

# Main Contractors' Strategies in Managing Construction Quality of Sub Contracted Works in Tanzania

Dennis N.G.A.K. Tesha<sup>1</sup>, Valentine G.M. Luvara<sup>2</sup>,

<sup>1</sup>Assistant Lecturer, Dept of Building Economics, Ardhi University, P.O Box 35176, Dar-Es-Salaam, Tanzania.

<sup>2</sup>Assistant Lecturer, Dept of Building Economics, Ardhi University, P.O Box 35176, Dar-Es-Salaam, Tanzania.

\*\*\*

**Abstract** - Most construction projects involve a number of subcontracted works, due to subcontracting practice being so necessary. The performance of subcontractors is a major factor, contributing to the project success, which is possible due to proper conduction of monitoring and performance, that may also result to a better construction quality of subcontracted works, speed up construction time, reduced overhead cost and overall construction cost. The study aimed at assessing strategies used by main contractors in managing construction quality of sub-contracted works, by determining the level of application of quality control methods used by main contractors, as well as to identify challenges facing the main contractors. The study's methodology involved questionnaires and interviews to building main contractors, and the data collected were analyzed by Descriptive Statistical Methods, and presented by using table, charts, and graph. The study findings indicated that the most applicable quality control methods used by main contractors on subcontracted works includes; material and engineering inspection, sampling and testing, as well as qualification requirements of subcontractors and personnel. The study's main challenge facing main contractors includes; the cash flow management, poor management practices by subcontractors, and subcontractor's lack of enough competence. The study concluded that; the application of quality control methods does not automatically guarantee delivery of a high construction quality project by subcontractors, hence recommending the presence of proper cash flow management between main contractors and subcontractors; close supervision of subcontractors works done by main contractors; conduction of daily and weekly site meetings with subcontractors; sample testing, performance of regular inspection and promotion of full time site health and safety status of staff and works.

**Key Words:** Main Contractor, Sub Contractors, Strategies, Quality, Construction, Management & Tanzania

## 1.0. INTRODUCTION:

Construction has been, and continues to be an industry complemented by numerous subcontractors, who are vital in construction projects as their specialized skills and experience helps in ensuring the work is completed according to the time, cost, quality, safety and environmental requirements of the client and statutory bodies, [29].

Basically, in today's construction market, subcontractors execute significant portions of construction work, which in really sense main contractors have a major influence on their access. Key factors influencing a main contractors' choice of subcontractors include the subcontractor's; financial capability, track record, construction management systems, compliance with legislative requirements, and BEE status.

Often, main contractors perform the basic operations and prefers to subcontract the remainder of the work, to various specialty contractors; because of insufficient resources or lack of expertise in a specific area, [35][6]. Furthermore, (Lian at el,2012)[22]; (Chamara, Waidyasekara & Mallawaarachchi,2015)[6]. argues that; specialized works makes construction process more complex, and thus creating difficulty for the main contractor in fulfilling the client's requirements. To solve the problem, specialized knowledge and experience of a sub contractor, must be used by subletting a parts of the contract to other contractor or several contractors, who end up offering their consultancy to overcome the demand on special expertise, advanced equipment, and huge investment cost. Hinze and Tracey,(1994); Shash,(1998); and Kumaraswamy & Matthews,(2000) in El-Mashaleh(2009)[12]; state that it is common for the main contractors to subcontract 80% to 90% of the construction work to subcontractors; leaving them acting as construction management agents only. Example in UK, over 90% of the construction activities, ranging from "fix only to "design, manufacture, supply and fix" are subcontracted, [15]. Besides, main contractors prefer this option because the qualified subcontractors performs their work specialty more quickly and at a lesser cost than main contractor, [24].

El-Mashaleh(2009)[12]; (Kumaraswamy & Matthews,2000) [20]; Lian at el,(2012)[22]., defines "Subcontractors" the construction firm that contracts with a main contractor to perform some aspect of the main contractor's work; hence playing a vital role in most construction projects. Moreover, Lian at el,(2012)[22]. emphasizes that; subcontractors are specialist in the execution of a specific job, by acting as agents of the production system of the contractor company in supplying materials, manpower, equipment, tools or designs, and they are much more extensively used on building construction projects than on engineering projects. According to Albino and Garavelli,(1998)[1]., subcontractors can contribute more than 50% of the total project works, and can be as much as 90% of total project value to a

construction process. However, large presence of subcontracting practice poses challenges to main contractors, client and their project management teams, in terms of managing the subcontractors' work, given the fact that success of a construction project depends much on the ability of main contractor in selecting the appropriate subcontractor and managing them during construction.

The strategies used in managing subcontractors differs depending on country's of practice institutional framework. Example in the USA, construction industry is geared towards high productivity, with subcontractors well coordinated by the main contractors and accepting the total responsibility for product, [15]. Besides, (Gray & Flanagan,1989)[15], adds that; "higher quality, value to the owner, faster construction time, reduced overhead cost and overall construction cost are the main reasons for subcontracting in USA construction industry". Comparing to the Sub-Saharan Africa, one of the challenges facing main contractors in managing construction of subcontracted works, is loss of control over the work [1], particularly in relation to quality standards achievement. In South Africa for instance, subcontracting which includes specialist, generalist, trade and labour-only subcontractors, is very prevalent in the South African construction industry, with up to 70% of building and 30% of civil construction projects subcontracted out. The most prevalent types of subcontracting are labour-only, trade contracting in the building sector and specialist subcontracting in the building and civil sectors, [7].

However, disputes in South African construction industry, between of the main contractors and subcontractors arise because of late payments, under-payment from clients, hence forcing the main contractors to put pressure on subcontractors so that they can reduce their price. Specifically, the main contractors identified payment practices as the main source of conflict between the parties, with the "pay-when-paid" principle being singled out as chief amongst these. Other challenges facing main contractors include; weak management practices by subcontractors, skill shortages of the workers employed by subcontractors, [7]. As strategies to overcome these challenges, main contractors are typically active in passing on skills in labour, health and safety, environmental management practices so as to reduce the probability of default on the part of the subcontractors and to achieve proper construction quality of the subcontracted works, as the clients hold the main contractor accountable for compliance with the contract requirement, [7].

Additionally, the main contractors typically keep a database of subcontractors whom they have worked with in the past and have been satisfied with the quality of their work. Enrolment onto these databases is usually not exclusive and most contractors continuously consider applications from subcontractors by looking at: financial capability as evidenced by bank statements, available financial guarantees, the quality of previous work done, and/or client and consultant recommendations, subcontractor's business, health and safety and quality management systems levels of compliance with industry regulations, [7]. Main contractors

are required to submit a contractor quality control plan (CQCP) as part of the strategies for managing construction quality of subcontracted works. A CQCP is the documentation of the contractor's process for delivering the level of construction quality required by the contract,[14].

The document serves as a framework for the contractor's process for delivering quality construction work. Whilst the plans and specifications define the expected results the CQCP outlines how these results will be achieved, the requirements for a contractor's quality control plan (CQCP) include: Process control testing that shows various tests done on all materials supplied by main contractors and subcontractors, Inspection/control procedures on all works by domestic and nominated subcontractors, Proper description of records/list of the records to be maintained, Submission of personnel qualifications including all subcontractors involved and a detailed work plan on how subcontractors will interface with the contractor's and/or other subcontractor's organizations in the given project [14].

Basically, Elazouni & Metwally, (2000), in El-Mashaleh (2009)[12], insists that; subcontractors helps main contractors in overcoming problems related to special expertise need, shortage in resources, and limitation in finances. The operations of the average main contractor are not sufficiently extensive to afford full-time employment of skilled craftsmen in each of the several trade classifications needed in the field, [4]. Sub-contracting allows main contractors to employ a minimum workforce in construction projects and promotes specialization, [12]. It capitalizes on the skills of trade specialists and copes with the fluctuating construction demand, and thus why it might improve quality and reduce project time and costs, [12]. Arditi and Chotibhongs (2005)[4], advocate that the use of subcontracting has proved to be efficient and economical in the use of available resources. Qualified subcontractors are usually able to perform their work specialty more quickly and at a lesser cost than the main contractor, [4]. More recently, Ng et al. (2008a, 2008 b); Arditi & Chotibhongs (2005) [4]; and Wang and Liu (2005); in El-Mashaleh(2009) [12], indicate that subcontractors continue to play a vital role in executing significant portions of construction work.

### 1.1. Research Problem

According to URT,(2003) [33], in Tanzania, local consultants and contractors are marginalized partly due to the general low productivity and poor quality of services. Furthermore, It has been suggested that the local construction industry must mount productivity and quality improvement revolution to achieve international competitiveness (*ibid*). The main contractors' performance is strongly dependant on subcontractors[1]. This statement is reinforced by Mbachu,(2008)[23], who stated that the ability of the main contractor and consultant to deliver the project within time, quality and cost depends largely on performance of subcontractors. Therefore proper management of subcontractors, if ignored, can cause a great impact to the construction project, and can extend into and affect the

operation of the main contractors' organization. In that case issues concerning subcontractors should not be overlooked in defeating the challenge of achieving planned budget, quality and schedule.

Therefore, this study attempts to fulfill the gap between required and current performance of main contractors against subcontractors by assessing the possible strategies that may be used by main contractors in managing construction quality of subcontracted works in Tanzania. This is achieved by ensuring that the existing situation is addressed and worked out, through the following questions like:- What is the level of application of quality control methods used by main contractors in managing construction quality of subcontracted works? What are the challenges facing main contractors in managing construction quality of subcontracted work? and What are possible strategies that may be used by main contractors in managing construction quality of subcontracted works?.

