UNIVERSITY OF EDUCATION, WINNEBA

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# COST TREND OF VARIATION ORDERS IN DISTRICT ASSEMBLY CONSTRUCTION PROJECTS: A CASE STUDY OF JASIKAN DISTRICT ASSEMBLY

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# DECLARATION

## Student's Declaration

I hereby declare that this dissertation with the exception of quotations and references contained in published works which have been identified and dully acknowledged, is entirely my original work, and it has not been submitted, either in part or whole for another degree elsewhere.

Candidate's Signature: …… Date: ……

Name: HOLY AVORNORKADZI

## Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation was supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Education, Winneba.

Supervisor's Signature: …… Date: ……..

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## DEDICATION

I dedicate this work to my lovely wife Salomey and Children: Dziedzrom, Elikem and Edudzi for the inspiration, encouragement and support.

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## ABSTRACT

Variation orders are an inevitable occurrence in construction projects execution. It is common in all types of construction projects and plays an important role in determining the final cost and time of completion of projects. The study examined cost trend of variation orders in Jasikan District Assembly construction projects. The study used a descriptive research design. Data was collected using structured questionnaire and in-depth interviews. Simple random sampling was used to draw a sample of 30 professional staff, consultants, contractors involved in handling government projects from Jasikan District. The case study approach was used to obtain data from source documents of the completed projects. This allowed an in-depth understanding and help explained the process and the outcome of the analysis of cost trend of variation orders in building construction projects. The study identified the following as dominant factors causing variation orders: changes in the plan or scope by owner, owner instructing for modification or specifications errors and omission in design and change in design by consultants. The significant impacts found included; contractual dispute and claims, cost overrun, productivity degradation, and delays in payment. The impact of variation orders calls for attention to issues of variation in the Jasikan District. The research conclude that increasing in the scope of the works or omission, changes in government policy relating to the project and changes in the quality of materials to be used for projects result in variation orders. It is recommended that careful investigation should be carried out properly by qualified professional staff at the initial stage of projects and adequate planning in advance is required by all stakeholders before work starts at the site.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

The construction industry has a great impact on the economy of all nations and one of the sectors that aids in the development of a country. In the building construction industry, most projects are characterized with changes, which may occur on a daily basis and change the form of work, construction approach, quantity and quality of work, technological advancement, which may result in changes of amount of resource associated to labor and material. Variation orders have been traditionally part of the process of building construction and are not a new concept (Lokhande and Ahmed, 2015)

Cost as one of the major elements of a construction project and can be regarded as one of the most important parameters of a project and the driving force of the success of a project. Regardless of its importance, it is common to see a construction project failing to accomplish its stated objectives within the specified time and cost. Cost trend of variation order is a recurrent phenomenon and is almost associated with nearly all building constructing projects. However, maintaining steady cost projection on building projects had been an issue of serious concern to the key players in the construction industry (Arain and Pheng, 2006).

Construction projects are long process having more complicated small tasks involved. For completion of a large construction projects, there should be work break down in smaller units. In spite of this some variation orders may occur which, may perhaps affect the pace of work. The management of these changes is essential in delivering the expected output of the project. Managing change is the greatest importance to the success of construction project, which also

depends on the expertise of the professionals involved right from the design phase to the implementation stage (Yadeta, 2016).

The nature of the construction process means that variations are inevitable. According to Sunday (2010), variation is to be expected in construction projects due to the multifaceted nature of the building construction industry. This is common in most construction projects, which determines the time limits and projected budget of the projects. The execution of public projects is expected to propel the construction sector in delivering the required service. Therefore, it is crucial to ensure these projects are implemented successfully without any major impediment while minimizing the adverse impacts of variation orders on the project outcome (Ruben, 2008). Moreover, variation order is observed as one of the most frequently occurring issues in construction projects in developing nations. Variation orders affect the progress of any construction project and may be one of the main factors that might cause failure in delivering a project successfully. On the contrary, it is relatively difficult to deliver a project without any variation orders during the design stage, or even the construction stage. Therefore, it is necessary to identify cost trend of variation orders and treat them as such in building construction when it arises.

The construction industry in Ghana plays a major role in the socio-economic development and contributes to the gross domestic product of the country. Ghana within the last ten years experienced a huge volume of work in the field of building constructions. A lot of government buildings be it large or complex have been put up, attracting foreign construction companies and domestic contractors. This situation coupled with inexperienced consultants has led to inadequate

design resulting in changes to plans, specifications, and contract terms, which resulted in variation orders (Anaman and Osei-Amponsah, 2007).

However, most construction projects vary from the original design, scope and definition. Whether small or large, construction projects may depart from the original tender design, specifications and drawings prepared by the design team. This may arise due to some technological advancement, statutory enforcement, changes in conditions of contract, geological anomalies, non-availability of specified materials, and continuous development of the design after the contract have been awarded. Sometimes variation orders are issued to correct or modify the original scope of work because changes during construction of projects are unavoidable that have an impact on overall project performance (Ruben, 2008). This is because variations can cause significant alteration, addition, omission, and substitution in terms of quality, contract time schedule, and total direct and indirect cost. In large civil engineering projects, variations can be very significant, whereas on small building contracts they may be relatively minor (Arain and Pheng, 2006).

Nevertheless, some changes can cause the demolition and rework of the whole structure. This would have significant impact on the cost of the building project. Although, change orders are easy to manage at the design stage of construction, which reduces the rework and extra effects for particular stage. In most cases, rework due to change order may cause dispute among client sand contractors, in cases where clients have to pay extra amount of money (Anaman and Osei-Amponsah, 2007).

## 1.2 Statement of Problem

Cost trend of variation orders have long been an inherent part of the construction industry around the world (Memon et al., 2014). Cost trend of variation orders is a major phenomenon in the construction industry in Ghana as well as other developing nations. Regardless of the consequences associated with variation orders in construction projects in Ghana, many government projects are affected by variation orders be it in the design stage or the construction stage. This has resulted in cost overrun, litigations and payment of huge extra sum of the budgeted cost (Aibinu and Jagboro, 2002).

However, as the number of variation orders on a project increases, so does the possibility of misunderstanding among the contracting parties. Such a misunderstanding may be due to lack of full knowledge of the variation order process by one party, in case of additional work, the extra cost involved in implementing changes may result in a misunderstanding, and interruption of the construction process and schedule, which can adversely impact project management. In addition, variation orders may cause delays in time schedule, cost overrun and quality defects of a construction at various stages of the project (Ruben, 2008).

In the building construction industry, many professionals argue that variation orders affect portions of the project directly or indirectly and result in reduced productivity. This is always a subjective issue as the contractor feel that the loss due to variation order is the fault of the designers and the client. Mostly, the contractor has to apply for extension of time if additional work is needed, which adversely affect the labor cost. On the contrary, clients usually claim that the loss in productivity is due to poor management on the part of the contractors. However, not

every variation order would influence the productivity of the project negatively. Variations in any planned activity would cause a disturbance and will require the rearrangement or review of the existing plan under the current development (Yadeta, 2016).

More so, because of these changes, variation orders are issued to modify the original scope or the designed plan (Alnuami et al., 2010). Most of the variation orders issued during construction have significant impact on cost and time of project and in worst cases could lead to delay, abandonment of project and disputes, which are common in developing countries. These changes may lead to a high cost of variation order.

Variation orders in building projects in the Jasikan District is not a new development as many contracts that have been awarded experienced variation, which some are deliberate and some comes along with the execution of the projects. Therefore, as the District Assembly undertake building projects, it is necessary to spotlight these issues since many projects suffer from a high rate of variation orders. The Government of Ghana, as well as counterpart funding and donor support funds most of these projects, which are spearhead by the District Assembly. Nonetheless, most of the variation orders that occurs within the District brings about increase in contract sum which affect the total annual budget for construction projects for the Assembly where some funds meant for administration and social intervention projects are diverted to supplement for the extra cost of the variation. Another problem of cost trend of variation order, which is of concern to the researcher, is the issue of litigation between the contractors and the District Assembly. In addition, variation orders bring about delay in delivery of work on the part of the contractor and most times leads to abandonment of projects.

The Jasikan District assembly has made some conscious efforts in addressing these challenges by meeting with the management staff and work sub-committee but there has not been a significant change in resolving these problems of variation orders in the construction industry (Jasikan District Assembly Annual Action Plan Report, 2015). Notwithstanding the severity of these issues in the Jasikan District Assembly, there have not been concerted efforts in research aimed at overcoming the problems associated with variation orders.

### 1.3 Aim and Objectives of the Study

+The aim of the study is to examine the impact of variation orders on the cost and time performance of building construction projects in the Jasikan District. The specific objectives of the study are a+s follows:

- to identify the significant causal factors in variation orders in building construction projects in the Jasikan District;
- to assess the impact of variation orders on the cost performance of building construction projects in the Jasikan District; and,
- to make recommendations for optimizing the beneficial effects of variations on building project performance in the Jasikan District.

### 1.4 Research Questions

- What are the factors that contribute to variation orders in building construction projects?
- What are the impacts of variation orders on building construction projects?
- What are the control measures in minimizing variation orders on building construction projects?

## 1.5 Significance of the study

The study provides relevant information to policy makers in formulation and implementation of policies and programs to tackle issues of variation orders in construction projects. The study also provides insight into appropriate strategies to adopt by the District Assembly in minimizing the effects of variation orders in construction projects. The findings of the research provided useful information in equipping the key players in construction industry towards efficient management of variation orders. Other researchers could also rely on this study as a source of literature to continue researching into cost trend of variation orders within the District Assemblies and Ghana in a larger context.

## 1.6 Scope and Limitations of the Study

The study focused on the projects awarded and executed by the Jasikan District Assembly as well as Government of Ghana project supervised by the District Assembly and other donor funded completed projects from the period 2012 to 2016. The research was carried out within the Jasikan District.

