



**VARIATION: ITS REGULATION & MANAGEMENT
UNDER THE MDB-FIDIC (2006) & THE PPA (2011)
CONDITIONS OF CONSTRUCTION CONTRACTS &
THE APPLICABLE LAWS**

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JUNE 2018



VARIATION: ITS REGULATION & MANAGEMENT UNDER THE MDB-FIDIC (2006) & THE PPA (2011) CONDITIONS OF CONSTRUCTION CONTRACTS & THE APPLICABLE LAWS

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A project submitted to

College of Architecture and Civil Engineering AASTU for the Partial Fulfilment of the Requirements for the Degree of Master of Engineering in Construction Technology and Management

ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

JUNE 2018

Declaration

I, declare that this project is my original work and that all sources of the materials in the project have been duly acknowledged. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Certificate

This is to certify that the Project prepared by Fisseha Yirgu entitled "*Variation: Its Regulation & Management under the MDB-FIDIC (2006) & the PPA (2011) Conditions of Construction Contracts & the Applicable Laws*" and submitted in fulfillment of the requirements for the Degree of Master of Engineering complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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1. Examiner

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3. Coordinator

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SUMMARY

The main objective of this study to analyze MDB-FIDC(2006) and PPA(2011) condition of contract with respect to variation. This deals with variation to the contract terms or conditions which referred to as an amendment to the contract. In other words it is a change to the terms that the parties had agreed and accepted when the contract was signed. According to FIDIC (2006), “variation” means any change to the works, which is instructed or approved as a variation. According to PPA-2011, the term “variation” is changed to “Modifications” and describe as, the Engineer shall have power to order any modification to any part of the works necessary for the proper completion and /or functioning of the works. This study focused on the variation orders in construction projects and the right and obligation of the engineer in variation of works.

ACKNOWLEDGMENT

First of all, I would like to thank my instructors of the Addis Ababa Science & Technology University. All instructors' office was always open whenever I had a question during learning process. I would also like to thank Ethiopian Road authority for giving me this opportunity.

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LIST OF ABBREVIATIONS

PPA: Public Procurement Agency

MDB-FIDIC: Multilateral Development Bank-Federation International Des Ingenieurs-Conseils

BOQ: Bill OF Quantity

VE: Value Engineering

GCC: General Conditions of Contract

SCC: Special Conditions of Contract

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

A the number of variation orders on a project increases, so does the possibility of misunderstanding among the contracting parties. Such a misunderstanding may occur because one or more of the parties lacks full knowledge of the variation order process itself, the costs involved in implementing changes, or the delays, conflicts, and interruption of the construction sequence and schedule which can adversely impact project coordination. Previous studies on variation orders are mainly focused on the sources and causes of variation orders. The sources of variations include the performance of construction parties, resources availability, environmental conditions, involvement of other parties, and contractual relation. Many times delays, cost overrun and quality defects of a construction can be attributed to variation at various stages of the project (Buratiet *et al.*, 1992). Variations and conflicts in construction projects, at work, and even in our daily lives are very common (Arain and Low,2006).Variation orders involved alteration, addition, omission, and substitution in terms of quality, quantity and schedule of work (Adnan *et al.*, 2010). Any addition, deletion, or any other revision to project goals and scope of work are considered to be variation, whether they increase or decrease the project cost or schedule (Ibbset *et al.*, 2001). The work of Sun and Meng (2008) mentioned that a variation in construction projects refers to an alteration to design, building works, project programs or project aspects caused by modifications of pre existing conditions, assumptions, or requirements. Variation orders have an impact on overall project performance (Ruben, 2008). This is because variations can cause substantial adjustment to the contract duration, total direct and indirect cost, or both.

1.2 Objectives of the Study

The general objective of the study is to define & discuss the concept, types, categories (instructed & approved variation) and management of such variations including the impacts of the absence of variation clause.

1.3 Methodologies

- ✓ Review of previously written study by researchers.
- ✓ Reference books
- ✓ Websites
- ✓ Case study

1.5 Limitations

The scope of the study is under Ethiopia construction industry, the concept of value engineering is not exercised and not incorporated in PPA conditions of contract so it limits our discussion on the value engineering concept.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. General

There is no single definition of what constitutes a variation. The term ‘variation’ as described and/or defined by various standard forms of contract differs from one to another but in principle the definition and/or meaning is more or less similar. Usually, any standard form of building contract will contain a definition of a variation in terms of specific actions and activities.

The building contract dictionary defined variations as alterations, additions or omissions in work, materials, working hours, work space, etc.

According to FIDIC (2006), “variation” means any change to the works, which is instructed or approved as a variation.

According to PPA-2011, the term “variation” is changed to “Modifications” and describe as, The Engineer shall have power to order any modification to any part of the works necessary for the proper completion and /or functioning of the works.

Hayati (2006) described that each standard form of building contract has its own definition but clearly ‘variation’, in generic sense, refers to any alteration to the basis upon which the contract was let. This means the term embraces not only changes to the work or matters pertaining to the

work in accordance with the provisions of contract, but also changes to the contract conditions themselves.

According to Hayati (2006) variation can be taken to be any, a combination of any or all of the following:

- i. Variation in building projects may mean ‘the alteration or modification of the design, quality or quantity of the works, as shown upon the contract drawings and described by or referred to in the contract bills, and includes the addition, omission or substitution of any work, the alteration of the kind or standard of any of the materials as goods to be used in the works, and the removal from the site of any work materials or goods executed or brought thereon by the contract or for the purposes of the works other than work or material or goods which are not in accordance with the contract’.
 - ii. Variations in building projects with instructions concerning the nature of the works which are not specifically termed as variation in the contract documents.
 - iv. Variation of price clause which
 - iii. Variation of contract in law, i.e. if both parties alter a contract document by agreement after execution of the original contract this is a variation of the contract terms or conditions.
- enables the contract sum to be adjusted for rises and falls in the cost of labor or materials.

Hibberd (1986) defined variation as any changes in the quality or quantity of the works as mentioned or spelled out in a contract document. Bin-Ali (2008) defined variation orders as any deviation i.e., alteration, addition or omission, from the contract with regard to contract drawings, specifications, and/or bills of quantities. Variation order was also defined as the alteration or modification of the design, quality of works, as agreed upon the contract drawings, bill of quantities, and/or specifications (Bin-Ali, 2008).

Popescu (1995) indicated that a contract variation order is when a change is made in the original contract that will affect the scope of work. Variation order is authorized by the owner and is often initiated by the contractor. Schexnayder *et al.* (2004) explained that the variation order directives issued by the owner to change the contract by adding or subtracting features within the scope of the work. Variations that are outside the scope of work require a supplementary agreement. Variation orders change the details or conditions of the work and they are used to add “extra” or delete work.

In general, the term 'Variation' usually means a change, modification, alteration, revision or amendment to the original intent of the contract and/or its works. A variation order is the formal document that is used to modify the original contractual agreement and becomes part of project's documents (Fisk, 1997). Furthermore, a variation order is a written order issued to the contractor after the contractual agreement by the owner, which authorize a change in the work or an adjustment in the contract sum or even the contract time.

2.2. Type of Variation

2.2.1. Contract Variation

This deals with variation to the contract terms or conditions which referred to as an amendment to the contract. In other words it is a change to the terms that the parties had agreed and accepted when the contract was signed. To vary the terms and conditions of a contract the same degree of formality is required as was the case with the original contract. It must be in writing, signed by the respective authorized party representatives, and in same form as the original contract. Normally variation to terms and conditions could occur under the following conditions:-

- ✓ Increased costs due to inflation or higher taxation.
- ✓ The varied work is not similar in charter or is not executed under similar conditions to that priced in the Bill of Quantities.
- ✓ Variation order renders contract rates or prices unreasonable in the opinion of the contractor.

All the construction contracting parties are free to create & vary their contractual agreement according to the applicable law of Article 1675 of the Civil Code for all construction contract variation in Ethiopia.

2.2.2. Variation In Work

The more common understanding and indeed use of the term variation relates to a variation in the scope of works. Since the very concern of this study is more focused on the variation in works my evaluation and main part will elaborate with this respect. Under MDB Harmonized Edition March 2006, Variation in work is regulated and administered under Clause 13.1 Right to

Vary. In addition to this according to the PPA- 2011 General Condition of Contract, Modifications by Change Orders is regulated and administered under clause 15, which comply with the Applicable laws where the site is located.

According to the Ethiopia applicable law,

- Civil Code Art 3031 - Alterations required by client.
- Civil Code Art 3034 - Alterations required by Contractor.

