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KUMASI, GHANA

**Assessing the Quality of Design and Contract Documentation and its Impact on  
Construction Projects Performance in Northern Ghana.**

**By**

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**A Dissertation Submitted to the Department of Building Technology,  
College of Art and Built Environment in partial  
fulfilment of the requirements for a degree of**

**MASTER OF SCIENCE**

**NOVERMBER, 2016**

## DECLARATION

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

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## **ABSTRACT**

Building construction projects in Ghana's construction industry are facing many quality issues most especially with design and contract documentation. The main purpose of this study was to assess the quality of design and contract documentation, and the impact it has on the performance of construction projects in Northern Ghana. A questionnaire survey was performed on 85 respondents (40 Consultants, 25 Clients, and 20 Contractors), 52 responses were received representing 61.2% response rate, and 96.15% of these respondents acknowledged there were indeed deficiencies in design and contract documentation. The data were analyzed using Relative Importance Index (RII) and Kendall's concordance testing. Majority believed that consultants were mostly responsible for this problem followed by clients. A conclusion was drawn based on the data analysis that, out of the 40 factors, these were the critical factors that bring about design and documentation deficiencies. They are: the selection of designers on the basis of lowest price selection strategy (Lowest bid approach), the unwillingness to pay fees commensurate with the design of high-quality services, the last minute changes by the client, insufficient design reviews with relevant parties, the slow payments system for design services, and the insufficient and missing input information from the client. It was also concluded that the following affected the time and cost performance of public construction projects in Northern Ghana which are in order of the degree of severity: Projects abandonment, Delays (Time overrun), Cost overrun, Payment claims, and Variation/Change orders. Recommended to the Clients and Consultants to help in the prevention of design and contract documentation deficiencies in construction projects in Northern Ghana are the following strategies. These are: Clients must ensure that consultancy fees are proportionate to the required service quality, Consultants should make sure there is an adequate review of design and documentation with all stakeholders involved, and Clients must ensure that the selection of consultants is on meritorious grounds. And the rest are Prompt changes should be tolerated if the need be, Ensuring timely and regular payments for design service providers and that Clients must make sure that briefs are adequate, clear, precise and concise.

**Key Words/Terms** Quality, Deficient Design and Contract documentation, Construction projects performance, Northern Ghana

## DEDICATION

I dedicate this whole-heartedly to Almighty Allah whose guidance and protection have brought me this far in life.

I finally dedicate this manuscript to my parents, wife and children.



## TABLE OF CONTENTS

DECLARATION.....	ii
ABSTRACT.....	iii
DEDICATION.....	iv
TABLE OF CONTENTS .....	v
LIST OF TABLES .....	viii
ACKNOWLEDGEMENT.....	ix
CHAPTER ONE:.....	1
INTRODUCTION.....	1
1.1 BACKGROUND.....	1
1.2 PROBLEM STATEMENT.....	2
1.3 RESEARCH QUESTIONS .....	3
1.4 AIM OF RESEARCH .....	4
1.5 OBJECTIVES OF RESEARCH .....	4
1.6 SCOPE AND LIMITATIONS OF THE STUDY .....	4
1.7 SIGNIFICANCE OF THE STUDY .....	6
1.8 ORGANIZATION OF THE STUDY .....	6
CHAPTER TWO .....	8
LITERATURE REVIEW .....	8
2.1 INTRODUCTION .....	8
2.2 QUALITY OF DESIGN AND CONTRACT DOCUMENTATION .....	9
2.3 DEFICIENT DESIGNS AND DOCUMENTATION.....	11
2.4 CAUSES OF DESIGN DEFICIENCY .....	14
2.5 IMPACTS OF DESIGN AND DOCUMENTATION DEFICIENCY .....	19
2.6 INFLUENCE OF FEES ON CONTRACT DOCUMENTATION QUALITY .....	24
2.7 DESIGN QUALITY MEASUREMENT .....	27
2.8 IMPROVING THE QUALITY OF CONTRACT DOCUMENTATION .....	28
2.9 SUMMARY .....	36
CHAPTER THREE .....	39
METHODOLOGY.....	39



<b>3.1 INTRODUCTION .....</b>	<b>39</b>
<b>3.2 LITERATURE REVIEW .....</b>	<b>39</b>
<b>3.3 RESEARCH APPROACH .....</b>	<b>39</b>
<b>3.4 DATA COLLECTION .....</b>	<b>41</b>
<i>SECTION A: General Information .....</i>	<i>41</i>
<i>SECTION B: Impact on Project Performance .....</i>	<i>41</i>
<i>SECTION C: Factors Causing Design and Documentation Deficiency .....</i>	<i>41</i>
<i>SECTION D- Preventive Methods .....</i>	<i>41</i>
<b>3.5 SAMPLE DESIGN .....</b>	<b>43</b>
<i>3.5.1 Population Definition .....</i>	<i>43</i>
<i>3.5.2 Sampling Techniques Employed .....</i>	<i>44</i>
<i>3.5.3 Sample Size .....</i>	<i>45</i>
<b>3.6 DATA ANALYSIS TOOLS .....</b>	<b>46</b>
<b>CHAPTER FOUR .....</b>	<b>47</b>
<b>ANALYSIS AND DISCUSSIONS OF SURVEY RESULTS .....</b>	<b>47</b>
<b>4.1 INTRODUCTION .....</b>	<b>48</b>
<i>4.1.1 Detailed Structure of Analysis and Discussion .....</i>	<i>48</i>
<i>4.1.2 Survey Results .....</i>	<i>48</i>
<b>4.2 RESPONDENTS BACKGROUND INFORMATION .....</b>	<b>49</b>
<i>4.2.1 Respondents Category .....</i>	<i>49</i>
<i>4.2.2 Class of Contractor .....</i>	<i>50</i>
<i>4.2.3 Respondents Professional Background .....</i>	<i>50</i>
<i>4.2.4 Highest Educational Qualification of Respondent .....</i>	<i>51</i>
<i>4.2.5 Type of Projects Executed by Respondents .....</i>	<i>52</i>
<i>4.2.6 Respondents Experience in the Construction Industry .....</i>	<i>52</i>
<i>4.2.7 Error/Deficiency in Design and Contract Documentation .....</i>	<i>53</i>
<i>4.2.8 Responsibility for Design and Documentation Deficiency .....</i>	<i>54</i>
<b>4.3 IMPACT/EFFECTS ON PROJECT PERFORMANCE DUE TO DESIGN AND DOCUMENTATION DEFICIENCY .....</b>	<b>54</b>
<b>COMMENTS/ DISCUSSIONS .....</b>	<b>56</b>
<b>4.4.1 MOST SEVERE FACTORS .....</b>	<b>72</b>
<b>COMMENTS/ DISCUSSION .....</b>	<b>73</b>

4.2.2 MOST FREQUENT FACTORS.....	77
COMMENTS/ DISCUSSION .....	77
4.4.3 AGREEMENT ANALYSIS .....	82
4.5 PREVENTIVE METHODS FOR DESIGN AND CONTRACT DOCUMENTATION DEFICIENCY .....	83
COMMENTS/ DISCUSSIONS .....	85
4.5.1 SPEARMAN CORRELATION OF PREVENTIVE METHODS.....	89
CHAPTER FIVE .....	91
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATION .....	91
5.1 INTRODUCTION .....	91
5.2 SUMMARY OF FINDINGS.....	91
5.2.1 To identify the factors that affect the quality of design and contract documentation of construction projects in Northern Ghana .....	91
5.2.2 To assess the extent to which the quality of design and contract documentation affects the performance construction projects .....	93
5.2.3 To identify preventive measures in managing design and contract documentation deficiencies and improving the performance of construction projects.....	93
5.3 CONCLUSIONS.....	95
5.4 RECOMMENDATIONS.....	97
5.5 RECOMMENDATION FOR FUTURE RESEARCH .....	99
REFERENCES .....	100
APPENDIX: QUESTIONNAIRE.....	108

## LIST OF TABLES

Table 4.1 Respondents Response Rate .....	50
Table 4.2 Class of Contractor .....	52
Table 4.3 Professional Background .....	52
Table 4.4 Highest Educational Qualification .....	53
Table 4.5 Type of Projects Executed by Respondents .....	54
Table 4.6 Experience in the Construction Industry.....	54
Table 4.7 Respondents Acknowledgement of Deficiency in Design and Contract Documentation .....	55
Table 4.8 RII and Ranks of the severity of the effects of Design and Documentation Deficiency on Project performance. ....	57
Table 4.9 RII and Ranks of Factors Causing Design and Contract Documentation Deficiency by all respondents .....	61
Table 4.10a RII and Ranks of Factors Causing Design and Contract Documentation Deficiency by Clients .....	65
Table 4.10b RII and Ranks of Factors Causing Design and Contract Documentation Deficiency by Consultants .....	68
Table 4.11 RII and Ranks of the Most Severe Factors Agreed by Clients and Consultants. ....	72
Table 4.12 RII and Ranks of the most Frequent Factors agreed by Clients and Consultants. ....	79
Table 4.13 Showing Kendall's Rank of Concordance Coefficient .....	83



Table 4.14 RII and Ranks of the preventive methods for each group of respondents ..... 84

Table 4.15 Showing the Rank Correlation Coefficient (Using SPSS) ..... 90

## **LIST OF FIGURES**

Figure 4.1 Respondents Category ..... 51

Figure 4.2 Responsibility for Design and Documentation Deficiency ..... 56



## ACKNOWLEDGEMENT

My utmost thanks go to no other than the Almighty Allah, the creator and sustainer of lives for His guidance and protection throughout my life, especially in my academic career.

My second thanks go Mr. J.C. Danku (My supervisor) for squeezing time out of his busy schedule to go through this work and making very useful suggestions to make it a success. I am indeed grateful.

Another person worthy of thanks is Mr. Stephen Akunyumu a Graduate Assistant for my Supervisor for his relentless effort in guiding me through this work and I salute him for that.

My heart pours out to my family for their understanding during these hard times especially my wife (Nazifa) who has been supportive in diverse ways towards the success of this programme.

I am also indebted to my friends and loved ones Suleman Yakubu, Dawdi Abdul-Aziz, Abdul Rahaman Abdul Basit etc. for their inspiration, encouragement and support during this period. I say thank you.

Last but not the least I am very grateful for all those who participated in this survey.

Thank You to All and May Allah (God) Bless You Abundantly!!!

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## CHAPTER ONE:

### INTRODUCTION

#### 1.1 BACKGROUND

According to Tilley *et al.* (1999), there is a significant impact on the overall performance and efficiency of construction projects by the quality of design and documentation.

Typically, tender documents usually consist of design drawings, specifications, bill of quantities/schedule of rates, instructions to tenderers, conditions of the contract, a form of contract, and other attachments (Buchan *et al.*, 2003) and (Cook, 1991). This is usually a proposed contract document.

“Designers provide the graphic and written representations, which allow contractors and subcontractors to transform concepts and ideas into physical reality. How effectively and efficiently this transformation occurs, depends largely on the quality of the design and documentation provided” (Tilley and Barton, 1997, p.703).

This, however, implies that poor and inefficient design and documentation may have a negative effect on the entire project.

According to Long (2011), Defective drawings and specification result due to the following: incompleteness, conflicts, inadequate description or detail, insufficient legibility or coordination to permit satisfactory construction, inability to use specified materials or procedures, inconsistency or incompatibility, omission or error, nonavailability of specified item commercially or misleading provisions, or other similar



problems. When specifications are prepared with a reasonable standard of care and are of average quality, there is the likelihood of a reasonable and an acceptable number of errors.

Specifications do not have to be perfect to be efficient.