## 2.0. LITERATURE REVIEW

The literature review gives a clear understanding of the main contractors' strategies in managing construction quality of subcontracted work. It begins by giving the history of subcontracting and later reviews types and roles of subcontractors, reasons for subcontracting, quality control methods adopted by main contractors in managing construction quality of subcontracted works, and challenges facing main contractors in managing subcontracted works.

### 2.1. History of Sub-Contracting

According to Thomas,(2002)[30]; subcontracting has existed since time immemorial, but it became an increasingly popular practice in the Australian construction industry in 1960's and over the years, it has established itself as an integral part of the industry's production process. Subcontracting is particularly popular in the building sector of the industry, where subcontractors perform up to 90% of all construction work (ibid). The advent of managed delivery methods has provided the opportunity for subcontractors to either expand their activities across a range of related trade or form alliances with other subcontractors in order to bid for competitive work processes. The reasons behind the development of subcontracting are numerous and are attributed not only to the needs of the construction industry but also to the changes in economic and social climates of western countries.

Additionally, Thomas,(2002)[30], narrated that; throughout the early 1950's and 1960's the construction industry largely operated on full documentation, whereby the projects were procured using traditional method of delivery, with the main contracts awarded through competitive tendering. Those were the years of economic prosperity, little inflation; low and stable interests rate an industrial peace. Moreover Thomas,(2002)[30], discovered that at that time the contractor was regarded as a master builder in the true and apprentices. Only high specialized area of works such as; mechanical and electrical works were performed by

subcontractors. Most western economies were at their prime in the 1950's and early 1960's enjoying the fast economic growth, low inflation and almost full employment. The construction industry too enjoyed prosperity and stability. Since the late 1960's, however, the world economies began to experience periodic economic downturns, spiraling inflation, high interest rates and growing unemployment. Since the construction industry is highly sensitive to fluctuations in the economic climate (it is said to be a barometer of the national economy), the emergence of adverse economic factors were instrumental in changing established practices and processes of the construction industry. One of a number of significant changes was a shift towards subcontracting. Subcontracting emerged principally because (ibid):—

- Contractors capacity,
- Projects became more complex, hence requiring services of highly specialized workers
- Subcontracting provided an opportunity to individuals to set up and run their own business

Today, the diversity of subcontractors is considerable, ranging from the one-person operation to large, highly sophisticated corporations. Since main contractors prefer to operate in a more risk-immune environment of construction and project management, subcontracting firms have been given an opportunity to pursue 'packaged contracts' which may go well beyond the boundaries of their traditional trade expertise, [30].

### 2.2. Types of Sub-Contractors

In building industry contract law, particularly when using Joint Contract Tribunal(JCT) standard form contracts, three subcontractor types are identified, and these includes:—

- **Domestic Subcontractors;** is a subcontractor who contracts with the main contractor to supply or fix any materials or good or execute work forming part of the main contract. Essentially this contractor is employed by the main contractor, [21].
- **Nominated Subcontractors;** is one that is selected by the client to carry out an element of the works. Nominated sub-contractors are imposed upon the main contractor after the main contractor has been appointed
- **Named Subcontractors;** is the one selected by the main contractor from a cumulative list of one or more preferred sub-contractors by both the employer and the main contractor. (Gould,2011), reports that; the subcontractor may be treated as a domestic sub-contractor of the main contractor hence avoiding the employer liability.

### 2.3. Responsibilities of the Sub-Contractor

According to Andrey,(2010) [3]; the main obligation of the subcontractor is the implementation of all works meant in the contract within the time schedule. Timing and order of

execution of works are necessary to be done as meant in the contract. Also before starting work the subcontractor must develop and conform works implementation plan. A technical engineer must be placed in charge of brigades that are working on the object. Additionally, works by subcontractors should be implemented in accordance with project and working drawing. Quality should be on the demanded level, defects and flaws detected during acceptance or within the guarantee period must be terminated for his own expense. Moreover, materials provided by the subcontractor himself should be certificated. Examples of these materials should be given to the main contractor on demand for tests. The subcontractor must implement the instructions given by the main contractor, if they are not contrary to the contract. Furthermore the subcontractor is allowed to engage his own subcontractors, but only by agreement with the main contractor. Personnel, equipment and works must be ensured.

#### 2.4. Reasons for Subcontracting

Subcontracting improves flexibility, and can be defined as the ability of the company in responding to market changes. According to Brandli(1998)[5], labor subcontracting improves the functional flexibility (the workers' functions), of volume (number of workers) and financial of the company (smaller fixed costs). Subcontracting increases productivity since, in a general way, the subcontracted teams are specialized in certain services; they start to present a larger productivity when compared with the company's own labor force. This probably happens due to effects of repetition, learning and concentration, besides the use of work organization methods, [34]. Moreover subcontracting improves the product's quality: if qualified workers are used, the specialties of the labor take better quality products. However, according to Brandli,(1998)[5], subcontracting leads to control and coordination problems that can result in low quality products.

The quality of the products is not affected by the main contracting party's competence, and attributed it exclusively to the subcontractor's performance. Subcontracting eliminates sub-used labor and equipment maintenance: now the companies that possess enough work fronts to provide services to the whole production team, maintaining it continually busy, are rare (*ibid*). This condition extends to the equipment that would be sub-used. The use of subcontractors with contracts of fixed price facilitates costs control and reduces the responsibility of the manufacturer's supervision, [10]. Subcontractors reduce delays: as the productivity services executed with subcontracted labor is larger, if there is good programming and planning of the tasks and if other external factors don't act directly, a reduction of delays results as natural effect.

#### 2.5. Approach to Subcontracting in Different Standard Forms of Contract

##### 2.5.1. National Construction Council (NCC) of Tanzania Form of Contracts.

According to the NCC,(2000)[26], standard form of contract has no provision for domestic subcontractor as it assumes that the main contractor is liable for all works done by domestic subcontractors as they work under the main contractor. Subcontractors and employers in an ordinary construction project would normally not have direct contractual relationships with each other; an employer usually appoints a main contractor, and the main contractor then appoints its own single or multiple subcontractors. Each subcontractor maybe specialized in a particular field of a related construction industry. This means that in any case of default or breach of agreement, the employer would not be able to sue the subcontractor directly for defaults associated with its performance, and equally the subcontractor would not be able to sue the employer for payment of the subcontractor's entitlement by the main contractor. However the NCC,(2000)[26], standard form of contract has provision for nominated subcontractors. A subcontractor nominated by the architect are hereby declared to be sub-contractors employed by the contractor and are referred to in these conditions as nominated subcontractors. Under Clause 31.2 of the NCC,(2000)[26], It is provided that the architect shall not nominate any person as a sub-contractor against whom the contractor shall make reasonable objection or save where the architect and contractor shall otherwise agree.

##### 2.5.2. International Federation of Consulting Engineers (FIDIC) Form of Contracting

The FIDIC Conditions of Contract for Construction (*Red Book*) do not permit the contractor to subcontract the whole of the works. These conditions of contract hold the contractor responsible for the acts or defaults of any of his domestic subcontractors as if they were the acts and defaults of the Contractor himself, [7]. FIDIC does not provide any standard form of subcontract for use with the FIDIC (*Red Book*) or any of its standard forms of contract. Provision is made for nominated subcontractors. In terms of these conditions, a Contractor is not under any obligation to employ a nominated subcontractor against whom he/she raises reasonable objection by written notice to the Engineer which may include:—

- The subcontractor has insufficient competence, resources or financial strength and
- The subcontract does not require the subcontractor to indemnify the main contractor against negligence or misuse of goods or specify that the nominated subcontractor undertake all obligations and liabilities to discharge the main contractor from obligations under the contract and indemnify the main contractor from all the consequences of any failure of the subcontractor to perform his obligations or fulfill his liabilities.

These conditions of contract empower the Engineer to request reasonable evidence before issuing a payment certificate that the nominated subcontractor has received all monies due in previous certificates. In the event that no reasonable evidence is provided, the Employer is permitted

to pay the nominated subcontractor directly. The FIDIC Short Form of Contract (*Green Book*) has no specific provisions for subcontracting. Main contractors may accordingly subcontract portion of the work to domestic subcontractors, but are responsible for the work executed by such subcontractors as if they had not subcontracted such works.

### 2.5.3. Public Procurement Regulatory Authority (PPRA) Form of Contracting

This form of contract does not name sub-contractors, but it just call them contractors. Under this form the contract, the contractors (sub-contractors) enter into contract with the client which makes them to be in the same level as the main contractors.

## 2.6. Construction Quality Control Methods Used by Main Contractors in Managing Construction Quality of Subcontracted Works, World Wide.

The quality control methods are generally grouped into the following categories: material prequalification, qualification requirements for facilities and personnel, submittal requirements, materials sampling and testing, certificate of compliance, material and engineering inspection, and warranty. The methods can be used alone, but are generally used in combination or series to achieve the level of quality assurance desired. Decisions on the quality assurance level required are based on the use or application of the item and the severity of the consequences of its failure, [9].

### 2.6.1. Qualification Requirements

Qualification requirements for subcontractor's personnel are required to be certified to a recognized standard to ensure that work performed is executed by qualified contractors through experience and technical training. This help to evaluate if the subcontractor has the resource to perform works to the quality indicated in the specifications, (*ibid*).

