcontractors in our country context is incomparable. Therefore by considering the limited capacity of subcontractors timely valuation and measurement of works and immediately effecting payments will motivate subcontractors to perform their activity based on the contract so that their good relationship can be maintained and it helps the main contractor to efficiently utilize subcontractors.

Main contractors find reputation which could be gained through best performing projects based on the schedule, the allocated budget and the required quality to achieve this selection criteria is vital for them. Therefore subcontractors work to organize their documents on their previous experience, resources like skilled and qualified manpower and equipments to show their performance in terms of quality and time during tendering. Moreover Subcontractors are recommended to avoid sources of interface problems with main contractors such as delay from the scheduled period, producing poor quality products and being careless for resources and materials of the main contractor to sustain their reputation.

Finally the sector especially in the subcontracting regime extremely traditional critically requires improvement for better performance of construction projects. This can be achieved by conducting more researches in related areas. The focus for this study was on

the relationship between main contractors and subcontractors and only in building construction projects. It is the researcher's view that future research could therefore investigate the other aspect subcontracting in general in road and building projects performance will potentially contribute a lot in the improvement of the sector in particular and development of the country in general. In this study it is recommended only preparation of standard form of contract for the subcontract regime is important but developing guide lines and provide for the government bodies for approval and implimentation is important and expected from future researchers.

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APPENDIX A - Questionnaire



Adama Science & Technology University

**Questionnaire for Assessment of the Relationship between Main Contractors and their Subcontractors and its impact on building construction projects in Ethiopia
(The case of Addis Ababa)**

Dear Sir / Madam

This questionnaire is prepared for academic study (MSc) conducted by a student at Adama Science and Technology University School of Civil Engineering and Architecture, Department of Civil Engineering.

I kindly request your cooperation to fill the required information in the attached questionnaire that aims to identify the relationship between the main contractor and their subcontractors and its impacts on project performance in Ethiopia (the case of Addis Ababa). All the data gathered will be held confidential.

Thank you in advance for your time and kind cooperation

Mandefro Fikir

(Mobile. 0912415193 or 0918715719)

Part One: General Information (Main contractors)

- 1- Name of the Company (Optional) _____
- 2- Classification Category of the Company
☐ Class 1 ☐ Class 2 ☐ Class 3
- 3- Years of Experience of the company
☐ Less than 5 years ☐ 5-10 years
☐ 11-15 years ☐ More than 15 years
- 4- Position/Role of the respondent in the company
☐ Project Manager ☐ Office Engineer
☐ Site Engineer ☐ Company's owner
- 5- Years of Experience of the respondent
☐ Less than 5 years ☐ 5-10 years
☐ 11-15 years ☐ More than 15 years

Part One: General Information (Subcontractors)

- 1- Name of Sub contractor (Optional) _____
- 2- Specialty of Sub contractor
☐ Carpentry ☐ Concrete ☐ Masonry
☐ Plastering ☐ Tiling ☐ Painting
☐ Electrical ☐ Sanitary ☐ Others (Specify _____)
- 3- Years of Experience of the Sub contractor
☐ Less than 5 years ☐ 5-10 years
☐ 11-15 years ☐ More than 15 years
- 4- Staff of the Sub contractor
☐ Less than 5 ☐ 5-10
☐ 11-15 ☐ More than 15

Part two: Factors used by main contractors for selection of suitable Subcontractors.

S.N	Factors used by main contractors for selection of suitable Subcontractors	Very Important (5)	Important (4)	Moderate (3)	Least Important (2)	Not Important (1)
1	Experience in similar projects					
2	Quality performance in previous projects					
3	Possession of qualified, skilled and strong workmanship					
4	Efficient programming of subcontract work and proper fit with main contractor's master work program					
5	Evidence of adequate resources/ materials, equipment and machinery					
6	Leadership qualities and ability to manage own workmanship					
7	Reference from previous employers					
8	Health and safety records					
9	Competitiveness of the tender price					
10	Financial capacity					
11	Current workload and commitment					
12	Owner's acceptance of the subcontractor					
13	Regular payments for his employees					
14	Efficient resource management and waste minimization					
15	Ability to work efficiently with other subcontractors					
16	Regular and effective communication with main					
17	Site proximity (living distance from the site)					
18	History of contract completion					
19	Specialty in certain type of work					
20	Care to works done by others subcontractors					
21	Commitment to do remedial works (correcting defects)					
22	Existence of proper organizational structure					
23	Commitment to the provided prices after awarding					
24	Not partnering the works to another subcontractor					

Part Three: Causes of the contractor- subcontractor interface problems

S.N	Causes of the contractors- subcontractors interface problems	Very high	High effect (4)	Moderate effect	Little effect (2)	No effect (1)
1	Factors causing interface problems between main contractors and subcontractors caused by main contractors					
1.1	Delay in valuation, measurement and progress payments					
1.2	Interruptions and termination of work by the contractor					
1.3	Delay in necessary clarifications of design and sample material approval					
1.4	Delay by the main contractor in providing the necessary materials to the subcontractor					
1.5	Providing low-quality materials that result in low-quality workmanship					
1.6	Delay of the main contractor in submitting the formal documents to the supervision staff, which leads to delay in					
1.7	Assigning part of the works to another sub contractor, without informing the original sub contractor					
1.8	Failure of the main contractor to use the insurance in case of injury of subcontractor's labor					
1.9	Failure to provide the subcontractor with essential services such as electricity, water, etc.					
1.10	Failure to provide proper security for the site and equipments					
1.11	Using distant location for storage of materials					
1.12	Frequent absence of the main contractor from the site					
1.13	Involvement of the main contractor in several projects at the same time					
1.14	Scheduling conflicts among the subcontractors					
1.15	Low experience and low capability of the main contractor					
1.16	Incomplete understanding of the main contractor to the contract documents					
1.17	Mistrust relationship of the contractor with the subcontractor					
1.18	Asking the subcontractors to reduce the agreed costs in the tendering stage.					