There is a recognition by a report that the practice and behavior of clients as well as the disciplines adopted by project documentation teams will collectively contribute to the quality of service provided (ACIF and APCC, 2002).

Whilst ensuring the need for “effective” design, it is also necessary to communicate effectively through documentation, i.e., specifications, drawings, bills of quantities etc.(Tilley, 1997).

## **1.2 PROBLEM STATEMENT**

Proper documentation in every formal organization is key in their operations as far as meeting their target aims and objectives are concerned.

In an ideal situation, contract documentation for construction projects should be complete and error free and should be able to meet the Client’s requirements i.e. effective.

A case study conducted in the UK on the quality of tender documents by Laryea (2011) revealed that, there has been disputes and claims among contractual parties due to substandard information provided for construction in designs and contract documentation in terms of details, accuracy, adequacy and ambiguity in design drawings, specifications, bills of quantities etc.

ACIF and APCC (2002) also stated that there is a seeming deterioration in the quality of design and contract documentation resulting in inadequacies and unascertained costs in

the construction process in recent years. This is confirmed by a study conducted by Laryea (2011) on the quality of tender documents which revealed that, in the past 15-20 years, there is the perception of a significant drop in the quality of tender documents and this causes extensive problems for tenderers. According to Tilley (2005b), there is a continuous significant effect on the construction industry's efficiency due issues regarding design and contract documentation quality and as such contributes greatly to rework in construction.

Aibinu and Odeyinka (2006) in their study cited Chang (2002) who stated, "Identifying reasons are usually the first step when addressing a problem and then corrective actions can be taken". In view of this assertion, there is, therefore, the need to investigate the above problem to assess the cause of the deterioration of design and contract documentation quality and the extent to which these affect the performance of construction projects in the Ghanaian construction industry and hence find remedies to the situation based on previous studies.

### **1.3 RESEARCH QUESTIONS**

This study intends to answer the following research questions towards achieving the objectives:

- What are the significant and frequently occurring factors, which are causing the poor quality of design and contract documentation?
- What problems are often encountered in the use of poor quality design and contract documents?

- To what extent do these problems/effects affect the performance of construction projects?
- What are the best remedial measures that can be put in place to prevent the deficiencies in design and contract documentation?

#### **1.4 AIM OF RESEARCH**

The main aim of this dissertation is to assess the quality of design and contract documentation and its impact on the performance of construction projects in Northern Ghana.

#### **1.5 OBJECTIVES OF RESEARCH**

This research seeks to achieve the following objectives:

- To identify the factors that affect the quality of design and contract documentation of construction projects in Northern Ghana.
- To assess the extent to which the quality of design and contract documentation affects the performance construction projects.
- To identify preventive measures in managing design and contract documentation deficiencies and improving the performance of construction projects.

#### **1.6 SCOPE AND LIMITATIONS OF THE STUDY**

This study will be restricted to the Public sector construction projects that are executed in Northern Ghana. This is limited to the three Northern regions of Ghana, namely: Upper

West, Upper East and Northern regions respectively. It is further restricted to the Tamale metropolis , Wa and Bolga municipalities of the Northern, Upper West and East regions of Ghana due to the limited time and financial constraints to carry out this research work and also the fact that clients and consultants executing larger projects are concentrated in these areas. The intention was however to cover a broader portion of Ghana.

Construction industry Professionals (i.e. Architects, Civil/Structural Engineers, Quantity Surveyors etc.) with an appreciable level of experience working with Consulting, Construction and Client organizations in these regions will be surveyed to ascertain the factors affecting the quality of design and contract documentation and identify some remedial measures to enhance project performance through administration of questionnaires.

Clients were chosen because they initiate and promote projects and as such, the results of the projects are of great concern to them. Consultants were also chosen because they produce architectural and structural designs based on the client's initiatives and briefs, quantity surveying services as well as supervision of the construction process which determine the likely outcome of the project. And finally, contractors because they do the actual execution of the project based on what the consultants will deliver to them.

How successful the project will perform will depend on how well these three parties interrelate from start to finish of the project.

Architectural and structural drawings and bills of quantities are the only contract documents that this study will be focussing on.



## **1.7 SIGNIFICANCE OF THE STUDY**

Since the quality of the design and contract documentation generated by consultants has a substantial influence on the overall performance and efficiency of construction projects, it is highly significant that issues confronting the quality of design and contract documentation be identified and discussed to improve projects performance.

After a thorough check, it came to the realization that, not much research work was carried out in the area of design and documentation quality deficiencies on construction projects in the Ghanaian construction industry. The outcome of this study shall inure to the benefit of all contractual parties, i.e. all professionals working with clients, contractors and consulting firms. It will serve as guidelines to all stakeholders in the construction industry in Ghana.

According to a report, where there is a recognition of the factors that are likely to lead to better project outcomes, there is the prospect that, there will be enhanced standards of documentation (ACIF and APCC 2002).

## **1.8 ORGANIZATION OF THE STUDY**

The study is organized into five comprehensive chapters. The first chapter is an introduction to the research. It outlines the study background, statement of the problem, aims, objectives, scope, and its significance. The second chapter reviews the literature associated with factors affecting contract documentation quality and identification of its impacts on the performance of construction projects. In the third chapter is an outline of the methods and techniques employed to collect and analyse data to achieve the aim and objectives of this study to be able to draw valid conclusions. The fourth chapter discusses

and analyses the results of the collected data through questionnaire survey and finally the fifth chapter draws conclusions from the discussions and analysis and makes recommendations.

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## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 INTRODUCTION

The chapter seeks to appraise the existing literature in the context of contract documentation quality in the construction industry to get an in-depth knowledge and to achieve the research objectives.

This will lead to the identification of the factors influencing the poor quality of the design and contractual documentation, their effects and ways of eliminating or minimizing these effects.

Designs are normally services rendered by consultants to their clients according to the client's requirements. Love *et al.* (2000) defined Quality as accomplishing or exceeding the expectation of the customer. Quality is also defined in terms of a construction project by Arditi & Gunaydin (1997, p.235) as:

Meeting the legal, aesthetic and functional requirements of a project. Requirements may be simple or complex, or they may be stated in terms of the end result required or as a detailed description of what is to be done. However, expressed, quality is obtained if the stated requirements are adequate, and if the completed project conforms to the requirements.

This, therefore, implies that design quality is providing the contractor with all the necessary details that will make the construction work to be executed as required, without any interference and in an efficient manner (Tilley *et al.*, 1997).

## 2.2 QUALITY OF DESIGN AND CONTRACT DOCUMENTATION

It is assumed that the issues of quality in design documents could transpose into the issues of quality in construction, particularly where short time frames and error checking are reduced. There is the tendency that under design and build procurement, design changes and errors are increased (Balson *et al.*, 2012).

When the quality of design is being considered according to McGeorge (1988) as cited in Tilley et al (1997, p.3 of 14) : ‘a good design will be effective (i.e. Serve the purpose for which it was intended ) and constructible with the best possible economy and safety’. According to Arditi & Gunaydin (1997), drawings and specifications issued to the contractor by the Consultant contain technical information of materials and various components that affect the standard of quality required by the construction. The drawings are the sole documents that the contractor receives which show the concept of the design, its size, the quantity and size of the material, and the scope of the works. Inconsistencies in drawings and specifications have been a headache in the construction process. It has therefore become very necessary that the specifications and drawings are brief, uniform and clear. The project must be constructible by the contractor contracted to construct it. Construction methods and materials that contractors will be using in the execution of the project must be familiar to the professionals producing the designs. Queensland (2005) affirms the above in their report that the following characteristics are required for a proper contract documentation quality in projects:

- They should be coherent and explicit
- Precise, complete and timely



- There should be that ease in communication and construction, in the best possible way economically and safely
- Fit for purpose
- In line with the client's requirements in the project's brief.

The systematic documentation and proper organization of drawings and other mediums of communication such as a bill of quantities, specifications, etc., will ensure the process of transfer of information works effectively (Hamzah *et al.*, 2011).

However, there have been several concerns raised in the building and construction industry, according to McLennan & Parminter (2004), that a falling standard of the quality of the of documentation has contributed significantly to a similar drop in the efficiency of construction.

Queensland (2005,p.6) quoted Janet Holmes á Court (Chairman of John Holland Construction) as having said that:

I see the poor quality or late delivery of design documentation on every single one of our projects, with architects encouraged (by clients) to allow builders to start building before all the drawings are quite ready. It starts from day one and everybody gets into strife. On every project where we have difficulties, I can guarantee that design documentation is the main source of the problem.

This assertion is confirmed by a statement made by Ishak *et al.* (2007,p.115) who is quoted to have interpreted Newton's third law of Force in the perspective of Architects/Designers as: "for every design decision or consideration (action) there is a consequence (reaction)".

Upon seeking the perception of contractors, Tilley *et al.* (1999) came to a conclusion that over the past 12-15 years, there has been a steady increase of deficiencies in the design and documentation that consultants provide and this has a corresponding increase of inefficiency within the construction process. Hence, a decrease in quality of the project which is inversely proportional to the overall costs of the project. Unclear or missing project information alone contributes to approximately 30% of the problems of quality confronted on the construction sites as captured in a report by (Building Economic Development Council, 1987).

There are huge financial losses running into millions of dollars every year in the Queensland construction budget due to substandard project documentation (Queensland, 2005).

### **2.3 DEFICIENT DESIGNS AND DOCUMENTATION**

In a web publication, Gatlin (2013) defined design deficiency as the failure to produce an accurate, complete and well-coordinated set of design and construction documentation by a design professional.

Abdalaziz (2009,p.7) quoted Lutz *et al.* (1990) as having also defined design deficiency as "any deficiency in the drawings and / or the specifications which result in a facility which will not adequately perform its intended mission".

According to a study conducted by Burati Jr *et al.* (1992), it was indicated that several deviations were identified after the construction phase and it is alarming to note that only deviations in design out of the total identified deviations, contributed to an estimated average of 78%.

It was observed by participants in a research conducted in the construction industry in Australia by Slater and Radford (2012) that, some of the difficulties encountered on a site can be traced to design decisions by architects, deficient specifications, as well as erroneous documentation. In the UK construction industry, some common problems identified to be related to bid documents according to Brook (2004) were: inconsistencies between drawings and bill of quantities and specifications, poor specification writing, and poorly prepared tender documents.

Also, Lutz *et al.* (1990) as cited in Abdalaziz (2009) Classified most design deficiencies under one of these three (3) categories:

1. Conflicting contract documents: disagreements between drawings, bill of quantities and specifications.
2. Coordination errors within parties: problems of interference with consultants of other engineering disciplines such as structural, mechanical, electrical, etc.
3. Discrepancies due to technical compliance: non-adherence to the right design guidelines, building codes and specifications.

In a study conducted by Dosumu and Adenuga (2013), errors were categorized according to the type of construction document as follows:

- Drawings-design errors, poor coordination between disciplines, inaccuracy of details, dimensional errors, missing information, symbol and abbreviation errors;
- Specifications-designer errors, poor coordination between disciplines, missing information, abbreviation and symbol errors;

- Bill of quantities-approximation errors, measurement errors, omissions and ambiguity, dimensional errors, random errors and arithmetic errors;
- Schedules-pricing errors, missing information and arithmetic errors;
- A form of contract-non-conformance of contract documents to codes, symbol errors, ability to bid, abbreviation errors and non-conformance of contract documents to building regulations.

Major variations may occur if drawings and specifications are inadequate and would ultimately affect the completion of the project. If specifications or drawings are incomplete or unclear; it will create interpretation problems, thereby compromising the quality of the project (Assaf *et al.*, 1996).