## 1.7 Organization of the Study

The research report is made up of five chapters. Chapter One which is the introduction of the report contains the background of the study, statement of the problem, aim and objectives of the study, research questions, significance of the study, scope and limitation of the study and organization of the study.

Chapter Two is the review of related literature. The chapter presented the review of various work related to the topic and discussions of concepts on the subject matter, from both published and unpublished sources.

Chapter Three contained the research methodology in details. Chapter Four is the data analysis and discussion of results. The final chapter, which is Chapter Five, includes summary of research findings, conclusion, recommendations and suggestion for further studies.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

The chapter reviews relevant literature on variation orders in building construction projects and the associated cost trends. The review is organized into nine main sections. The nine sections are; introduction, overview of the construction industry of Ghana, concept of variation in construction projects, causes of variations in construction projects, the impact of variations on the performance of construction projects, factors influencing the occurrence of variations, measures to control variations in building construction projects, variation order and change management and a theoretical framework of the study.

## 2.2 Overview of the Construction Industry of Ghana

The construction industry is a group of firms with closely related activities involved in the construction of real estate, buildings, private and public infrastructure. It also deals with all kinds of economic activities directed at the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature and other engineering constructions such as roads, bridges and dams. This means that construction firms are those involved with the direct construction of buildings and infrastructure and those supplying materials for construction-related activities (Barot, 2002).

The construction industry in Ghana, as in other parts of the world, is huge and a crucial segment in economic development. No matter what one does, there is construction, as it cuts across all sectors. Being among the top drivers of the Ghanaian economy, including agriculture, manufacturing and mining, its importance cannot be overemphasised, especially as the country is

one of the most economically active in West Africa. It is well known that an active construction industry adds to growth as it employs skilled and unskilled labor, from engineers and consultants to artisans and laborers. Construction and maintenance of buildings, housing, roads, bridges and other physical infrastructure are crucial to generate employment, development and growth. But the question remains whether the players in the industry, especially contractors, are playing the roles expected from them to drive it harder (Ruddock $ Lopes, 2006).

In Ghana local contractors are ill-equipped, lack the necessary qualifications and finances and have been beaten by foreign contractors who have won the major construction works, be the roads, bridges, and other infrastructure. The industry has the potential to help accelerate economic growth in Ghana. Construction firms in Ghana are classified as small or large based on their levels of output which are in turn largely dependent on their financial capabilities. Eyiah and Cook (2003) observe that the large firms consist of mainly foreign firms while the small firms are mostly local Ghanaian businesses. The construction industry in Ghana is one of the most highly regulated industries. Contractors find themselves interfacing with national, regional and district bureaucracies at all levels of a project: to obtain building permits, to have work inspected and to have the completed project certified so that they can be paid by the relevant authorities.

The construction industry plays an important role in the economy, and the activities of the industry are also vital to the achievement of national socio-economic development goals of providing shelter, infrastructure and employment. A report by the United Nations Industrial

Development Organization (UNIDO) in 1993 suggested that inadequate attention is given by policy makers and economic planners to the construction industry in developing countries.

Ghana, a fast growing developing country situated in the West African region, is dependent on international funding and technical assistance as it restructures its economy to a more broad-based and sustainable one (Eyiah, 2004). The construction industry is often seen as a driver of economic growth especially in developing countries. The industry can mobilize and effectively utilize local human and material resources in the development and maintenance of housing and infrastructure to promote local employment and improve economic efficiency. The industry accounts for a significant share of Gross Domestic Product and is currently the third largest economic sector after agriculture and government services. From a low point in the 1970s and 1980s the share of construction in the Gross Domestic Product has moved up from 4.5% in 1975 to 8.5% by the turn of the century. The construction industry contributed 8.8% to GDP in 2003 and 2004, ranking third behind agriculture and government services in terms of economic importance. The sector grew by 10% in 2008 but registered a negative growth rate of 1% in 2009 due to the global economic recession (Anaman, 2006).

Surprisingly, policy makers have not promoted this industry as a driver of economic growth. This is reflected in the lack of attention given to the construction industry in recent government policies and strategy documents. This low level of attention to the construction industry can be compared to the considerable attention given by the government to the agriculture, tourism and information and technology communication sectors and even the sports industry as the main drivers of economic growth. An argument put forward by some analysts for using the construction industry as a driver of economic growth is the need to diversify the economy. Given

the persistent fluctuations in terms of trade of agricultural export commodities and the heavy reliance on the largely rain-fed agricultural sector as the main driver of economic growth, may affect its contribution to Gross Domestic Product (Anaman, 2006).

The argument is that the importance of the construction industry as a major growth pillar in Ghana needs to be continuously publicized to policy makers, economic planners and the general public in order to accelerate sustainable economic growth. As part of an advocacy drive to convince policy makers on the importance of the construction industry in Ghana, the Institute of Economic Affairs has undertaken several publicity drives through the mass media in 2006 in order to increase attention and investment in this sector.

## 2.3 Concept of Variation in Construction Projects

There are varied definitions for variation used by professionals in the construction industry. Fong (2004) and Mohammad et al., (2010) defined variation for the purpose of the contract as the alteration or modification of the design, quality and quantity of works shown on the contract drawings, bills of quantities and or the specification of the project requirements. This definition emphasizes on the addition, omission or substitution of any work. Fisk (1997) and O'Brien (1998) observed that variation is any deviation from an agreed well-defined scope and schedule of work. However, Hegazy et al., (2001) had a different view as to what qualified to be a variation. They explained variation as a change or modification to the contractual guidance provided to the contractor by the client. In a different view, Wambeke et al., (2011) noted that the difference between what was originally planned and what actually took place qualifies to be variation.

Another generic term usually used in the constriction field is variation order. Fisk (1997) and O'Brien (1998) defined variation order as a formal document that is use to modify the original contractual agreement, which becomes part of project's documents. From another point of view, Clough and Sears (1994) argued that a variation order is a written order issued to the contractor after execution of the contract by the client of a project, which authorize a change in the work or an adjustment in the contract sum or sometimes the contract time. Memon et al., (2014) added another definition of variation order as a written agreement between the contracting parties that represent an addition, deletion, or revision to the contract documents, as well as identify the change in price and time and describes the nature of the work involved.

### 2.3.1 Types of Variation Orders

According to Arain and Pheng (2005b), the nature of a variation order can be determined by referring to both the reasons for their occurrence and subsequent effects on a project. They identified two types of variation orders namely: beneficial and detrimental variation order.

#### 2.3.1.1 Beneficial Variation Orders

Beneficial variation order is issue to improve the quality, reduce cost, schedule, or the degree of difficulty in a project. As a result, it optimizes the client's benefits against the resource input by eliminating unnecessary costs from a project (Arain and Pheng, 2005b). This type of variation orders is initiated for value analysis purposes to realize the balance between the cost, the functionality and the durability aspect of the project to maximize the satisfaction of the client. This type of variation order also eliminates unnecessary cost from a project so that the client's benefits against the resources input can be optimize. In addition, Kelly (2002) argued that a

variation order is beneficial if it is initiated to enhance the client's value. The client's value system elements include time, capital cost, operating cost, environmental cost and aesthetic cost.

#### 2.3.1.2 Detrimental Variation Orders

Arain and Pheng (2005b) are of the view that a detrimental variation order is one that negatively influences the client's value and project performance. This type of variation order has the likelihood to compromise the client's value system. For instance, a client who is facing a financial challenge may require the substitution of quality standard materials to substandard materials. On the contrary, Ndihokubwayo and Haupt (2009) study on the nature of variation orders in building construction projects in South Africa found out that 95% of variation orders issued were beneficial to the project performance.

## 2.4 Origin and Causes of Variation Orders in Construction Projects

Arain and Pheng (2006a) identified four main origins of variation orders in their study, which suggest that there are four main origins as to why variation orders occur in construction projects. The four main sources include; clients, consultants, contractors and others (unspecified). The four sources are shown in Figure 2.1. The subsections that follow expound upon the four of variations or variation orders.

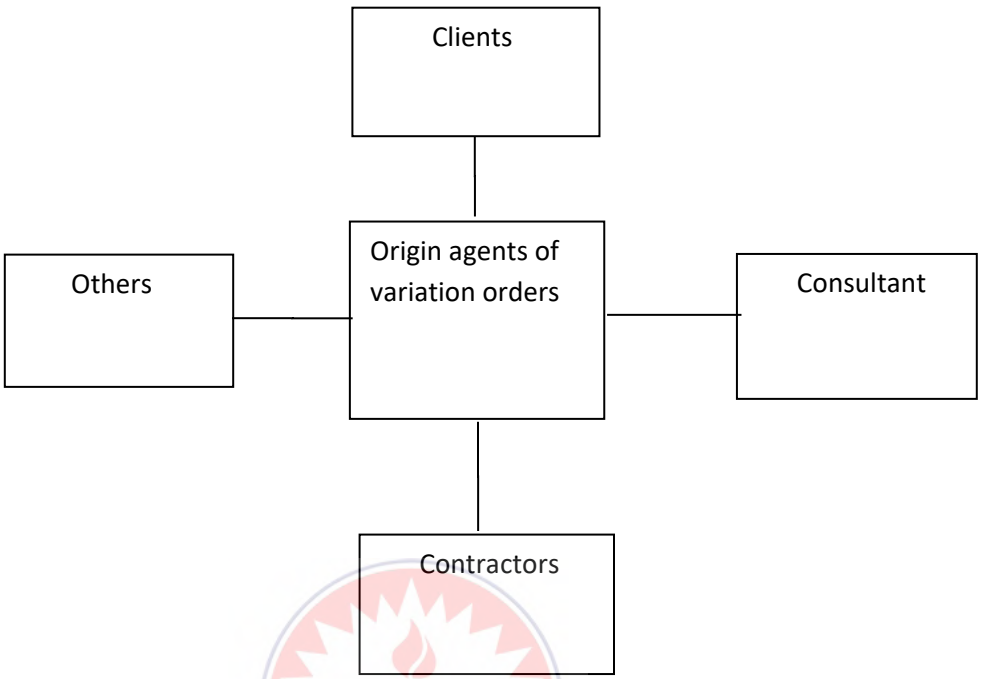


**Figure 2.1: Origin agents of variation orders**

**Source: Arain and Pheng (2006b)**

### 2.4.1 Client

Arain and Pheng (2006a) noted that the client as the project initiator plays a major role in the construction project from the initial phase to the completion of the project. As a result, the client has the power to influence the needs and the objectives of the project hence the likelihood of the occurrence of variation orders. In addition, the client establishes the scope of works and the required quality standards. The clients have the potential to minimize the variation during the project design and construction stage. Arain and Pheng (2006a) states that the most important steps in the development of the variation order are the scope definition. A poorly defined scope may not provide a clear base line, which may give rise to variation order.