### 2.6.2. Material Pre-qualification

The materials are pre-qualified and authorized for use on construction projects. These materials cannot be evaluated or tested within typical construction project timeframes and require extensive prequalification testing, which is not practical to repeat for every job. The strategy developed to ensure quality for these types of products involves the manufacturer submitting prequalification samples or an accredited/certified laboratory testing to ensure specification requirements are met prior to entry of the material, (*ibid*).

### 2.6.3. Material Sampling and Testing

Division of Construction (2015)[9], argued that; the optimal material sampling and testing plan is based on the criticality of the quality characteristic to be tested and the uniformity of the materials in question. Quality control testing by the contractor, its representatives, or subcontractors is required

during the construction process to measure the quality characteristics that affect the construction at a time when corrective action can be taken to prevent appreciable nonconforming material from being incorporated in the project. Example items include aggregate bases and sub bases, asphalt and concrete pavement, and structural concrete.

### 2.6.4. Submittal Requirement

Prior to the start of construction or fabrication, required drawings and plans submittals from the contractor that provide details on proposed methods of construction or fabrication are reviewed by project designers to assure conformance with design requirements. Typical drawing and plan features reviewed include weld details, non destructive testing requirements and constructability. Action submittals include shop drawings, product data, test samples, quality control plans, work plans, and material source data. Informational submittals include certificates of compliance and manufacturer instructions not associated with drawing submittals, (*ibid*).

### 2.6.5. Certificate of Compliance

More over Division of Construction (2015)[9], claim that; certificates of compliance are used for acceptance of products for which the industry has demonstrated a high degree of reliability in meeting contract specifications. The certificate of compliance is submitted before the material is incorporated into the work, for each batch or lot of the material. This written statement, accompanied by field or laboratory test data from a producer, affirms a product meets specification requirements example concrete test reports

### 2.6.6. Material and Engineering Inspection

Inspection is one of the most important aspects of construction work. Inspection consists of careful reviews and critical examination of the factors entering into the construction of transportation projects to ensure the proper combination of materials and details of construction. It involves monitoring the contractor's construction processes to ensure that the construction quality and workmanship are in compliance with the plans and specifications as per contract, (*ibid*).

### 2.6.7. Warranty Provisions

Warranty is a guarantee of the integrity of a product and the maker's responsibility for the repair or replacement of the deficiencies. A warranty specifies the desired performance characteristics of a particular product over a specified period and defines who is responsible for the product. A material and workmanship warranty holds the contractor responsible for correcting defects in work elements within the contractor's control during the warranty period. The contractor or manufacturer warrants that material complies with specifications, and agrees to repair or replace, (*ibid*).

## 2.7. Challenges Facing Main Contractors In Managing Construction Quality of Subcontracted Works Globally.

Selecting the right subcontractor does not guarantee the success of a construction project. Coordination and monitoring of subcontracted work during the construction is essential to achieve construction quality of subcontracted works, [35]. However there are various challenges that main contractors encounter when managing subcontracted works, these include:—

### 2.7.1. Cash Flow Management

A significant feature of construction firms is their pattern of cash flow. Low profit margins and low overheads are normal in the construction industry, [16]. In stable and certain conditions this would be a reasonable strategy, but construction projects are characterized by uncertainty. Payments to contractors can be constrained by the client and consultant team: clients do not always pay promptly and consultants do not always certify fairly, [28]. The contractor can manipulate payments to subcontractors and suppliers to offset problems with receiving payment.

### 2.7.2. Under-valuation

There are often disputes over the measurement and valuation of the subcontracted work, particularly where an item has not been specified in the bill of quantities. One reason for this may be a contractor's reluctance to commit expenditure on subcontractor's unspecified work before agreeing it with the employer. Under most procurement methods, contractual mechanisms are provided to protect Specialist and Trade Subcontractors from the worst excesses of some contractors. Because of this, a chain of measurement and approval follows the chain of contracts providing many opportunities for negotiation and dispute, [17].

### 2.7.3. Set-off

Furthermore Hughes, Gray and Murdoch, (1994)[17], argued that; set-offs can also reduce payments to subcontractors. This covers contractors for the expense of employing a replacement subcontractor to finish off the work if necessary. The survey revealed a high incidence of spurious counter-claims aimed at retaining as much money as possible. It also showed that genuine claims were rarely pursued through the courts and were usually settled by negotiation.

### 2.7.4. Pay-When-Paid

It is quite common for contractors to withhold payments to subcontractors until their own payment has been received. This is another technique by which contractors can protect their own cash flows (*ibid*).

### 2.7.5. Variations

Variations are often not valued until long after their issue, which has the effect of delaying or even avoiding payment

for the work. Many variations occur as a natural part of the evolution of the design details. This is difficult to trace and sometimes can only be adequately evaluated at the end of the project. When left this late it inevitably results in claims, counterclaims and protracted arguments. Variations clearly attributable to the client are not as problematic (*ibid*).

### 2.7.6. Final Accounts

Further problems arise from unreasonable delays to final account settlement. When work is inadequately specified, or subject to excessive variations, there is inevitably much re-measurement and negotiation to be done after completion. Earlier research studies have revealed that contractors, clients and consultants sometimes have little will to settle final accounts when they have got plenty of other, more lucrative work to distract them. Because of this, contractors and especially subcontractors must wait much longer than the payment period specified in their contracts. Only main contractors and subcontractors with large cash reserves and/or healthy cash flows on other projects can sustain this level of disruption to their cash flow.

**Table 2.1:** Main contractors' strategies in managing subcontracted works as summarized from different studies done in USA, United Kingdom, Singapore, and South Africa.

| No. | Categories                    | Strategies   |
|-----|-------------------------------|--|
| 01. | Subcontractors<br>Schedule    | <ul style="list-style-type: none"> <li>Penalty for Subcontractor delay of work</li> <li>Performance of weekly meetings,</li> <li>Qualification and certificate requirements for particular job,</li> <li>Bonus and Incentives to subcontractors upon early finish of work, and</li> <li>The good planner and updated schedule for all site works and procurement work that will be affected with on time schedule of project.</li> </ul> |
| 02. | Subcontractors<br>Cost        | <ul style="list-style-type: none"> <li>Involving subcontractors for price estimation before tendering process,</li> <li>Main contractors should consider retaining payments,</li> <li>Payment to sub-contractors should be made upon acceptance and completion of works, and</li> <li>Main contractors should acquire bonds and insurances when necessary.</li> </ul>  |
| 03. | Subcontractors<br>Quality     | <ul style="list-style-type: none"> <li>Provide quality checklist inspection and tests,</li> <li>Weekly meetings, Training provision and</li> <li>Reporting of unacceptable works performed</li> </ul>  |
| 04. | Subcontractors<br>Safety      | <ul style="list-style-type: none"> <li>Main contractors developing standard safety policy,</li> <li>Safety meetings, trainings and provision of PPE</li> <li>Safety budget for safety program implementation, and</li> <li>Risk response plan, emergency response plan, risk assessment applied for safety management</li> </ul>   |
| 05. | Subcontractors<br>Procurement | <ul style="list-style-type: none"> <li>Selection of subcontractors should base on their capabilities; financial, resources and quality performance and previous experiences,</li> <li>Registration of subcontractors and rating them based on their capabilities, and Time, Quality and Cost are the project success measurement</li> </ul>  |

Source: Authors,(2017)

### 3.0. METHODOLOGY

The methodology used in this study was survey methodology, with the research design being descriptive, in which questionnaire and interviews were used by approaching various building main contractors. In this study, the questionnaires were prepared in accordance with objectives of the research. The questionnaire was divided into two parts; first part requested on general information about respondent, second part focused on barriers, as well as determining the level of application of quality control methods used by main contractors in managing construction quality of subcontracting work. It also focused on identifying the challenges facing main contractors, and suggestions on the best strategies to be used by main contractors in managing construction quality of subcontracting work. Descriptive design was used to make a detailed assessment of strategies used by building main contractors in managing construction quality of subcontracted works. As identified by Mugenda and Mugenda (1999)[25], and Kothari (2004)[19]; descriptive research is a process of collecting data in order to test hypothesis or to answer questions concerning the current status of subjects in the study.

#### 3.1. Questionnaire Design

This study is limited to strategies used by building main contractors in managing construction quality of subcontracted work in Tanzania, with specific attention on the works done by domestic subcontractors who contracts with the main contractor to supply or fix any materials or goods or execute work forming part of the main contract. The study considered the building clients, consultants and building main contractors (Class I – III). Strategies were gathered based on literature review. Through a quantitative approach, data used were acquired with a questionnaire survey. The questionnaire which had a close ended questions, was compiled based on the refined list of quality control methods, barriers, and challenges, used by main contractors in managing construction quality of subcontracting work after a pilot study. Closed-ended questions were used as they are very convenient for collecting factual data and are simpler to analyze because the range of potential answers is limited, [2]. However, open ended questions were also incorporated to get further opinions from respondents. The pilot was carried out to mark better the quality of the questionnaire and improve reliability of the questions.