According to Arain and Assaf (2007), for the timely commencement and accomplishment of projects, construction documents are important and must be clear and concise to convey a complete project scope for the parties. The outcome of some interviews conducted in the US with 12 contractors indicates the lack of clarity of contract documents to be one of the factors responsible for the increase in contingency markups in bids by contractors (Smith and Bohn, 1999).

In a study by Josephson (1998), a total of 645 design defects were recorded with consequences for the construction sites and this relates to about 26% of the total defects cost. Also, Josephson (1998) cited lack of coordination among design professionals as the most common type of defect as a result of which conflicting drawings exist, and this alone is 28% of the cost of a design defect. Unsuitable design and faulty design resulted in 18%, and 13% respectively of the cost of design. By faulty design, it means that designed solutions are impossible to achieve on the site. By unsuitable design, it means solutions



which are possible to accomplish but are obviously considered unsuitable. Other common types of defects were incomplete drawings, incorrect measurement, and indistinct drawings.

In both developed and undeveloped countries, faulty designs and its consequence have become a global problem. Design errors can lead to unplanned maintenance where the designer does not understand the initial concept of buildability. This, in the long run, is expensive to the cost of repairs and the lives of occupants (Ishak *et al.*, 2007).

Alarcon and Mardones (1998) in their study concluded that three main problems confront the design and construction interface and they are poor quality design, lack of standards in design and constructability of designs. Most often, design documents are inconsistent, erroneous and details omitted or they simply lack clarity of presentation and as such, the required information for the execution of the job is either lacking or wrong.

## **2.4 CAUSES OF DESIGN DEFICIENCY**

The causes of inaccuracies in contract documents according to Dosumu and Adenuga (2013) in a study conducted in Nigeria were classified under the type of construction document and ranked in severity using mean scores as presented below:

### **1. Drawings:**

- Missing or deficient input information
- Drawings being incomplete
- Unsatisfactory planning and design work
- Errors in design

- Professional negligence
- Incorrect drawings

## 2. Specifications:

- Changes in specifications
- Incorrect drawings
- Unsatisfactory planning and design work
- the experience of the designer

## 3. Bill of quantities :

- Inadequate documentation
- Poor communication between the professional and the client
- Negligence of the professional.

## 4. Schedules:

- information availability
- Professional experience
- Inadequate documentation
- Inadequate computation

## 5. The form of contract:

- Poor cost control method
- Availability of detailed information
- Lack of adequate documentation
- Long period between tendering and award

Also, another study in Nigeria by Dosumu and Iyagba (2013) reveals the following overall significant factors causing errors in contract documents as ascertained by both consultants and contractors out of a total of sixty-three factors that were identified and these are consistent with that outlined in the study of (Dosumu and Adenuga, 2013):

- The experience of designer
- Lack of reviews in design, constructability and value engineering
- Inconsistent decision-making
- coordination lacking between design disciplines
- project inspection and planning lacking
- the experience in design management lacking
- unawareness of changes in documentation standards
- Poor communication between the parties
- Lack of clarity, and ambiguity of the specifications in design
- Unavailability of information.

The perspective of designers concerning the causes of the reduction in design and documentation quality was sought and according to Tilley (1998) and these were considered as the primary causes: Reducing the fees of design consultants, an increasing number of customers (owners) who have unrealistic expectations and a failure to define clearly the requirements and objectives of the project, and reduction in design time and project runtime.

The lack of enthusiasm of the client to put in more investment towards achieving highquality of bid documents, the impatience of clients, the lack of knowledge and the lack of skill were the four key reasons identified for the decline in the quality of tender documents according to (Laryea, 2011).

A study by Queensland (2005) goes to confirm the above per the ten major causes of design and documentation deficiency outlined below:

1. Insufficient project briefs based on targets that are not realistic.

2. Devaluation of ethics and professional standards of business practice.
3. The selection of consultants based on submission of lowest bid regardless of value for money.
4. Within the supply chain, there is an absence of integration linking the stakeholders to the project and between the various phases of the project.
5. The ineffective/low use of technology to carry out design and documentation activities.
6. Poor communications between contracting parties
7. Poor understanding of the requirements for the optimization of designs and provision of quality documentation.
8. Lack of knowledge and the requisite skills in the procedures of assessment and management of risks.
9. The absence of an overall experienced design coordinator who is to be appointed by the client.
10. The recruitment of less skilled and experienced human resources due to inadequate availability of personnel.

According to a survey by Zidan (2013), he drew a conclusion by identifying and ranking 45 causes that affect the quality of design and contract documentation in Syria's construction industry using the relative importance index and finally arrived at the four most important factors as follows:

- Insufficient time for overall design
- Lowest price offer method of designer selection
- Requirements change by client



- Lack of documentation

ACIF and APCC (2002) identified the following under listed as being the cause of design problems:

- Insufficient client brief;
- Design details not known;
- Problems of constructability;
- Compliance problems of statutory regulations; and
- Inadequate time for design.

From a study conducted by Slater and Radford (2012), it appeared from the building industry perspective in Australia that six main factors outlined below are said to be leading to inadequate architectural documentation:

- Pressure placed on the designer by other parties and consultants to complete documentation and cross-checking procedures by a predetermined time;
- Disregard of required documentation standards through the inadequate and ineffective use of technology. Thus, inappropriate use of technical detailing, lack of clarity and poor application of CAD techniques;
- Reduced consultancy fees;
- Inadequate coordination of architectural documentation with that of civil, structural, electrical, mechanical;
- Extensive use of CAD and direct transferal of information and removing the opportunities for cross checking during redrawing;
- Increasing pressure on architectural services to adopt lean principles in order to meet the competitive environment of today.

Love *et al.* (2008) revealed that a number of factors contribute to the incidence of design errors in construction projects. For instance, the pressures from clients on design consultants to provide detailed design documentation can result in the making of errors in design. According to Busby (2001), individuals easily violate the agreements that were established when under pressure for the production of documents, knowing well that this practice is not professionally appropriate.

A case study conducted by Love *et al.* (1999) revealed poor quality contract documentation to be among some inhibiting factors that contributed to rework according to interviews conducted with the project manager, the architect, the structural engineer, structural, the steel subcontractor, and the draftsman. They revealed that poor quality contract documentation was due to the absence of skilled resources to enable a request for information (RFIs) to be resolved and low design fees. They stressed further that the lack of resources and scheduled program prohibited them from providing fully documented working drawings.

## **2.5 IMPACTS OF DESIGN AND DOCUMENTATION DEFICIENCY**

The poor management of the design process frequently results in misunderstandings and conflicts in complex construction projects (Nicholson and Naamani, 1992). In a study by Assah-Kissiedu *et al.* (2010), oversights and omissions or errors in design, and specification due to the lack of the coordination of civil, structural, architectural, mechanical and electrical designs were identified to be among some of the most significant reasons for disputes that occur in construction projects in Ghana. This supports a study in the USA by Levy (2007) who reported that one of the primary causes for misunderstanding

leading to claims and disputes is building plans and specifications having errors, uncertainties, and omissions.

Campbell (1997) also cited improper contractual documentation as one of the reasons of disputes in the UK construction industry which backs the above assertions. Also, Laryea (2011) asserts that claims and disputes at the construction stage are due to lack of clarity of tender documents.

Love *et al.* (2009) in their study concluded that in engineering and construction projects, design errors are considered to be a problematic issue and according to (Lopez *et al.* 2010), this can lead to the unsafe working environment resulting in fatalities, the magnitude of which can be disastrous.

According to Dosumu and Adenuga (2013), design and documentation errors have serious effects on the construction process as outlined by respondents in the study: projects abandonment, delays, rework, client dissatisfaction, lack of confidence in consultants, reputation of the consultant's office, frustration of stakeholders, lack of concentration on other projects, discourages investment, and designers profit.

Mryyian and Tzortzopoulos (2013) in their study stated that depending on the type of design and documentation errors and the time of their detection, they have great negative effects throughout the project. Thus the design, construction, and post-construction phases. Bubsshait *et al.* (1998) stated that deficiencies in design have an effect the cost of operation and maintenance over the building's lifecycle. Due to design deficiencies, the additional costs of operations and maintenance, and a possible loss of productivity of occupant can exceed the construction cost.

Burati Jr *et al.* (1992) in his analysis did indicates that on the average, 12.4% of the construction project cost was due to deviations and 79% of which was due to design deviation alone which is 9.5% of the total project sum. The study of Hilman and William (1996) supports the above assertion by the indication that "... the heavy industrial construction industry averages more than 12% deviation correction of the total project cost."

Design omission on the part of the design professional results in 15% of the cost of change orders on the premium cost. Due to this, there is bound to be an additional cost over and above the actual cost to be paid for the changed work which was not competitively priced according to (Gatlin, 2013).

In the Australian construction industry, Tilley (1998) sought the views of contractors in a workshop and it was acknowledged that in the past 10-15 years, it is realized that deficiencies of contract documentation that is provided by design consultants has been steadily increasing and is directly proportional to inefficiency in the construction process. This as a consequence result in an increase in overall project cost and a reduction in the project quality.

According to a report from Queensland (2005), poor quality of design documentation has led to 60 to 90% of all variations in the construction industry. The report also indicates that poor documentation quality has led to:

- Extensions of time, cost overruns, and rework
- Adversarial behaviour
- An inefficient, non-competitive industry.



In a study conducted by Kikwasi (2013), design changes are considered the topmost cause of delays and interferences in projects delivery in Tanzania and these results in:

- Time extensions
- Project cost being exceeded
- Adverse impact on social life
- Resources left to idle
- Disputes;
- Arbitration

Ismail *et al.* (2012), reported that errors and omissions in the designs were ranked the second most critical factors causing variation orders in construction projects. In a similar study by Tiware and Kulkarni (2013), drawing details comprising drawing mistakes, unclear specifications, client interference in drawings, delay in the review of drawings and client delay in the decision for changes is considered one of the topmost root causes of variations in construction. It is, therefore, imperative that the poor quality of contract documentation has the following effects on the construction projects according to (Ismail *et al.*, 2012) as outlined:

- Delay in the scheduled completion period
- Project cost rise
- Disputes between client and contractor.

In a case study conducted by Love *et al.* (2011), it was discovered that incomplete and erroneous drawings which resulted in very costly rework leading to disputes among the parties. Due to the resulting dispute, the project was delayed by eight (8) months whilst the dispute was resolved through a negotiation process resulting in an extra cost amounting

to about 13% of the original contract sum. Sinha and Wayal (1998) stated that omission errors that arise within the contract documentation may not be identified until the construction is in progress and the time that may be required to correct this error may hinder the work progress or even require a change in design. This thus may lead to payment claims being made, disputes or an extension of time.

The study of Memon *et al.* (2012) also identified design and documentation issues as the topmost factor that brings about costs and time overruns in the Malaysian construction industry.

The response of contractors in study to ascertain the factors responsible for project delays in traditional contracts was that, change orders, mistakes, and discrepancies, etc. were the leading causes of delays and delays are costly and often result in claims and disputes, impair the feasibility of clients and impede the development of the construction industry (Odeh and Battaineh, 2001). In support of the impact of delays as ascertained by Odeh and Battaineh (2001), Sambasivan and Soon (2007) emphasized more on the adverse impact of delays of projects as follows: overruns in projects cost and time, disputes, arbitration and litigation, and total projects abandonment.