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S.N	Causes of the contractors- subcontractors interface problems	Very high effect (5)	High effect (4)	Moderate effect (3)	Little effect (2)	No effect (1)
2	Factors causing interface problems between main contractors and subcontractors caused by subcontractors					
2.1	Delay of the works behind the time schedule					
2.2	Failure to preserve and take care of the materials					
2.3	Exhausting equipments and other resources of the main contractor					
2.4	Partnering the works to another sub contractor without getting approval of the main contractor					
2.5	Absence of the sub contractor from the site					
2.6	Involvement of the sub contractor in several projects at the same time					
2.7	Neglecting the instructions of the main contractor					
2.8	Shortage of skilled labor with the sub contractor					
2.9	Non-adherence to the conditions of the contract					
2.10	Lack of construction quality work					
2.11	Shortage of equipment or machinery at the sub contractor					
2.12	Neglecting the safety measures					
3	Factors causing interface problems between main contractors and subcontractors caused by the owner.					
3.1	Awarding the tender to the contractor with lowest price					
3.2	Delay in providing information such as additional drawings, benchmarks, etc.					
3.3	Giving instructions to the subcontractor directly without consulting the main contractor					
3.4	Objection of the owner on the implementation method used by the sub contractor					

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3.5	Using several variation orders					
3.6	Delay in releasing payments to the main contractor					
3.7	Short period allowed for implementing the project					
4	Factors causing interface problems between main contractors and subcontractors caused by the consulting firm					
4.1	Contradiction among the tender documents					
4.2	Ambiguity of the drawings and technical specifications					
4.3	Delay in approving materials samples and shop drawings					
4.4	Delay in hand-over of sub contractor's works					
4.5	Low experience of the consultant's team					
4.6	Delay in approving payment documents of the main contractor					
5	Factors causing interface problems between main contractors and subcontractors caused by the external factors					
5.1	Shortage of construction materials in the market					
5.2	Changes in material and labor cost					
5.3	Weather conditions					
5.4	Underground condition of the site					
5.5	Non existence of standard condition of contract					

Part four: Impacts of the relationship between contractors and their subcontractors on project performance

S.N	Aspects negatively affecting project performance	Very high effect (5)	High effect (4)	Moderate effect (3)	Little effect	No effect (1)
1	Aspects negatively affecting project performance in terms of time					
1.1	Delay in valuation, measurement and progress payments					
1.2	Interruptions and termination of work by the contractor					
1.3	Delay by the main contractor in providing the necessary materials to the subcontractor					
1.4	Delay in providing information such as necessary clarifications of design, benchmarks, etc.					
1.5	Absence of the sub contractor from the site					
1.6	Absence of good working relationship between subcontractors					
2	Aspects negatively affecting project performance in terms of cost					
2.1	Late information such as on design changes					
2.2	Lack of cooperation between personnel of main contractor and subcontractor					
2.3	Absence of good working relationship between subcontractors					
2.4	Absence of clear working drawings and specifications					
2.5	Rework					
3	Aspects negatively affecting project performance in terms of quality					
3.1	Providing low-quality materials that result in low-quality workmanship					
3.2	Shortage of required equipment or machinery at the sub contractor					
3.3	Shortage of skilled labor with the sub contractor					
3.4	Failure of the subcontractor to preserve and take care of the materials					
3.5	Absence of good working relationship between subcontractors					
3.6	Poor supervision					
3.7	Absence of clear working drawings and specifications					

Part Five: Contractual Relationship between the Main Contractor and the Subcontractor

1. Type of Contract governing the Contractual relationship between the Main Contractor and the Sub Contractor
☐ Written Contract ☐ Verbal Contract ☐ Other (Specify :_____)
2. Who prepares the Contract between the Main Contractor and the Sub Contractor?
☐ Main Contractor ☐ Sub Contractor
☐ Both ☐ Other (Specify: _____)
3. Is the contract prepared based on known conditions of contract and certain specifications?
☐ Always ☐ Sometimes ☐ No ☐ Don't know
4. Is there a penalty condition in the contract, in case that one of the parties doesn't comply? ☐ Always ☐ Sometimes ☐ No ☐ Don't know
5. When shall interim payments effective?
☐ If reasonable amount of work executed ☐ When the contractor Paid by the owner
☐ owner ☐ Other (Specify: _____)
6. The Main Contractor specifies that the final payment to the sub contractor shall be after_____
☐ Completing the works ☐ Paid by the owner ☐ Preliminary Handover
☐ Final Handover ☐ others: (specify _____)
7. Are the situations that lead to termination of the contract between the main contractor and subcontractor clearly specified in the contract?
☐ Always ☐ Sometimes ☐ No ☐ Don't know
8. Is there any safety guideline included in the contract?
☐ Always ☐ Sometimes ☐ No ☐ Don't know

APPENDIX B - t- Test tables

Table 1. Group Statistics for the factors used by main contractors to select suitable subcontractors

Factors used by main contractors to select suitable subcontractors	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Experience in similar projects	Main contractors	69	4.3	0.99	0.119
	sub-contractors	83	4.29	0.69	0.076
Quality performance in previous projects	Main contractors	69	4.45	0.814	0.098
	sub-contractors	83	4.28	0.611	0.067
Possession of qualified, skilled and strong workmanship	Main contractors	69	4.38	0.859	0.103
	sub-contractors	83	3.77	0.902	0.099
Efficient programming of subcontract work and proper fit with main contractor's master work program	Main contractors	69	3.93	1.075	0.129
	sub-contractors	83	3.71	0.982	0.108
Evidence of adequate resources/ materials, equipment and machinery	Main contractors	69	3.9	0.894	0.108
	sub-contractors	83	3.63	1.145	0.126
Leadership qualities and ability to manage own workmanship	Main contractors	69	4.25	0.755	0.091
	sub-contractors	83	3.72	1.3	0.143
Reference from previous employers	Main contractors	69	3.93	0.828	0.1
	sub-contractors	83	3.75	1.198	0.131
Health and safety records	Main contractors	69	2.8	1.267	0.153
	sub-contractors	83	3.47	1.328	0.146
Competitiveness of the tender price	Main contractors	69	4.2	0.933	0.112
	sub-contractors	83	4.07	0.745	0.082
Financial capacity	Main contractors	69	4.14	0.862	0.104
	sub-contractors	83	4.16	0.773	0.085
Current workload and commitment	Main contractors	69	4.16	0.76	0.091
	sub-contractors	83	3.65	1.017	0.112
Owner's acceptance of the subcontractor	Main contractors	69	3.86	1.019	0.123
	sub-contractors	83	4.36	0.932	0.102
Regular payments for his employees	Main contractors	69	3.67	1.39	0.167
	sub-contractors	83	4.02	0.584	0.064
Efficient resource management and waste minimization	Main contractors	69	4.23	0.894	0.108
	sub-contractors	83	4.11	0.963	0.106
Ability to work efficiently with other subcontractors	Main contractors	69	3.81	0.928	0.112
	sub-contractors	83	3.61	1.333	0.146