The respondents were asked to provide their views on the most influencing strategies, barriers and challenges using a 5-point scale. In a scale, the respondent was asked to respond to each of the statements in terms of several degrees, normally five degrees, [19]. The ratings used were depending on the data needed, whereby for the level of application of quality control methods: Not at all= 1; Low = 2; Moderate = 3; High = 4; and Very high = 5. For the barriers to application of quality control methods, and the challenges facing main contractors in managing construction quality of subcontracting work: Never = 1; Rare = 2; Moderate = 3; Frequent = 4; and Very Frequent = 5, were

used. and, for the strategies to be used by main contractors: Not at all= 1; Very Low = 2; Low= 3; To some extent = 4; and To great extent = 5, ratings were used. This type of scale has been found to be acceptable in other construction management research.

#### 3.2. Data Collection

In general the data collection process through this method had been quite good. Multiple sources of evidence were used to collect data. Literature was reviewed to determine the level of application of quality control methods; the barriers to application of quality control methods; the challenges facing main contractors in managing construction quality of subcontracting work: and the strategies to be used by main contractors. Questionnaires survey was used to collect primary data from clients, consultants, main contractors and sub contractors. The questions were on seeking strategies used by main contractors in managing quality of sub contracted works in Tanzania, alongside the challenges and barriers encountered. All respondents had different years of experience in the construction industry as seen in table 3.2 below, which indicate that most of respondents are familiar with management of building projects, within a group.

**Table: 3.2:** Experience of the respondents

| No. | Years of Experience   | Less than 5 Years | 5 - 10 Years | More than 10 Years |
|-----|-----------------------|-------------------|--------------|--------------------|
| 01. | Number of Respondents | 9                 | 19           | 9                  |

**Source:** Authors,(2017).

Moreover, for the sake of this study the snowballing sampling technique was used to collect data from the registered building main contractors (Class I – III) specifically those who have tendencies of subcontracting works. This sampling technique is useful if the researcher knows little about the group or organization he/she wishes to study, as it needs only to make contact with a few individuals, who can then direct you to the other members of the group. This sample selection method is useful for studying communication patterns, decision making of diffusion of knowledge

#### 3.3. Response to Questionnaires

This study consisted of questionnaires that required information from different respondents including from clients, consultants, main contractors and sub contractors. The general response from questionnaires distributed and returned from building main contractors is as shown below on table 3.1, whereby a total of 44 questionnaires were distributed to various construction firms, 28 of the distributed questionnaires were returned. This response amount to 63.6% which was used to represent the targeted sample in the study. While 36.4% were not returned. All questionnaires were properly filled. The analysis of the data collected from this study was done using Descriptive Statistical Methods (i.e. calculating their cumulative mean score and ranking the points based on the response rate). Basically, according to the list of building contractors in DSM

(2015) from Contractors Registration Board; the total number of listed contractors from Class I-III are 146 in total out of 211 listed in Tanzania, hence making DSM the prime areas for this study. Orodho and Kombo,(2002)[32], argued that the study sample should be 30% of the population under study, hence making the sample size of this study being 44 building main contractors.

**Table: 3.1:** Questionnaire Distributed and Returned from Main Contractors

| No. | Building Contractors | Registered Contractors in Tanzania | Registered Contractors in Dar | Distributed | Returned  | Percentage Returned |
|-----|----------------------|------------------------------------|-------------------------------|-------------|-----------|---------------------|
| 01. | Class I              | 130                                | 85                            | 26          | 12        | 46.2%               |
| 02. | Class II             | 38                                 | 32                            | 10          | 10        | 100%                |
| 03. | Class III            | 43                                 | 29                            | 8           | 6         | 75%                 |
|     | <b>TOTAL</b>         | <b>211</b>                         | <b>146</b>                    | <b>44</b>   | <b>28</b> | <b>63.6%</b>        |

Source: Authors,(2017).

#### 4.0. RESULTS, ANALYSIS, AND DISCUSSION

Main parameters used for investigation in study included; determining the level of application of quality control methods used by main contractors in managing construction quality of subcontracted works, and challenges facing main contractors in managing construction quality of works done by subcontractors. These paved the way to provide probable recommendations of best strategies to be used by main contractors towards achieving construction quality of subcontracted works. Data collected, analyzed and presented using Microsoft word (Tables, Bar charts and Pie charts) in order to get more accurate computation that will map out a pattern or relationship between measured or comparable variables. The study adopted descriptive statistical method where analysis was done based on the frequency of occurrence to analyze the data based on the research questions depending on how the respondents have responded to the questionnaires. Analysis on the level of application of quality control methods, potential barriers to application of quality control methods, challenges facing main contractors and main contractors' strategies in managing construction quality of subcontracted works was done by Descriptive Statistical Method, to obtain their cumulative means score and ranking them accordingly.

The value of Cumulative Mean Score is calculated by:—

$$\sum (f \times S) \div N$$

Where; f = Significance rank (1-5),

S = Number of respondent on the particular rank, and

N= Total number of respondents.

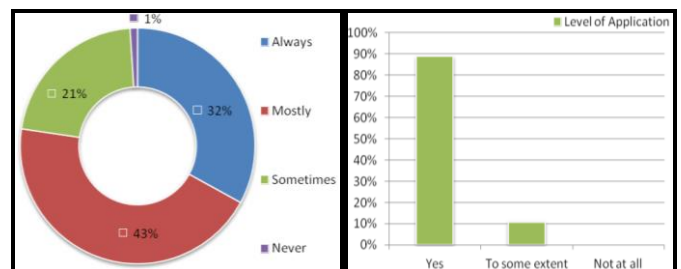
**Table 1.2:** Interpretation of results scores

| No. | Level of Consideration (M.S)      | Interpretation    |
|-----|-----------------------------------|-------------------|
| 01. | C. Mean Score (M.S) ≥ 4.0         | Most Critical     |
| 02. | C. Mean Score (MS) 3.0 ≤ MS ≤ 3.9 | Critical          |
| 03. | C. Mean Score (MS) 2.0 ≤ MS ≤ 2.0 | Average Important |
| 04. | C. Mean Score (MS) ≤ 1.9          | Not a factor      |

Source: Authors,(2017).

#### 4.1. The Level of Application of Quality Control Methods Used By Main Contractors in Managing Construction Quality of Subcontracted Works at Site.

a) The respondents were asked to indicate the frequency of subcontracting in their construction firms and results were presented as follows:—



**Figure 3.1: (LEFT);** Responses on the frequency of subcontracting in construction firms, **(RIGHT);** Responses to application of quality control methods, **Source:** Authors,(2017)

From fig. 3.1 above(left), it shows that; 9 out of 28 (32%) of respondents 'Always' subcontract works, 12 out of 28 (43%) of respondents 'Mostly' subcontract works, 6 out of 28 (21%) of respondents subcontract works 'Sometimes' while 1 out of 28 (4%) of respondents "Never" subcontract work. This implies that majority of building main contractors have tendencies of subcontracting works in Tanzania as illustrated by a great percentage shown by those who 'mostly' and 'always' subcontract works. While some construction companies especially the small and large construction companies have low tendencies of subcontracting works due to low capital, reduction of extra costs of employing other workers respectively.

b) The respondents were asked if they applied use of quality control methods in managing construction quality of subcontracted works

From the result of the analysis, Fig. 3.1 above(right) , shows 25 out of 28 respondents (89%) apply quality control methods in managing construction of subcontracted works, while 3 out of 28 respondents (11%) of the main contractors apply quality control methods 'To some extent'. Taking the average of the outcomes, it is safe to say majority of the building main contractors in Tanzania apply these quality control methods in managing construction quality of subcontracted work



c) When respondents were asked how they considered the level of application quality control methods. A list of various quality control methods was given and the level of application was ranked based on the scales as follows:—

Very high = 5, High = 4, Moderate = 3, Low = 2, Not at all =1

Analysis on the level of application of quality control methods, potential barriers challenges and strategies were done by Descriptive Statistical Method to obtain the cumulative means score of the factors and ranking them based on the responses from respondents.

The value of Cumulative Mean Score is

calculated by:—  $\sum (f \times S) \div N$

Where; f = Significance rank (1-5),  
 S = Number of respondent on the particular rank,  
 N= Total number of respondents.

Level of Consideration:

- C. Mean Score (MS)  $\geq 4.0$  - Most Critical
- C. Mean Score (MS)  $3.0 \leq MS \leq 3.9$  - Critical
- C. Mean Score (MS)  $2.0 \leq MS \leq 2.0$  - Average
- C. Mean Score (MS)  $\leq 1.9$  - Not a factor

Further discussions were made on the results analyzed from the tables and factors were categorized basing on their level of consideration as shown above

**Table: 3.3:** Analysis of results on level of application quality control methods in managing construction quality of subcontracted works

| No. | Quality Control Methods<br>Managing Construction<br>Quality of Sub-Contracted<br>Works | SCALE |    |    |   |   | TOTAL | MEAN<br>SCORE | RANK |
|-----|--|-------|----|----|---|---|-------|---------------|------|
|     |  | 5     | 4  | 3  | 2 | 1 |       |               |      |
| 01. | Material Pre-qualification   | 10    | 15 | 3  | 0 | 0 | 28    | 4.3           | 5    |
| 02. | Qualification Requirements<br>for Sub-contractors and<br>Personnel                     | 19    | 7  | 2  | 0 | 0 | 28    | 4.6           | 2    |
| 03. | Submittal Requirements   | 14    | 7  | 4  | 3 | 0 | 28    | 4.1           | 6    |
| 04. | Certificate of Compliance  | 16    | 8  | 3  | 1 | 0 | 28    | 4.4           | 4    |
| 05. | Material and Engineering<br>Inspection   | 17    | 12 | 0  | 0 | 0 | 28    | 4.8           | 1    |
| 06. | Provision of Warranties  | 3     | 9  | 10 | 6 | 0 | 28    | 3.3           | 7    |
| 07. | Sampling and Testing   | 15    | 11 | 2  | 0 | 0 | 28    | 4.5           | 3    |

Source: Authors,(2017).