### 2.4.2 Consultant

The consultant team usually consists of an architects, designers, specialist engineers, project managers, surveyors, quantity surveyors and construction economists. Members of the consultant team have power to effect variation orders upon instructions by the client (Ndihokubwayo and Haupt, 2008). Arain and Pheng (2006a) suggested that the consultant should aim at getting understanding of the overall scope and goals of the projects. However, the feeling of superiority of the consultant over the contractor may prevent the consultant from giving attention to the request made by the contractor. In this regards, if the consultant failed to interpret the requirements and the needs of their clients, it may result in a different design from the perceived one and this may eventually lead to variation orders issued to ensure compliance with the clients' requirements.

### 2.4.3 Contractor

Sweeney (1998) noted that it is the contractor's responsibility to advise the consultant to issue a variation order when a technical problem is discovered. According to Sweeney (1998), a contractor may propose alternative construction methods where his experience shows that the proposed technology would not fulfill the desired fitness and function of a design. In addition, he may also propose a different method where his knowledge in that field will work better and fit the desired fitness and function of the design than the method proposed by the client or consultant. Therefore, all parties involved in the contract should be aware that the information provided by the consultant might not always be correct. A contractor may discover discrepancies, omissions, errors in drawings and conflicts in the documents and may require a

consultant opinion regarding the problem. Hence, variation order will be issue with additional cost to solve the problem.

### 2.4.4 Other Variations

Arain and Pheng (2006a) observed that situations beyond the control of the contractual parties may give rise to variation orders, these include; weather conditions, certain health and safety considerations, change in government regulations, change in economic conditions and socio-cultural factors. These unforeseen events are known as 'Force Majeure'. Awad (2001) study on combined sewage construction projects in Michigan found out that the most frequently project parties generating variation orders were: the engineer (consultant) generating about 47.1% of total cost; and the owner (client) generating 43.1%. The study further found that the owner group generated about 55.4% of the variation orders causing total time extension.

## 2.5 The Impact of Variation Orders on Construction Projects

Variation order has a significant impact on project performance. Memon et al., (2014) associated the poor construction performance with variation order. They noted that variation orders even influenced the most organized projects thus regardless of the design, scope and specifications. This has major consequence on project performance, time and cost (Fisk, 1997; Ibbs et al., 2001; O'Brien, 1998).

In addition, they revealed that performance of projects might be affected by performance of the team working on the project. Project performance is a set of measures and standards used for evaluating the achievement of a project. Time and cost are necessary variables for measuring performance (Memon et al., 2014). The influence of variation orders on performance may be due to changes in design and scope (Zaneldin, 2000). According to Osman (2009) and Ijaola (2012),

variation order generated from the construction process may include changing, adding, eliminating, substitution in terms of quality, quantity and time schedule.

Al-Hakim (2005) noted that, the achievement of project performance will be maximizing if the work consistently flows efficiently within the time and projected budget limit given a well-structured schedule of works. Nevertheless, it is unusual for projects to perform exactly in line with their original schedule of work due to reasons such as changes in scope of work, contract drawings and corrections to design and specification. Arain and Pheng (2005) study on the effects of variation orders on institutional building projects revealed that variation orders contributed significantly to increase in cost of construction project. Chan and Yeong (1995) and Awad (2001) arrived at a similar conclusion that variation orders are the main reasons for time overruns and cost overruns of project. In a related study by Koushki (2005), it found that variation orders issued during various phases of the projects adversely affect both the time of completion and costs of projects.

Similarly, Hanna et al., (2002) observed that increase in variation orders leads to a more significant loss in productivity. The more frequent a variation order, it may potentially influence the quality of projects. Contracts with a considerable degree of risk such as lump sum, it is likely for contractors to cut corners on quality and quantity of material in order to maximize profits. Thereby, quality of works may be compromise as the contractor may try to pay compensation for the losses, as they are not hopeful about cost recovery of the variation, which occurred.

Again, Hanna et al. (2002) argued that variation orders have an impact on labor efficiency hence productivity. Most often evaluating this impact may result in dispute between the client and the

contractor where both parties are likely to blame each other for the losses due to the variation. Furthermore, Charoenngam, Coquinco, and Hadikusumo (2003) confirmed that disputes between the client and the contractor could occur if variation orders are not managed properly. Harbans (2003) warned that unless the parties agreed on a mutually acceptable solution, assessment of variation orders would continue to remain at the forefront of disputes and payment of claims resulting in conflicts. Finsen (2005) found that a large proportion of current arbitrations were on claims for additional time and additional expenses. Ssegawa et al., (2002) was of the view that more than one-third of disputes are linked to how to determine losses that arises from variation orders. According Al-Hakim, (2005), variation order affects the project performance in terms of costs overruns, time overruns, quality degradation, health and safety issues and professional relations. These effects are discussed below:

### 2.5.1 Cost Overruns

Clients desire to know in advance the total cost of their finished construction project. However, most construction projects would incur cost overruns because of variation order. Variation orders have both direct and indirect effect on cost. Bower (2000) identified the following direct cost associated with variation orders.

i. Time and material charges related to immediately affected tasks
ii. Recalculation of network increased time-related charges and overheads
iii. Reworks and standing time
iv. Timing effects, for instance extension of time
v. Inflation change to cash flow and loss of earnings
vi. Management time, head office and site charges

Bower (2000) observed that most often these direct costs are easier to calculate compared to indirect cost. He identified the following indirect cost:

i. Rework and making good on affected trades other than the actual variation order.
ii. Change in cash flow due to effect on inflation and financial charges.
iii. Loss of productivity due to interruption where the parties have to familiarize with new working conditions, tools and materials
iv. Cost for re-design and administration of the variation order
v. Litigation-related costs in case of disputes arising from the variation order.

### 2.5.2 Time Overruns

Koushki (2005) observed that variation order that arises during various phases in the construction project might adversely affect both the time of completion and costs of project. Most often, clients usually want their projects completed within the stipulated time of the project duration. Contractors may be penalized if they fail to deliver on the original project delivery date and this penalty (Liquidated and Ascertained Damages) imposed is usually used to pay for the damages suffered by the client for the prolonged time. Hanna et al., (2002) states that the more variation orders occur, the more significant the productivity losses become.

### 2.5.3 Quality Defect

According to Patrick and Toler (n.d.), contract with a significant degree of risk for unknown variables such as lump sum, the contractor may cut corners on quality and quantity to maximize their profits. Quality may be compromise as contractors try to compensate for losses they are not

optimistic about covering. In addition, quality defect due to poor workmanship and inferior standards materials may adversely affect the aesthetic nature of the project.

### 2.5.4 Health and Safety Issues

The Occupational Health and Safety Act (2003) stipulates that where the changes arise in building projects, sufficient health and safety information and appropriate sources are to be made available to the contractor to execute the work safely. Arain and Pheng (2005) noted that the change in construction methods, materials and equipment might require additional health and safety measures. This shows that variation orders can lead to the revision of health and safety considerations.

### 2.5.5 Professional Relations

Dispute may arise due to variation orders. Misunderstanding may occur when contractors are not satisfied with the determination of the variation orders by the client's consultant. For instance, a client may feel that the variation order is due to the mismanagement by the contractor where he may not be willing to pay for additional cost of the variable. Bower (2000) states that tension may arise between parties as the contractor continually pushes the client to settle claims for additional costs while invariably feels that the reimbursement has been insufficient. This can be very damaging to the relationship among the parties.

## 2.6 Factors Influencing the Occurrence of Variations

Arain and Pheng (2005a) argued that the frequency of occurrence of variations vary from one project to another depending on various factors. Ndihokubwayo and Haupt (2008) identified the factors influencing the occurrence of variation orders as the nature of the works, the complexity of the project and the procurement method.

### 2.6.1 Nature of the Works

According to Ndihokubwayo and Haupt (2008), construction projects that involve extensive unforeseen conditions are likely to generate variation orders. For example, civil works involving bulk earth excavation and building works that include specialist works beyond the expertise of the designer cannot accurately be determined before works commence on site. More so, drawings and specifications do not always show the real site conditions nor do preliminary investigations. Despite this situation, it is common that works commence on site while some trades and building elements still need to be completely designed or detailed. Consequently, contracts contain provisional quantities and sums that may be subject to future adjustment. Uyun (2007) concedes that the presence of provisional quantities or sums in a contract is a clear indication of the likely occurrence of variation orders in a project.

Gidado (1996) points out four major possible causes of project uncertainty, namely:

i. Lack of complete specification for the activities to be executed
ii. Unfamiliarity with the inputs and or environment by management
iii. Lack of uniformity, such as when material is to be worked with varies with place and time or teams working together vary with place and time or the role of the teams keeps varying with place and time

iv. Unpredictability of the environment, such as the effect of weather and refurbishment of very old buildings having no record drawings.