The contract will usually, but not always, provides a method that allows a client to make changes to the scope of works. By signing to this the contractor effectively consents to such changes being made. Accordingly, for building and Engineering works, the root causes of variation in works grouped under four categories:-

1. Owner related variations.
2. Consultant related variations.
3. Contractor related variations.
4. Other variations.

Variation orders can be also classified in many different ways depending on the basis and the purpose of classifications. Referring both the reasons for their occurrence and subsequent effects, Arain and Pheng (2005) distinguisher and classified two types of variation orders, namely: beneficial and detrimental variation order. A beneficial variation order is one issued to improve the quality standard, reduce cost, schedule, or degree of difficulty in a project. A beneficial variation order eliminates unnecessary costs from a project as a result; it optimizes the client's benefits against the resource input by eliminating unnecessary costs. A detrimental variation order is one that negatively impacts the client's value or project performance (Arain and Pheng, (2005). For example a client who is experiencing financial problems may require the substitution of quality standard or expensive materials to sub-standard or cheaper ones.

The research team Ming *et al.* (2004) reported that project variations can be classified as anticipated variations” and “emergent variation”. Anticipated variations are planned in advance and occur as intended. On the other hand, emergent variation arise spontaneously and are not originally anticipated or intended.

Another way to view project variation is through its necessity. In this way, project variation can be classified as “elective variations” and “required variations”. According to Ming *et al.* (2004) an elective variation is where one may choose whether or not to implement; and a required variation is where there is no option but to make the variation.

2.3. Categories of variation

2.3.1 Instructed variation/ordered variation

A variation order is any modification to the contractual terms of a project by the client or the client's representative (Arain & Pheng, 2005b). It is a formal decision to alter a previous decision which affects the work or objectives of the other teams (Bennett, 1985). In practice, variation orders are issued in the form of site instructions typically issued by architects. Uff (2005) argued that disputes often arise as to whether an instruction constitutes a variation order because the contract does not contain a definition of what may constitute a variation. Ssegawa *et al.* (2002) contend that there is no single definition of what a variation is. Not all architect's instructions constitute variation orders such as for example, an instruction to remove defective work (Wainwright & Wood, 1983; FIDIC, 1999). The JBCC6 (2005) defined a contract instruction as a written instruction signed and issued by or under the authority of the principal agent to the contractor. The FIDIC (2006) general conditions clause 3.3 stipulates that the engineer may issue to the contractor instructions and additional or modified drawings which may be necessary for the execution of the works and the remedying of any defects, all in accordance with the contract.

2.3.1.1 Causes Of Variation

Introduction

These causes of Variations were grouped under four categories: Employer related Variations, Consultants related Variations, Contractor related Variations and other Variations. The root causes of Variations some of which are financial, design aesthetics, changes in drawings, weather, geological and geotechnical reasons. These Causes of Variations have been identified by many researchers (CII, 1990a; Thomas and Napolitan, 1994; Clough and Sears, 1994; Fisk, 1997; Ibbs *et al.*, 1998; O'Brien, 1998; Mokhtar *et al.*, 2000; Gray and Hughes, 2001; Arain *et al.*, 2004). The causes of Variations can be categorized according to the originators (CII, 1990a;

Thomas and Napolitan, 1994). The 53 causes identified from the literature review are also discussed below.

2.3.1.1.1 Employer Related Changes

This section discusses the causes of Variations that were initiated by the Employer. In some cases, the Employer directly initiates Variations or the Variations are required because the Employer fails to fulfill certain requirements for carrying out the project.

Change of plans or scope by Employer: Change of plan or scope of project is one of the most significant causes of Variations in construction projects (CII, 1990b) and is usually the result of insufficient planning at the project planning stage, or also can be because of lack of involvement of the Employer in the design phase (Arain et al., 2004). This cause the Variations affects the project severely during the later phases.

Change of schedule by Employer: A change of schedule or master programme during the project construction phase may result in major resource reallocation (Fisk, 1997; O'Brien, 1998). This is because time has an equivalent money value. A change in schedule means that the Contractor will either provide additional resources, or keep some resources idle in the construction site. In both cases additional cost is incurred.

Employer's financial problems: The Employer of the project may run into difficult financial situations that force him to make changes in an attempt to reduce cost of the project. Employer's financial problems affect project progress and quality (Clough and Sears, 1994; O'Brien, 1998). Proper financial planning and review of project cash flow would be effective in avoid this problem to from happening.

Inadequate project objectives: Inadequate project objectives are one of the causes of Variations in construction projects (Ibbs and Allen, 1995). Due to inadequate project objectives, the designers would not be able to develop a comprehensive design which leads to many of Variations during the project construction phase.

Replacement of materials or procedures: Replacement of materials or procedures may cause major Variations during the construction phase. The substitution of procedures includes

Variations in application methods (Chappell and Willis, 1996). Therefore, an adjustment to the original contract value is required if there is a change in procedures.

Impediment in prompt decision making process: Prompt decision making is an important factor for project success (Sanvido et al., 1992; Gray and Hughes, 2001). A delay in decision making may obstruct the progress of subsequent construction activities and that may eventually delay the entire project progress.

Obstinate nature of Employer: A building project is the result of the combined efforts of the professionals. They have to work at the various interfaces of a project (Wang, 2000; Arain et al., 2004). If the Employer is obstinate, he may not accommodate other creative and beneficial ideas. Eventually, this may cause major Variations in the later stages and affect the project negatively.

Change in specifications by owner: Changes in specifications are frequent in construction projects with inadequate project objectives (O'Brien, 1998). In a multi-player environment like any construction project, change in specifications by the Employer during the construction phase may require major Variations and adjustments in project planning and procurement activities.

2.3.1.1.2 Consultant Related Variations

This section discusses the causes of Variations that were initiated by the consultant. In some cases, the consultant directly initiates Variations or the Variations are required because the consultant fails to fulfill certain requirements for carrying out the project.

Change in design by Consultants: Change in design for improvement by the Consultant is a norm in contemporary professional practice (Arain et al., 2004). The changes in design are frequent in projects where construction starts before the design is finalized (Fisk, 1997). Design changes can affect a project adversely depending on the timing of the occurrence of the changes.

Errors and omissions in design: Errors and omissions in design are an important cause of project to delays (Arain et al., 2004). Design errors and omissions may lead to loss of productivity and delay in project schedule (Assaf et al., 1995). Hence, errors and omissions in design can affect a project adversely depending on the timing of the occurrence of the errors.

Conflicts between contract documents: Conflict between contract documents can result in misinterpretation of the actual requirement of a project (CII, 1986a). To convey complete project

scope for participants, the contract documents must be clear and straight to the point. Insufficient details in contract documents may adversely affect the project, leading to delay in project completion.

Inadequate scope of work for contractor: In a multi-player environment like construction, the scope of work for all the players must be clear and without uncertainty for successful project completion (Fisk, 1997; Arain et al., 2004). Inadequate scope of work for the contractor can cause major Variations that may negatively affect the project, and leads to changes in construction planning.

Technology change: Technology change is a potential cause of Variations in a project. Project planning should be flexible for accommodating new beneficial Variations (CII, 1994b). This is because the new technology can be beneficial in the project life cycle, for instance, reducing maintenance cost of the project. Or new methods of constructions that reduce construction cost.

Lack of coordination: A lack of coordination between parties may cause major variations that could eventually impact the project adversely (Arain et al., 2004). Unfavourable Variations, which affect the projects negatively, can usually be managed at an early stage by paying extra focus in coordination.

Design complexity: Complex designs require unique skills and construction methods (Arain et al., 2004). Complexity affects the flow of construction activities, whereas simple and linear construction works are relatively easy to handle (Fisk, 1997). Hence, complexity may cause major Variations in construction projects.

Inadequate working drawing details: To convey a complete concept of the project design, the working drawings must be clear and concise (Geok, 2002). Insufficient working drawing details can result in misinterpretation of the actual requirement of a project (Arain et al., 2004). Thorough reviewing of design details would assist in minimizing Variations.

Inadequate shop drawing details: Shop drawings are usually developed for construction\ work details for site professionals (Cox and Hamilton, 1995). As mentioned earlier with regard to working drawing details, likewise, inadequacy of shop drawing details can be a potential cause of Variations in the construction projects.

Consultant's lack of judgment and experience: Professional experience and judgment is an important factor for a successful completion of a building project (Clough and Sears, 1994; O'Brien, 1998). The lack of professional experience increases the risk of errors in design as well as during construction. Eventually, this may affect the project quality and delay the project completion.

Lack of consultant's knowledge of available materials and equipment: Knowledge of available materials and equipment is an important factor for developing a comprehensive design (Geok, 2002). In the construction industry where material standardization is not common, the consultant's lack of knowledge of available materials and equipment can cause numerous major Variations during various project phases.