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Factors used by main contractors to select suitable subcontractors	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Regular and effective communication with main contractor	Main contractors	69	4.36	0.641	0.077
	sub-contractors	83	4.1	0.995	0.109
Site proximity (living distance from the site)	Main contractors	69	2.93	1.252	0.151
	sub-contractors	83	2.96	1.383	0.152
History of contract completion	Main contractors	69	3.75	0.961	0.116
	sub-contractors	83	3.52	1.016	0.112
Specialty in certain type of work	Main contractors	69	3.96	1.13	0.136
	sub-contractors	83	3.25	1.022	0.112
Care to works done by others subcontractors	Main contractors	69	3.49	1.066	0.128
	sub-contractors	83	3.2	1.332	0.146
Commitment to do remedial works (correcting defects)	Main contractors	69	4.25	0.736	0.089
	sub-contractors	83	4.06	1.004	0.11
Existence of proper organizational structure	Main contractors	69	3.62	1.059	0.127
	sub-contractors	83	3.63	1.237	0.136
Commitment to the provided prices after awarding	Main contractors	69	3.49	1.024	0.123
	sub-contractors	83	3.37	1.207	0.132
Not partnering the works to another subcontractor	Main contractors	69	2.64	1.098	0.132
	sub-contractors	83	2.75	1.208	0.133

Table 2. Independent Samples Test for the factors used by main contractors to select suitable subcontractors

factors used by main contractors to select suitable subcontractors		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. 2-(tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Experience in similar projects	Equal variances assumed	4.447	0.037	0.111	150	0.912	0.015	0.137	-0.255	0.285
	Equal variances not assumed			0.108	118.089	0.915	0.015	0.141	-0.264	0.295
Quality performance in previous projects	Equal variances assumed	5.613	0.019	1.488	150	0.139	0.172	0.116	-0.057	0.401
	Equal variances not assumed			1.450	124.055	0.150	0.172	0.119	-0.063	0.407
Possession of qualified, skilled and strong workmanship	Equal variances assumed	0.002	0.961	4.213	150	0.000	0.606	0.144	0.322	0.890
	Equal variances not assumed			4.231	147.189	0.000	0.606	0.143	0.323	0.889
Efficient programming of subcontract work and proper fit with main contractor's master work	Equal variances assumed	0.002	0.960	1.297	150	0.197	0.217	0.167	-0.113	0.547
	Equal variances not assumed			1.286	139.396	0.200	0.217	0.168	-0.116	0.550
Evidence of adequate resources/ materials, equipment and machinery	Equal variances assumed	15.137	0.000	1.608	150	0.110	0.272	0.169	-0.062	0.606
	Equal variances not assumed			1.645	149.445	0.102	0.272	0.165	-0.055	0.599
Leadership qualities and ability to manage own workmanship	Equal variances assumed	17.245	0.000	2.954	150	0.004	0.523	0.177	0.173	0.874
	Equal variances not assumed			3.093	135.232	0.002	0.523	0.169	0.189	0.858

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factors used by main contractors to select suitable subcontractors		F	sig	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Reference from previous employers	Equal variances assumed	24.718	0.000	1.059	150.000	0.291	0.181	0.171	-0.156	0.517
	Equal variances not assumed			1.094	145.423	0.276	0.181	0.165	-0.146	0.507
Health and safety records	Equal variances assumed	2.663	0.105	-3.175	150.000	0.002	-0.673	0.212	-1.092	-0.254
	Equal variances not assumed			-3.188	147.155	0.002	-0.673	0.211	-1.090	-0.256
Competitiveness of the tender price	Equal variances assumed	3.626	0.059	0.959	150.000	0.339	0.131	0.136	-0.138	0.400
	Equal variances not assumed			0.940	129.183	0.349	0.131	0.139	-0.144	0.405
Financial capacity	Equal variances assumed	2.888	0.091	-0.088	150.000	0.930	-0.012	0.133	-0.274	0.250
	Equal variances not assumed			-0.087	138.078	0.931	-0.012	0.134	-0.277	0.253
Current workload and commitment	Equal variances assumed	12.753	0.000	3.434	150.000	0.001	0.509	0.148	0.216	0.802
	Equal variances not assumed			3.525	148.390	0.001	0.509	0.144	0.224	0.794
Owner's acceptance of the subcontractor	Equal variances assumed	0.716	0.399	-3.198	150.000	0.002	-0.506	0.158	-0.819	-0.193
	Equal variances not assumed			-3.172	139.507	0.002	-0.506	0.160	-0.822	-0.191
Regular payments for his employees	Equal variances assumed	65.435	0.000	-2.129	150.000	0.035	-0.357	0.168	-0.689	-0.026
	Equal variances not assumed			-1.995	87.850	0.049	-0.357	0.179	-0.713	-0.001