### 2.6.2 Complexity of the Project

Gidado (1996) asserted that project complexity is attributed to the continuous demand for speed in construction, cost and quality control, health and safety in the work place and avoidance of disputes, together with technological advances, economic liberalization and globalization, environmental issues and fragmentation of the construction industry. Baccarini (1996) and Ireland (2007) agreed that two types of project complexity are distinguished, namely organizational or management complexity and technological or technical complexity. According to Ireland (2007), the degree of project complexity is classifying as low, medium and high complexity. The greater the project complexity, the greater the likelihood of variation order occurrence. Ndihokubwayo and Haupt (2008) noted that variation order issued due to the complexity of the design might take time for the design team to understand the required change and redesign while works on site are on hold.

### 2.6.3 Procurement Methods

According to Love (2002), the path followed to deliver the project differs from one project to another. Typically, procurement method stipulates the form of contractual arrangement between participants or parties to the contract. One type of procurement method may result in more variation orders. For example, non-traditional procurement methods are subject to greater occurrence of errors, omissions and changes than the traditional methods.

### 2.6.3.1 Traditional Method

Ashworth (1998) contended that traditionally, an employer who wished a project to be constructed would invariably commission a designer or design team to prepare drawings of the proposed scheme and, if the scheme was sufficiently large, employ a quantity surveyor to prepare documentation, such as bills of quantities, from which the contractor could prepare a bid price. Since the works commence on site when the design is complete, the occurrence of variation orders in this arrangement is minimize. Koushki et al., (2005) agreed that clients who spent more time and money on the design phase issued less variation orders than those who allocated insufficient money and time to this phase. Turner (1990) was of the view that the more time spent on completing the contract documents before commencement of works, the more likely the avoidance of discrepancies between the contract documents, errors and omissions into the design. Consequently, there is less variation orders. Since clients and their consultants control the origin of variations, variations should not occur if pre-construction design has been good.

### 2.6.3.2 Non-traditional Methods

Ashworth (1998) noted that changes in procurement methods are the result of a move away from the craft base to the introduction of off-site. The recognition of the involvement of the contractor into both the design and the way works are carry out on site will result into quality of finished works. For example, design and construct procurement methods where the contractor is responsible for the design and construction are deem to overcome the problem of variation order occurrence.

Ashworth (1998) further stated that the involvement of contractors into the design is an opportunity for them to use specialized knowledge and methods of construction evolving from

their own design and as a result, there is less scope for variations than with the design and construct approach. The procurement method requires the client to view completed projects of a specific design and choose a suitable project or design from the catalogue. Owing to the completeness of the design, this procurement method is less prone to variation orders.

Ashworth (1998) recommended that the fast track procurement method is appropriate for situations where the client targets the shortening of the overall design and construction process. When the design for the whole section of the works, such as foundations is completed, the work is then let to the contractor, who will start this part of the construction work on site while the remainder of the project is still being designed. Turner (1990) warned that variations should be expected on construction projects that lack pre-design. Variation orders resulting from design errors and omissions can be problematic where construction overlaps the design.

## 2.7 Measures to Control Variations in Building Construction Projects

Most researchers argue that no matter how methodically a project are carefully planned taking cognizance of material and labor cost, change will inevitably occur in construction works. In any building construction project, it is important to consider the most frequent cause of variation orders where some of these causes are unavoidable. This is because as time needed to complete the project goes up, the cost also spikes and probably the quality of the work may be compromised (Ashworth, 1998; Arain $ Pheng, 2005a; Ireland, 2007). A study conducted by the American Society of Civil Engineers in 2012 on 290 large construction projects found out that 4 out of 10 of these projects suffered cost and time overruns due to variation orders. Even though, the more changes that are required, the more productivity also suffers, as owners are force to

choose between approving overtime, hiring additional workers or suffering project delays (Arain and Pheng, 2005a).

However, an essential element to consider is timing in controlling variation orders, Researchers found out that the faster a variation order is dealt with, the less impact it had on productivity and cost of project. Smith (2016) argued that, the only way to know how efficiently variation is handle is to have a standard way to measure it across all projects. More so, there should be a collaborative effort by all actors involved in the construction work, right from the design phase until the completion of the project. At this instance, all parties can make their input which would be inculcated before the project begins, hence variation can be minimized (Smith, 2016). In addition, when actors or project partners gained visibility into the status of all variations, they would be able to measure performance and institute a process of continual improvement on project; this can help reduce time and cost overruns of projects caused by variation orders.

## 2.8 Variation Order and Change Management

Hwang and Low (2012) verified that change management is an essential element for the construction project. Change management differs from project to another in terms of size, type, complexity, and nature. In spite of that, convenient measures may settle problems with no losses and guarantee a successful management. They stated that the source of project change can be either internal or external and both can affect the project performance and have to be minimized (Love et al., 2002).

Zhao et al., (2009) showed that change management is important in not only minimizing changes, but also predicting the changes, identifying the already occurred changes and taking corrective actions. Motawa et al., (2007); Lee and Pena-Mora (2005); Charoenngam et al., (2003;

Isaac and Navon (2008) reported that a valid change management is substantial to prevent disputes that may generate due to unstable management. Several models and change management systems were established to control and manage problems, evaluate negative impact of errors and identifying the sources of changes. Ibbs (2012) summarized that change is inevitable in any project. Changes are numerous such as deletion or addition to the scope or to the contract, which is a common thing in any project, which can as well cause rework of tasks.

## 2.9 Theoretical Underpinnings of the Study

### 2.9.1 Systematic Management Theory

Knowledge of Management theories is a basic requirement for solving organizational problem and essential for successful management and leadership roles in every institution in order to meet the challenges of efficient and economic uses of resources and maximizing output (Ziarab et al., 2012). Management is therefore important in every institution as it would be difficult to achieve objectives without proper management. Management has to do with getting things done with the help of other people (Drucker, 1974). According to Weijrich and Koontz (1993), cited in Ziarab et al., (2012) Management involves the process of planning, leading, organizing and controlling people within a group in order to achieve set goals.

This study considers Systematic Management Theory, which focuses on the processes and procedures of achieving a given goal and ensuring that organizational operations are economical. Systematic management establishes organizational controls and maintain suitable inventory so that the demands of clients can be attain. Shied (2010) indicates that there should be well laid out plans for effective management, as guidance and control actions are required to execute program.

The above definitions emphasize on management as a process that includes strategic planning, setting objectives, managing resources, developing the human and financial assets needed to achieve objectives set.

Systematic management theory can be successfully applying in building construction industry in order to manage and at the same time controlling the extent of variation, orders that might arise which adversely have an influence on cost, time and overall productivity of the project. Actors such as the client, contractors and consultants needs to pay attention to the processes and procedures involved in designing a project up to the completion stage as well as having exquisite knowledge in delivering these projects to its maximum benefits by involving qualified personnel in the executing process. This management practices also make them to have control measures in place in reducing the extent of variation orders.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter captures the research methodology, sampling techniques and finally data collection tools and how data was analyzed

## 3.2 Methodology

Methodology is the general principles behind research. The methodology of any research underpins the values and assumptions that form the rationale for the research. It also directs the criteria the researcher chooses to use for collecting and interpreting data (Ahiadeke, 2008). According to Sarantakos (2005) methodology is a research study that translates ontological and epistemological principles into guidelines that shows how research is conducted. Methodology is critical in research because the reliability and validity of the research work greatly depend on the methods employed in the data collection process.

## 3.3 Research Design

The study adopts Krueger (1988) definition of a research design thus a research design as a plan, structure and strategy of investigation conceived to obtain answers to questions. For the purpose of this study, descriptive research design was used which is mainly a case study where both qualitative and quantitative approaches were adopted. The case study approach was used to obtain data from the source documents of the completed projects. This allowed an in-depth understanding and help explained the process and outcome through analysis of the cost trend of variation orders in building construction projects in the Jasikan District.

The form of data collection was centered on structured questionnaire, and in-depth interviews. The responses from the data were summarized in frequency and percentages.

### 3.4 Target Population

The target population of the study consisted of professional construction staff of the Jasikan District Assemble and site managers of registered contractors at the Jasikan District Assembly. The population of professional staff stands at 15 and number of registered contractors with the Assembly as at 15th March 2017 is 50. From the aforementioned figure, the sample for the study was determined. The Jasikan District Assembly is selected because the 2014 annual auditor's report indicates that cost trend of variation orders are high in contract awarded by the Assembly.

### 3.5 Sampling Techniques

Sampling refers to the process of selecting sample units or elements for a research to be conducted by a researcher. According to Moser and Kalton (1971), sampling enables a higher overall accuracy in a data collected than does in census. Millar (1991) is of the view that a study based on representative sample, is often better than a larger sample or the whole population.

#### 3.5.1 Purposive Sampling

The sample units were selected because they meet certain criteria (knowledge about the phenomena). In line with this, purposive sampling was used to select the sample of the study. Professional construction staff of the Assembly were purposefully selected because of their knowledge of the research phenomena under consideration; cost trends and variation orders.

The construction firms selected were those that had successfully completed the Assembly's projects by July 2017 and the previous year; 2016.

### 3.5.2 Sample Size

Ghosh (1992) observed that the sample must be small enough to avoid unnecessary expenditure and large enough to avoid sample error, to Sarantokos (2005:154) the wise rule is that the sample must be "as large as necessary, and as small as possible." From his viewpoint, the determination of one's sample size depends on the following factors: the paradigm that guides the research, the underlying methodology, the nature of the target population, available time and resources as well as the purpose of the study. For these reason the researcher considers a sample size of thirty (30) respondents for the study.

## 3.6 Data Collection Sources

The research relied on both primary and secondary sources of information sources. These include journals, text books reports, contract documents, variation orders documents, contract drawings, built drawings, theses, Internet and articles both published and unpublished as secondary and primary sources information. The solicited data from the following primary sources;

### 3.6.1 Structured Questionnaire

The researcher employed structured questionnaire+ to elicit information on the objectives of the study from thirty respondents. This involved some background information of respondents such as sex, age and educational level as well as open and close-ended questions were asked. The closed-ended questions included a list of predetermined answers from which participants choose whereas open-ended questions allowed the participant to answer the questions in their own words on factors, impacts and control measures of cost trend of variation orders in building construction projects. Open-ended questions were asked for participants to provide answers for gathering insightful information, which the researcher was not privy to or anticipated by the researcher.