Honest wrong beliefs of consultant: Honest wrong beliefs may cause construction professionals to contribute poor value add in projects (Arain, 2002; Arain et al., 2004). Consultants, without having firsthand knowledge, may make decisions based on their wrong beliefs which would adversely affect the pace of the project.

Consultant's lack of required data: A lack of data can result in misinterpretation of the actual requirements of a project (Assaf et al., 1995; Arain, 2002). When there is insufficient data, consultants are prone to develop designs based on their own perceptions, which may not be what the Employer wants. Eventually, this may cause major Variations and affect the project negatively.

Obstinate nature of consultant: In a multi-player environment like construction, the professionals have to work as team at the various interfaces of a project (Wang, 2000; Arain et al., 2004). If the consultant is obstinate, he may not accommodate other creative and beneficial ideas. Eventually, this may cause major Variations in the later stages and affect the project negatively.

Ambiguous design details: A clearer design tends to be comprehended more readily (O'Brien, 1998). Ambiguity or Doubtfulness or uncertainty in design is a potential cause of Variations in a project. This is because ambiguity in design can be misinterpreted by project participants, leading to rework and delay in the project completion. Eventually, this may affect the project progress negatively.

Design discrepancies (inadequate design): Inadequate design can be a frequent cause of Variations in construction projects (CII, 1990a; Fisk, 1997). Design discrepancies affect the project functionality and quality. Eventually, this can affect a project adversely depending on the timing of the occurrence of the Variations.

Noncompliance of design with government regulations: Noncompliance of design with government regulations or policies would cost the project difficult to execute (Clough and Sears, 1994). Noncompliance with government regulations may affect the project safety and progress negatively, leading to serious accidents and delays in the project completion.

Noncompliance of design with owner's requirements: A comprehensive design is one that accommodates the owner's requirements (Cox and Hamilton, 1995). A noncompliance design with the owner's requirements is considered an inadequate design (Fisk, 1997). Eventually, this may cause Variations for accommodating the Employer's requirements. This may affect the project adversely during the construction phase.

Change in specifications by consultant: Changes in specifications are frequent in construction projects with inadequate project objectives (O'Brien, 1998). As mentioned earlier with respect to changes in specifications by the Employer, this is also a potential cause of Variations in a project, leading to reworks and delays in the project completion.

2.3.1.1.3 Contractor Related Variations

This section discusses the causes of Variations that were related to the Contractor. In some cases, the contractor may suggest Variations to the project, or the Variations may be required because the contractor fails to fulfill certain requirements for carrying out the project.

Lack of Contractor's involvement in design: Involvement of the Contractor in the design may assist in developing better designs by accommodating his creative and practical ideas (Arain et al., 2004). Lack of Contractor's involvement in design may eventually cause Variations. Practical ideas which are not accommodated during the design phase will eventually affect the project negatively.

Unavailability of equipment: Unavailability of equipment is a procurement problem that can affect the project completion (O'Brien, 1998). Occasionally, the lack of equipment may cause major design Variations or adjustments to project scheduling to accommodate the replacement.

Unavailability of skills (shortage of skilled manpower): Skilled manpower is one of the major resources required for complex technological projects (Arain et al., 2004). Shortage of skilled manpower is more likely to occur in complex technological projects. This lack can be a cause for Variations that may delay the project's completion date.

Contractor's financial difficulties: Construction is a labour intensive industry. Whether the Contractor has been paid or not, the wages of the worker must still be paid (Thomas and Napolitan, 1994). Contractor's financial difficulties may cause major Variations during a project, affecting its quality and progress and in some cases even the safety of the site is affected if there is an argument.

Contractor's desired profitability: Contractor's desired profitability can be a potential cause of Variations in construction projects. This is because Variations are considered a common source of additional works for the contractor (O'Brien, 1998). The Contractor may eventually strive to convince the project Employer to allow certain Variations, leading to additional financial benefits for him.

Differing site conditions: Differing site condition can be an important cause of delays in large building projects (Assaf et al., 1995). The contractor may face different soil conditions than those indicated in the tender documents. Eventually this may affect his cost estimates and schedule negatively.

Defective workmanship: Defective workmanship may lead to demolition and rework in construction projects (Fisk, 1997; O'Brien, 1998). Defective workmanship results in low quality in construction projects (Arain et al., 2004). Even the Contractor bares the cost of the defective work, but this also may affect the project negatively, leading to rework and delay in the project completion.

Unfamiliarity with local conditions: Familiarity with local conditions is an important factor for the successful completion of a construction project (Clough and Sears, 1994). If the Contractor is

not aware of local conditions, it would be extremely difficult for him to carry out the project. Eventually, project delays may occur that end up with vital Variations in the entire design entity.

Lack of a specialized construction manager: The construction manager carries out the construction phase in an organized way to eliminate the risks of delays and other problems. Lack of a specialized construction manager may lead to defective workmanship and delay in the construction project.

Fast track construction: Fast track construction requires an organized system to concurrently carry out interdependent project activities (Fisk, 1997). When the public and private sectors have large funds and want to complete projects in a very short time, complete construction drawings and specifications may not be available when the contractor starts work (Arain et al., 2004). Eventually, this procurement mode may cause major Variations.

Poor procurement process: Procurement delays have various negative effects on other processes in the construction cycle (Fisk, 1997). Occasionally, the procurement delay may cause an entire change or replacement for originally specified materials or equipment for the project (Arain et al., 2004). This may therefore cause a need for project activities to be reworked.

Lack of communication: Detrimental Variations, which affect the projects adversely, can usually be managed at an early stage with strong and incessant communication. A lack of coordination and communication between parties may cause major Variations that could eventually impact the project negatively (Arain et al., 2004).

Contractor's lack of judgment and experience: The consultant's lack of professional experience increases the risk of errors during construction (O'Brien, 1998). This lack may cause major construction Variations in a project, when both Contractor and consultant could not identify or foresee the problems in the planning stage due to both parties are lacking of experience. Eventually, this may affect the project quality and delay the project completion.

Long lead procurement: Procurement delays have various adverse affects on other\ processes in the construction cycle (Fisk, 1997). Occasionally, the procurement delay may cause an entire change or replacement for originally specified materials or equipment for the project. Delay in long lead procurement is a common cause of delays in building projects (Assaf et al., 1995).

Honest wrong beliefs of contractor: As mentioned earlier with respect to honest wrong beliefs of the consultant, honest wrong beliefs of the contractor can also be a potential cause of Variations in construction projects. Contractors, without having firsthand knowledge, may make decisions based on their wrong beliefs which would adversely affect the quality and pace of the project.

Complex design and technology: Complex design and technology require detailed interpretations by the designer to make it comprehensible for the Contractor (Arain, 2002). A complex design may be experienced for the first time by the Contractor. Eventually, the complexity may affect the flow of construction activities, leading to delays in the project completion.

Lack of strategic planning: Proper strategic planning is an important factor for successful completion of a building project (Clough and Sears, 1994; CII, 1994a). The lack of strategic planning is a common cause of Variations in projects where construction starts before the design is finalized, for instance, in concurrent design and construction contracts (O'Brien, 1998).

Contractor's lack of required data: A lack of required data may affect the contractor's strategic planning for successful project completion, leading to frequent disruptions during the construction process. This is because a lack of data can result in misinterpretation of the actual requirements of a project (Assaf et al., 1995; Arain et al., 2004).

Contractor's obstinate nature: As mentioned earlier with regard to the obstinate nature of consultant, likewise, this can be a potential cause of Variations in construction projects. If the Contractor is obstinate, he may not accommodate creative and beneficial ideas suggested by others. Eventually, this may cause major Variations in the later stages and affect the project negatively.

2.3.1.1.4 Other Variations

This section discusses the causes of Variations that were not directly related to the project team.

Weather conditions: Adverse weather conditions can affect outside activities in construction projects (Fisk, 1997; O'Brien, 1998). When weather conditions vary such as the various monsoon

seasons in Malaysia, the contractor needs to adjust the construction schedule accordingly. Occasionally, this may affect the project progress negatively, leading to delays in construction.

Safety considerations: Safety is an important factor for the successful completion of a building project (Clough and Sears, 1994). Noncompliance with safety requirements may cause major Variations in design. Lack of safety considerations may affect the project progress negatively, leading to serious accidents and delays in the project completion.

Change in government regulations: Local authorities may have specific codes and regulations that need to be accommodated in the design (Arain et al., 2004). Change in government regulations during the project construction phase may cause major Variations in design and construction. This can affect a project negatively depending on the timing of the occurrence of the changes.