From the result of the analysis in Table 3.3:the following are the 'most applicable' quality control methods by main

contractors in managing construction quality of subcontracted works in Tanzania:—

**Material and Engineering Inspection:**— From the data collected, quality control inspection is the most applicable quality control method by the contractor. It involves of careful reviews and critical examination of the factors entering into the construction ensure that a material and works meets the contract requirements, [9]. 17 respondents gave it 'very high', while 12 respondents said its application is 'high', hence scoring a cumulative mean score of 4.8

**Qualification Requirements for Subcontractors and Personnel:**— Survey has revealed that submission of qualification requirements by subcontractor is a normal practice and highly applicable in tendering processes. As the subcontractors are required submit their C.V, documents showing their previous works executed, financial resources and technical capabilities as a way of assuring that the works will be properly executed, (*ibid*). 19 respondents gave it 'very high', while 7 respondents said its application is 'high' and 2 respondents gave it 'moderate', hence scoring a cumulative mean score of 4.6

**Material Sampling and Testing:**— According to Division of construction,(2015)[9], another method is the material sampling and testing plan is based on the criticality of the quality characteristic to be tested, Quality control testing by the contractor, is required during the construction process to measure the quality characteristics that affect the construction at a time when corrective action can be taken to prevent appreciable non conforming material from being incorporated in the project. 15 respondents gave it 'very high', 11 respondents said its application is 'high'. While 2 respondents gave it 'moderate', hence scoring a cumulative mean score of 4.5.

**Certificate of Compliance:**— Respondents claim that certificate of compliance is an applicable quality control method for acceptance of subcontractor's products as it informs the contractor has accepted the material and is confident that the material complies with the contract specifications (*ibid*). 16 respondents gave it 'very high', 8 respondents said its application is 'high', 3 respondents gave it 'moderate' while 1 respondent gave it low, hence scoring a cumulative mean score of 4.4

**Material Pre-qualification:**— From the data collected pre-qualification of materials seem to be well applicable by contractors to ensure quality of products. According to, [9]. It involves the manufacturer submitting prequalification samples to an accredited/certified laboratory testing to ensure specification requirements are met prior to entry of the material at site. 10 respondents gave it 'very high', 15 respondents said its application is 'high' while 3 respondents gave it 'moderate', hence scoring a cumulative mean score of 4.3.

**Submittal Requirement:**— Main contractors also indicated that submittal requirements are also applicable towards achieving construction quality of subcontracted works. They show detailed proposed procedures for the construction or fabrication of an item quality control plans, subcontractors

work plans, and subcontractors material source data (*ibid*). 14 respondents gave it 'very high', 7 respondents said its application is 'high', 4 respondents gave it 'moderate' while 3 respondent gave it low, hence scoring a cumulative mean score of 4.1.

Other 'applicable' quality control methods by main contractors in managing construction quality of subcontracted works in Tanzania.

**Provision of Warranties for Material and Performance:**— Survey has revealed that in some cases main contractors demand material and workmanship warranty which holds the subcontractor responsible for correcting defects in work elements within the contractor's control during the warranty period. Division of Construction,(2015)[9], narrates that the contractor or manufacturer warrants that material complies with specifications, and agrees to repair or replace if, during the period of the warranty. 3 respondents gave it 'very high', 9 respondents said its application is 'high', 10 respondents gave it 'moderate' while 6 respondents gave it low, hence scoring a cumulative mean score of 3.3

Other Comments from respondents on quality control methods, applicable in their construction firms are as follows:—

- Material Testing
- Quality test of concrete, bitumen, field density test in soils; and Testing of the works (Electrical and Plumbing)
- Close supervision; and
- Supervising as well as inspecting every works

d) To identify the possible barriers a list of barriers to effective application of quality control methods and respondents were asked to indicate the extent/frequency of barriers, the scales were ranked as follows:—

Very Frequent = 5, Frequent = 4, Moderate = 3, Rare = 2, Never = 1

**Table: 3.4:** Analysis of the results on potential barriers to effective application of quality control methods in managing construction quality of subcontracted works.

| No. | Barriers to application of quality control methods in managing construction quality of Sub-Contracted works | SCALE |    |   |   |   | TOTAL | MEAN SCORE | RANK |
|-----|---|-------|----|---|---|---|-------|------------|------|
|     |   | 5     | 4  | 3 | 2 | 1 |       |            |      |
| 01. | Ineffective reporting system  | 10    | 15 | 3 | 0 | 0 | 28    | 4.3        | 4    |
| 02. | Lack of proper equipments by the sub-contractors  | 16    | 8  | 2 | 2 | 0 | 28    | 4.4        | 3    |
| 03. | Lack of the support from the top management   | 9     | 9  | 7 | 3 | 0 | 28    | 3.9        | 5    |
| 04. | Lack of skilled workers   | 18    | 8  | 1 | 1 | 0 | 28    | 4.5        | 2    |
| 05. | The nature of construction process  | 20    | 7  | 1 | 0 | 0 | 28    | 4.7        | 1    |

|     |  |    |    |   |   |   |    |     |   |
|-----|--|----|----|---|---|---|----|-----|---|
| 06. | Lack of training policy                                  | 15 | 10 | 3 | 0 | 0 | 28 | 4.4 | 3 |
| 07. | Lack of formal procurement standards for sub-contractors | 8  | 7  | 9 | 4 | 0 | 28 | 3.7 | 6 |

Source: Authors,(2017).

From the result in Table 3.4: the following are the 'most critical' barriers to application of quality control methods in managing construction quality of subcontracted works in Tanzania

**The Nature of the Construction Process:**— the primary barrier to effective application of quality control methods was the nature of the construction process. The 'nature' of construction is a complex system in which several participants, each with their own perspectives and interests, are brought together to complete a project plan that typically changes several times during construction, while each tries to minimize the effects of weather, occupation hazards, schedule delays, and building defects. The many changes can lead to delays in completion of the construction project, complaints about quality, and rework, which in turn can lead to further delays and so forth, [18]. 20 respondents gave it 'very frequent', 7 respondents gave it 'frequent', 1 respondent gave it 'moderate, while 1 respondent gave it 'rare', hence scoring a cumulative mean score of 4.7

**Lack of Enough Skilled Workers By Subcontractors:**— main contractors have also indicated that lack of skilled workers by the subcontractors involved in construction project is a critical barrier to application of quality control methods. A study conducted by Ofori,(1991)[31], in Singapore indicated most of the labors employed are less aware of the construction works as a result works are poorly executed by the subcontractors. 18 respondents gave it 'very frequent', 8 respondents gave it 'frequent', 1 respondent gave it 'moderate, while 1 respondent gave it 'rare', hence scoring a cumulative mean score of 4.5

**Lack of Training Policies:**— respondents claim that lack of training policies perhaps is one of the aspects of the subcontracting that requires more attention, As most of the subcontractors lack operational and managerial skills which are necessary for implementation of quality control methods. Therefore training policies should be developed to achieve proper construction quality of subcontracted works. 15 respondents gave it 'very frequent', 10 respondents gave it 'frequent' while 3 respondents gave it 'moderate, hence scoring a cumulative mean score of 4.4.

**Ineffective Reporting Systems:**— results have also exposed that ineffective reporting systems by the subcontractors is one of the potential barriers towards achieving construction quality of subcontractor's works. As per (Kakande,2013), this is mainly due to relationships between prime and subcontractors being largely informal. Main contractors highlighted areas of improvement, in their words, as: *improve communication; do not just depend on electronic communication but face-to-face too; and know your subcontractor*, have face to face meetings with them before the contract is let and during construction process. 10 respondents gave it 'very frequent', 15 respondents gave it

‘frequent’, while 3 respondents gave it ‘moderate’, hence scoring a cumulative mean score of 4.3

Other ‘critical’ barriers to application of quality control methods used main contractor in managing construction quality of subcontracted works in Tanzania.