### 3.6.2 In-depth Interview

Interview is a data collection tool employed by social researchers where the researcher interacts with the interviewee (respondents) by posing questions and recording answers. Twumasi (2001: 35) defines interview as a method of field investigation whereby the researcher meets his respondents and through interaction, he or she asks specific questions to find answers to the research problem. For the purpose of this study, an in-depth interview was conducted for the District Engineer, District Budget Analyst, District Planning Officer, District Coordinating Director, and District Finance Officer all of the Jasikan District Assembly, two contractors and two consultants of projects completed.

## 3.7 Methods of Data Analysis

Data analysis defined by Ellen (1984) as the computation of certain measures along with searching for patterns of relationship that exist among data groups. For any data to be

meaningful, the data must be organized and interpreted by the researcher. This was done by integrating the data together, examining variations and determining the patterns involved. Qualitative method of data analysis in this research was used to better understand, explain and build on the results from responses obtained on the research objectives. Qualitative data analysis was conducted after data collection based on descriptive content analysis due to the nature of the data collected. Data was edited and examined, information that were not relevant to the study were removed. The researcher read all the data in order to determine whether the replies are meaningful and all questions answered properly. The data was grouped into categories and themes for analysis. This was done manually by collating all the responses from the qualitative methods used in collecting the data.

This research as well depended on the quantitative method to collect, analyze and interpret data in numeric forms through questionnaires administered to respondents. Quantitative data analysis was conducted with the use of Statistical Package for Social Sciences (SPSS) version 20 and Microsoft Excel. Data was checked, edited and close-ended questions coded for computer processing. To guarantee accuracy, the data was first cleaned by removing information that were not relevant to the study. This is because accuracy enhances the reliability of data.

Neuman and Wiegand (2000) indicated that even though the researcher's sample can be perfect and no errors committed in data collection, however errors in coding or entering of data into the computer could result into errors. For this reasons data cleaning is important. The coded answers were entered into the computer, which involves thirty (30) structured questionnaires.

The responses from the open-ended questions were collated manually and aggregated for analysis. The findings of the analysis were presented using frequency tables, pie chart and bar graph.

### 3.8 Ethical Considerations

The researcher obtain consent from Jasikan District Assembly, before interviewing the respondents within the district assembly. The respondents were informed about the purpose of the study, how they were expected to participate and how the study would affect them directly or indirectly. This enable them to decide whether to volunteer information by responding to the questionnaire. The researcher also acknowledged all sources of information from other researchers.

To comply with internationally accepted ethical codes of ethics, names of individuals were not recorded on the questionnaire. In this way, no individual is link to a particular completed questionnaire thus assuring anonymity. In addition, the information provided by the respondents is used for academic writing and not shared anywhere else, bringing the issue of confidentiality in play. The researcher endeavored to report the findings of the study as accurately and as objectively as possible and in turn disseminate the findings to the Jasikan District Assembly.

# CHAPTER FOUR

# DATA ANALYSIS, PRESENTATION AND DISCUSSION

## 4.1 Introduction

This chapter presents the major findings of the study. Descriptive statistical tools such as frequencies and percentages were used to analyze the background data of the respondents. The study assessed the significant causal factors in variation orders in building construction projects. Emphasis is placed on the impact of variation orders on the cost performance of building construction projects as well, measures are proposing for optimizing the effects of variations on building project in the Jasikan District. Tables, graphs and pie-charts were used to present results on qualitative data.

## 4.2 Background Information of Respondents

### 4.2.1 Sex and Age of the Respondents

The study revealed that, out of the 30 respondents interviewed, 87% were males whereas 13% were females from the Jasikan District, 6.7% were under 30 years, 50(%) were between 31-40 years, 36.6(%) were between 41-50 years, 6.7% were between 51-60 years. Table 4.1 revealed that male participated more than their female counterparts did because construction industry has been perceived as male dominated so is not surprising this study revealed a high participation of male. Table 4.1 further revealed the details.

**Table 4.1: Sex and age of respondents**

| Age | Frequency/ Percentage | Gender | | Total |
|---|---|---|---|---|
| | | Male | Female | |
| Under 30 | Frequency | 1 | 1 | 2 |
| | Percentage | 3.3(%) | 3.3(%) | 6.7(%) |
| 31-40 | Frequency | 13 | 2 | 15 |
| | Percentage | 43.3(%) | 6.7(%) | 50(%) |
| 41-50 | Frequency | 10 | 1 | 11 |
| | Percentage | 33.3(%) | 3.3(%) | 36.6(%) |
| 51-60 | Frequency | 2 | 0 | 2 |
| | Percentage | 6.7(%) | 0 | 6.7(%) |
| 61-70 | Frequency | 0 | 0 | 0 |
| | Percentage | 0 | 0 | 0 |
| Above 70 | Frequency | 0 | 0 | 0 |
| | Percentage | 0 | 0 | 0 |
| Total Frequency | | 26 | 4 | 30 |
| Total Percentage | | 87(%) | 13(%) | 100(%) |

Source: Field Survey, October 2017

### 4.1.2 Academic Qualification of Respondents

The respondents answered a close-ended questions in relation to their academic qualification. This aided the study in determining the respondent's education background especially the contractors, consultants and professional construction staff whether they possess the necessary

skills and qualification to match the job description. The study revealed that majority of the respondents thus 13 of them (43.3%) attained a first-degree level whereas 10 respondents making (33.3%) attained Higher National Diploma level (HND) and 3 of them (10%) have attained either PHD/Masters level. This data presupposes that the academic qualification of the respondents to handle projects is high which when well utilized can reduce the rate of variation orders when they exhibit a high rate of professionalism in carrying out their work. Table 4.2 further give the details of the various academic qualification of the respondents.

**Table 4.2: Academic qualification of respondents**

| Academic Qualification | Frequency | Percentage (%) |
|---|---|---|
| PHD/Masters | 3 | 10 |
| First degree | 13 | 43.3 |
| HND | 10 | 33.3 |
| Senior High/ O' Level | 1 | 3.3 |
| Vocational/Technician Certificate | 3 | 10 |
| Middle School Leaving | 0 | 0 |
| No formal education | 0 | 0 |
| Total | 30 | 100 |

Source: Field Survey, October 2017

## 4.3 Factors Contributing to Variation Orders in Building Construction

The study also delved into some possible factors causing variation orders in the building construction industry, with a likert scale item ranging from five to one where 1 for strongly

disagree, 2 represent disagree, 3 represent not sure, 4 represent agree and 5 represent strongly agree. From Table 4.3, 46.7% of the respondents revealed that variation orders could result in the extension in the scope of work or additional works. About 40% strongly agree that reduction in the scope of the works or omission can bring about variation orders whereas 50% revealed changes in government policy relating to the project and finally 57% revealed changes in the quality of materials to be used for projects. Table 4.3 further give the details on factors that are likely to result in high rate of variation orders arising in the building construction industry.

**Table 4.3: Causes of Variation in Building Construction Industry**

| Factors Causing Variation Orders | Strongly disagree | | Disagree | | Not sure | | Agree | | Strongly agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| Extending in the scope of the works or additional works | 2 | 6.7 | 1 | 3.3 | 5 | 16.7 | 14 | 46.7 | 8 | 26.7 |
| Reduction in the scope of the works or omission | 8 | 8 | 1 | 3.3 | 4 | 13.3 | 5 | 16.7 | 12 | 40 |
| Change in timing of the project | 2 | 6.7 | 3 | 10 | 3 | 10 | 13 | 43.3 | 9 | 30 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Changes in government policy relating to the project | 1 | 3.3 | 2 | 6.7 | 4 | 13.3 | 8 | 26.7 | 15 | 50 |
| Lack of materials needed for the project | 6 | 20 | 4 | 13.3 | 4 | 13.3 | 7 | 23.3 | 9 | 30 |
| Changes in the quality of materials to be used for projects | 5 | 17 | 6 | 20 | 4 | 13 | 10 | 33 | 5 | 17 |
| Design errors necessitating variation | 5 | 17 | 0 | 0 | 1 | 3 | 7 | 23 | 17 | 57 |
| Government laws necessitating design changes | 5 | 17 | 2 | 6.7 | 3 | 10 | 8 | 26.7 | 12 | 40 |
| Contractors' suggestions for improvements in project design to secure value for money | 3 | 10 | 6 | 20 | 6 | 20 | 10 | 33.3 | 5 | 17 |

Source: Field Survey, October 2017

The data in Table 4.3 pre supposes that, variation orders arising can come from different degrees of causes enumerated with their intensity of how the outcome of the project may be affected. Notwithstanding, some of these causes may be beneficial to the outcome of the project thus improving the quality, reduce cost, schedule, or the degree of difficulty in a project. For instance,

Contractors' suggestions for improvements in project design to secure value for money indicated in Table 4.3 can be beneficial to the client. As a result, it optimizes the client's benefits against the resource input by eliminating unnecessary costs from a project. This confirm Arain and Pheng, 2005b view of beneficial variation orders, not all variation orders are bad but some can help improve upon the quality of work. However, some can be detrimental to the client as well.

### 4.3.1 Origin Agents of Variation Orders

The study revealed the origin of variation orders with the consultants having the highest of 50% from the respondents; the client rated 34% whereas contractors and other forms of variations rated 33% and 3% respectively. Besides the respondents ranking the origin of variation orders, is it further indicated in Figure 4.1 that among these actors the client (50%) is most likely to cause a significant change in variation orders in projects. This position confirms Arain and Pheng (2006a), they noted that the client who is the initiator of the project play major roles from the initial phase to the completion of the project. As a result, the client has the power to influence the needs and the objectives of the project hence the likelihood of the occurrence of variation orders.