Change in economic conditions: Economic conditions are one of the influential factors that may affect a construction project (Fisk, 1997). The economic situation of a country can affect the whole construction industry and its participants. Eventually, this may affect the project negatively, depending on the timing of the occurrence of the Variations.

Socio-cultural factors: Professionals with different socio-cultural backgrounds may encounter problems due to different perceptions, and this may affect the working environment of the construction project (Arain et al., 2004). Lack of coordination is common between professionals with different socio-cultural backgrounds (O'Brien, 1998). Eventually, project delays may occur that end up with vital changes in the entire project team.

Unforeseen problems: Unforeseen conditions are usually faced by professionals in the construction industry (Clough and Sears, 1994; O'Brien, 1998). If these conditions are not solved as soon as possible, they may cause major Variations in the construction projects. Eventually, this may affect the project negatively, leading to reworks and delays in the project completion.

2.3.1.2 Impacts Of Variations

Given a well-structured schedule of works, the maximum project performance could be achieved if the work progress flows smoothly within the time frame and within the budget. However, it is rare that a project performs according as scheduled due to several reasons such as

market conditions changes and Variations on the design drawings or contract. Therefore, the occurrence of Variations has negative impact on project performance. Thomas et al (2002:144) believe that variability generally impedes project performance. Ibbs (1997:308) concluded that Variations have tremendous effect on the project performance as they negatively affect the productivity and cost. Arain & Pheng (2005:285) argued that Variations are unwanted but inevitable reality of any construction project. Hanna et al (2002:57) indicated that projects impacted by Variations causes the contractor to achieve lower productivity level than planned. There are 16 effects identified from the literature review, as shown in Figure 1 is discussed below.

Delay in payment: Delay in payment occurred frequently due to Variations in construction projects (CII, 1990a). Variations may slow down the project progress, leading to delays in achieving the targeted dateline during construction (CII, 1995). Eventually, this may affect payment to the contractors. These delay may causes severe problems until it end up in delays in payment to the subcontractors; this is because the Contractors may not be able to pay the Sub-Contractors unless they get paid by the Employer first.

Quality degradation: If occurrence of Variations is frequent, they may affect the quality of works. According to CII (1995), the quality of work was usually poor because of frequent variations because Contractors tended to compensate for the losses by doing "short cut" works.

Productivity degradation: Interruption, delays and redirection of work that are associated with Variations have a negative impact on labor productivity. These in turn can be translated into labor cost or monetary value (Ibbs, 1997b). Hester et al. (1991) argued that the productivity of workers was expected to be greatly affected in cases where they were required to work overtime for prolonged periods to compensate for schedule delays. Thomas and Napolitan (1995) concluded that Variations normally led to disruptions and these disruptions were responsible for labor productivity degradation. The most significant types of disruptions were due to the lack of materials and information as well as the work out of sequence. Lack of material was reported as the most serious disruption, because labors could not continue their works and end up idling while waiting for the materials to be available. Hence, to manage Variations, one needed to manage these disruptions. However, the disruptive effects could not be avoided in many instances.

Rework and demolition: Rework and demolition are frequent occurrences due to Variations in construction projects (Clough and Sears, 1994). Variations which are imposed when construction is underway or even completed, usually lead to reworks and delays in project completion (CII, 1990a). Rework and demolition are potential effects of Variations in construction, depending on the timing of the occurrence of the Variations. These effects are to be expected due to Variations during the construction phase. This is because the Variations during the design phase do not require any rework or demolition on construction sites.

Logistics delays: Logistics delays may occur due to Variations requiring new materials and equipment (Fisk, 1997). Hester et al. (1991) observed that logistics delays were significant effects of Variations in construction projects. Logistics delays were experienced in construction projects where Variations in the construction phase required new materials, tools and equipments.

Tarnish firm's reputation: Variations are referred to as a major source of construction claims and disputes (Fisk, 1997; Kumaraswamy et al., 1998). The claims and disputes may affect the firm's reputation negatively, due to unable to solve sever Variation cases. Variations also increase the possibility of professional disputes. Conventionally, Variations present problems to all the parties involved in the construction process.

Poor safety conditions: Variations may affect the safety conditions in construction projects (O'Brien, 1998) as changes in construction methods, materials and equipment may require, therefore additional safety measures are needed during carrying out the construction phase.

Poor professional relations: A construction project is not a mere brick and mortar brought together. Rather, it creates professional relationships between parties to the contract. Each project successfully completed constitutes an added experience to participants and their reputation builds up. But disputes may arise between parties to the contract owing the occurrence of Variations. Misunderstanding may arise when the Contractor is not satisfied with the judgment of the consultant in terms of a fair valuation of a variation. Bower (2000:264) argued that parties to a contract have been left to argue over the cost, time effects and due compensation of a variations. Since the contractors are pessimist of the outcome of the negotiations, they usually allow higher value than the real cost incurred. Bower (2000:264) opined that this causes

the contention between parties as the contractor continually push the client to settle the claim for additional costs while invariably feeling that the reimbursement has been insufficient. As a consequence, this can be very damaging to relationship between all parties' representatives (Bower 2000:264). Charoenngam et al (2003:197) remarked that disputes between the Employer and the contractor can occur if the Variations undertaking is not managed carefully. Harbans (2003:42) warned that unless a mutually acceptable solution is agreed by the parties, valuation of variations would remain at the forefront of disputes and claims making their way ultimately to arbitral tribunals or the corridors of justice. Ssegawa (2002:92) revealed that more than one-third of disputes occurs pertain to how to ascertain losses arising from variations. The excessive occurrence of variations due to design errors or omission may undermine the professionalism of the designer. Furthermore, workers get demoralized when they demolish a portion of work that has already been done.

Additional payments for contractor: Additional payments for the contractor can be a potential effect of Variations in construction projects. Variations are considered to be a common source of additional works for the contractor (O'Brien, 1998). Due to additional payments, the contractor looks forward to variations in the construction project because contractor benefits from the additional profit on variations.

Disputes among professionals: Like poor professional relations, disputes among professionals are also potential effects of frequent variations in construction projects. The disputes over variations and claims are inevitable and the variation clauses are often the source of project disputes (CII, 1986a). Clear procedures presented in the contract and fair allocation of risks can help in resolving disputes through negotiation rather than litigation (CII, 1986a). Frequent communication and strong coordination can assist in eliminating the disputes between professionals.

Completion schedule delay: Various authors agree that variations could be one of the reasons behind project time overruns or delays (Chan &Yeong 1995:467, Mohamed 2001:1). It is said that a project that finished within the shortest time could, achieves some monetary savings. Unfortunately, each additional day due to occurrence of Variations on a project implies additional money. Variations issued during any various phases of construction gives negative affected to both project's completion time and cost increase (Koushki 2005:292). Hanna et al

(2002:63) revealed that the more the variations occurrence the more significant productivity losses. The productivity is the amount of output over a unit of time.

2.3.1.3 To Reduce Number And The Impact Of Variations

Controls for Variations and Variation Orders have been suggested by many researchers (Mokhtar et al., 2000; Ibbs et al., 2001). Below are 30 approach identified from a literature review to reduce number and the impact of Variations. These approaches were categorized into three categories: Design stage, Construction stage and Design-Construction interface stage.

2.3.1.3.1 Design Stage Approach to Control Variations

1. Review of contract documents

Comprehensive and balanced Variation clauses would be helpful in improving coordination and communication quality .Conflicts between contract documents can result in misinterpretation of the actual requirement of a project.

(CII, 1994a)

2. Freezing design

Variations in design can affect a project adversely depending on the timing of the occurrence of the changes. Therefore, freezing the design is a strong control method.

Many owners freeze the design and close the door for variations after the completion of the drawings.

(CII, 1990a)

3. Involvement of professionals at initial stages of project

Involvement of professionals in design may assist in developing better designs by accommodating their creative and practical ideas. This practices would assist in developing a comprehensive design with minimum discrepancies .Practical ideas that are not accommodated during the design phase may affect the project adversely. Variation during the construction phase is a costly activity as it may initiate numerous changes to construction activities.

(Arain et al., 2004) (O'Brien, 1998).

4. Employer's involvement at planning and design phase

Involvement of the Employer at the design phase would assist in clarifying the project objectives and identifying noncompliance with their requirements at the early stage. Hence, this may help in eliminating variations during the construction stage where the impact of the variations can be severe

(Fisk, 1997)

5. Involvement of contractor at planning and scheduling process

Involvement of the Employer at the design phase would assist in clarifying the project objectives and identifying noncompliance with their requirements at the early stage. Hence, this may help in eliminating variations during the construction stage where the impact of the variations can be severe.

(Fisk, 1997).