Inaccurate drawings/specifications were ranked among the first three significant factors that affect construction productivity on sites in Lagos, Nigeria as reported by (Ameh and Osegbo, 2011). Similarly, Serious concerns such as rework and wastages occur in projects due to design and construction errors which have effects on project performance and productivity aspects (Palaneeswaran *et al.*, 2007). This is supported by Hwang *et al.* (2009) identified an omission/error in design as the core cause of rework in construction projects and has led to cost increases in reported projects thus impact on the cost

performance. It is estimated that an average of 30% loss in efficiency is experienced on construction sites due to disruptions, rework and change work (Thomas and Napolitan, 1995).

## **2.6 INFLUENCE OF FEES ON CONTRACT DOCUMENTATION QUALITY**

In order to achieve construction project quality, the selection of design professionals is critical. The level of services provided by professionals should determine the level of the design fee. Design fee increases as design deficiency per project decreases, but there is, however, an economic aspect to the relationship. It is neither economical nor practical to pursue absolute design perfection (Bubsshait *et al.*, 1998). Reduced consultancy fees lead to inadequate architectural documentation (Slater and Radford, 2012) and it is consistent with an assertion by Love *et al.* (1999) in a case study they conducted where an architect and an engineer conceded that errors made in design documentation were due to low design fees.

Design fees have a great influence on the quality of design documentation. According to an interview conducted in a study by Love *et al.* (2009,p.430):

For detailed design, you can pay a lump sum for certain parts of the design. There is always a lot of pressure on the consultant to be competitive either through minimum target man-hours, through the man-hour rates. Consultants tend to recover by increasing scope through claiming for changes in the design. They often “take short cuts” when they think they are not getting a good design fee. If they work on a lump sum basis, there is always a lot of pressure on a total number of man-hours required to do the work and if they need more man-hours, then as they have to deliver within the lump sum so their way to save money is by reducing what they pay their people. It is only under the fully reimbursable type of contract that you can take that kind of pressure away. You need some idea how much a project is going to cost you, the cost of blank cheque approach is high to clients.

In a study conducted by Okonkwo (2014), he stated as part of his conclusion based on the respondents agreement that, discounted professional fees offered have a negative impact

on the ability of the designer to deliver good quality professional services and constitutes an additional risk for their practice. He went further and identified risks that are influenced by discounted professional fees and among them are:

- Insufficient supervision and control of quality
- Drawings and design rework; □ Poor quality contract documentation;
- Liabilities, etc.

Tilley and Barton (2000) in a study stated that complications in projects are bound to occur when clients through their actions to reduce design consultants fees in order to decrease cost. This would usually result in construction process inadequacies, a rise in the overall project time and costs, and finally leading to disputes among parties. Darwish (2007) as part of the conclusion stated that the reasonableness of design fee levels would facilitate designers to restoring training programs for their staff which would go ahead to enhancing the standard of the designer and also boost creativity and innovation within the quality of contract documentation.

In a research conducted regarding design errors and their prevention by Love *et al.* (2012.p.107), it was unearthed from an interview with an engineer in a case study of school upgrade project that, there was no encouragement of design consultants to work collaboratively and harmoniously because there was no incentives or motivation. In a response to a question of design fees, a design consultant stated that:

It is a cutthroat out there. Fees are very tight and clients are not willing to pay us what we require. I understand that documentation is sometimes poor, but we also do not have enough time to prepare it. Client's expectations have increased, but fees have not. They think that we can design overnight sometimes.



Consultants implemented “time-boxing” to make sure that main parts of the design were complete as fees were considered to be tight and, with an unrealistic plan in place to document the design. Thus, as a result, led to reduced “scope of work” leading to aspects of their design being incomplete and finally resulting in discrepancies between architectural and engineering designs and also raising contractual relationship in the construction process.

The most common response from interviewees when asked about what might be the influence on construction documentation quality was “appropriate fees”. Some further stated that consultants are under pressure from the very onset of the project to try to make it viable for themselves owing to the competitive nature of the fees. This, therefore, can lead to poor quality of work owing to lack of senior staff review. The client in trying to save on consultant fees may ultimately cost them more due to cost relating to poor documentation quality. One interviewee stated that : “You think it’s expensive to hire a professional, try hiring an amateur” (Flentje *et al.*, 2012,p.11). In the view of design consultants, fee competition remains a challenge in the bid to produce high-quality documentation. It was strongly agreed that, by default, lower fees can lead to the likelihood of errors and lower design quality due to the less involvement of key experienced staff (Balson *et al.*, 2012).

According to Tilley *et al.* (2002), the reduction in the level of service being provided by consultants often results in design and documentation being substandard was due to competitive fee tendering and limited budget, planning the design and documentation of projects and this is also confirmed by (Love *et al.*, 2011).

## 2.7 DESIGN QUALITY MEASUREMENT

Measurement can guide steady progress towards establishing targets and identify gaps or recession (Rose, 1995).

Arditi and Gunaydin (1997) explained quality in the construction industry's perspective as the meeting of the requirements of all contractual parties, i.e. Client, Consultant, and Contractor as well as regulatory agencies. According to an ASCE report, as cited in the work of Arditi and Gunaydin (1997), quality can be characterized as outlined:

- Satisfying client's requirement in terms of adequacy of function, operation, and maintenance, meeting timelines and budget, and life cycle cost.
- Satisfying the requirement of the design consultant by providing: a defined scope of work, adequate budget to provide field information to guide in design and to bring together well-trained and experienced staff, contract with proportionate risk sharing, and timely decisions by client and design consultant.
- Satisfying the contractor's requirements for the provision of a well-detailed and accurate set of design drawings, specifications and other documents to assist the contractor in the pricing of his tender. Others include client's timely decisions and also assist the design consultant when ordering for variations, fair treatment, realistic risk sharing and a contract that allows for realistic schedule and which permits equitable profit.
- Satisfying the requirements of public regulatory agencies as to the protection of public property, including utilities, environmental concerns, public health and safety, and conformance with relevant laws, regulations, codes and policies.

Tilley *et al.* (1997) in the study outlined a number of measures that can assist to regulate the level of quality as far as contract documentation is concerned and these go to affirm ASCE's assertion above:

- Timeliness: avoiding delays by the timely supply of needed requirements;
- Accuracy: precision and correctness of information;
- Completeness: provision of all required information;
- Coordination: bringing together all parties to work in a team;
- Conformance: meeting performance standards and statutory regulations.

Functionality i.e. the end- product should be fit for purpose, was considered most important criteria for measuring project quality performance followed by the satisfaction of the client, which is suggested to be in correlation with functionality.

The remaining variables for measuring quality that was identified are health and safety, the level of complaints, completion of projects within time and cost (Ali, 2010). John (1995) also proposed that one way to measure quality is the meeting of specifications.

## **2.8 IMPROVING THE QUALITY OF CONTRACT DOCUMENTATION**

For a dramatic improvement in the contract documentation quality to occur, it is necessary to change the way the design process is managed. However, it is seen by many that, the adoption of "Lean production" principles can help improve its efficiency. By the adoption of this approach to design management, many believe that deficiencies of the traditional management approach can be improved to make the design process more efficient and optimize the use of the limited resources available. Removal of potential obstacles through better management of the available time would help alleviate one of the most noted root

causes of design deficiency i.e. inadequate/insufficient time and the recovered additional time could be used for the provision of better project outcomes and increase value for the customer (Tilley, 2005a).

Also, Tilley (2005a) further stated that lean design processes can assist in enabling design solutions to be more coordinated, integrated and focused on delivering value to the client by the promotion of high levels of communication and collaboration within the project team. He recommended that relationship-based procurement approach is used in order to maximize the benefit of the application of lean principles within design management. According to Darwish (2007), at the design phase of projects, the client's requirements should be clearly specified to avoid deficiencies in the design which may result in contract variations during the construction stage. There would be an effective improvement in the overall design and documentation quality if the client and contractor were properly involved at the inception of the design stage. This will enable the consultant to have ample time to rectify and make corrections to any omissions, inaccuracies or ambiguities before the start of the construction process. Sinha and Wayal (1998) alluded that there can be an improvement in constructability and a reduction of the probability of design changes if the contractor is involved in the process of the design.

ACIF and APCC (2002) established the following principles and protocols that are anticipated to improve contract documentation quality in the construction industry and is also backed by Queensland (2005):

1. Project Establishment and a clearly defined brief of client comprising of important drivers and considerations such as budgets, functions, and quality. Also, better



delivery of requirements by clients will lead to an enhanced response of consultants.

2. The selection of consultants by making consultants' fees corresponding to the required effort and selection based on non-price and price criteria to establish value and ensure selection assessment practices are ethical and transparent.
3. Team formation and project integration by ensuring that there is a clear understanding of the responsibilities, roles, and obligations of by the parties and also establish and decide on a review procedure for contract documentation including review points and milestones for the client project team.
4. Quality management system including project implementation and documentation by actively considering the life cycle cost of the project in the design process, developing and agreeing upon quality management implements comprising checklist, review and audit processes and the use of information technology by consultants to support in the process of documentation and coordination.
5. Consultant's obligations and functions:
  - Advising the project owners on the sufficiency of the brief and the risk associated with poor allowance for proper documentation in both budgets and programs;
  - Creating designs and documentation, coordination roles within the project team.
  - Complying with the code of ethics and professional conduct requirements regarding documentation quality and propose that fees proportionate with the effort involved.

The following recommendations were made by Serpell *et al.* (2002) from study of quality in construction in Chile:

- Integration of quality improvement efforts within the construction sector.
- Training people in the professional, management and the supervisory level in the tools and concepts of quality.
- Improvement and extension of quality issue education at the tertiary institutions and technical institutes where most of the construction professionals are trained.
- Improving quality regulations and defining better the responsibilities regarding defects in the quality of construction projects.

Adherence to project management and organizational practices and creating an atmosphere that allows individuals to learn from their mistakes can help prevent many of the errors that occur in the design and documentation of construction projects (Lopez *et al.*, 2010).

To assist in the improvement of overall documentation quality, it was suggested by Flentje *et al.* (2012) that vast improvement in coordination and management between disciplines should be a requirement. The significance of this was highlighted in a report by Tilley *et al.* (2002) that, the contract documentation coordination among design disciplines should be an obligatory component of a scheduled set of minimum standards for any design consultancy. He further suggested that a consultant with appropriate skills and authority is appointed to oversee the coordination function throughout the whole project delivery process.

Johansen and Carson (2003) conceded that the process of design management is a complex problem and that it has ballooned to the extent that most people are aware of the need for proficient management. In order to improve, it is suggested that the most important ideas

that require attention are the provision of adequate design time, the need for a working team approach, the quality of clients briefing and that a clearly identified competent manager controls the process and the task dependencies are understood. To avoid substandard documentation in projects due to consultants selection process dominated solely by price competition, Love *et al.* (2011) suggested that there is the need to shift from the competitive selection towards negotiation to ensure that consultants with the capability and required experience are selected to undertake projects. However, it is believed that public clients would have to confront issues surrounding probity and the perception of public accountability and eventual “value for money”.

A study undertaken by Abdel-Razek (1998) to attain a consensus on the factors essential to improve the quality of construction in Egypt were outlined in order of significance as follows as the 3 most ranked;

- Improvement in planning and design at the stage of design;
- Development and improvement of systems of quality control and assurance;
- An improvement of the financial level and standard of living of employees. Due to the several errors plaguing design and documentation in the Nigerian construction industry, it was recommended by Dosumu and Adenuga (2013) that:
  - It should be encouraged that designers partner one another while preparing construction documents.
  - Adequate time should be allowed for the preparation of design and documentation in order that comprehensive information is provided for use in the design of construction documentation, constructability, and design reviews.
  - It is also advised that clients should use the right procurement methods for construction projects.

- There should be good communication among the construction project team.
- The use of electronic documents management system is advised.
- There should be effective and efficient project management.
- There should be adequate financial provision.
- Adequate contingencies should be allowed.