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factors used by main contractors to select suitable subcontractors		F	sig	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Efficient resource management and waste minimization	Equal variances assumed	0.037	0.848	0.813	150.000	0.418	0.123	0.152	-0.177	0.423
	Equal variances not assumed			0.819	148.160	0.414	0.123	0.151	-0.175	0.421
Ability to work efficiently with other subcontractors	Equal variances assumed	16.278	0.000	1.037	150.000	0.301	0.197	0.190	-0.178	0.573
	Equal variances not assumed			1.071	145.749	0.286	0.197	0.184	-0.167	0.561
Regular and effective communication with main contractor	Equal variances assumed	7.075	0.009	1.913	150.000	0.058	0.266	0.139	-0.009	0.541
	Equal variances not assumed			1.988	141.704	0.049	0.266	0.134	0.002	0.530
Site proximity (living distance from the site)	Equal variances assumed	0.008	0.930	-0.168	150.000	0.867	-0.036	0.216	-0.463	0.390
	Equal variances not assumed			-0.170	148.883	0.865	-0.036	0.214	-0.459	0.386
History of contract completion	Equal variances assumed	0.399	0.529	1.458	150.000	0.147	0.236	0.162	-0.084	0.555
	Equal variances not assumed			1.465	147.498	0.145	0.236	0.161	-0.082	0.553
Specialty in certain type of work	Equal variances assumed	2.838	0.094	4.026	150.000	0.000	0.704	0.175	0.358	1.049
	Equal variances not assumed			3.989	138.728	0.000	0.704	0.176	0.355	1.052
Care to works done by others subcontractors	Equal variances assumed	18.525	0.000	1.450	150.000	0.149	0.288	0.199	-0.104	0.680
	Equal variances not assumed			1.480	149.798	0.141	0.288	0.195	-0.096	0.672

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factors used by main contractors to select suitable subcontractors		F	sig	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Commitment to do remedial works (correcting defects)	Equal variances assumed	0.054	0.816	1.280	150.000	0.203	0.186	0.145	-0.101	0.473
	Equal variances not assumed			1.316	147.782	0.190	0.186	0.141	-0.093	0.466
Existence of proper organizational structure	Equal variances assumed	2.478	0.118	-0.018	150.000	0.986	-0.003	0.189	-0.377	0.370
	Equal variances not assumed			-0.018	149.862	0.986	-0.003	0.186	-0.371	0.365
Commitment to the provided prices after awarding	Equal variances assumed	4.640	0.033	0.649	150.000	0.517	0.119	0.184	-0.244	0.482
	Equal variances not assumed			0.659	149.932	0.511	0.119	0.181	-0.238	0.477
Not partnering the works to another subcontractor	Equal variances assumed	3.257	0.073	-0.579	150.000	0.564	-0.109	0.189	-0.483	0.264
	Equal variances not assumed			-0.584	148.788	0.560	-0.109	0.187	-0.479	0.261

Table 3. Group Statistics for factors leading to contractor-subcontractor interface problems caused by main contractors

factors leading to contractor-subcontractor interface problems caused by main contractors	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Delay in valuation, measurement and progress payments	Main contractor	69	4.06	1.097	0.132
	Subcontractor	83	4.36	0.983	0.108
Interruptions and termination of work by the contractor	Main contractor	69	3.55	1.119	0.135
	Subcontractor	83	3.81	1.264	0.139
Delay in necessary clarifications of design and sample material approval	Main contractor	69	3.45	1.119	0.135
	Subcontractor	83	3.96	0.862	0.095
Delay by the main contractor in providing the necessary materials to the subcontractor	Main contractor	69	3.77	1.319	0.159
	Subcontractor	83	4.01	1.174	0.129
Providing low-quality materials that result in low-quality workmanship	Main contractor	69	3.33	1.28	0.154
	Subcontractor	83	3.82	1.28	0.14

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factors leading to contractor-subcontractor interface problems caused by main contractors	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Delay of the main contractor in submitting the formal documents to the supervision staff, which leads to delay in implementing the works	Main contractor	69	3.14	1.047	0.126
	Subcontractor	83	3.69	0.962	0.106
Assigning part of the works to another sub contractor, without informing the original sub contractor	Main contractor	69	3.16	1.302	0.157
	Subcontractor	83	3.55	1.271	0.14
Failure of the main contractor to use the insurance in case of injury of subcontractor's labor	Main contractor	69	3.12	1.278	0.154
	Subcontractor	83	2.75	1.387	0.152
Failure to provide the subcontractor with essential services such as electricity, water, etc.	Main contractor	69	3.33	1.28	0.154
	Subcontractor	83	3.52	1.223	0.134
Failure to provide proper security for the site and equipments	Main contractor	69	3.14	1.407	0.169
	Subcontractor	83	3.08	1.579	0.173
Using distant location for storage of materials	Main contractor	69	3.29	1.226	0.148
	Subcontractor	83	3.27	1.593	0.175
Frequent absence of the main contractor from the site	Main contractor	69	2.99	1.367	0.165
	Subcontractor	83	3.14	1.231	0.135
Involvement of the main contractor in several projects at the same time	Main contractor	69	2.77	1.374	0.165
	Subcontractor	83	3.41	1.423	0.156
Scheduling conflicts among the subcontractors	Main contractor	69	3.26	1.146	0.138
	Subcontractor	83	3.6	0.826	0.091
Low experience and low capability of the main contractor	Main contractor	69	3.12	1.323	0.159
	Subcontractor	83	3.36	1.358	0.149
Incomplete understanding of the main contractor to the contract documents	Main contractor	69	3.2	1.558	0.188
	Subcontractor	83	3.33	1.094	0.12
Mistrust relationship of the contractor with the subcontractor	Main contractor	69	3.42	1.366	0.164
	Subcontractor	83	3.89	1.059	0.116
Asking the subcontractors to reduce the agreed costs in the tendering stage.	Main contractor	69	3.04	1.377	0.166
	Subcontractor	83	3.02	1.506	0.165