6. Thorough detailing of design

A clearer design tends to be comprehended more readily. This would also assist in identifying the errors and omissions in design at an early stage. Eventually, thorough detailing of design can eliminate variations arising from ambiguities and errors in design.

(O'Brien, 1998)

7. Clear and thorough project brief

A clear and thorough project brief is an important control for Variations in construction projects as it helps in clarifying the project objectives to all the participants. Eventually, this may reduce the design errors and noncompliance with the Employer's requirements.

(O'Brien, 1998)

8. Reducing contingency sum

The provision of a large contingency sum may affect the construction team's working approaches. This is because the designer may not develop a comprehensive design and would consequently carry out the rectifications in design as variations during the later stages of the construction

project. Therefore, reducing the contingency sum would be helpful in ensuring that the professionals carry out their jobs with diligence.

2.3.1.3.2 Construction Stage Approach to Control Variations

1. Clarity of Variation Order procedures

Clarity of Variation Order procedures is an integral part of effective management of variation Orders. Early in the project construction stage, the procedures should be identified and made clear to all parties. Clarity of Variation Order procedures would help in reducing the processing time and other mishandling issues.

(Mokhtar et al., 2000) (Ibbs et al., 2001).

2. Written approvals

Any variation in the work that involves a change in the original price must be approved in writing by the employer before a variation can be executed. Any party signing of behalf of the employer must have written authorization from the employer. It is difficult to prove the right for compensation if there is no such authorization from the employer. In the hectic environment of construction, many verbal agreements can be forgotten, leaving the Contractor without any legal proof to get compensation for the variations works.

(CII,1990a; Hester et al., 1991; Cox, 1997).

3. Variation Order scope

A well defined scope can assist the professional team in recognizing and planning appropriately to minimize the negative impact of the variation. The original scope should be clear and well defined to distinguish between a variation of scope and a variation due to design development. It is common that there are disagreement between parties in a project was about defining the variation scope. Thus, the effective definition of the scope of work helps us to identify and manage variations.

(Ibbs et al. 2001).(CII ,1994b)

4. Variation logic and justification

Variation logic and justification for implementation was one of the principles of effective change management. This principle required a change to be classified as required or elective. Required changes were required to meet original objectives of the project while elective changes were additional features that enhanced the project. Knowing the logic and justification behind the proposed

Variations assist the professionals in promoting beneficial variations and eliminating non-beneficial variations.

Proposed by (Ibbs et al. 2001).

5. Appointment Project manager from an independent firm to manage the project

Involvement of a project manager from an independent firm would assist in eliminating variations that arise due to the lack of coordination among professionals. This practice may assist in reducing design discrepancies through early reviews of the contract documents and drawings.

(Arain et al., 2004)

6. Restricted pre-qualification system for awarding projects

A restricted pre-qualification system for awarding projects would act as a filter to select only the capable Contractors for project bids.

(Chan and Yeong, 1995; Fisk, 1997)

7. Employer's involvement during construction phase

Involvement of the employer during the construction phase would assist in identifying noncompliance with the requirements and in approving the variations promptly. The involvement of the employer during the construction phase allows to keep him aware of ongoing activities and assist in prompt decision making.

(Ibbs et al., 2001).

8. Avoid use of open tendering

Competitive open tendering usually encourages the contractor to price very low to win the contract, especially in bad times when they are in need of jobs. This practice would give rise to the contractor trying to claim more to compensate for the low price award. Avoiding the use of open tender would help in eliminating the risks of unfair bids. This may also help in reducing Variations that may arise due to the contractor's bidding strategy.

(Chan and Yeong, 1995)

9. Use of project scheduling/management techniques

To manage a variation means being able to anticipate its effects and to control, or at least monitor, the associated cost and time impact. The most known scheduling techniques in the construction industry are CPM, PERT and Gantt chart; Microsoft Project. These techniques are helpful in identifying the critical path of any Variations on subsequent construction activities. Well planned and close monitoring on the schedule plan will help to reduce the Variations effects on the project.

(Hester et al., 1991)(Clough and Sears, 1994).(Mokhtar et al., 2000).

10. Comprehensive documentation of variation order

Through timely notification and documentation of variation orders, participants will have kept their rights and thereby their option to pursue a subsequent claim or to defend against a claim. One of the most aggravating conditions is the length of time that elapses between the time when a proposed contract modification is first announced and when the matter is finally rejected or approved as a variation order. Documentation of variation and claims had assisted in tracking the effects of the Variation and claim events on time and cost. A documented source of knowledge about previous Variation instructions would be helpful in making decisions concerning the appropriate handling of variation instructions.

(Cox, 1997; O'Brien, 1998).(Fisk, 1997), Cox (1997)

2.3.1.3.3 Design-Construction Interface Stage Approach to Control Variations

1. Prompt approval procedures

One of the most aggravating conditions is the length of time that elapses between the time when a proposed contract modification is first announced and when the matter is finally rejected or approved as a variation .However, the longer the period between recognition and implementation, the more costly the change will be.

(Fisk, 1997).

2. Ability to negotiate Variation

Ability to negotiate variation is an important factor for the effective control of variations. Effective negotiation can assist the professional team in minimizing the negative impacts of the variation. There are certain skills required for effective negotiation of variations, i.e., the knowledge of contract terms, project details, technology, labor rates, equipment, methods and communication skills.

(Clough and Sears, 1994), (Cushmanand Butler, 1994)

3. Valuation of indirect effects

Consequential effects can occur later in the downstream phases of a project. Therefore, it is essential to acknowledge this possibility and establish the mechanism to evaluate its consequences.

Professionals should thus evaluate the total overall effects a change may have on the later phases of a project, in order to manage the variations effectively.

(Ibbs et al., 2001).

4. Team effort by employer, consultant and Contractor to control Variation

Coordination is important in a multi-participant environment as in most construction projects detrimental variations, which affect the projects negatively, can usually be managed at an early stage with due diligence in coordination.

(CII, 1994a; Assaf et al., 1995).

5. Utilize work breakdown structure

A work breakdown structure (WBS) is a management tool for identifying and defining work. A Contractor should consider using this as an evaluation tool, especially on large projects. If a Variation involves work not previously included in the WBS, it can be logically added to the WBS and its relationship with the other WBS element can be easily checked. Domino effects can also be traced by the use of WBS.

(Hester et al., 1991; Mokhtar et al., 2000).

6. Continuous coordination and direct communication

Coordination, and frequent communication are essential to reduce miscommunication among team members, hence reduce the chances of occurring variations.

(Assaf et al., 1995).

7. Control the potential for Variations to arise through contractual clauses

Selection of the appropriate standard contract form (JKR, PAM2006 etc) with the necessary and unambiguous Variation clauses would be helpful in the management of variations. Clear procedures presented in the contract and fair allocation of risks can help in resolving disputes through negotiation rather than litigation.

(Cox, 1997)

8. Comprehensive site investigation

Comprehensive site investigations assist in proper planning for construction activities. Differing site conditions are an important cause of delays in large building projects. Therefore, a comprehensive site investigation would help in reducing potential Variations in a project.

(Fisk, 1997).

9. Use of collected and organized project data compiled by Employer, consultant and Contractor

The Variations works should always be documented for future references. Hence, better controls for Variations were achievable by sharing a database compiled by all the team members

(Fisk,1997).

10. Knowledge-base of previous similar projects

From the outset, project strategies and philosophies should take advantage of lessons learned from past similar projects. If professionals have a knowledge-base established on past similar projects, it would assist the professional team to plan more effectively before starting a project, both during the design phase as well as during the construction phase, minimize and control Variations and their effects.

(CII, 1994b).

11. Comprehensive analysis and prompt decision making through computerized

Knowledge-based decision support system

A Decision Support System (DSS) approach for management decisions seems to be the ideal approach to follow. The system would be helpful in presenting an example scenario of the causes of variations, their relevant effects and potential controls that would assist in decision making at the early stage of the variations occurring.

(Miresco and Pomerol, 1995).

2.3.1.4 Management Of Variations In Construction

Management of Variations could be counted as one of the most significant challenges in construction management. The nature and amount of Variations occurrence varies from one project to another depending on various factor (CII, 1986; Kaming, Olomloaiye, Holt & Harris, 1997). Arain and Low (2005a) identified the design phase as the most likely area on to focus to reduce the number of Variations. The newsletter Law Talk by McKays Solicitors discussed that Contractor's inability to successfully pursue variations claims, is one of the main factors contributing to business bankruptcy in the industry.