In an attempt to eliminate design defects, Chong and Low (2006) suggested that designers should be encouraged to adopt and use standards and codes such as British Standards (BS) etc.. Designers are also encouraged to abreast themselves with the latest knowledge, ideas and technologies in the industry, and they are again invigorated to develop a file whereby hidden defects could be traced and mistakes avoided in future and a decision framework to assist in simplifying the process of identifying defective designs.

The following recommendations were made in a study conducted by Laryea (2011) for the adoption of clients to increase the quality of tender documents. They are ‘know what you want, describe it very clearly, do not assume that the other person knows what you want, tell them what you want, do not change your mind, allow a sensible tender period, and be sensible about risk sharing.’

In a study conducted in the Middle East, Ezeldin and Abu-Ghazala (2007) concluded with a recommended quality management system (QMS) for the design consultants in an operational manual. This model was based on information collected from 32 design experts working in the province and on universal quality requirements. It was realized that the enactment of the quality system resulted in a more consistent design production process. In a study by Said *et al.* (2009), it was suggested that the implementation of QMS will bring about an enhancement in the image and reputation of the organization, followed by an improvement in performance and customer satisfaction. The work of Hilman and



William (1996) on quality performance management system (QPMS) indicated that, the first projects that amalgamated the QPMS experienced deviation correction costs 5% and is predicted that full-length projects that adopt QPMS together with a teamwork approach will lead to less than 2% of deviation correction costs. For an effective QPMS program, it is necessary to support it with construction and engineering management in that it provides the motivation, training, inspiration, challenging and resources to make the program economically fruitful.

Love *et al.* (1999) also claimed the development of a culture of total quality management (TQM) throughout a supply chain will boost individuals and organizations to learn together to decrease rework and enhance client satisfaction.

In order to minimize rework in projects that is caused by omission/error in design, design change, Hwang *et al.* (2009) recommended that project managers should note the different cost impact of rework when drafting quality management plans. Also putting in place systems for tracking and controlling these errors/omissions will aid in curtailing rework.

Love and Smith (2003) conceded that great portion of construction project rework originates from the design phase and as such effective customer and design management appear to be the key to minimizing the unexpected change in design which results in rework.

A study conducted in Ghana by Asamaoh and Nyako (2013) on the determinants of variations in building construction made the following recommendations that will help control the causes of variations in construction projects. It is required that a comprehensive review of the design and contract documents is done by the design team at all times, there should be an improvement in communication between the contractual parties, and before

the works start on site and it is required by all parties to do feasibility studies and adequate planning.

The implementation of design audits, design reviews and verifications, provision of adequate time for designers to produce documentation and using computer aided design (CAD) applications will help minimize the impact of errors before documentation is distributed for tender though this will not prevent errors from occurring (Reason, 2002) and (Love *et al.*, 2008).

Aagaard and Pedersen (2013) concluded in their study the need for emphasis on the review and control of documentation as a means of integrating tasks in the design and construction phases. It is also required that special attention is given to the review and control of the use of ICT in modeling and structural design.

According to Love *et al.* (2011), Building information modeling (BIM) will considerably increase the performance of projects if it used as an enabler compared with other key strategic and process improvements that have been acknowledged.

Penttilä (2006) stated that BIM makes it explicit the interdependence that exists between architectural layout, mechanical, structural, electrical, and hydraulic services by technologically coupling project organizations.

Dossick and Neff (2010) indicated that it is the development and the potential application of mapping information management and building information modeling that is best for the customer's interest. High-end ICT and modeling of current products seem to offer valuable control features and analytical tools that are suitable for designers, builders, project managers, building owners and maintenance parties and to remember the content rich architectural design and its values.

The culture of collaboration between project participants where project information is accessible by all parties is well enhanced by the adaptation of information management system (IMS) and the fact that IMS has been embraced can ensure that the risk of litigation is lessened. And this will eventually bring about a more competitive and active construction industry (Craig and Sommerville, 2006).

The study of Love *et al.* (2005) suggested that there would be enhanced contract documentation quality if higher design fees are paid to consultants. Chong and Low (2006) suggested that in as much as we are interested in reducing hidden defects in our design documentation, cost, and other design concerns are equally important.

## **2.9 SUMMARY**

In summary, quality is defined as meeting the requirements of the customer. In terms of design and documentation, quality is also defined as is providing the contractor with all the necessary details that will make the construction work to be executed as required, without any interference and in an efficient manner.

For the achievement of a better quality design and contract documentation, they should be coherent and explicit, precise, complete and timely. Also, there should be that ease in communication and construction, in the best possible way economically and safely. And finally, designs and contract documentation should be fit for purpose and in line with the client's requirements in the project's brief.

Design deficiency is thus defined as failure to produce design and construction documentation that are accurate, complete and well coordinated by design professionals and therefore not able to perform its intended mission adequately. The review of the literature also revealed that several studies have been conducted in the past in the area of

quality of design and documentation of construction projects in Nigeria, Tanzania, South Africa, Australia, UK, USA, Chile, Saudi Arabia, Palestine, Malaysia, Syria, Japan etc due to the ever increasing complexity of construction projects and Ghana is no exception. Several causes of deficiencies in design and Contract documentation were revealed in literature such as the experience of designer, Lack of reviews in design, constructability and value engineering, inconsistent decision-making, coordination lacking between design disciplines, project inspection and planning lacking, the experience in design management lacking, unawareness of changes in documentation standards, poor communication between the parties, lack of clarity, and ambiguity of the specifications in design, and unavailability of information. Others are Insufficient client brief, Design details not known, problems of constructability, compliance problems of statutory regulations, insufficient time for overall design, lowest price offer method of designer selection, requirements change by client, and lack of documentation.

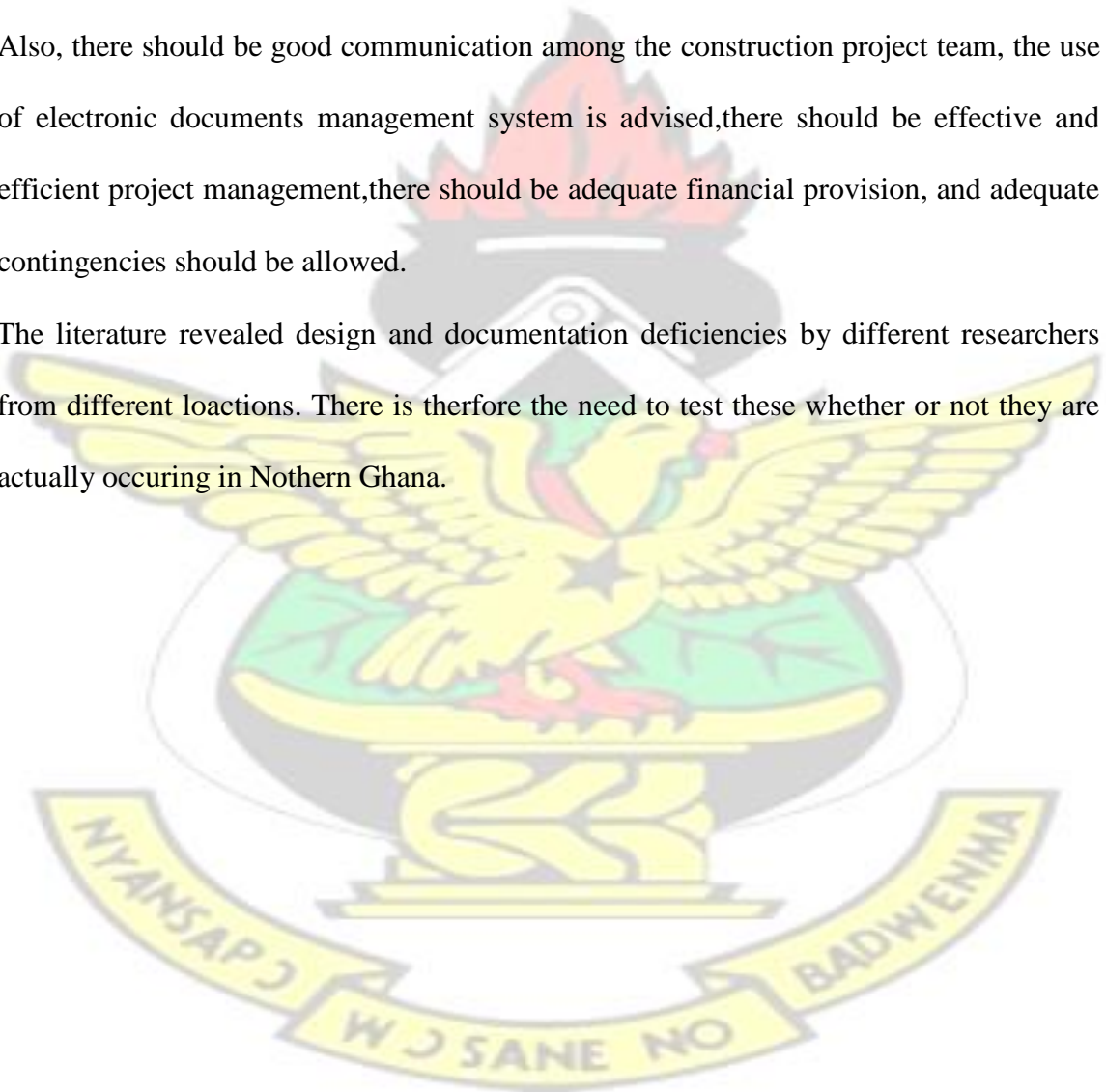
The literature also revealed quite a number of effects that deficiencies in design and contract documentation have on the performance on construction projects. And some of these are: Time extensions, cost overruns, adverse impact on social life, resources left to idle, disputes, arbitration, litigation, rework, and total projects abandonment.

The literature further revealed the need to prevent or minimize deficiencies in design and contract documentation as early as possible to avoid the above effects on projects. The following techniques were suggested; Integration of quality improvement efforts within the construction sector, training people in the professional, management and the supervisory level in the tools and concepts of quality, and improving quality regulations



and defining better the responsibilities regarding defects in the quality of construction projects. It should also be encouraged that designers partner one another while preparing construction documents, adequate time should be allowed for the preparation of design and documentation in order that comprehensive information is provided for use in the design of construction documentation, constructability, and design reviews, It is also advised that clients should use the right procurement methods for construction projects. Also, there should be good communication among the construction project team, the use of electronic documents management system is advised, there should be effective and efficient project management, there should be adequate financial provision, and adequate contingencies should be allowed.

The literature revealed design and documentation deficiencies by different researchers from different locations. There is therefore the need to test these whether or not they are actually occurring in Northern Ghana.



## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 INTRODUCTION**

The chapter outlines how the research was conducted, the tools and the techniques used to carry out the investigation to achieve the aim and objectives of the study. It presents the method of collecting data through the review of existing literature and questionnaire survey. This chapter also outlines the sample characteristics and the methods of analysing the data and follows by sections of discussions, recommendations, and conclusions.

#### **3.2 LITERATURE REVIEW**

Secondary data for the study were collected through the review of related literature of previous studies from journal publications, thesis/dissertations, conference papers, the university library resources and internet sources towards achieving the research objectives. Review of this literature led to information about the causes of poor quality construction design and contract documentation, the effects of poor quality design and documentation on the performance of construction projects and some remedial methods to curb this poor quality. This information obtained from the reviewed literature was therefore used in the development of a questionnaire survey to enable the collection of our primary data from the targeted respondents.