Table 4 Independent Samples Test for the factors leading to contractor-subcontractor interface problems caused by main contractors

factors leading to contractor subcontractor interface problems caused by main contractors		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Delay in valuation, measurement and progress payments	Equal variances assumed	0.009	0.93	-1.798	150	0.074	-0.303	0.169	-0.637	0.03
	Equal variances not assumed			-1.780	138.06	0.077	-0.303	0.17	-0.641	0.034
Interruptions and termination of work by the contractor	Equal variances assumed	0.029	0.87	-1.312	150	0.191	-0.257	0.195	-0.643	0.13
	Equal variances not assumed			-1.327	149.39	0.187	-0.257	0.193	-0.638	0.125
Delay in necessary clarifications of design and sample material approval	Equal variances assumed	3.32	0.07	-3.202	150	0.002	-0.515	0.161	-0.832	-0.197
	Equal variances not assumed			-3.127	126.19	0.002	-0.515	0.165	-0.84	-0.189
Delay by the main contractor in providing the necessary materials to the subcontractor	Equal variances assumed	1.204	0.27	-1.206	150	0.23	-0.244	0.202	-0.644	0.156
	Equal variances not assumed			-1.193	137.57	0.235	-0.244	0.204	-0.648	0.16
Providing low-quality materials that result in low-quality workmanship	Equal variances assumed	1.812	0.18	-2.331	150	0.021	-0.486	0.208	-0.898	-0.074
	Equal variances not assumed			-2.331	144.98	0.021	-0.486	0.208	-0.898	-0.074
Delay of the main contractor in submitting the formal documents to the supervision staff, which leads	Equal variances assumed	0.836	0.36	-3.321	150	0.001	-0.542	0.163	-0.864	-0.219
	Equal variances not assumed			-3.295	139.81	0.001	-0.542	0.164	-0.867	-0.217
Assigning part of the works to another sub contractor, without informing the original sub	Equal variances assumed	0.067	0.8	-1.886	150	0.061	-0.395	0.209	-0.808	0.019
	Equal variances not assumed			-1.881	143.67	0.062	-0.395	0.21	-0.81	0.02

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factors leading to contractor-subcontractor interface problems caused by main contractors		Levene's Test for Equality of		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Failure of the main contractor to use the insurance in case of injury of subcontractor's labor	Equal variances assumed								-0.062	0.8
	Equal variances not assumed			1.705	148.38	0.09	0.369	0.216	-0.059	0.797
Failure to provide the subcontractor with essential services such as electricity, water, etc.	Equal variances assumed	0.054	0.82	-0.908	150	0.365	-0.185	0.204	-0.587	0.217
	Equal variances not assumed			-0.904	142.42	0.368	-0.185	0.204	-0.589	0.219
Failure to provide proper security for the site and equipments	Equal variances	2.374	0.13	0.247	150	0.805	0.061	0.245	-0.423	0.544
	Equal variances			0.250	149.26	0.803	0.061	0.242	-0.418	0.539
Using distant location for storage of materials	Equal variances	16.42	0	0.106	150	0.916	0.025	0.234	-0.438	0.488
	Equal variances			0.108	149.16	0.914	0.025	0.229	-0.427	0.477
Frequent absence of the main contractor from the site	Equal variances assumed	0.119	0.73	-0.754	150	0.452	-0.159	0.211	-0.576	0.258
	Equal variances not assumed			-0.747	138.45	0.456	-0.159	0.213	-0.58	0.262
Involvement of the main contractor in several projects at the same time	Equal variances assumed	0.364	0.55	-2.811	150	0.006	-0.642	0.228	-1.092	-0.191
	Equal variances not assumed			-2.820	146.66	0.005	-0.642	0.227	-1.091	-0.192
Scheduling conflicts among the subcontractors	Equal variances assumed	6.433	0.01	-2.131	150	0.035	-0.342	0.16	-0.658	-0.025
	Equal variances not assumed			-2.069	120.69	0.041	-0.342	0.165	-0.668	-0.015
Low experience and low capability of the main contractor	Equal variances assumed	0.561	0.46	-1.123	150	0.263	-0.246	0.219	-0.678	0.187
	Equal variances not assumed			-1.125	146.23	0.262	-0.246	0.218	-0.677	0.186

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factors leading to contractor-subcontractor interface problems caused by main contractors		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Incomplete understanding of the main contractor to the contract documents	Equal variances assumed								-0.549	0.304
	Equal variances not assumed			-0.549	118.65	0.584	-0.122	0.223	-0.564	0.319
Mistrust relationship of the contractor with the subcontractor	Equal variances assumed	8.91	0.00	-2.395	150	0.018	-0.471	0.197	-0.86	-0.082
	Equal variances not assumed			-2.340	126.75	0.021	-0.471	0.201	-0.87	-0.073
Asking the subcontractors to reduce the agreed costs in the tendering stage.	Equal variances assumed	1.061	0.31	0.082	150	0.935	0.019	0.236	-0.447	0.486
	Equal variances not assumed			0.083	148.62	0.934	0.019	0.234	-0.443	0.482

Table 5. Group Statistics for factors leading to contractor-subcontractor interface problems caused by subcontractors

factors leading to contractor subcontractor interface problems caused by sub contractors	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Delay of the works behind the time schedule	Main contractors	69	4.51	.720	
	sub-contractors	83	4.72	.450	.049
Failure to preserve and take care of the materials	Main contractors	69	4.32	.866	.104
	sub-contractors	83	4.54	1.063	.117
Exhausting equipments and other resources of the main contractor	Main contractors	69	3.93	1.048	.126
	sub-contractors	83	4.02	.826	.091
Partnering the works to another sub contractor without getting approval of the main contractor	Main contractors	69	3.55	1.219	.147
	sub-contractors	83	3.24	1.340	.147
Absence of the sub contractor from the site	Main contractors	69	3.75	1.277	.154
	sub-contractors	83	3.47	1.549	.170
Involvement of the sub contractor in several projects at the same time	Main contractors	69	3.94	.983	.118
	sub-contractors	83	3.87	1.057	.116
Neglecting the instructions of the main contractor	Main contractors	69	4.22	.953	.115
	sub-contractors	83	4.04	.956	.105
Shortage of skilled labor with the sub contractor	Main contractors	69	4.35	.682	.082
	sub-contractors	83	3.99	.862	.095
Non-adherence to the conditions of the contract	Main contractors	69	3.71	1.113	.134
	sub-contractors	83	3.72	1.108	.122
Lack of construction quality work	Main contractors	69	4.39	.771	.093
	sub-contractors	83	4.00	.826	.091
Shortage of equipment or machinery at the sub contractor	Main contractors	69	3.70	.960	.116
	sub-contractors	83	3.54	1.319	.145
Neglecting the safety measures	Main contractors	69	3.33	1.080	.130
	sub-contractors	83	2.80	1.575	.173