One way to reduce Variations on site is to begin with is to focusing on what and how does the project team can help in minimizing the problems during the design phase (Arain, 2005). Variations changing the design or the specifications usually have a time impact and a cost impact. It is for this reason that the construction drawings and specification should be prepared

with great care and precision. The less ambiguity in terms of design documentation, then lower the potential for Variations (Stuart Miller, 2009).

CHAPTER THREE

3 CONTRACTUAL PROVISIONS RELATIVE TO VARIATION ORDERS

Most standard forms of contract include a clause under which the employer or his representative is able to issue an instruction to the contractor to vary the works which are described in the contract. A change in shape of the scheme, the introduction of different materials, revised timing and sequence are all usually provided for by the variations clause. It will also usually include a mechanism for evaluating the financial effect of the variation and there is normally provision for adjusting the completion date. In the absence of such a clause the employer could be in a difficulty should a variation to the works be required. The contractor could either refuse to carry out the work or under take the work or insist up on payment on a quantum merit or fair valuation basis. Calculation of the price for the extra work applying this method could involve payment in excess of the contract rates.

Among the different conditions of contract, the MDB-FIDIC (2006), and PPA (2011) are widely used in Ethiopian construction industry. These contract conditions clearly define the duties and responsibilities of the parties involved in the contract and it describes the guidelines for contract administration, they consequentially alter variation of construction works unless and otherwise they are deleted or replaced by other words or sentences in the specific conditions of contract for a project.

3.1 Variations And Their Regulation Under The MDB-FIDIC 2006 And PPA-2011 Conditions Of Contract And The Applicable Law

3.1.1 MDB-FIDIC 2006 Conditions Of Contract

Engineer's Duties and Authority: Sub-Clause 3.1

Whenever, the Engineer exercises a specified authority for which the Employer's approval is required, then (for the purposes of the Contract) the Employer shall be deemed to have given approval.

Evaluation: Sub-Clause 12.3

Except as otherwise stated in the Contract, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the Contract Price by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Clauses 12.1 and 12.2 and the appropriate rate or price for the item.

For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contract or, if there is no such item, specified for similar work.

Any item of work included in the Bill of Quantities for which no rate or price was specified shall be considered as included in other rates and prices in the Bill of Quantities and will not be paid for separately.

However, a new rate or price shall be appropriate for an item of work if:

- (a) (i) the measured quantity of the item is changed by more than 25% from the quantity of this item in the Bill of Quantities or other Schedule,
 - (ii) this change in quantity multiplied by such specified rate for this item exceeds 0.25% of the Accepted Contract Amount,
 - (iii) this change in quantity directly changes the Cost per unit quantity of this item by more than 1%, and
 - (iv) this item is not specified in the Contract as a “fixed rate item”;
- or
- (b) (i) the work is instructed under Clause 13 [Variations and Adjustments],
 - (ii) no rate or price is specified in the Contract for this item, and
 - (iii) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Contract, with reasonable adjustments to take account of the matters described in sub-paragraph (a) and/or (b), as applicable. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable Cost of executing the work, together with profit, taking account of any other relevant matters.

Right to Vary: Sub-Clause 13.1

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, or (ii) such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

Each Variation may include:

- (a) changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation),
- (b) changes to the quality and other characteristics of any item of work,
- (c) changes to the levels, positions and/or dimensions of any part of the Works,
- (d) omission of any work unless it is to be carried out by others,
- (e) any additional work, Plant, Materials or services necessary for the Permanent Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, or
- (f) changes to the sequence or timing of the execution of the Works.

The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Engineer instructs or approves a Variation.

Value Engineering: Sub-Clause 13.2

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor's opinion) will, if adopted,

- (i) accelerate completion,
- (ii) reduce the cost to the Employer of executing, maintaining or operating the Works,
- (iii) improve the efficiency or value to the Employer of the completed Works, or
- (iv) otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor.

Variation Procedure: Sub-Clause 13.3

If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

- (a) a description of the proposed work to be performed and a program for its execution,
- (b) the Contractor's proposal for any necessary modifications to the program according to Sub-Clause 8.3 [Program] and to the Time for Completion, and
- (c) the Contractor's proposal for evaluation of the Variation.

Payment in Applicable Currencies: Sub-Clause 13.4

If the Contract provides for payment of the Contract Price in more than one currency, then whenever an adjustment is agreed, approved or determined as stated above, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified for payment of the Contract Price.

Provisional Sums: Sub-Clause 13.5

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed.

Day work: Sub-Clause 13.6

For work of a minor or incidental nature, the Engineer may instruct that a Variation shall be executed on a day work basis. The work shall then be valued in accordance with the Day work Schedule included in the Contract, and the following procedure shall apply. If a Day work Schedule is not included in the Contract, this Sub-Clause shall not apply.

Before ordering Goods for the work, the Contractor shall submit quotations to the Engineer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

Adjustments for Changes in Legislation: Sub-Clause 13.7

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

Adjustments for Changes in Cost: Sub-Clause 13.8

In this Sub-Clause, "table of adjustment data" means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub-Clause shall not apply.

If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs. The amounts determined by the formulae given in the Sub-Clause.

The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be

made to the values of the indices at stated dates for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the “currency of index” is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable.

3.1.2 PPA-2011 Conditions Of Contract

Section 6D:

Sub-Clause 5

(a) Day work schedule

A day work schedule should be included only if there is a high probability of unforeseen works not covered by the bill of quantities. To facilitate checking by the Public Body of the realism of rates quoted by the Bidders, the daywork schedule should normally comprise the following:

(iv) A list of the various classes of labor, materials, and construction plant for which basic daywork rates or prices are given by the Bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a daywork basis;

(v) The nominal quantities for each item of daywork, to be priced by each Bidder in its Bid. The rate to be entered by the Bidder against each basic daywork item should include the Contractor's profit, overheads, supervision and other charges.

Section 7:

Sub-Clause 15.1

The Engineer shall have power to order any modification to any part of the works necessary for the proper completion and/or functioning of the works. Such modifications may include additions, omissions, substitutions, changes in quality, quantity, form, character, kind, position, dimension, level or line and changes in the specified sequence, method or timing of execution of the works. No order for a modification shall have the effect of invalidating the contract, but the financial effect, if any, of all such modifications shall be valued in accordance with GCC Clauses 15.5 and 15.7.

Sub-Clause 15.2

All change orders shall be issued in writing, it being understood that:

- (a) if for any reason, the Engineer shall find it necessary to give an order orally, he shall as soon as possible thereafter confirm the order by an change order;
- (b) if the Contractor shall confirm in writing an oral order given for the purpose of GCC Clause 15.2 (a) and the confirmation shall not be contradicted in writing forthwith by the Engineer, a change order shall be deemed to have been issued for the modification.

A change order for modification shall not be required for increase or decrease in the quantity of any work where such increase or decrease is the result of the quantity exceeding or being less than that stated in the bill of quantities or price schedule, as the result of valuation of works laid down in GCC Clause 63.

Sub-Clause 15.3

Except as provided by GCC Clause 15.2 prior to any change order for modification, the Engineer shall notify the Contractor of the nature and form of such modification. As soon as possible, after receiving such notice, the Contractor shall submit to the Engineer a proposal containing:

- (a) a description of the tasks, if any, to be implemented or the measures to be taken and a program for execution; and
- (b) any necessary modifications to the program of implementation of tasks or to any of the Contractor's obligations under the contract; and
- (c) any adjustment to the contract price in accordance with the rules as set out in this Clause.

Sub-Clause 15.4

Following the receipt of the Contractor's submission referred to in GCC Clause 15.3, the Engineer shall, after due consultation with the Public Body and, where appropriate, the Contractor, decide as soon as possible whether or not the modification shall be carried out. If the Engineer decides that the modification shall be carried out he shall issue the change order stating that the modification shall be carried out at the prices and under the conditions given in the Contractor's submission referred to in GCC Clause 15.3 or as modified by the Engineer in accordance with GCC Clause 15.5.

Sub-Clause 15.5

The prices for all modifications ordered by the Engineer in accordance with GCC Clause 15.2 and 15.4 shall be ascertained by the Engineer in accordance with the following principles:

- (a) where work is of similar character and executed under similar conditions to work priced in the bill of quantities or price schedule it shall be valued at such rates and prices contained therein;
- (b) where work is not of a similar character or is not executed under similar conditions, the rates and prices in the contract to be agreed through negotiation between the Engineer and the Contractor shall conform to the prevailing market price;
- (c) if the nature or amount of any modification relative to the nature or amount of the whole of the contract or to any part thereof shall be such that in the opinion of the Engineer any rate or price contained in the contract for any item of work is by reason of such modification rendered unreasonable, then the Engineer shall fix such rate or price as in the circumstances he shall think reasonable and proper;
- (d) where a modification is necessitated by default or breach of contract by the Contractor, any additional cost attributable to such modification shall be borne by the Contractor.