#### **3.3 RESEARCH APPROACH**

This research adopted the quantitative research technique through the use of a questionnaire survey in the collection of data. The quantitative technique involves the

collection of data through making measurement and it is built upon previous literature, which has established laws, principles and theories to aid in deciding the requirements for data for the particular research. Measurements (quantified data) are obtained through the use of scientific techniques (Fellows and Liu, 2008). It can be deduced from Creswell (1994) as cited by Naoum (2007) that, quantitative research is characterised by an investigation into a social or human problem and is based on testing a hypothesis or a theory composed of variables. Usually, is measured with numbers and analysed with statistical techniques, in order to determine whether the hypothesis or the theory is true or not.

The samples collected are usually large and can be generalised to a population to some extent so that an interpretation can be made about some attitude, behaviour or a characteristic of the population (Creswell, 2014). A survey approach was adopted because the survey design is economic in nature and also due to the swift turnaround in the collection of data (Creswell, 2014).

The design of the survey research was cognisant of the aim and objectives of this research. The aim of the questionnaire survey was to collect data that is representative of the industry to attest to previous work findings to bring up to date existing knowledge of the subject. It is also to reassess the level of the status of the problem.

The questionnaire was therefore outlined to seek the opinions of construction industry professionals working with client, consultancy and contracting firms/organisations as follows:

- Causes of the poor quality of construction design and contract documentation;

- The effects of poor quality on the performance of projects and;
- The possible measures to remedy the deteriorating quality of design and documentation.

### **3.4 DATA COLLECTION**

The questionnaire was designed based on the research aim and objectives with the mind of providing enough background and obtaining the opinions of professionals from the industry to cover the concerns that are within the limitations of this study. The survey design was also to verify the level of significance of the possible causes of the declining quality of design and contract documentation in the construction industry. The content and format of the questionnaire was based on the outcome of the literature review and previous professional opinions on the subject matter.

The questionnaire was organised into four sections in line with the objectives as follows:

SECTION A: General Information

SECTION B: Impact on Project Performance

SECTION C: Factors Causing of Design and Documentation Deficiency

SECTION D- Preventive Methods

#### **SECTION A: General Information**

In this section, questions regarding the respondents professional background, the kind of organisation he is working, the position in the organisation, the length of experience in the construction industry, the level of education, the number of staff and the type of projects being undertaken .



## SECTION B: Impact on Project Performance

This covers questions relating to the severity of a list of eleven (11) effects on the performance of construction projects due to poor design and documentation quality. The severity of these effects was measured using a nominal scale as shown in the table below:

Scale	Severity
1	No effect
2	Low severe
3	Fairly severe
4	Severe
5	Very severe

## SECTION C: Factors Causing Design and Documentation Deficiency

This section consists of a list of factors obtained from the literature review considered to be causing design and contract documentation deficiencies in the construction industry.

These factors were categorised under the three major headings:

- Factors relating to designer (DF)
- Factors relating to client (CF)
- Factors relating to tendering procedures (TF)

To determine the severity weight and the frequency of occurrence of the factors causing of design and documentation deficiency/error, a five point Likert scale of weighting in the research survey ranges from 1-5 as shown in the table below:

Scale	Severity	Occurrence
1	No effect	Never
2	Low severe	Rarely
3	Fairly severe	Occasionally
4	Severe	Frequently
5	Very severe	Constantly

## SECTION D- Preventive Methods

Presented in the last section are possible preventive methods to reduce the deteriorating quality of design and documentation. Also, a five-point Likert scale ranging from 1-5 was used the measure the relative use and importance respectively as shown below:

Scale	Importance
1	Not important
2	Low important
3	Medium important
4	Important
5	Very important

Contractor's respondents were only required to answer Sections A and C of the questionnaire and the other respondents i.e. Clients and Consultants were required in addition to answering sections B, C, and D.

### 3.5 SAMPLE DESIGN

There is a rare possibility of examining an entire population hence the need to sample which is much smaller than the total population. This may be due to changes in population, cost, time, tracing respondents and obtaining the data. The Sample is structured and sized in a manner that it is statistically representative of the population (Fellows & Liu, 2008).

#### 3.5.1 Population Definition

Respondents' selection was limited to Clients, D1 Contractors and Consultants mostly consisting of Architects and Quantity surveyors located and working in the Northern, Upper West and Upper East Regions of Ghana. Clients approached consisted of entities implementing and managing public construction projects who are familiar with design documentation processes. These were the Works

departments of Tamale Metropolitan, Wa and Bolga Municipal assemblies, the Works and Physical Development offices of Tamale, Wa and Bolga Polytechnics, University for Development studies with campuses in all the three regions (Both Clients and consultants), all in Northern Ghana.

The choice of this class of building contractors was due to the magnitude of projects they undertake which involve large volumes of design and contract documentation that are prone to deficiencies or errors.

The aforementioned Clients for their services approached consultants with their offices located and working in the three Northern Regions.

### **3.5.2 Sampling Techniques Employed**

In identifying the key respondents namely, Clients, Contractors, and Consultants: purposive sampling was adopted for this study. This method is a "... non-probability sampling that is most effective when one needs to study certain cultural domain with knowledgeable experts within" (Tongco, 2007, p.147). This was due to the fact that certain categories of respondents such as Construction industry Professionals (i.e. Architects, Civil/Structural Engineers, Quantity Surveyors etc.) working with Consulting, Construction and Client organizations in these regions who had been engaged in numerous and large construction projects and could encounter deficiencies in design and documentations were required to answer the questionnaires.

The same purposive sampling technique was used in selecting the Clients for the study. This led to the selection of Clients stated above which are seen to be representative of public Clients in the three Northern Regions of Ghana and could give meaningful

responses to the questions asked. This gave a target population of 25 respondents representing the Clients.

The purposive sampling technique was also used in selecting the consultants for the study. A list of Consultants registered and working with the various Clients and their office locations were obtained and sorted out to select the sample for the study. This resulted in the target of 40 respondents.

Snowball sampling technique was adopted in the selection of D1 contractors working on public projects in the region due to the difficulty in accessing data for this category of respondents. In this sampling technique which is a non-probability technique, the researcher identifies some few respondents and after gathering data requested them to identify further sources thereby increasingly building adequate sample (Fellows and Liu, 2008). As a result, some selected Clients and Consultants were consulted who gave names and location of D1 Contractors working on projects in the three regions who were under their jurisdiction as clients or supervision as consultants. Identified respondents (D1 Contractors) were further asked if they were aware of others with similar characteristics within this region. This led to a total of 20 respondents and were targeted for the research.

### **3.5.3 Sample Size**

The population sizes for the three categories of respondents, namely: Consultant, Client and Contractors were 40, 25 and 20 respectively making 85. Due to small nature of the population size, a census was used in order to attain an anticipated precision level.

According to Israel (1992), when a census is used, there is an advantage that information on every individual in the population can be provided. He further stated that sampling errors are eliminated. Hence, questionnaires were distributed to all 85 respondents.



### 3.6 DATA ANALYSIS TOOLS

In order to achieve the aim of this study, the completed questionnaires were analysed using the SPSS (Statistical Package for the Social Science) software and Microsoft Excel. SPSS is one of the most common statistical packages that is used in the manipulation and analysis of complex data with the use of simple coded instructions.

The following statistical techniques were therefore employed for the data analysis:

1. Descriptive statistics: This was used in computing frequencies and percentages of the background information of the respondents such as category, professional background, years of experience etc. also mean and standard deviation would used where there is a tie in the ranking using RII.

2. Relative Importance Index (RII): 
$$= \frac{\sum W}{(A \times N)}$$
 (Fugar and Agyakwah-baah, 2010)

Where: W is the weighting given to each factor by respondents, ranging from 1 to 5, A is the highest weight (5) and N is the number of samples in the study. It was used in analysing the three main objectives of the study as follows:

- Ranking the significant factors in terms of the degree of severity.
  - Ranking factors to determine the frequency of occurrence.
  - Ranking the effects of poor quality design and contract documentation to determine the degree of severity of construction projects performance.
  - Ranking of the possible remedial methods to ascertain the level of importance of each method.
3. Agreement analysis: A non-parametric statistic known as Kendall correlation coefficient was used for evaluating the level of agreement/similarity between the

two sets of rank (Clients and Consultants) to the same set of possible causes of poor quality of design and contract documentation in Northern Ghana. This tool was used to assist the researcher to find out whether there is a trend of agreement among the respondents.

$$W = \left[ \frac{\sum_{i=1}^k (R_i - R)^2}{n(n^2 - 1)/12} \right]$$

$n(n^2 - 1)/12$  is the maximum possible squared deviation i.e. the numerator which will occur if there were perfect agreements among k sets of ranks and the average rankings were 1,2,3...n;

$R_i$ =rank assigned by an individual judge to one factor;

$$0.0 \leq W \leq 1.0$$

K is number of sets of ranking (2); n is a number of factors to be ranked (40);

R is an average of the ranks assigned to the nth factor been ranked.

4. Spearman correlation: this is an inferential statistics method and was used to ascertain whether the differences in ranking of the two groups of respondents on the possible methods of preventing deficiencies in design and contract documentation were statistically significant or not.

## CHAPTER FOUR

### ANALYSIS AND DISCUSSIONS OF SURVEY RESULTS

## **4.1 INTRODUCTION**

This chapter deals with the statistical analysis, discussions, and findings of the data collected from the survey. Through the data collected, the analysis is being discussed in detail linking it to relevant literature pursuant to the aim and objectives of the study.

### **4.1.1 Detailed Structure of Analysis and Discussion**

The analysis is going to follow the format of the questionnaire and would be discussed based on the category of respondents and inferences would be made accordingly.

The analysis and discussions are categorised under the following sections:

1. Respondents background information
2. Impact on project performance
3. Factors causing design and documentation deficiency
4. Preventive methods

### **4.1.2 Survey Results**

Eighty-five (85) questionnaires were sent out to the various respondents comprising 25 clients, 40 Consultants and 20 Contractors. Moreover, out of the 85 respondents for the study, 52 responses were received within a period of two weeks representing a response rate of 61.2%. Clients and Consultants were asked to answer all the sections of the questionnaire whilst Contractors were required to answer sections A and B only. Table

4.1 outlines the details of the various responses.

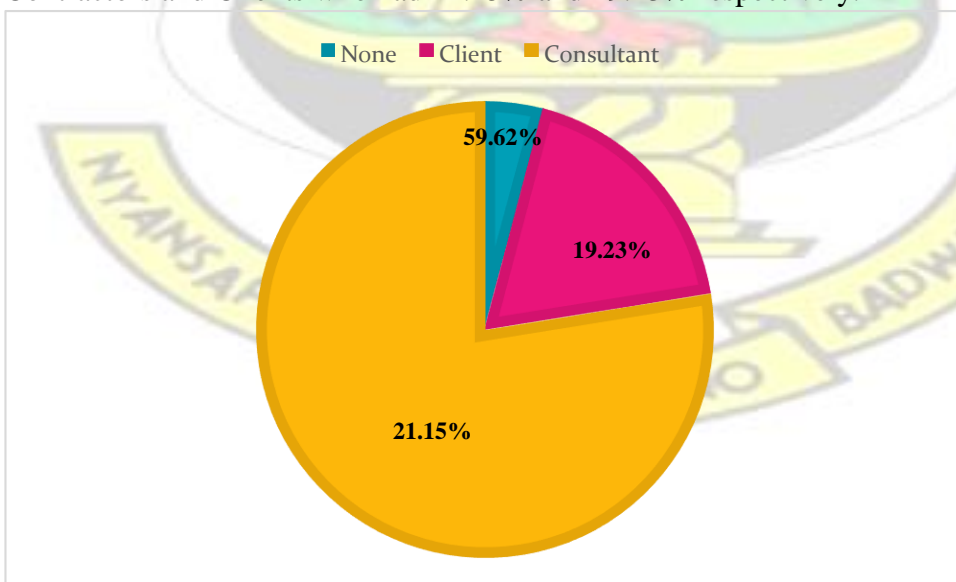
**Table 4.1 Respondents Response Rate**

<b>Respondent Category</b>	<b>Questionnaires Issued</b>	<b>Responses</b>	<b>% of Response</b>
<b>Client</b>	25	10	40
<b>Consultant</b>	40	31	77.5
<b>Contractor</b>	20	11	55
<b>Total</b>	85	52	61.2

## **4.2 RESPONDENTS BACKGROUND INFORMATION**

### **4.2.1 Respondents Category**

Figure 1 illustrates the category of respondents that took part in this survey. Three sets of respondents namely Client, Consultant and Contractor and these are usually the key stakeholders in the construction industry. Generally, a greater number of the responses came from Consultants with a total number of 31 representing 59.62% and followed by Contractors and Clients who had 21.15% and 19.23% respectively.