Table 6 Independent Samples Test for factors leading to contractor-subcontractor interface problem caused by subcontractors

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Delay of the works behind the time schedule	Equal variances assumed	12.985	.000	-2.251	150	.026	-.216	.096	-.405	-.026
	Equal variances not assumed			-2.161	109.790	.033	-.216	.100	-.413	-.018
Failure to preserve and take care of the materials	Equal variances assumed	.107	.744	-1.401	150	.163	-.223	.159	-.538	.092
	Equal variances not assumed			-1.428	149.948	.155	-.223	.156	-.532	.086
Exhausting equipments and other resources of the main contractor	Equal variances assumed	.894	.346	-.635	150	.526	-.097	.152	-.397	.204
	Equal variances not assumed			-.622	128.079	.535	-.097	.155	-.404	.211
Partnering the works to another sub contractor without getting approval of the main contractor	Equal variances assumed	1.443	.232	1.478	150	.142	.310	.210	-.104	.724
	Equal variances not assumed			1.491	148.747	.138	.310	.208	-.101	.720
Absence of the sub contractor from the site	Equal variances assumed	11.305	.001	1.216	150	.226	.284	.233	-.177	.745
	Equal variances not assumed			1.238	149.992	.218	.284	.229	-.169	.737
Involvement of the sub contractor in several projects at the same time	Equal variances assumed	1.984	.161	.447	150	.656	.075	.167	-.255	.404
	Equal variances not assumed			.450	148.060	.653	.075	.166	-.253	.402
Neglecting the instructions of the main contractor	Equal variances assumed	.764	.383	1.166	150	.246	.181	.155	-.126	.488
	Equal variances not assumed			1.166	145.124	.246	.181	.155	-.126	.488
Shortage of skilled labor with the sub contractor	Equal variances assumed	4.511	.035	2.811	150	.006	.360	.128	.107	.613
	Equal variances not assumed			2.871	149.657	.005	.360	.125	.112	.608

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		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Non-adherence to the conditions of the contract	Equal variances assumed	.155	.695	-.070	150	.944	-.013	.181	-.370	.345
	Equal variances not assumed			-.070	144.734	.944	-.013	.181	-.370	.345
Lack of construction quality work	Equal variances assumed	.039	.844	2.996	150	.003	.391	.131	.133	.649
	Equal variances not assumed			3.015	147.975	.003	.391	.130	.135	.648
Shortage of equipment or machinery at the sub contractor	Equal variances assumed	17.592	.000	.805	150	.422	.153	.191	-.223	.530
	Equal variances not assumed			.829	147.542	.409	.153	.185	-.212	.519
Neglecting the safety measures	Equal variances assumed	30.285	.000	2.406	150	.017	.538	.224	.096	.980
	Equal variances not assumed			2.487	145.032	.014	.538	.216	.111	.966

Table 7. Group Statistics for factors leading to contractor-subcontractor interface problems caused by the owners

	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Awarding the tender to the contractor with lowest price	Main contractors	69	4.13	0.999	0.12
	sub-contractors	83	3.9	0.821	0.09
Delay in providing information such as additional drawings, benchmarks, etc.	Main contractors	69	4.23	0.825	0.099
	sub-contractors	83	4.24	0.892	0.098
Giving instructions to the subcontractor directly without consulting the main contractor	Main contractors	69	3.49	1.335	0.161
	sub-contractors	83	3.23	1.509	0.166
Objection of the owner on the implementation method used by the sub contractor	Main contractors	69	3.13	1.083	0.13
	sub-contractors	83	3.36	1.089	0.119
Using several variation orders	Main contractors	69	3.48	1.335	0.161
	sub-contractors	83	3.59	1.288	0.141
Delay in releasing payments to the main contractor	Main contractors	69	4.48	0.885	0.106
	sub-contractors	83	4.46	0.915	0.1
Short period allowed for implementing the project	Main contractors	69	3.87	0.969	0.117
	sub-contractors	83	4.35	0.772	0.085

Table 8. Independent Samples Test for factors leading to contractor-subcontractor interface problem caused by the owner

factors leading to contractor-subcontractor interface problem caused by the owner		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Awarding the tender to the contractor with lowest price	Equal variances assumed	2.94	0.088	1.537	150	0.126	0.227	0.148	-0.065	0.518
	Equal variances not assumed			1.51	131.43	0.134	0.227	0.15	-0.07	0.524
Delay in providing information such as additional drawings, benchmarks, etc.	Equal variances assumed	5.56	0.020	-0.07	150	0.949	-0.009	0.14	-0.287	0.268
	Equal variances not assumed			-0.07	148.25	0.948	-0.009	0.139	-0.285	0.266
Giving instructions to the subcontractor directly without consulting the main contractor	Equal variances assumed	5.55	0.020	1.13	150	0.26	0.264	0.233	-0.197	0.725
	Equal variances not assumed			1.143	149.39	0.255	0.264	0.231	-0.192	0.72
Objection of the owner on the implementation method used by the sub contractor	Equal variances assumed	0.17	0.679	-1.31	150	0.194	-0.231	0.177	-0.581	0.119
	Equal variances not assumed			-1.31	145.21	0.194	-0.231	0.177	-0.581	0.119
Using several variation orders	Equal variances assumed	1.18	0.280	-0.53	150	0.6	-0.112	0.213	-0.534	0.309
	Equal variances not assumed			-0.52	142.97	0.601	-0.112	0.214	-0.535	0.311
Delay in releasing payments to the main contractor	Equal variances assumed	0	0.947	0.139	150	0.89	0.02	0.147	-0.27	0.311
	Equal variances not assumed			0.14	146.57	0.889	0.02	0.146	-0.269	0.31
Short period allowed for implementing the project	Equal variances assumed	0.87	0.353	-3.4	150	0.001	-0.48	0.141	-0.759	-0.201
	Equal variances not assumed			-3.33	128.94	0.001	-0.48	0.144	-0.765	-0.195

Table 9. Group Statistics for the factors leading to contractor-subcontractor interface problems caused by the consulting firm