Sub-Clause 15.6

On receipt of the change order requesting the modification, the Contractor shall proceed to carry out the modification and be bound by these GCC in so doing as if such modification were stated in the contract. The works shall not be delayed pending the granting of any extension of time for completion or adjustment to the contract price. Where the order for a modification precedes the adjustment to the contract price, the Contractor shall keep records of the costs of undertaking the modification and of time expended thereon. Such records shall be open to inspection by the Engineer at all reasonable times.

Sub-Clause 15.7

Where on provisional acceptance an increase or reduction in the total value of the works resulting from a change order, or from some other circumstance which is not caused by the Contractor's default, exceeds 25% of the initial contract price (or as modified by addendum), the Engineer shall, after consultation with the Public Body and the Contractor determine any reduction from the contract price as a consequence of the application of GCC Clause 15.5. The sum so determined shall be based on the amount by which the increase or decrease in value of

the works exceeds 25%. The sum shall be notified by the Engineer to the Public Body and the Contractor and the contract price adjusted accordingly.

Sub-Clause 15.8

The total value of the works resulting from a change order shall not exceed 30% of the total value of the initial contract price.

Sub-Clause 15.9

Any change to the terms of the Contract must be recorded in writing and executed by authorized signatory of the Contractor and the Engineer. Such record of the change in question must address all consequential amendments required to be made to the Contract as a result of such change.

Sub-Clause 15.10

Changes will take effect as from the date specified in the signed record of change and shall not have retrospective effect unless expressly provided for in such record.

Sub-Clause 15.11

Each record of change must be dated and sequentially numbered. Each of the Public Body and the Contractor will be entitled to an original executed counterpart of the record of variation.

Sub-Clause 15.12

Except as provided in any such record of variation, the Contract will continue in full force and effect.

Sub-Clause 59.1

Payments shall be made in currency as specified in the SCC. The SCC shall lay down the administrative or technical conditions governing advance payments, interim and/or final payments made in accordance with the GCC.

| Item No | Evaluation Criteria | Similarity | Differences |
|---------|--------------------------------|--|---|
| 1 | Definition of variation | <p>According to MDB-FIDIC 2006 “Variation” means any change to the Works, which is instructed or approved as a variation under Clause 13 [<i>Variations and Adjustments</i>].</p> <p>According to PPA-2011 ”Modifications by Change Orders” The Engineer shall have power to order any modification to any part of the works necessary for the proper completion and /or functioning of the works. (Sub-clause 15.1)</p> <p>Both of conditions of contracts define as varied work.</p> | <p>-According to PPA-2011 “Variation” is stated as “Modifications”.</p> <p>-In the case of PPA-2011 condition of contracts “Modifications” is defined as only instructed by the Engineer, but in the case of MDB-FIDIC 2006 variation may be instructed or approved according to the conditions specified in Clause 13.</p> |
| 2 | Right to vary | <p>Both under MDB-FIDIC 2006 sub-clause 13.1 (a) up to(f) and PPA-2011 condition of contracts (Sub-clause 15.1) contain: Changes to quantities, quality of item of works, changes to levels, positions and/or dimensions, omission of any work any additional work, changes to the sequence or timing of the execution of the works, etc.</p> | No difference |
| | (i) Engineer | <p>Both under MDB-FIDIC 2006 (sub-clause 13.1) and PPA-2011 (sub-clause 15.1 up to 15.4) condition of contract the engineer has right to initiate, order, confirm, omit and asses the variations.</p> | No difference |

| | | | |
|---|---|--|---|
| | (ii) Contractor | Both under MDB-FIDIC (sub –clause 13.1) and PPA-2011 (sub-clause 15.2(b) and 15.3) condition of contract state the right and the obligation of the contractor. | No difference |
| | (iii) Employer | No similarity | Under MDB-FIDIC the Employer has to approve the variation order by the Engineer(Sub-Clause 3.1) Under PPA-2011 there is no any clauses that state about this. |
| 3 | Value Engineering | No similarity | The basic concept of Value Engineering is more detailed and properly addressed by MDB-FIDIC 2006 but there is no a value engineering concept under PPA-2011 General Conditions of Contract. |
| 4 | Procedure of variation | Both under MDB-FIDIC 2006 sub-clause 13.3 and PPA-2011 condition of contracts (Sub-clause 15.3 and 15.4) describes the same procedure of variation, which is the engineer instruct the variation and the contractor respond accordingly. | No difference |
| 5 | Payment in Applicable Currencies | Both under MDB-FIDIC 2006 (Sub-Clause 13.4) and PPA-2011 (Sub-Clause 59.1) state that the payment currency for the varied works should be based on the proportions of various currencies specified for payment of the Contract Price. | No difference |
| 6 | The provisional sum | Both under MDB-FIDIC 2006 sub-clause 13.5 and PPA- | According to PPA-2011(Sub-clause 15.7) The sum so |

| | | | |
|---|---|---|--|
| | | 2011 (Sub-clause 15.7) describes in accordance with the Engineer's instructions, and the Contract Price shall be adjusted accordingly. | determined shall be based on the amount by which the increase or decrease in value of the works exceeds 25%. The sum shall be notified by the Engineer to the Public Body and the Contractor. |
| 7 | Day work | Both under MDB-FIDIC 2006 Sub-Clause 13.6 and PPA-2011(Section-6D, Sub-Clause 5(a)) allows execution of these works based on day work basis. The rate of price shall be paid based on the day work schedule specified in the contract document in both cases. | No difference |
| 8 | Adjustments for Changes in Legislation | No similarity | In MDB-FIDIC 2006 the contractor has the right to ask any adjustments regarding to cost and time whenever he feels that he suffers from additional cost as result of changes in the laws of the country, including introduction of new laws and modification of the existing one. But in PPA-2011 Sub Clause 16.1 Unless otherwise expressly agreed in the SCC. if, after the deadline for submission of the Bid then such Contract Price shall not be correspondingly increased or decreased and/or the Completion Date shall not be adjusted to the extent that Contractor has thereby been affected in the performance of any of its obligations under the Contract. |

| | | | |
|----|--|--|---|
| 9 | Adjustments for Changes in Cost | Both under MDB –FIDIC 2006 Sub-Clause 13.8 & PPA-2011 Sub-clause 62.4 consider increase or decrease the contract price amount. | <p>-PPA-2011(Sub-clause 62.1 and 62.2) Adjustments of contract prices shall be allowed after 12 months from the effective date of the contract where it is verified that the performance of the contract requires more than 18 months. But in MDB-FIDIC 2006 there is no time restriction for price adjustment</p> <p>-MDB-FIDIC 2006 Sub-clause 13.8 states:</p> $P_n = A + b \frac{L_n}{L_o} + c \frac{M_n}{M_o} + d \frac{E_n}{E_o} + etc.$ <p>-PPA-2011(Sub-clause 62.12) states:</p> $PA = \left[NV + A \frac{(MLI - BLI)}{BLI} + B \frac{(MMI - BMI)}{BMI} + C \frac{(MEI - BEI)}{BEI} + D \frac{(MFI - BFI)}{BFI} \right] (BC) Q$ |
| 10 | Valuation of Variation | Both under MDB –FIDIC 2006 Sub-Clause 12.3a(i) & PPA-2011 Sub-clause 15.7 consider Valuation of Variation after 25% increment in bill of quantities or initial contract price for the particular item. | <p>PPA-2011 Sub Clause 15.8 states, the total value of the works resulting from a change order shall not exceed 30% of the total value of the initial contract price.</p> <p>But in MDB -FIDIC 2006 there is no any clauses that state this case.</p> |

Table 1- Comparison between MDB-FIDIC 2006 and PPA-2011 Conditions of Contract with respect to variation.

3.1.3 Civil Code

The Civil Construction Law in Ethiopia provides that variation is allowed whether or not a clause to that effect is incorporated in the contract. While establishing the right, it imposes certain restrictions on the right of exercising and implementing changes or variations to the work.

Arts.3031-3034 of the Civil Code provide thus:

Art.3031. - Alterations required by client- 1. Right of client

The client may demand that alterations be made in the work as originally planned where such alterations can technically be made and are not such as to impair the solidity of the work.

Art.3032.- 2. Effect

- (1) The client may require a reduction in the price as originally agreed where the alterations required by him reduce the expenses of the contractor.
- (2) The contractor may require an increase in the price and his remuneration as originally agreed, where the alterations required by the client increase his expenses, work or liability.
- (3) Where the parties do not agree, such reduction or increase shall be settled by arbitrators appointed by the parties or, failing such, by the court.