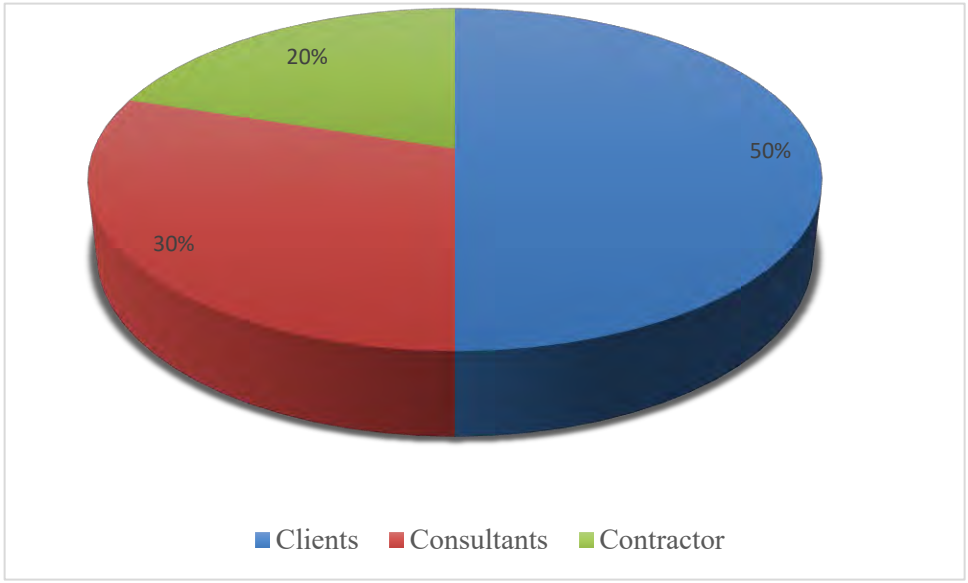


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**Figure 4.1: showing actors causing significant change in variation orders of projects**

**Source: Field Survey, October 2017**

### 4.3.2 Dominant Factors of Variation Orders in Building Construction at Jasikan District Assembly

The Jasikan District Assembly have supervised and awarded some building projects within the period of 2012 to 2016 that were completed and over the years, some dominant factors keep on emerging that greatly causes variation. Figure 4.2 spelt out the extent of the variation caused within the district in terms of percentages.

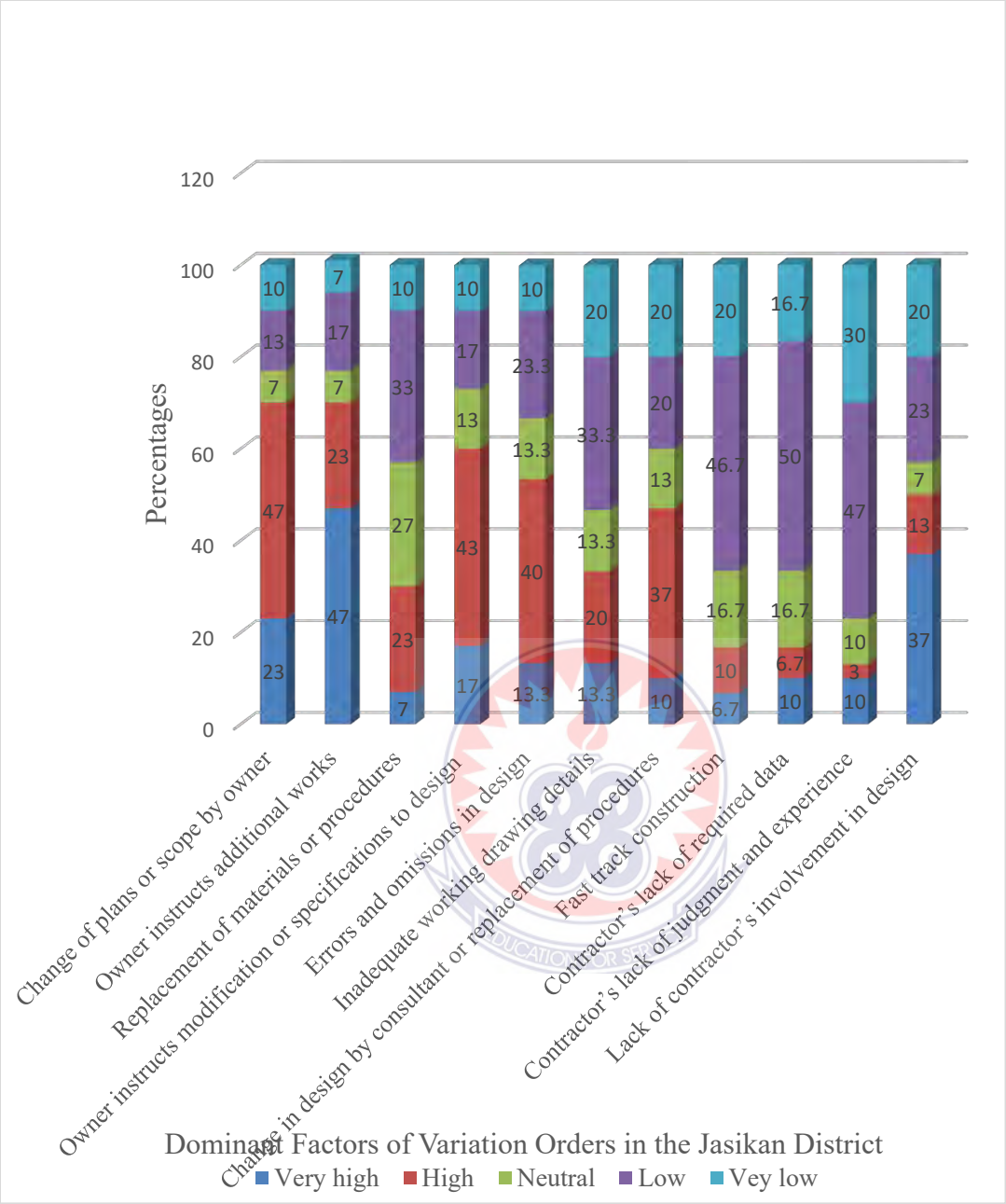


**Figure 4.2: Causes of Variation Orders in Building Projects in the Jasikan District**

Source: Field Survey, October 2017

As indicated in Figure 4.2, 47% of variation is caused by changes in the plan or scope by owner, 43% is caused by the owner instructing for modification or specifications to design and 40% caused by errors and omission in design, 37% caused change in design by consultants or

replacement of procedures. The respondents rate all these high. This revealed that these factors contributed significantly in variation orders in Jaskisn District. On the other hand, an interview conducted separately for the Jasikan District Engineer, District Coordinating Director, District Planning Officer, District Finance Officer, District Budget Analyst, two contractors and two consultants revealed that they have been involved in administration of variation orders. Nevertheless, they have not recorded any form of litigation between the contracting parties be it the contractor or consultant though some dispute arose in the estimating the percentage of variation. They also admitted that they recorded few occasions where variation orders resulted in delay of work consequently payment but these were settled amicably among the contracting parties without any disputes since proof of evidence of variation were made available. However, in the aspect of variation claims, the District engineering team considers the following before issuing variation order: Site visit by the team to ascertain the evidence of proof of variation where, measurement is taken on site against the estimate. They revealed that when all parties are satisfied the certificate is then prepared for payment based on evidence of variation.

## 4.4 Impacts of Variation Orders in Building Construction

An in-depth interview with the Jasikan Distrcit Engineer revealed that the impact of variation can be felt at different levels be it in terms of cost, time and overall productivity of the project. He admitted that there were instances where there were misunderstanding between the District Assembly (Client) and the contractor in arriving at the exact estimate for the variation. He had this to say:

*"In order not to have a negative effect on the outcome of the project, adequate steps were taken in addressing these challenges. The work have to be re-measured or re-evaluated and proper*

*estimation carried out in order to contain the contractors claims, this they undertake by doing site inspection to ascertain the situation."*

He further emphasized that there should be proper dialogue between the contractor and the client in resolving the issue and after the certificate prepared for the contractor. One of the contractors interviewed revealed that the payment for the variation is based on rigorous negotiation and availability of funds, which sometimes may delay the progress of work.

On the contrary, the consultant observed that through dialogue between the contractor and client, market survey must be undertaken in relation to the prices of materials to check correct prices to juxtapose original prices. The two party should come to an agreement on the variation but not a situation where only one party come out with an estimated cost of variation. He added this might bring room for suspension, which is not healthy for the project. For instance, in the case of any changes in prices of materials resulting in variation then the parties can check public procurement authority website to check government approved prices of materials to resolve early conflict or misunderstanding in relation to variation. In addition, bringing in outside consultants (experts) to have a second opinion in the area of variation to review the contract to resolve the misunderstanding relating to variation is greatly commended. More, so the District Engineer revealed that the variation orders caused resulting in cost and time overruns from the year 2012 to 2016 can be said to be between 20%-50% though this depend on the time frame of project and the extent of the delay. This findings side with Koushki (2005), who found that variation orders issued during various phases of the projects adversely affect both the time of completion and costs of projects. The understanding of the impacts of variation orders in better enhanced in

Figure 4.3, where the respondents rate the level of impacts base on very high, high, not sure, low and very low percentages.