	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Contradiction among the tender documents	Main contractors	69	3.57	1.289	0.155
	sub-contractors	83	3.93	1.368	0.15
Ambiguity of the drawings and technical specifications	Main contractors	69	3.88	0.978	0.118
	sub-contractors	83	4.02	1.168	0.128
Delay in approving materials samples and shop drawings	Main contractors	69	3.87	0.906	0.109
	sub-contractors	83	4.35	0.652	0.072
Delay in hand-over of sub contractor's works	Main contractors	69	3.51	1.208	0.145
	sub-contractors	83	3.9	1.236	0.136
Low experience of the consultant's team	Main contractors	69	3.45	1.334	0.161
	sub-contractors	83	3.64	1.154	0.127
Delay in approving payment documents of the main contractor	Main contractors	69	3.99	1.105	0.133
	sub-contractors	83	4.33	0.912	0.1

Table 10. Independent Samples Test for factors leading to main contractor subcontractor interface problem caused by the consulting firm

factors leading to main contractor subcontractor interface problem caused by the consulting firm		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Contradiction among the tender documents	Equal variances assumed	0.08	0.78	-1.67	150	0.097	-0.362	0.217	-0.792	0.067
	Equal variances not assumed			-1.68	147.65	0.095	-0.362	0.216	-0.789	0.064
Ambiguity of the drawings and technical specifications	Equal variances assumed	12	0	-0.79	150	0.43	-0.14	0.177	-0.49	0.21
	Equal variances not assumed			-0.8	149.99	0.423	-0.14	0.174	-0.484	0.204

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factors leading to main contractor subcontractor interface problem caused by the consulting firm	Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Delay in approving materials samples and shop drawings	Equal variances assumed	2.99	0.09	-3.79	150	0	-0.48	0.127	-0.73	-0.23
	Equal variances not assumed			-3.68	120.62	0	-0.48	0.13	-0.738	-0.222
Delay in hand-over of sub contractor's works	Equal variances assumed	0.08	0.78	-1.99	150	0.049	-0.396	0.199	-0.79	-0.003
	Equal variances not assumed			-1.99	146.09	0.048	-0.396	0.199	-0.789	-0.003
Low experience of the consultant's team	Equal variances assumed	4.5	0.04	-0.94	150	0.35	-0.189	0.202	-0.588	0.21
	Equal variances not assumed			-0.93	135.42	0.356	-0.189	0.205	-0.594	0.215
Delay in approving payment documents of the main contractor	Equal variances assumed	1.38	0.24	-2.08	150	0.039	-0.34	0.164	-0.663	-0.017
	Equal variances not assumed			-2.04	131.81	0.043	-0.34	0.166	-0.669	-0.011

Table 11. Group Statistics for the factors leading to contractor-subcontractor interface problems caused by external factors

	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Shortage of construction materials in the market	Main contractors	69	3.97	1.283	.154
	sub-contractors	83	4.14	1.221	.134
Changes in material and labor cost	Main contractors	69	3.86	1.019	.123
	sub-contractors	83	3.39	1.267	.139
Weather conditions	Main contractors	69	3.19	1.004	.121
	sub-contractors	83	3.45	1.232	.135
Underground condition of the site	Main contractors	69	3.00	1.150	.138
	sub-contractors	83	3.51	1.347	.148
Non existence of standard condition of contract	Main contractors	69	3.35	1.174	.141
	sub-contractors	83	3.98	1.024	.112

Table 12. Independent Samples Test for the group of factors leading to contractor-subcontractor interface problems caused by the external factors

factors leading to contractor-subcontractor interface problems caused by the external factors		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Shortage of construction materials in the market	Equal variances assumed	.162	.688	-.853	150	.395	-.174	.204	-.576	.229
	Equal variances not assumed			-.849	142.132	.397	-.174	.205	-.578	.231
Changes in material and labor cost	Equal variances assumed	7.068	.009	2.482	150	.014	.470	.189	.096	.843
	Equal variances not assumed			2.532	149.845	.012	.470	.185	.103	.836
Weather conditions	Equal variances assumed	2.870	.092	-1.393	150	.166	-.257	.185	-.623	.108
	Equal variances not assumed			-1.419	149.948	.158	-.257	.181	-.616	.101
Underground condition of the site	Equal variances assumed	5.152	.025	-2.462	150	.015	-.506	.206	-.912	-.100
	Equal variances not assumed			-2.498	149.880	.014	-.506	.203	-.906	-.106
Non existence of standard condition of contract	Equal variances assumed	1.706	.193	-3.523	150	.001	-.628	.178	-.980	-.276
	Equal variances not assumed			-3.479	136.091	.001	-.628	.181	-.985	-.271

Table 13. Group Statistics for the factors negatively affecting project performance in terms of time

factors negatively affecting project performance in terms of time	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Delay in valuation, measurement and progress payments	Main contractors	69	4.13	1.162	0.14
	sub-contractors	83	4.81	0.551	0.061
Interruptions and termination of work by the contractor	Main contractors	69	3.75	1.168	0.141
	sub-contractors	83	3.63	1.386	0.152
Delay by the main contractor in providing the necessary materials to the subcontractor	Main contractors	69	3.72	1.293	0.156
	sub-contractors	83	4.43	0.886	0.097
Delay in providing information such as necessary clarifications of design, benchmarks, etc.	Main contractors	69	3.81	1.128	0.136
	sub-contractors	83	3.78	1.269	0.139
Absence of the sub contractor from the site	Main contractors	69	3.87	0.938	0.113
	sub-contractors	83	3.54	1.243	0.136
Absence of good working relationship between subcontractors	Main contractors	69	3.7	1.075	0.129
	sub-contractors	83	3.7	1.207	0.132

Table 14. Independent Samples Test for the factors negatively affecting project performance in terms of time

factors negatively affecting project performance in terms of time		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Delay in valuation, measurement and progress payments	Equal variances assumed	36.627	0	-4.71	150	0	-0.677	0.144	-0.961	-0.393
	Equal variances not assumed			-4.44	93.117	0	-0.677	0.152	-0.979	-0.374
Interruptions and termination of work by the contractor	Equal variances assumed	5.853	0.017	0.604	150	0.547	0.127	0.21	-0.289	0.543
	Equal variances not assumed			0.614	149.97	0.54	0.127	0.207	-0.282	0.536