Art.3033.-3.Contracting refusing alterations

- (1) The contractor may refuse the alterations required by the client where such alterations affect plans, schemes or other documents on which the parties had agreed.
- (2) The contractor may also refuse the alterations where they are of such a nature or importance that they constitute a work absolutely different to the agreed work.
- (3) The work shall be deemed to be absolutely different to the agreed work where it implies an alteration exceeding by twenty per cent the value at which the original work was or could have been estimated.

Art.3034. - Alterations required by contractor

- (1) Where it appears necessary for technical reasons to make alterations in the work as originally agreed, the contractor shall, except in urgent cases, give notice thereof to the client.

- (2) The contractor shall give such notice notwithstanding that the proposed alterations do not result in the client having to pay an increased price.

The following provisions also govern variations in a Government Construction Contract as provided under the Administrative Contracts Law regime in the Civil Code of Ethiopia of 1960. The provisions clearly establish the right of the employer to vary the work at any stage of the construction phases and try to regulate how its effect should be managed.

Art.3283. - Unilateral modification of contract.- 1. Right of administrative authorities

- (1) During the currency of the contract of public works, the administrative authorities may, notwithstanding any stipulation to the contrary, impose unilaterally upon the contractor changes in the original conditions of the contract as indicated in the specifications.
- (2) Such changes may affect only the provisions which concern the arrangement of the public works.
- (3) They may not affect the financial conditions of the contract.

Art.3284. - 2. New works.

- (1) The administrative authorities may, against payment of an additional remuneration, require the contractor to perform works which were not mentioned in the contract.
- (2) They may not, however, require him to perform a work which by its object would be totally different to the work mentioned in the contract or which would have no relation to such work.
- (3) Nor may they require him to perform a work under conditions entirely different to those which have been mentioned in the contract.

Art.3285. - Rights of contractor

- (1) Unless otherwise provided in the contract, the contractor may cancel the contract where the increase or reduction of the works as a whole required by the administrative authorities involves a variation of more than one-sixth of the cost mentioned in the contract.
- (2) In the case of reduction of the works as a whole, he shall be entitled to compensation equal to the loss suffered by him and profit of which he is deprived by reason of the variation of the contract.

(3) The court may limit the amount of compensation for deprivation of profit where it appears that the variation is due to extraneous circumstances and not to the default of the authorities having made the contract.

CHAPTER FOUR

4.Role of the Engineer

Both under MDB-FIDIC 2006 and PPA-2011 condition of contract the engineer has right to initiate, order, confirm, omit and assess the variations.

4.1 Table 2-Role of the Engineer in variation under PPA-2011 Conditions Of Contract.

| Clauses | Description of subject Matter | Engineer | Remarks |
|--------------------------------------|---|--|---|
| 15 | Modifications by Change Orders | | |
| | -Ordering any modification to any part of the works; | Right/ power | -This concept is related to the very concept of change in the works or variation in the works; -Increase or decrease in quantity may not require change order; -Not exceeding 30% of the total value of the initial contract price; see Clause 15.8 |
| | -Issuing all change orders in writing; | Obligation | Oral change order possible; it has to be subsequently be confirmed in writing; |
| | -Notifying the contractor the nature & form of modification; | Obligation | |
| | -Deciding whether or not the modification to be carried out; | Obligation | In consultation with the employer |
| | Issuing a change order to the contractor; | Right/ Obligation | As per the contractor's proposal or modification thereof; |
| | -Ascertaining the prices of all modifications based on some contractual principles; | Right/ Obligation | The Principles: BOQ-Based; Negotiation-Based; Decision-Based; Default-Based; |
| -Changing the terms of the contract; | Right/ Power | See Article 1675 cum 1763(Variation of Contracts) of the Civil Code; -The Engineer has been contractually authorized to sign a contract with the contractor; see Clause | |

4.2 Table 3-Role of the Engineer in variation under MDB-FIDIC 2006 Conditions Of Contract.

| Clauses | Description of subject Matter | Engineer | Remarks |
|---------|--|-------------|--|
| 13 | Right to Vary | Right/Power | Variations may be initiated by the Engineer at any time |
| | Value Engineering | Obligation | The proposal which is submitted by the contractor is approved by the Engineer. |
| | Variation Procedure | Right/Power | The Engineer shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Engineering] or otherwise), respond with approval, disapproval or comments. |
| | Provisional Sums | Right/Power | Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions |
| | Day work | Right | The Engineer may instruct that a Variation shall be executed on a day work basis. |
| | Adjustments for Changes in Legislation | Obligation | After receiving this notice in sub-clause 13.7, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters. |
| | Adjustments for Changes in Cost | Obligation | If their source the cost indices or reference prices stated in the table of adjustment data is in doubt, it shall be determined by the Engineer. |

CHAPTER FIVE

5 ANALYSIS AND DISCUSSION

5.1 Case Study

The project located around Ras-Desta hospital which is B+G+10 commercial building. The tender sum for labor base structural work was 10,621,796.62 birr and the original planned works duration was 24 months. There were numerous additional works associated with the continuously revised works. The building design changed from B+G+10 to B+G+11 and additional floor area was added. As the contractor could not finish on agreed time, the extension time granted was 7 months. The actual completion period was 24 months which was an increase of 29.2% of the original contract period. The numerous changes of works contributed to delay.

Due to additional floor & floor area expansion of the building were the main reasons for the occurrence of variation. The consultant through his design review and actual investigation, has identified and report to the owner massive variation will be expected because of these reasons.

Relay on the Consultant's report, the owner allows him to grant an order to the contractor and at the same time to quantify and submit the final estimation of the varied quantity for approval.

The project includes the following variations during the construction period:

- ✓ Design change initiated by owner from B+G+10 to B+G+11
- ✓ And additional floor area expansion

From the above reasons the total area of slab concrete and slab formwork varied from 11,520.20m² to 14,434.00m²

Cause and effects of variation

| Item | No Causes of Variation | Nature of Variation | Source of Variation | Effects | |
|--------------|---|---------------------|---------------------|----------------|-------------------|
| | | | | Time | Cost(Birr) |
| 1 | Variation caused by additional floor and floor area expansion | Addition | Employer | 7 Months | 865,398.60 |
| Total | | | | 7 Month | 865,398.60 |

* The engineer approved 10% of the initial cost of varied item.

Condition of Contract Applied For The Case Study

The contract agreement was made on the basis of PPA-2006, Standard Bidding Document (SBD) For Procurement of Works For International Competitive Biddings (ICB). Therefore , the Variation Procedures and Valuation methods are as per Clauses 38.1 and 40.1 of PPA-2006 General Conditions of Contract.

As per clause 40.1

“For both Admeasurement and Lump Sum Contracts, the Contractor shall provide the Engineer with a quotation for carrying out the Variation when requested to do so by the Engineer. The Engineer shall assess the quotation, which shall be given within seven days of the request or within any longer period stated by the Engineer and before the Variation is ordered.”

Subsequently, the engineer assesses the varied works and instructs the contractor to carry out the varied work accordingly.

As per clause 38.1

“If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 5 percent of the Initial Contract Price, the Engineer shall adjust the rate to allow for the change.”

Since, in our case the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item is 25.3 percent, and the change in Initial Contract Price is 8.15percent, then engineer adjusted the rate.

5.2 Result of the Case Study

The result of the case study show as the engineer approved the variation, since the particular item is 25.29% of the bill of quantities which provided 8.15% of initial contract price. The cause of this significant amount of variation is related to the owner interest on design modification which causes quantity change as a result this variation causes 7month delay in project completion time.

CHAPTER SIX

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Variations are often source of dispute and consume a lot of time and money in arguments and negotiations. Accordingly, for building and engineering works, the causes of variation in works are: Employer related variations, Consultants related variations, Contractor related variations and other variations. For those variations some of the root causes are financial, design aesthetics, changes in drawings, weather, geological and geotechnical reasons. To minimize the above causes of variations, we have to follow and apply the approaches that use to reduce number and the impact of variations, which are Design stage, Construction stage and Design-Construction interface stage.

6.2 Recommendations

This study focused on the variation orders in construction projects, while variation cannot be completely avoided but it can be reduced. To reduce the occurrence of variation orders recommendations from the analysis were stated as follows:

- ✓ The client should allow sufficient time to prepare an elaborately detailed project brief. This will eliminate frequent variations to the original plan of the project due to client change of mind.
- ✓ Direct communication among the project team is a key to eliminate variations occur due to communication gap during design and execution phase.
- ✓ Enhance communication and all parties should be proactive all times.
- ✓ Consultants should give sufficient time for planning and design phase, this will assist in minimizing variation orders due design changes at construction stage.

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