**Lack of Support from Top Management:**— research findings indicated that top management should take a leader role in commitment toward quality. Main contractors claim that this a potential barrier and suggested that there should be quality policy and activities performed in an effort to implement the quality policy. Subcontractor Management Strategy,(2010) narrated that subcontractor should understand the quality policy and follow it as a quality standard of the work. The problems related with low quality can be prevented. 9 respondents gave it ‘very frequent’, 9 respondents gave it ‘frequent’, 7 respondents gave it ‘moderate’ while 3 respondents gave it ‘rare’, hence scoring a cumulative mean score of 3.9

**Lack of Formal Procurement Standards for Subcontractors:**— from the data collected, lack of formal procurement standards for subcontractors was considered to be a potential barrier to quality implementation. During construction, main contractors want to ensure quality throughout the project. However, according to Rowlinson and Walker,(1995)[27], the construction industry is characterized by its non-standardization. Very often, products are one-offs and the production processes are to some extent different from each other. Hence, no universal standard or specification applied to the product, which leads to difficulties in quality assurance. 8 respondents gave it ‘very frequent’, 7 respondents gave it ‘frequent’, 9 respondents gave it ‘moderate’ while 4 respondents gave it ‘rare’, hence scoring a cumulative mean score of 3.7

Other comments from respondents on other potential barriers of effective application of quality control methods includes:—

- Poor communication channels among subcontractors and main contractors
- Awarding of contracts to low bid subcontractors without evaluating their performance

#### 4.2. The Challenges Facing Main Contractors in Managing Construction Quality of Subcontracted Works in Tanzania.

Respondents were asked to indicate challenges facing them in managing construction quality of subcontracted works. A list of possible challenges was given and the extent/frequency of the challenges were ranked as follows:—

Very Frequent = 5, Frequent = 4, Moderate = 3, Rare = 2, Never=1

**Table: 3.5:** Analysis of the results on challenges facing main contractors in managing construction quality of subcontracted works.

| No. | Challenges facing main contractors in managing construction quality of sub-contracted works | SCALE |    |    |   |   | TOTAL | MEAN SCORE | RANK |
|-----|---|-------|----|----|---|---|-------|------------|------|
|     |   | 5     | 4  | 3  | 2 | 1 |       |            |      |
| 01. | Cash flow management  | 20    | 5  | 3  | 0 | 0 | 28    | 4.6        | 1    |
| 02. | Under valuation   | 3     | 10 | 12 | 2 | 1 | 28    | 3.4        | 7    |
| 03. | Set-off costs   | 8     | 5  | 10 | 5 | 0 | 28    | 3.6        | 6    |
| 04. | Pay-when-paid tendency  | 10    | 6  | 7  | 5 | 0 | 28    | 3.8        | 5    |
| 05. | Unreasonable delays to settlements of variations  | 9     | 10 | 6  | 3 | 0 | 28    | 3.9        | 4    |
| 06. | Unreasonable delays to final accounts settlements   | 7     | 8  | 10 | 2 | 1 | 28    | 3.6        | 6    |
| 07. | Migration of subcontractor’s workers  | 18    | 6  | 2  | 2 | 0 | 28    | 4.3        | 2    |
| 08. | Poor management practices by sub-contractors  | 19    | 7  | 2  | 0 | 0 | 28    | 4.6        | 3    |
| 09. | Sub-contractor’s lack of enough working tools and equipments                                | 11    | 8  | 7  | 2 | 0 | 28    | 4.0        | 3    |
| 10. | Sub-contractors lack of enough competencies   | 11    | 9  | 4  | 4 | 0 | 28    | 3.9        | 5    |

Source: Authors,(2017).

From the result of the analysis in Table 3.5; the following are the ‘most critical’ challenges facing main contractors in managing construction quality of subcontracted works in Tanzania from the analyzed data:—

**Cash Flow Management:**— from the findings the main contractors indicated that cash flow management was a big challenge in managing construction quality of subcontracted works, issues of delays in payments from clients or consultants are very common and the effect goes all the way down the contractual chain to subcontractors and their suppliers, therefore affecting the delivery times, [28]. 20 respondents gave it ‘very frequent’, 5 respondents gave it ‘frequent’ while 3 respondents gave it ‘moderate’, hence scoring a cumulative mean score of 4.6

**Poor Management Practices By Subcontractors:**— results exposed that most of main contractors complained that subcontractors were unable to perform efficiently and effectively due to poor management practices by their gang leaders as a result works are poorly executed in the absence of main contractors at site. A study conducted by CIBD,(2013)[7], in South Africa has also indicated weak management practices by subcontractors as one of the challenges.19 respondents gave it ‘very frequent’, 7 respondents gave it ‘frequent’ while 2 respondents gave it ‘moderate’, hence scoring a cumulative mean score of 4.6

**Migration of Sub-contractors’ Labour:**— survey findings, shows most of the main contractors claim that the labour migrations have always happened among the construction sites. Furthermore, Chamara, Waidyasekara and Mallawaarachchi,(2015)[6], argued that labour migration was an uncontrollable issue in construction works. 18 respondents gave it ‘very frequent’, 6 respondents gave it ‘frequent’, 2 respondents gave it ‘moderate’ while 2

respondents gave it 'rare', hence scoring a cumulative mean score of 4.3

**Lack of Enough Tools and Equipments For Works:**— from the data collected it has been observed that many subcontractors have a tendency of relying on tools and equipments from the main contractors as a result much time is wasted sharing equipments or other alternatives looking for equipments. 11 respondents gave it 'very frequent', 8 respondents gave it 'frequent', 7 respondents gave it 'moderate' while 2 respondents gave it 'rare'. This has yield a cumulative mean score of 4.0. The following are other 'critical' challenges facing main contractors in managing construction quality of subcontracted works in Tanzania from the analyzed data.

**Lack of Enough Competencies By Sub-contractors:**—the results have exposed that most of main contractors complained that the site works were unable to perform efficiently and effectively due to lack of enough skills on the particular activity. Chamara, Waidyasekara and Mallawaarachchi,(2015)[6], argued that most of the labours employed by subcontractors lack enough competencies and experience in works as a results subcontracted works are poorly executed. 11 respondents gave it 'very frequent', 9 respondents gave it 'frequent', 4 respondents gave it 'moderate' while 4 respondents gave it 'rare', hence scoring a cumulative mean score of 3.9

**Pay-When-Paid:**— the survey has revealed that it is quite common for main contractors to withhold payments to subcontractors until their own payment has been received. This is another technique by which contractors can protect their own cash flows. However this affects the general performance of works by subcontractors leading to delays of works. A study conducted by CIBD,(2013)[7], in South Africa indicated the 'pay when paid' clause as one of the main source of disputes between main contractors and subcontractors. 10 respondents gave it 'very frequent', 6 respondents gave it 'frequent', 7 respondents gave it 'moderate' while 5 respondents gave it 'rare', hence scoring a cumulative mean score of 3.8

**Unreasonable Delays to Final Accounts Settlement:**— the survey study has revealed that main contractors suffer from unreasonable delays to final account settlement. When work is inadequately specified, or subject to excessive variations, there is inevitably much re measurement and negotiation to be done after completion. Complex projects take even longer to settle. The final account process can to take up to ten years on major projects, being dependent upon the relationship between the client and consultants, [17]. 7 respondents gave it 'very frequent', 8 respondents gave it 'frequent', 10 respondents gave it 'moderate' while 2 respondents gave it 'rare', hence scoring a cumulative mean score of 3.6

**Set-off Costs:**— from the findings main contractors claims that set-off is another challenge as it reduces payments to subcontractors. Hughes, Gray and Murdoch (1994)[17], narrated that the main contractors are forced to cover expenses of employing a replacement subcontractor to finish off the work if necessary. 8 respondents gave it 'very

frequent', 5 respondents gave it 'frequent', 10 respondents gave it 'moderate' while 5 respondents gave it 'rare', hence scoring a cumulative mean score of 3.6

**Under-valuation:**— the survey data has revealed that there are often disputes over the measurement and valuation of subcontractor's works, particularly where an item has not been specified in the bill of quantities. One reason for this may be a contractor's reluctance to commit expenditure on subcontractors' unspecified work before agreeing it with the employer, [17]. 3 respondents gave it 'very frequent', 10 respondents gave it 'frequent', 12 respondents gave it 'moderate', 3 respondents gave it 'rare' while 1 respondent gave it 'never', hence scoring a cumulative mean score of 3.4

Other comments from respondents on the challenges facing main contractors in managing construction quality of subcontracted works in Tanzania are:—

- Theft by subcontractors is great challenges without supervision,
- Lack of honesty and trust by subcontractors to main contractors, and
- Challenges of managing a nominated subcontractors.

#### 4.3. Strategies that May be Used by Main Contractors in Managing Construction Quality of Subcontracted Works.

a) Respondents were asked to indicate strategies that may be used by main contractors in managing construction quality of subcontracted works. a list of possible strategies was given and suggestions were ranked as follows:—

*To great extent = 5, To some extent = 4, Low=3, Very low = 2, Not at all = 1*

**Table: 3.6:** Analysis of the results on best strategies used by main contractors in managing construction quality of subcontracted works.

| No. | Main contractors strategies in managing construction quality of sub-contracted works | SCALE |   |   |   |   | TOTAL | MEAN SCORE | RANK |
|-----|--|-------|---|---|---|---|-------|------------|------|
|     |  | 5     | 4 | 3 | 2 | 1 |       |            |      |
| 01. | Good cash flow management between main contractor and sub-contractor                 | 25    | 3 | 0 | 0 | 0 | 28    | 4.9        | 1    |
| 02. | There should be a close supervision by the main contractors                          | 22    | 4 | 2 | 0 | 0 | 28    | 4.8        | 2    |
| 03. | Promote full time site health and safety status of staff and work                    | 21    | 6 | 1 | 0 | 0 | 28    | 4.7        | 3    |
| 04. | Acquiring security bonds and insurance for works                                     | 16    | 7 | 4 | 1 | 0 | 28    | 4.5        | 5    |
| 05. | Site meetings with sub-contractors (Making a good coordination among workers)        | 22    | 5 | 1 | 0 | 0 | 28    | 4.8        | 2    |
| 06. | Keeping record of the sub-   | 19    | 8 | 1 | 0 | 0 | 28    | 4.6        | 4    |

|     | contractors, they have worked with   |    |   |   |   |   |    |     |   |
|-----|--|----|---|---|---|---|----|-----|---|
| 07. | Provision of warranties for materials and performance  | 15 | 8 | 5 | 0 | 0 | 28 | 4.4 | 6 |
| 08. | Regular inspection and testing of samples  | 20 | 7 | 1 | 0 | 0 | 28 | 4.7 | 3 |
| 09. | Identification of responsibilities by the main contractors and sub-contractors                             | 10 | 8 | 7 | 3 | 0 | 28 | 3.9 | 7 |
| 10. | Policy enhancement, activities performed in an effort to implement the quality policy                      | 19 | 8 | 1 | 0 | 0 | 28 | 4.6 | 4 |
| 11. | Employing sub-contract coordinator in order to improve coordination and communication with sub-contractors | 9  | 9 | 8 | 2 | 0 | 28 | 3.9 | 8 |

Source: Authors,(2017).