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		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Delay by the main contractor in providing the necessary materials to the subcontractor	Equal variances assumed	7.245	0.008	-3.99	150	0	-0.709	0.178	-1.06	-0.358
	Equal variances not assumed			-3.86	116.68	0	-0.709	0.184	-1.073	-0.345
Delay in providing information such as necessary clarifications of design, benchmarks, etc.	Equal variances assumed	1.537	0.217	0.145	150	0.885	0.028	0.197	-0.36	0.417
	Equal variances not assumed			0.146	149.31	0.884	0.028	0.195	-0.356	0.413
Absence of the sub contractor from the site	Equal variances assumed	10.321	0.002	1.803	150	0.073	0.327	0.182	-0.031	0.686
	Equal variances not assumed			1.849	148.7	0.066	0.327	0.177	-0.022	0.677
Absence of good working relationship between subcontractors	Equal variances assumed	2.374	0.125	-0.02	150	0.987	-0.003	0.187	-0.373	0.367
	Equal variances not assumed			-0.02	149.26	0.986	-0.003	0.185	-0.369	0.363

Table 15. Group Statistics for the factors negatively affecting project performance in terms of cost

	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Late information such as on design changes	Main contractors	69	3.88	1.323	.159
	sub-contractors	83	3.53	1.648	.181
Lack of cooperation between personnel of main contractor and	Main contractors	69	3.54	1.065	.128
	sub-contractors	83	3.71	1.099	.121
Absence of good working relationship between subcontractors	Main contractors	69	3.55	.963	.116
	sub-contractors	83	3.69	1.361	.149
Absence of clear working drawings and specifications	Main contractors	69	3.84	1.093	.132
	sub-contractors	83	3.71	1.461	.160
Rework	Main contractors	69	3.64	1.317	.159
	sub-contractors	83	4.07	1.166	.128

Table 16. Independent Samples Test for the factors negatively affecting project performance in terms of cost

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Late information such as on design changes	Equal variances assumed	8.213	0.005	1.439	150	0.152	0.354	0.246	-0.132	0.84
	Equal variances not assumed			1.468	149.84	0.144	0.354	0.241	-0.122	0.83
Lack of cooperation between personnel of main contractor and	Equal variances assumed	0.033	0.855	-0.99	150	0.324	-0.175	0.177	-0.524	0.174
	Equal variances not assumed			-0.99	146.48	0.323	-0.175	0.176	-0.523	0.173
Absence of good working relationship between subcontractors	Equal variances assumed	4.258	0.041	-0.7	150	0.487	-0.136	0.195	-0.521	0.249
	Equal variances not assumed			-0.72	146.46	0.473	-0.136	0.189	-0.51	0.238
Absence of clear working drawings and specifications	Equal variances assumed	8.91	0.003	0.609	150	0.543	0.13	0.213	-0.291	0.551
	Equal variances not assumed			0.625	148.44	0.533	0.13	0.207	-0.28	0.54
Rework	Equal variances assumed	6.898	0.01	-2.16	150	0.033	-0.435	0.202	-0.833	-0.036
	Equal variances not assumed			-2.13	137.22	0.035	-0.435	0.204	-0.838	-0.032

Table 17. Group Statistics for the factors negatively affecting project performance in terms of quality

factors negatively affecting project performance in terms of quality	Main contractors and subcontractors	N	Mean	Std. Deviation	Std. Error Mean
Providing low-quality materials that result in low-quality workmanship	Main contractors	69	3.80	1.037	.125
	sub-contractors	83	3.98	1.249	.137
Shortage of required equipment or machinery at the sub contractor	Main contractors	69	3.59	1.276	.154
	sub-contractors	83	3.70	1.496	.164
Shortage of skilled labor with the sub contractor	Main contractors	69	3.97	.939	.113
	sub-contractors	83	4.12	1.098	.120
Failure of the subcontractor to preserve and take care of the materials	Main contractors	69	3.70	.880	.106
	sub-contractors	83	3.89	1.148	.126
Absence of good working relationship between subcontractors	Main contractors	69	3.48	1.038	.125
	sub-contractors	83	3.58	1.191	.131
Poor supervision	Main contractors	69	3.67	1.184	.143
	sub-contractors	83	3.69	1.229	.135
Absence of clear working drawings and specifications	Main contractors	69	3.71	.972	.117
	sub-contractors	83	3.28	1.633	.179

Table 18. Independent Samples Test for the group of factors negatively affecting project performance in terms of quality

factors negatively affecting project performance in terms of quality		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Providing low-quality materials that result in low-quality workmanship	Equal variances assumed	.541	.463	-.948	150	.345	-.179	.189	-.552	.194
	Equal variances not assumed			-.964	150.000	.337	-.179	.185	-.545	.188

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		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Shortage of required equipment or machinery at the sub contractor	Equal variances assumed	3.179	.077	-.458	150	.647	-.105	.228	-.555	.346
	Equal variances not assumed			-.465	149.894	.642	-.105	.225	-.549	.340
Shortage of skilled labor with the sub contractor	Equal variances assumed	4.207	.042	-.892	150	.374	-.149	.168	-.481	.182
	Equal variances not assumed			-.905	149.868	.367	-.149	.165	-.476	.177
Failure of the subcontractor to preserve and take care of the materials	Equal variances assumed	3.238	.074	-1.162	150	.247	-.196	.169	-.529	.137
	Equal variances not assumed			-1.190	149.069	.236	-.196	.165	-.521	.129
Absence of good working relationship between subcontractors	Equal variances assumed	3.304	.071	-.546	150	.586	-.100	.183	-.462	.262
	Equal variances not assumed			-.553	149.649	.581	-.100	.181	-.457	.257
Poor supervision	Equal variances assumed	.248	.619	-.102	150	.919	-.020	.197	-.409	.369
	Equal variances not assumed			-.102	146.741	.919	-.020	.196	-.408	.368
Absence of clear working drawings and specifications	Equal variances assumed	69.847	.000	1.936	150	.055	.433	.224	-.009	.875
	Equal variances not assumed			2.023	136.805	.045	.433	.214	.010	.856