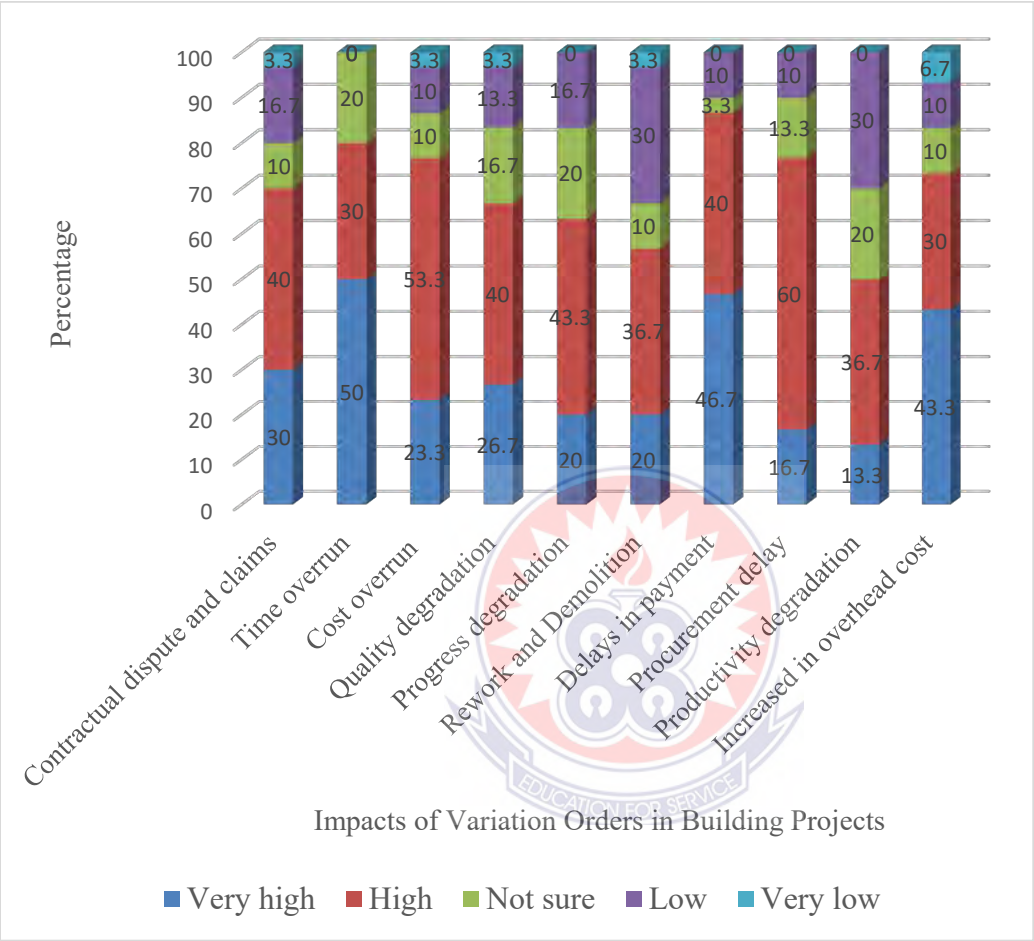


**Figure 4.3: Impacts of Variation Orders in Building Projects in Jasikan District**

**Source: Field Survey, October 2017**

As indicated in Figure 4.3, the impact of variation orders was felt in terms of the following taking into consideration completed projects from the year 2012 to 2016. All these are rated high by the respondents. Contractual dispute and claims 40%, cost overrun 53.5%, productivity degradation 32.7% and delays in payment was rated very high with 46.7%. These figures call for

attention to issues of variation in the Jasikan Districts. Similarly, Hanna et al., (2002) observed that increase in variation orders leads to a more significant loss in productivity. The more frequent a variation order, it may potentially influence the quality of projects.

## 4.5 Challenges in Compiling Claims Related to Variation Orders in Building Projects in Jasikan District

The study looked at some challenges the Jasikan District encounter in compiling claims related to variation orders. The Jasikan District Engineer revealed that, the District found it difficulty in paying for variation orders due to delay in releasing fund from the central government, which also brings about delay in project execution. On the other hand, negotiating become difficult when provisional sum quoted for the item are different from the prevailing market prices, which can easily provoke a misunderstanding between contractor and client. Therefore, the engineering team for the District have to do a good site inspection and have good knowledge of the market, because where not properly carried out can result in either underestimating or overestimating a variation claim. The District Planning Officer added that the inability of the engineering team to carry out regular supervision of site might lead to some contractors claiming illegitimate variation. Delay on the part of inspection team in verifying evidence of claims of variation hence preparing certificate for payment is also a challenge.

Nevertheless, the District Finance Officer opined that project is not always executed within time frame on the part of the contractor for payment to be made on time due to this some variation may arise cause by increase in prices of materials where payment becomes difficult because variations are not inculcated at the time of stating the contract sum. The lack of funds at the time of variation is also a challenge where some contractors at that point are unable to finance the cost

of variation at the time for them to be paid later. However, the study found out that there is a big problem of estimating the right percentage of variation. This the District Coordinator said cause financial lost to the assembly, in situation where the clients fail to do due diligence in terms of verifying market prices of materials, awarding contracts to only the lowest bidder, irregular site visit to ascertain what actually goes on at project site largely goes against the District Assembly.

## 4.6 Measures to Control Variation Orders in Building Construction

Most researchers argue that no matter how methodically a project are carefully planned taking cognizance of material and labor cost, change will inevitably occur in construction works. In any building construction project, it is important to consider the most frequent cause of variation orders where some of these causes are unavoidable. This is because as time needed to complete the project goes up, the cost also increases and probably the quality of the work may be compromised (Ashworth, 1998; Arain and Pheng, 2005a; Ireland, 2007). Due to these the study revealed some measures that when taken can minimize variation in building project if not unavoidable. However, the study revealed that budget and project must be completed on time, in other to avoid increase in prices of construction materials, which sometimes may be cause by inflation, in general prices of goods. Also full design of building project must be completely done before starting the project. The various agents should all meet and agree on the needed inputs for the executing of projects before the start of such projects.

More so, consultants should well define the scope of work before handing documents to contractors, which should involve precise drawings and specifications for projects. Consultants should do due diligence during drawing of bill of quantity in order to eliminate some of the

variations encountered at project site. Site supervisors should be well informed about the project that they are supervising. In addition, in other to enhance effective delivery of work, awarding agency should be sure funding is available for projects before awarding contracts in other to facilitate timely delivery. Smith, 2016 observed, when actors or project partners gained visibility into the status of all variations, they would be able to measure performance and institute a process of continual improvement on project; this can help reduce time and cost overruns of projects caused by variation orders.

Political interference is one of the challenges identified in the study, that can bring about a drastic change in variation, but the research opined that when this interference is minimize and contracts awarded to credible contractors in order to produce quality work not situation where 'politicians' award contracts to party faithful's. Even though, this at times may not have to do with the competence of the contractors but in most cases some of these contractors deliver poorly. Another dimension of this issue is payment of percentage of contract sums to government officials must be avoided, as this is likely to bring about issues of corruption, as some variations can be overestimated. The District Assembly should make payment to contractors on time to avoid delay in execution of assembly's projects

On the other hand, parties involved in the project management should play active parts and make the necessary inputs available on time to use when the need arises. For instance, the client has to make available the money for the purchase of materials for the project and the contractors have to be up and doing in the project execution and avoid 'stealing' and use of specified materials for the project. The study also revealed that most often some consultant collaborates with contractors to delay projects. This can be avoided when the government (Client) and authorities involved

make sure that consultants and contractors sign agreement or be responsible for delayed projects thus if the clients have also played their parts.

The research brought to light how the occurrence of variations be reduced in civil construction project in the Jasikan District. Proper feasibility study should be carried out before project implementation. Omission and addition should be check out when preparing Bill of Quantity. In addition, the contactor should be able to interpret design. The District Coordinator added that user agencies should be consulted to ascertain their specification regarding the projects. Another area of concern is that District Assembly should not necessarily award contracts to the lowest bidder because the likelihood of not getting the work done properly which would fall below the client's specification and thereby necessities variation is very high. The District Budget Analyst admonished that payment should be made promptly to contractors and awarding contracts in phases when possible can reduce the possibility of delay.

Notwithstanding contract must work within stipulated time of the contract period in order to reduce the possibility of variation. The District Finance Officer added that the plan of the project should be available before the start of the project. The plan should be open for stakeholders to make input in the design. Proper procedures must be follow in awarding of contract. The competency must be put into consideration in selecting contractor for the projects as well as proper estimate carried out before initiating a project. The consultant revealed that if all the necessary procurement procedures are followed and as well as intensifying monitoring and evaluation of projects and avoiding political interference in awarding projects, variations claims can be reducing to its minimal.

# CHAPTER FIVE

# SUMMARY, CONCLUSION, RECOMMENDATIONS AND SUGGESTION FOR FURTHER STUDIES

## 5.1 Introduction

This chapter discusses summary of the study, conclusion, recommendations and suggestions for further study.

## 5.2 Summary of Research Findings

The study became indispensable because actors in the construction industry expressed discernment about the increasing variation orders in the building construction industry. Therefore, this study on "cost trend of variation orders in district assembly construction projects" is relevant in addressing issues of variation orders and providing recommendations for reducing them to enhance pace of work in the Jasikan District and Ghana as a whole. The study took place in the Jasikan District of Volta Region of Ghana. This study focused on significant causes of variation orders, impacts of variation orders and possible measures of reducing this phenomenon in building construction projects in Jasikan District taken into consideration completed project for the period 2012 to 2016. The data for the analysis were collected using structured questionnaire administered to the professionals in the building construction industry and in-depth interviews for gathering insightful information on the study.

The study identified the following as dominant factors causing variation orders: changes in the plan or scope by owner, owner instructing for modification or specifications errors and omission in design and change in design by consultants or replacement of procedures in the building construction at Jasikan District. For example, the consultants do not carry out adequate

investigations at the initial design stage. Therefore, several site conditions rise in the construction stage. Further, failure on the parts of the District Engineering team to carry out regular site inspection and do thorough investigation of estimates**,** which are prepared by consultants and might not be accurate in most cases. Therefore, several unnecessary variations occur. The District blame this development on lack of logistics to carry out these inspections effectively.

The impact of variation orders in the building construction industry cannot be ignored, the impact was considered in terms contractual dispute and claims, cost overrun, productivity degradation, and delays in payment. These calls for attention to issues of variation in the Jasikan District. The study again revealed that in some cases ccontractors and consultants are reluctant to point out client's faults, considering their survival in their construction industry. According to the interview results, political interference during construction stage is identified as a worrying issue. Professionals do not seem to consider that the extension of allocated time is a critical factor for variations to arise.