From the results of the analysis from Table 3.6; the following are the *'most critical'* strategies used by main contractors in managing construction quality of subcontracted works in Tanzania from the analyzed data:—

**Good Cash Flow Management Between Main Contractors and Subcontractors:**— from the data collected, it was highly recommended that there should be good cash flow management between main contractors and subcontractors but more importantly prompt payments should be made by client when required this will reduce any unnecessary delays in the construction works by subcontractors. 25 respondents gave it a 'To great extent', 3 respondents gave it 'To some extent', hence scoring a cumulative mean score of 4.9

**Site Meetings with Sub-Contractors (Make Good Coordination among Workers):**— the survey data has also revealed that main contractors highly suggest or prefer daily and weekly site meetings to discuss and familiarize with those subcontractors responsible for performing, controlling, and managing the work with the quality control and workmanship requirements in advance of the start of work. According to Andrey (2010)[3], argued that one of the strategies used to improve coordination efforts is the weekly subcontractor meeting. 22 respondents gave it a 'To great extent', 5 respondents gave it 'To some extent' while 1 respondent gave it 'low'. This strategy is ranked 2 and has scored a cumulative mean score of 4.8

**There Should Be a Close Supervision By Main Contractors:**— it was recommended by respondents that close supervision of subcontracted works by the main contractors is one of the best mitigation strategy in managing construction quality of subcontracted works as it prevents any unnecessary delays in works and poor execution of works. 22 respondents gave it a 'To great extent', 4 respondents gave it 'To some extent' while 2 respondent gave it 'low'. This strategy is ranked 2 and has scored a cumulative mean score of 4.8

**Regular Inspection and Testing of Samples:**— the survey data shows that main contractors suggests and perform regular inspection and testing of sample during the construction process to ensure that construction quality of subcontracted works meets the contract requirements. 20 respondents gave it a 'To great extent', 7 respondents gave it 'To some extent' while 1 respondent gave it 'low', hence scoring a cumulative mean score of 4.7

**Promote Full Time Site Health and Safety Status of Staff and Work:**— from the findings it was also recommended by the main contractors to promote site full health and safety status of works so as to avoid damage of works, injury or accidents of subcontractor's employees during construction process. Subcontractor management strategy,(2010) suggested that subcontractors should understand the quality policy and follow it as a quality standard of the work. 21 respondents gave it a, 'To great extent', 6 respondents gave it 'To some extent' while 1 respondent gave it 'low', hence scoring a cumulative mean score of 4.7

**Policy Enhancement, (Activities Performed in An Effort to Implement the Quality Policy):**— it was also recommended by the main contractors that policies should be directed to promote the application of best practice standards on productivity, quality, management and appropriate delivery arrangements towards improving construction quality of subcontracted works. 19 respondents gave it a 'To great extent', 8 respondents gave it 'To some extent' while 1 respondent gave it 'low', hence scoring a cumulative mean score of 4.6.

**Acquiring of Security Bonds and Insurance for Works:**— the survey findings revealed main contractors claim that the current bonds and insurance practice by subcontractors is very low. However, one of them suggest it's a good strategy because it is one of the best way of risk sharing. 16 respondents gave it a 'To great extent', 7 respondents gave it 'To some extent' while 4 respondent gave it 'low'. This has yield a cumulative mean score of 4.5

**Provision of Warranties for Material and Performance:**— findings from the study shows that main contractors prefer the use of warranties as it guarantee of the integrity of materials and the maker's responsibility for the repair or replacement of the deficiencies. 15 respondents gave it a 'To great extent', 8 respondents gave it 'To some extent' while 5 respondent gave it 'low', hence scoring a cumulative mean score of 4.4

Other *'critical'* strategies used by main contractors in managing construction quality of subcontracted works in Tanzania from the analyzed data. From the findings it was also suggested that main contractors and subcontractors should fully identify responsibilities and contractual liabilities to the contract as it will make both parties full accountable to their works Furthermore, it was suggested that main contractors should consider employing a subcontract coordinator in order to improve coordination and communication with subcontractors however this was considered to be costly. Their cumulative means score was 3.9. Other comments from respondents on main contractor

strategies in managing construction quality of subcontracted works

- More emphasize on domestic subcontracting than client nomination
- Proper time management
- Careful selection of subcontractors based on their technical capabilities, financial stand and previous experiences

a) When respondents were asked on the possible ways to enforce subcontractors towards achieving planned budget, quality of work and time (Construction quality), a list of ways to enforce subcontractors was provided and the results was ranked as follows:—

**Table: 3.7:** Analysis of possible ways to enforce subcontractors towards achieving construction quality of subcontracted works in Tanzania.

|     | Ways to Enforce Sub-contractors | Number of Respondents | Percentage | Rank |
|-----|---------------------------------|-----------------------|------------|------|
| 01. | Payment procures                | 15                    | 54%        | 1    |
| 02. | Financial penalties             | 12                    | 43%        | 2    |
| 03. | Contract discharge              | 5                     | 3%         | 3    |
|     | <b>TOTAL</b>                    | 28                    | 100%       | N/A  |

Source: Authors,(2017).

From the result of the analysis in Table 3.7; the following are suggested possible ways to enforce subcontractors towards achieving construction quality of subcontracted works.

**Payment Procedures:**— the survey data revealed that the best way to enforce subcontractors was through payment procedures. 54% of the respondents claim that payments should be done only in the case of acceptance of works. Also the main contractors indicated that the magnitude of the retention was an important factor to be considered before entering into an agreement with the subcontractors, to avoid problems poor execution of works.

**Financial Penalties:**— furthermore 43% of the main contractors also recommended that penalties should be set upon the subcontractors to force them to mobilize and get to work if they are behind the schedule, but of course the amount of these penalties should be reasonable, because subcontractors can lose their financial strength and stop working at all. Furthermore, Andrey,(2010)[3], narrates that; the amount of penalty is to be agreed between main contractor and the subcontractor.

**Contract Discharge:**— the results of findings have also exposed that in some cases it is better to change the subcontractor that continuously causes problems and is moving behind the schedule. 3% of the main contractors claim that it is better to take another one than apply penalties to the first one, because the task is to finish the project on time rather than save money. However this has not received much attention. The contract should have paragraphs where the procedure of its discharge is described as well as reasons for it (*ibid*). Other comments

from respondents on possible ways to enforce subcontractors:—

- The main contractors should retain some amount of money when making payments to the subcontractors (Magnitude of retention to be discussed by both parties)
- Encourage bonus/ incentives to subcontractors upon early completion of works
- Subcontractors should be made aware of liquidated damage clauses and their liabilities

## 5.0. CONCLUSION

This research assessed strategies used by main contractors in managing construction quality of subcontracted works in Tanzania. Basing on the on the study primary objectives which were to determine the level of application of quality control methods in managing construction quality of subcontracted works, to identify the challenges facing main contractors and to recommend the best main contractors strategies that may be used in managing construction quality of subcontracted works; the study concludes the following:

### 5.1. Extent of Application of Quality Control Methods Used By Main Contractors in Managing Construction Quality of Subcontracted Works.

Generally, the application of quality control methods by main contractors in managing construction quality of subcontracted works in building construction sites in Tanzania, is at high level; however some of the large construction companies do not subcontract works as they are well equipped technically and financially. They have all the necessary materials and equipments for execution of works therefore in most cases they practice labour-only subcontracting. Practices of Inspections, material testing and sampling, submission of qualification requirements for subcontractors (C.V), Certificates of compliance seem to be the most applicable. While provision of warranties and security bonds by subcontractors are less practiced by main contractors. In most cases provision of warranties and security bonds are used by clients upon selecting a nominated subcontractor.

### 5.2. Challenges Facing Main Contractors in Managing Construction Quality of Subcontracted Works.

From the findings, it can be concluded that the main challenge facing main contractors in managing construction quality of subcontracted works is their cash flow management and poor management practices. Main contractors cash flow are very sensitive and greatly affected by the clients and consultants, as in most cases prompt payments are not made to main contractors, due to existence of the paid when paid tendencies. Additionally variations and unreasonable delays to final account settlement seem to affect main contractor's cash flow in most cases and hence in turn main contractors controls payments to subcontractors and therefore affecting their general performance in terms of

delivery times. Other problems like migration of subcontractor's labours; lack of enough competencies, equipments and skilled labour; poor management practices; theft by subcontractors seem to affect the construction quality of works; nature of construction process; and lack of training policies.