## Figure 4.1 Respondents Category

### 4.2.2 Class of Contractor

The class of construction firms is very significant in trying to get responses that are tangible enough to give a better appreciation. From table 4.3, it is indicative that a very large number of the respondents were working for D1K1 contractors, which is 81.82% of the 11 respondents in this category. In Ghana's construction industry, contractors classified as D1K1 contractors by the Ministry of Water Resources Works and Housing (MWRWH), are considered first class and as such take on large and complex projects and engage quite a number of construction professionals for the project execution. Due to the nature of the projects handled by these professionals, one can be very sure that the responses given by them would be relevant to the study.

**Table 4.2 Class of Contractor**

<b>Class of Contractor</b>	<b>Frequency</b>	<b>%</b>
<b>D1K1</b>	9	81.82
<b>D2K2</b>	2	18.18
<b>Total</b>	11	100

### 4.2.3 Respondents Professional Background

Table 4.3 shows the various backgrounds of the respondent's profession in the construction industry. 42.3% of the respondents were Quantity surveyors, 21.2% were

Civil/structural engineers and 19.2% were Architects. The remaining 17.3% representing others comprising of Construction Technologist, an Electrical Engineer and Clerk of works. This shows that respondents' profession were evenly spread and thus a balanced form of response were expected since these are the professions usually involved in the design and contract documentation process.

**Table 4.3 Professional Background**

	<b>Frequency</b>	<b>%</b>
<b>Architect</b>	10	19.2
<b>Civil/Structural Engineer</b>	11	21.2
<b>Quantity Surveyor</b>	22	42.3
<b>Other</b>	9	17.3
<b>Total</b>	52	100.0

#### **4.2.4 Highest Educational Qualification of Respondent**

The highest academic qualifications of the respondents as indicated in table 4.4 shows that majority of the respondents had, at least, a first degree in their various professions. Thus, 23% had a first degree, 16% had Master's Degree. Other respondents who were 4 representing 7.7% of the total had 2 of them having Postgraduate Diploma which is above first degree. This is indicative of the fact that there is a likelihood of a better appreciation of the problems usually encountered in design and documentation process in construction projects.

**Table 4.4 Highest Educational Qualification**

	<b>Frequency</b>	<b>%</b>
<b>HND</b>	9	17.3

<b>First Degree</b>	23	44.2
<b>Masters</b>	16	30.8
<b>Other</b>	4	7.7
<b>Total</b>	52	100.0

#### 4.2.5 Type of Projects Executed by Respondents

Table 4.5 shows the responses of the various respondents on the kind of projects they execute. It indicates that half (50%) of the total responses were engaged in both public and private projects, 46.2% in public projects and 3.8% engaged in only private. One can thus confidently infer that a vast majority of the respondents were engaged in public projects, which is predominant in Ghana.

**Table 4.5 Type of Projects Executed by Respondents**

	<b>Frequency</b>	<b>%</b>
<b>Public</b>	24	46.2
<b>Private</b>	2	3.8
<b>Both</b>	26	50.0
<b>Total</b>	52	100.0

#### 4.2.6 Respondents Experience in the Construction Industry

It can be deduced from table 4.6 that, almost 79% of the total respondents have been working in the construction industry for more than five (5) years out of which 51.9% fell between 6-10 years, 15.4% (11-15 years) whilst 6 respondents (11.5%) had more than 15 years. This, therefore, means that majority of the respondents had a considerable rich

background about construction projects coupled with their knowledge will lead to a better appreciation of the problems with design and contract documentation.

**Table 4.6 Experience in the Construction Industry**

	<b>Frequency</b>	<b>%</b>
<b>0-5 years</b>	11	21.2
<b>6-10 years</b>	27	51.9
<b>11-15</b>	8	15.4
<b>above 15 years</b>	6	11.5
<b>Total</b>	52	100.0

#### **4.2.7 Error/Deficiency in Design and Contract Documentation**

As shown in table 4.2, a very large number (96.15%) of the respondents alluded they had encountered a problem regarding design and documentation deficiency or error in construction projects at one point or another in their professional career with only 3.85% of them on the contrary. There is, therefore, a clear indication that, there indeed exist deficiencies in our construction projects designs and documentation hence a critical issue that requires attention.

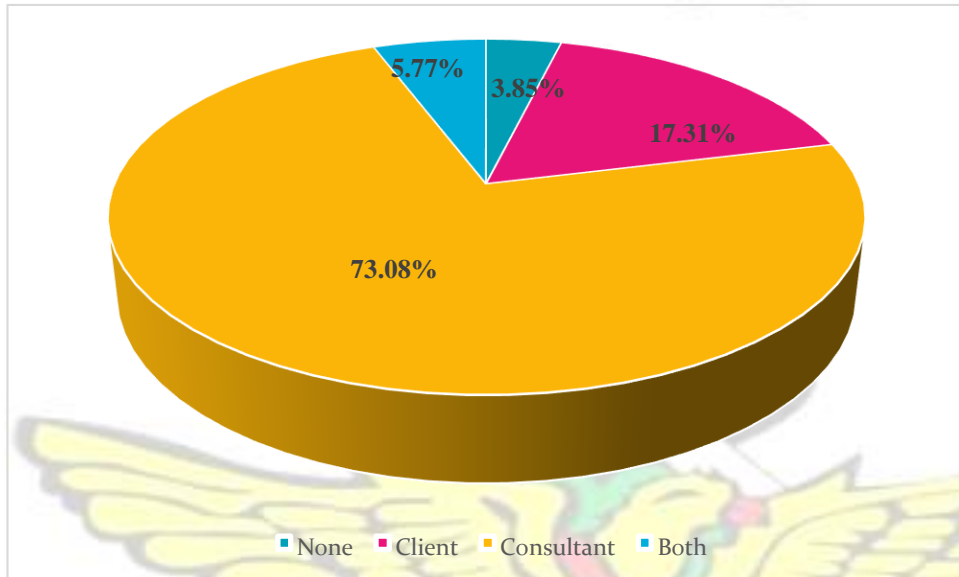
**Table 4.7 Respondents Acknowledgement of Deficiency in Design and Contract Documentation**

	<b>Frequency</b>	<b>%</b>
<b>Yes</b>	50	96.2
<b>No</b>	2	3.8
<b>Total</b>	52	100



#### 4.2.8 Responsibility for Design and Documentation Deficiency

Figure 4.2 illustrates that 73.08% have Consultants to blame for deficiencies/errors in design and contract documents, 17.31% believe Clients are to blame for the problem, 5.77% say both Clients and Consultants were responsible and 3.85% who not encountered design and documentation deficiencies before had none to blame.



**Figure 4.2 Responsibility for Design and Documentation Deficiency**

#### 4.3 IMPACT/EFFECTS ON PROJECT PERFORMANCE DUE TO DESIGN AND DOCUMENTATION DEFICIENCY

Table 4.8 shows the Relative Importance Indices (RII) and the rankings of the severity level the various effects of design and documentation deficiency on the performance of construction projects in Northern Ghana by the various respondents. These are discussed according to their rankings as follows.

**Table 4.8 RII and Ranks of the severity of the effects of Design and Documentation Deficiency on Project performance.**

Effects		Severity Level Of Effect On Performance							
		Client		Consultant		Contractor		Overall Response	
		RII %	RANK	RII %	RANK	RII %	RANK	RII %	RANK
1.	Projects abandonment	90	1	87.10	1	96.36	1	89.62	1
2.	Delays (Time overrun)	88	2	86.45	2	90.91	3	87.69	2
3.	Cost overrun	84	4	84.52	3	92.73	2	86.15	3
4.	Payment claims	86	3	83.23	4	87.27	4	84.62	4
5.	Variation/Change orders	82	5	76.13	6	85.45	5	79.23	5
6.	Suspension of works	76	7	79.35	5	78.18	9	78.46	6
7.	Client/owner dissatisfaction	72	9	72.26	7	81.82	7	74.23	7
8.	Disputes (Conflicts) among parties	80	6	68.39	9	80.00	8	73.08	8
9.	Rework	66	10	70.97	8	83.64	6	72.69	9
10.	Arbitration/Litigation	74	8	66.45	11	74.55	11	69.62	10
11.	Loss of confidence in consultants	64	11	67.74	10	76.36	10	68.85	11

## COMMENTS/ DISCUSSIONS

The following are comments and discussions on the impact of design and contract documentation deficiency on the performance of construction projects.

### **Projects abandonment**

According to table 4.8, there is an agreement between all the respondents, that projects abandonment had much impact on the performance of construction projects in Northern Ghana which was ranked 1<sup>st</sup> by all with an overall RII of 89.62%. This means that projects are usually abandoned and are brought to a halt and there are cost and time implications.

### **Delays (Time overrun)**

Delays (Time overrun) as an effect of defective design and documentation was considered to have a much severe impact on the performance of construction projects as it was ranked 2<sup>nd</sup> by both Client and Consultants with RIIs of 88% and 86.45% respectively. It was ranked in the 3<sup>rd</sup> position by Contractors respondents with a RII of 90.91% but overall it was ranked 2<sup>nd</sup> with a RII of 87.69. This is considered to have negatively influenced the time performance of public projects in Northern Ghana and this usually will trigger cost increases on projects.

Both the 1<sup>st</sup> and 2<sup>nd</sup> overall ranking agree with the work of Dosumu & Adenuga, (2013) in Nigerian construction documents.

### **Cost overrun**

This was considered 3<sup>rd</sup> by all respondent to have affected the performance of projects with a RII of 86.15%. It was ranked 4<sup>th</sup>, 3<sup>rd</sup> and 2<sup>nd</sup> by the Clients, Consultants, and

Contractors with RIIs of 84%, 84.52%, and 92.73% percent respectively. This has a considerable effect on the contract sum of the project, which negatively affects the final project cost, which probably might not be budgeted.

### **Payment claims**

The overall 4<sup>th</sup> ranked severe effect was payment claims with a RII of 84.62%. It was placed 3<sup>rd</sup> by the Clients and 4<sup>th</sup> by both the Consultants and the Contractors. Contractors usually bring claims forth for payment for work done due to defective design and documentation and this would usually affect the final cost of the project and consequently affect the performance of projects.

### **Variation/Change orders**

“Variation/Change orders” was one of the effects of design and documentation deficiency, which was considered to have a severe impact on the performance of construction projects. It was the 5<sup>th</sup> ranked among the eleven identified effects by all the respondent groups with a RII of 79.2% illustrated in table 4.7 above. Individually, both Consultants and Contractors were in agreement who both ranked it 5<sup>th</sup> and was ranked 3<sup>rd</sup> by the Clients with RIIs as follows 76.13%, 85.45%, and 82% respectively. Due to poor design and contract documentation, changes or corrections are done during construction and this might influence negatively on the performance of both time and cost of the project.