The study looked at some challenges the District have to go through in compiling claims related to variation orders. The District found it difficulty in paying for variation orders due to delay in releasing fund from the central government, which also brings about delay in project execution. On the other hand, negotiating become difficult when provisional sum quoted for the item are different from the prevailing market prices, which can easily provoke a misunderstanding between contractor and client. The lack of funds at the time of variation is also a challenge where some contractors at that point are unable to finance the cost of variation at the time for them to be paid later. However, the study found out that there is a big problem of estimating the right percentage of variation.

Therefore, the engineering team for the District have to do a good site inspection and have good knowledge of the market, because when not properly carried out can result in either underestimating or overestimating a variation claim.

## 5.3 Conclusion

The impact of variation has greater significant influence on the client (government projects) due to the delay in time and associated cost than the impact on either the contractor or the consultants irrespective of the type and size of the projects as it is established from the study that it is the client that causes most of the variation. It is hoped that these will encourage the management to review the conditions at which the consultant and the in-house staff operate to better understand the usefulness of the consultant and the construction professional staff. Variation orders arising can come from different degrees of causes enumerated with their intensity of how the outcome of the project may be affected. Notwithstanding, some of these causes may be beneficial to the outcome of the project thus improving the quality, reduce cost, schedule, or the degree of difficulty in a project. The research findings revealed that increasing in the scope of the works or omission, changes in government policy relating to the project and changes in the quality of materials to be used for projects result in variation orders.

## 5.4 Recommendations

The study therefore recommends the following in minimizing variation order hence reduce cost and time overrun of projects:

- The District Assembly should employ Architects to do detail design thus engaging professionals. All specifications should be inculcated at the design stage.
- Engineering technocracy and administrative financial principles of local government system should operate freely from political interference, politicians spreading infrastructure projects for scoring political points of their parties and ambitions which as a results delays payment of projects under construction. The practice makes contractors to deliver far below the expected project duration, which eventually give rise to variation order sometimes due to inflation of prices of materials.
- Project managers should be engaged to manage projects where proper utilization of work break structures are employ. Comprehensive site investigation should be carried out and lesson learnt from previous similar projects in order to avoid variation. This is because negative effects such as delay in payment may tarnish firms' reputation.
- Adequate cost analysis should be done before starting a comprehensive project to avoid large variations of projects costs. Inadequate cost analysis brings about delay.
- Contractors must be involved in project design. All stakeholders must be brought on board and proper cost analysis carried out to avoid projects variation. The terms and conditions governing the project should be spell out and adhered to by the contracting parties.
- Adequate funding should be available before the award of contract to prevent delays.

- District Engineers should be effective in project supervision thus proper supervision should be put in place to minimize variation orders. Engineers should visit the project as team.
- Awarding contracts can be done in phases by the central government. In awarding a contract, the concentration should not just be on lower bill of quantities but also the expertise of the contractor.

### 5.5 Suggestion for Further Studies

This study is conducted using only Jasikan District as a case study, to be able to generalize the findings of this study to cover the entire government projects in Ghana; similar studies should be done in other districts in order to arrive at a conclusion for the whole of Volta Region and Ghana in a larger context.

Although, this research work has generated important findings in the field of variation orders in the building construction industry. Future research can look at increasing the sample size in order to cover a larger respondent in the industry. In addition, more quantitative technique should be employed and a rigorous statistical test carried out. This could help to maximize the strengths and minimize the limitations of each technique employed. More so future research can also look at effect of cost on variation orders which this study have not tackled in detail. Besides, discussion of other relevant causes of variations in construction projects is beyond the scope of this study that can be studied in another research work.

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# Appendix I

## Structured Questionnaire

My name is Holy Avornorkadzi, a student of the University of Education, Winneba studying M-TECH-Construction Management. Currently, I am conducting a study on cost trend of variation orders in District Assembly construction projects. A case study of Jasikan District Assembly. I would like to ask you some questions relating to the study. The information given is strictly confidential and will be used solely for the research only.

**Section A: Background Information of Respondents**

1.0 What is your age category? *(Please tick [√]).*

| | | | |
|---|---|---|---|
| Under 30 years | ☐ | 31 – 40 years | ☐ |
| 41 – 50 years | ☐ | 51 – 60 years | ☐ |
| 61 – 70 years | ☐ | Above 70 years | ☐ |

2.0 Please indicate your gender. *(Please tick)*

| | |
|---|---|
| Mal | ☐ |
| Fem | ☐ |

3.0 What is your highest academic qualification?

| | | | |
|---|---|---|---|
| PhD/Masters | ☐ | HND | |
| First Degree | ☐ | Senior High/ O' | |
| Vocational/T | ☐ | Middle School | |
| No Formal | | | |

4.0 What is the value of the project that was last undertaken by your firm? *(Please tick)*

| | |
|---|---|
| Not exceeding GH¢20000 □ | Exceeding GH¢20000 to 40000 □ |
| Exceeding GH¢40000 to 60000 □ | Exceeding GH¢60000 to 80000 □ |
| Exceeding GH¢80000 to 100000 □ | Exceeding GH¢100000 to 120000 □ |
| Exceeding GH¢120000 to 140000 | Exceeding GH¢140000 to 160000 |
| Exceeding GH¢160000 to 180000 | Exceeding GH¢180000 to 200000 |
| Exceeding GH¢200000 | |

**Section B: Factors Causing Variation Orders in Building Construction Project**

5.0 Please indicate the extent to which you agree on the following factors causing variation orders in building construction projects of the Assembly. Please rate using a scale of 1 to 5; 1 is strongly disagree; 2 represents disagree; 3 represents not sure; 4 represents agree and 5 represents strongly agree. *(Please tick the box which best reflect your view).*

| Factors Causing Variation Orders | Rating | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Extending in the scope of the works or additional works | | | | | |
| Reduction in the scope of the works or omission | | | | | |
| Change in timing of the project | | | | | |
| Changes in government policy relating to the project | | | | | |
| Lack of materials needed for the project | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Changes in the quality of materials to be used for projects | | | | | |
| Design errors necessitating variations | | | | | |
| Government laws necessitating design changes | | | | | |
| Contractors' suggestions for improvements in project design to secure value for money | | | | | |
| Other (please specify) | | | | | |

6.0 Which among these is the origin agent of most variation orders in building construction? [a] Client [b]Consultant [c]Contractor [d] Other (Specify).....

7.0 To what extent do you agree with the following statement relating to assembly projects? Please tick [√] the appropriate box.

| Statement | Rating | | | | |
|---|---|---|---|---|---|
| | Strongly Disagree | Disagree | Not sure | Agree | Strongly agree |
| Unplanned delays due to cost and time factors on construction projects are often regrettable but unavoidable | | | | | |

8.0 Among the following actors, which of them causes the most significant change in projects resulting in variation orders. a] Clients [b] Consultants [c] Contractor

9.0 Please tick [√] the frequency with which the following causes of variations are encountered the Jasikan Assembly projects. Please rate using a rating scale: Very high [5] High [4] Neutral [3] Low [2] Very low [1]

| **Factors** | **Very high** | **High** | **Neutral** | **Low** | **Very low** |
|---|---|---|---|---|---|
| Change of plans or scope by owner | | | | | |
| Owner instructs additional works | | | | | |
| Replacement of materials or procedures | | | | | |
| Owner instructs modification or specifications to design | | | | | |
| Errors and omissions in design | | | | | |
| Inadequate working drawing details | | | | | |
| Change in design by consultant or replacement of | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| procedures | | | | | |
| Owner instructs modification or specifications to design | | | | | |
| Fast track construction | | | | | |
| Contractor's lack of required data | | | | | |
| Contractor's lack of judgment and Experience | | | | | |
| Lack of contractor's involvement in Design | | | | | |

10.0 Please tick [√] the option that best reflect the extent of impact of variation orders considering the following which arises out of variation orders in building projects.

Rating Scale: Very high [5] High [4] Neutral [3] Low [2] Very low [1]

| **Impacts** | **Very high** | **High** | **Neutral** | **Low** | **Very low** |
|---|---|---|---|---|---|
| Contractual dispute and claims | | | | | |
| Time overrun | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Cost overrun | | | | | |
| Quality degradation | | | | | |
| Progress degradation | | | | | |
| Rework and Demolition | | | | | |
| Delays in payment | | | | | |
| Procurement delay | | | | | |
| Productivity degradation | | | | | |
| Increased in overhead cost | | | | | |

11.0 Please suggest measures that could be adopted to minimize the variations in projects as well as their adverse effects on project cost and completion. Please write in the space provided below.

**THANKS FOR YOUR ASSISTANCE**

## Appendix II

### Semi-Structured Interview Guide for Construction professionals

My name is Holy Avornorkadzi, a student of the University of Education, Winneba studying M-TECH-Construction Management. Currently, am conducting a study on cost trend of variation orders in district assembly construction projects. A case study of Jasikan District Assembly. I would like to ask you some questions relating to the study. The information given is strictly confidential and would be used solely for the research only.

1. Have you ever been involved with the administration of variation orders?
2. Have there been any record of dispute between you and the contractor or consultant resulting from variation orders
3. If yes, how do you resolve this disputes resulting from variation orders?
4. How best can the occurrence of variations be reduced in civil construction project?
5. What key considerations do you make when assessing contractor's claims on variation orders? List them in the order of importance.
6. What is the estimation (in percentages) the variation orders caused resulting in cost and time overruns from the year 2012 to 2016

   [a] None [b]Less than 20% [c] between 20-50% [d] more than the50%?
7. What challenges do you encounter when compiling claims related to variation orders in your projects?
8. How do you overcome the above challenges?

**THANKS FOR YOUR ASSISTANCE**