### 5.3. The Main Contractors' Strategies in Managing Construction Quality of Subcontracted Work.

In solving the problem of poor construction quality of subcontracted works, it was concluded that the possible strategies to be adopted include; proper cash flow management between main contractors and subcontractors; main contractors making a close supervision of works done by sub-contractors; main contractors conducting daily and weekly site meetings with sub-contractors; regular inspection and testing of samples; and promoting full time site health and safety status of staff and works. Furthermore, enhancement of policies on best practice standards for sub-contractors; as well as taking on board the main contractors suggestion on sub-contractors bonds and guarantees submission. In line with that main contractors suggested that the best way to enforce subcontractors was through money, proper payment procedures that is part of payments must be done upon acceptance of works and retained amount to be released soon after completion of their works.

### 6.0. RECOMMENDATIONS

Based on the analysis of data collected and the interpretation of such analysis whilst keeping in mind the aim of the study, which is to assess the main contractors' strategies in managing construction quality of subcontracted works. The study concluded that the application of a quality control methods by main contractors on subcontracted works does not automatically guarantee delivery of a high construction quality project by sub-contractors on construction sites, and that adherence or compliance to the initial quality control plan by a sub-contractor on the construction site has a significant effect on the construction quality of the project delivered by the contractor. The following are the recommendations that if implemented will pave the way towards achievement of construction quality of subcontracted works in building construction projects.

- Good cash flow management is essential to the success of contractors and sub-contractors. Many payment problems are a direct consequence of the recession. A main contractor who is suffering cash flow difficulties can temporarily counteract them by withholding payments to subcontractors. Thus, strict rules and regulations must be put in place for the clients who do not pay the companies in time.
- Close Supervision and Critical Site Coordination by main contractors is essential towards proper construction quality because basically construction works are mainly carried out by main contractors. Therefore main contractors are supposed to monitor sub-contractor's works to determine if they comply with relevant quality standards and identifying ways

to eliminate cause of poor execution of works through close supervision and proper coordination of works to achieve construction quality of subcontracted works.

- Site meetings with Sub-contractors One of the important things of a site management process is week planning. Every week an internal meeting of the contractor and a meeting with sub-contractors are held. Week meetings help to introduce all project participants into situation and to deal with all possible problems. This is the main principle of control on building site.
- Main contractors and sub-contractors should fully be aware of their contractual responsibilities and liabilities. All stakeholders in the construction industry need to understand the importance of quality control plans and their implementation on construction sites, as available which can either improve or lower the quality of project delivery. Therefore insurance of compliance with the schedule proposed are essential to prevent the accumulation of service and even greater delays.
- Development of comprehensive project safety policy and safety programs which make provisions for subcontractor safety. Creating a good environment will play an important role in guaranteeing the quality and safety of construction projects, achieving civilized construction, and setting social image of Construction Corporation.
- There should be a formal procurement procedure for selection of subcontractors. There should be constant evaluation of subcontractors to determine their level of compliance with standard quality control practices and only those who maintain a specified level should be invited or selected for projects. Subcontractors could then be ranked according to their level of compliance.
- Development of training programmes to small and medium subcontractors in the construction industry. The training procedure must ensure that these contractors as well as emerging subcontractors will benefit from these development programmes so as to achieve proper construction quality of works.

### REFERENCES

- [1] Albino, V. & Garavelli A. "A Neutral Network Application to Subcontractor Rating in Construction Firms. International Journal of Project Management, (2006). Vol. 16.
- [2] Alinaitwe, H. and Ayesiga, R. 'Success Factors for the Implementation of Public Private Partnerships in the Construction Industry in Uganda'. In the Journal of Construction in Developing Countries. 2013. Vol#18; Issues# 02, Page# 1-14.

- [3] Andrey G. Project Closure Preparing And A Subcontractor's Work Performance Control And Acceptance In Construction Management In Russia. Saimaa University of Applied Sciences Technology, Lappeenranta, 2010.
- [4] Arditi, D. and Chotibhongs, R. 2005. Issues in Subcontracting Practice. In The Journal of Construction Engineering and Management. 2005. Volume# 131. Issue # 8. Page 866 - 876.
- [5] Brandli, L. The Subcontracting Strategy and The Organizational Relationships in Construction in Florianopolis. Florianopolis, Brazil. 1998.
- [6] Chamara, H., Waidyasekara, K & Mallawaarachchi, H. Evaluating Subcontractor Performance in Construction Industry. 6th International Conference on Structural Engineering and Construction Management, Kandy, Sri Lanka. 2015.
- [7] Construction Industry Development Board (CIBD). Subcontracting in the South African Construction Industry; Opportunities For Development. Pretoria. South Africa. 2013
- [8] Debrah, A. & Ofori, G. Flexibility, Labour Subcontracting and HRM in the Construction Industry in Singapore: Can the System Be Refined?. The International Journal of Human Resource Management. 1997. Vol. 8: Issues (5).
- [9] Division of Construction. Construction Quality Assurance Program Manual. State of California. Department of Transportation. California, USA. 2015.
- [10] Eccles, G. The Quasi-firm in the Construction Industry. In the Journal of Economic Behavior and Organization, EAU North-Holland, 1981, Page# 335-357.
- [11] English, J (2002). The Construction Labour Force in South Africa: A Study of Informal Labour in the Western Cape. Sectoral Activities Programme, Working Paper 188. Geneva: ILO.
- [12] El-Mashaleh, M.S. A Construction Subcontractor Selection Model. Jordan Journal of Civil Engineering, 2009: Vol. 3: No. 4: Page 375 - 383.
- [13] Fellows, R. and Liu, A. Research Methods for Construction. 2<sup>nd</sup> Edition. Published By Oxford: Blackwell Science. 2003.
- [14] Francis, Y., Joseph, L., Chan, K.T & Edward, Y. Best Practices in Managing Specialist Subcontracting Performance. The Hong Kong Polytechnic University. 2006.
- [15] Gray, C. & Flanagan, R. (1989). The Changing Role of Specialist and Trade Contractors. The chartered Institute of Building, United Kingdom. 1989.
- [16] Government Statistical Service. Size analysis of United Kingdom businesses. 1988. HMSO; London, United Kingdom.
- [17] Hughes, W, Gray, C, and Murdoch, J. Construction Subcontracts: For What We Are About to Receive. University of Reading, United Kingdom. 1994.
- [18] Kanji, G., and Wong, A. Quality Culture in the Construction Industry. In the Journal of Quality Management. 1998. Volume# 9. Issues(4-5). Page# 133-140.
- [19] Kothari, C. Research Methodology 2<sup>nd</sup> Edition, New Age International (P) Ltd, Mumbai, India. 2004.
- [20] Kumaraswamy, M. and Matthews. Improved Subcontractor Selection Employing Partnering Principles. ASCE Journal of Management in Engineering 2000; 16: 47-57.
- [21] Lawrence, E. Appropriate Method for Selecting Domestic Subcontractors in Tanzania Construction Projects. Unpublished Undergraduate Dissertation. Department of Building Economics. School of Construction Economics and Management, Ardhi University. 2009.
- [22] Lian L.Y., Hassim, S., Muniandy, R., and Hua, L.T. Review of Subcontracting Practice in Construction Industry. IACSIT International Journal of Engineering and Technology. 2012; Vol. 4: No. 4: Page 442 - 445.
- [23] Mbachu, J. "Conceptual Framework For The Assessment Of Subcontractors' Eligibility And Performance In The Construction Industry," Journal of Construction Management and Economics. (2008). Vol. 26, Page. 471-484.
- [24] Mohammad, S. A Construction Subcontractor Selection Model. Jordan journal of civil engineering. 2009. Vol. 3: Issues(4): Page 375-376.
- [25] Mugenda, O. M, and Mugenda, A. *Research Methods: Quantitative and Qualitative Approaches*, Nairobi. Published By Acts Press. 1999.
- [26] National Construction Council (NCC). Agreement and Schedule of Conditions of Building With (Quantities), Dar es salaam, Tanzania. 2000.
- [27] Rowlinson, S. M, and Walker, A. The construction Industry in Hong Kong. Hong Kong: China. Published By Longman.1995.
- [28] Sallis. M. & Co Ltd v. ECA Calil and others [1987] 4 Con LJ 125
- [29] Thomas N.S. & Martin, S. Developing A Framework For Subcontractor Appraisal Using a Balanced Scorecard. Journal of Civil Engineering and Management. 2014: Vol. 20: Issue (2): Page 149-158.
- [30] Thomas, E. Fundamentals of Building Contract Management. 2002. Sydney. UNSW Press LTD.
- [31] Ofori, G. 'Programmes for Improving the Performance of Contracting Firms Indeveloping Countries'. In the Journal of Construction Management and Economics. 1991. Volume# 9. Page# 19-38.



- [32] Orodho, A and Kombo, D. Research Methods. Nairobi: Kenyatta University Institute of Open Learning. 2002.
- [33] United Republics of Tanzania (URT); Construction Industry Policy. National Construction Council. Ministry of Works. (2003). Dar es Salaam. Tanzania
- [34] Villacreses, X. Strategical Analysis of Subcontracting in Small Building Construction companies. Rio de Janeiro, Brazil. 2007.
- [35] Lew Yoke-Lian, at el. Review of Subcontracting Practice in Construction Industry. In the International Journal of Engineering and Technology (IACSIT). 2012. Volume # 4. Issues# 4.

## BIOGRAPHIES



Dennis N.G.A.K. Tesha,  
B. Architecture (2010),  
M.Sc. Housing (2016),



Valentine G.M. Luvara  
B.Sc. Building Economics (2006)  
M.Sc. Construction Economics and  
Management (2009)  
PhD Candidate - Ardhi University