The rest of the effects of poor design and contract documentation based on the level of severity on the performance of construction projects were ranked overall by the respondents as follows. Suspension of works (6<sup>th</sup>), Client/owner dissatisfaction (7<sup>th</sup>),



Disputes (Conflicts) among parties (8th), Rework (9th), 10th for Arbitration/Litigation and finally Loss of confidence in consultants as 11th. It can be deduced generally that respondents do not believe the loss of confidence in Consultants has a severe impact on the performance of construction projects

#### **4.4 FACTORS CAUSING DESIGN AND CONTRACT DOCUMENTATION DEFICIENCY**

In all, forty-(40) factors considered being causing design and contract documentation deficiency were identified through the review of relevant literature and used for the questionnaire. Toward the attainment of the main objectives, the level of severity and the frequency of occurrence of these factors were sought from the various respondents. Analysis and discussions will focus the overall rankings of the respondents and that of the individual respondent groups (Clients and Consultant) will be compared. However, where there is a tie in ranking of the factors according to their Relative Importance Indices (RII), their Means or Standard Deviations are considered.

Table 4.9 shows a summary of the overall rankings of the factors with respect to severity and occurrence considered Causing Design and Contract Documentation Deficiency by all respondents.

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**Table 4.9 RII and Ranks of Factors Causing Design and Contract Documentation Deficiency by all respondents**

Factors		Overall Response								
		Category	Severity				Occurrence			
			RII %	Mean	Standard deviation	RANK	RII %	Mean	Standard deviation	RANK
1	Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)	CF	79.51	3.98	1.332	1	79.51	3.976	1.475	2
2	Unwillingness to pay fees commensurate with the design of high-quality services	DF	79.02	3.95	0.947	2	74.63	3.732	0.895	3
3	Last minute changes by the client	DF	78.54	3.93	0.932	3	69.27	3.463	0.951	5
4	Insufficient design reviews with relevant parties	CF	78.54	3.93	1.081	4	67.80	3.390	1.046	6
5	Inadequate client's communication /relationship with design team members	CF	76.10	3.80	1.167	5	65.37	3.268	1.119	13
6	Slow payments' system for design services	DF	75.61	3.78	1.129	6	72.20	3.610	0.945	4
7	Inadequate design coordination between design disciplines	DF	75.61	3.78	1.215	7	64.39	3.220	1.061	19
8	Insufficient and missing input information from the client	DF	75.12	3.76	0.916	8	65.85	3.293	0.929	8
9	Change in project requirements by stakeholders at later stages	DF	75.12	3.76	1.135	9	62.93	3.146	0.937	22

10	Erroneous and conflicting information from the client	DF	74.15	3.71	1.123	10	62.93	3.146	0.937	22
11	Lack of time for design reviews	CF	74.15	3.71	1.146	11	63.90	3.195	0.901	20
12	Unstable client's requirements	DF	73.66	3.68	1.128	12	65.85	3.293	1.078	9
13	Allocation of staff to more than one project at the same time	DF	73.66	3.68	1.404	13	65.85	3.293	1.209	11
14	Inaccurate time estimates or tight design schedule	DF	72.68	3.63	0.968	14	64.88	3.244	0.943	15
15	Poor workload planning	DF	72.68	3.63	1.067	15	65.37	3.268	1.025	12
16	Defensive approach to variations and claims for additional cost or time	CF	71.71	3.59	1.024	16	61.95	3.098	0.889	24
17	Copying and modifying from previous work to minimize time and cost	DF	70.24	3.51	1.434	17	64.39	3.220	0.962	17
18	Lack of time available for checking and correlating all the information on all design documents	DF	69.76	3.49	1.121	18	64.88	3.244	0.767	14
19	Lack of client reviewers for each project	D F	69.7 6	3.4 9	1.14 3	19	66.8 3	3.34 2	1.01 5	7
20	Selection of designers on the basis of reputation instead of efficiency	D F	69.2 7	3.4 6	1.05 1	20	86.8 3	4.34 2	7.54 2	1
21	Long waiting for the client decision	CF	69.2 7	3.4 6	1.07 5	21	64.3 9	3.22 0	1.06 1	19
22	Tight tender times	TF	68.7 8	3.4 4	1.24 6	22	63.4 1	3.17 1	1.04 6	21



2	Absence of an experienced overall design manager	D	68.2	3.4	1.53	23	57.0	2.85	1.27	29
3		F	9	1	3		7	4	6	

2	Lack of data integration across design disciplines	D	67.8	3.3	1.20	24	62.4	3.12	1.02	23
4		F	0	9	2		4	2	9	
2	Leaving design issues to be sorted out in the construction process	D	67.3	3.3	1.17	25	61.4	3.07	0.84	25
5		F	2	7	8		6	3	8	
2	Increase in current work load of the designer	D	67.3	3.3	1.44	26	62.4	3.12	1.02	23
6		F	2	7	5		4	2	9	
2	Lack of time available for continuous and effective communication between parties	D	66.8	3.3	1.08	27	57.0	2.85	0.93	28
7		F	3	4	7		7	4	7	
2	Reluctance by tenderers to ask questions that might reveal competitive edge	TF	66.3	3.3	1.19	28	64.8	3.24	1.15	16
8			4	2	2		8	4	7	
2	Ineffective/inadequate use of new technology	D	66.3	3.3	1.21	29	65.8	3.29	1.18	10
9		F	4	2	3		5	3	8	
3	Lack of funds for staff on the job training	D	65.8	3.2	1.10	30	64.3	3.22	1.01	18
0		F	5	9	1		9	0	3	
3	Absence of high cost experienced design team to projects	D	65.8	3.2	1.18	31	56.5	2.82	0.97	31
1		F	5	9	8		9	9	2	
3	Lack of qualified consultant's staff	D	64.8	3.2	1.41	32	51.7	2.58	0.94	34
2		F	8	4	0		1	5	8	
3	Reduced design fees levels	D	61.4	3.0	1.33	33	59.0	2.95	1.02	26
3		F	6	7	0		2	1	4	

34	Increase in the overall complexity of projects	D F	60.9 8	3.0 5	1.09 4	34	56.5 9	2.82 9	0.94 6	30
35	Multiple "notices to tenderers" and question/answer steps and short time for amendment	TF	60.0 0	3.0 0	0.89 4	35	52.2 0	2.61	0.86	33
36	Number of staff in each specialization (Architect, Structural Engineer etc.)	D F	59.5 1	2.9 8	1.21 4	36	58.5 4	2.92 7	1.17 0	27
37	Lack of experience on similar projects	D F	59.0 2	2.9 5	1.11 7	37	51.7 1	2.58 5	0.97 4	35
38	Designer's unfamiliarity with construction materials and techniques that will be used in the project	D F	58.0 5	2.9 0	1.24 1	38	46.3 4	2.31 7	0.85 0	37
	Increased statutory regulations, approvals and requirements	D F	57.5 6	2.8 8	1.10 0	39	52.6 8	2.63	0.97	32
	Increase design staff members rather than increasing the number of hours of work to overcome the problem of limited time	D F	53.6 6	2.6 8	1.17 1	40	49.2 7	2.46 3	0.89 7	36

Furthermore, table 4.10a shows a summary of the rankings of the factors causing design and contract documentation deficiency concerning their severity and occurrence by the Clients group.

**Table 4.10a RII and Ranks of Factors Causing Design and Contract Documentation Deficiency by Clients**

Factors		Clients							
		Severity				Occurrence			
		RII %	Mean	Standard deviation	RANK	RII %	Mean	Standard deviation	RANK
1.	Lack of time for design reviews	84	4.20	0.789	5	76	3.80	0.632	4
2.	Leaving design issues to be sorted out in the construction process	76	3.80	0.919	15	68	3.40	0.843	18
3.	Lack of qualified consultant's staff	64	3.20	1.033	29	56	2.80	0.789	32
4.	Erroneous and conflicting information from the client	80	4.00	1.054	9	70	3.50	1.080	14
5.	Lack of time available for checking and correlating all the information on all design documents	78	3.90	0.738	12	80	4.00	0.471	2
6.	Insufficient and missing input information from the client	66	3.30	1.059	27	64	3.20	0.919	21
7.	Increased statutory regulations, approvals and requirements	50	2.50	0.972	39	50	2.50	1.080	38
8.	Copying and modifying from previous work to minimize time and cost	74	3.70	1.337	19	68	3.40	0.699	17
9.	Ineffective/inadequate use of new technology	80	4.00	1.155	10	80	4.00	0.943	3
10.	Increase in the overall complexity of projects	68	3.40	0.966	23	60	3.00	0.667	25
11.	Slow payments' system for design services	72	3.60	1.075	20	72	3.6	0.97	10

12.	Lack of experience on similar projects	68	3.40	1.265	24	62	3.10	0.994	24
13.	Designer's unfamiliarity with construction materials and	62	3.10	1.524	32	50	2.50	0.850	36

	techniques that will be used in the project								
14.	Number of staff in each specialization (Architect, Structural Engineer etc.)	64	3.20	1.229	30	60	3.00	1.054	26
15.	Increase in current work load of the designer	66	3.30	1.494	28	58	2.90	0.876	28
16.	Insufficient design reviews with relevant parties	80	4.10	1.287	11	74	3.70	1.160	9
17.	Change in project requirements by stakeholders at later stages	90	4.50	0.527	2	70	3.50	0.850	12
18.	Lack of client reviewers for each project	78	3.90	1.287	13	70	3.50	1.269	15
19.	Lack of data integration across design disciplines	74	3.70	0.823	17	74	3.70	0.675	7
20.	Inadequate design coordination between design disciplines	76	3.80	1.135	16	70	3.50	0.972	13
21.	Reduced design fees levels	48	2.40	1.430	40	48	2.40	1.075	40
22.	Inaccurate time estimates or tight design schedule	70	3.50	1.179	22	62	3.10	1.197	23
23.	Poor workload planning	86	4.30	0.483	4	76	3.80	0.789	5
24.	Lack of funds for staff on the job training	60	3.00	1.054	33	64	3.20	1.033	22
25.	Absence of high cost experienced design team to projects	58	2.90	1.101	35	58	2.90	1.197	30
26.	Lack of time available for continuous and effective communication between parties	66	3.30	0.949	26	58	2.90	0.994	29



27.	Allocation of staff to more than one project at the same time	68	3.40	1.776	25	70	3.50	1.650	16
28.	Absence of an experienced overall design manager	78	3.90	1.663	14	68	3.40	1.647	19
29.	Increase design staff members rather than increasing the number of hours of work to overcome the problem of limited time	56	2.80	1.317	37	48	2.40	0.966	39
30.	Selection of designers on the basis of reputation instead of efficiency	80	4.00	0.667	8	74	3.70	0.949	8
31.	Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)	92	4.60	0.966	1	96	4.80	2.300	1
32.	Last minute changes by the client	88	4.40	0.516	3	72	3.60	1.075	11
33.	Defensive approach to variations and claims for additional cost or time	82	4.10	0.994	7	52	2.60	0.516	35
34.	Unstable client's requirements	62	3.10	1.370	31	56	2.80	1.135	33
35.	Unwillingness to pay fees commensurate with the design of high-quality services	82	4.10	0.738	6	76	3.80	1.033	6
36.	Long waiting for the client decision	72	3.60	1.174	21	60	3.00	1.333	27
37.	Inadequate client's communication /relationship with design team members	74	3.70	1.160	18	66	3.30	1.252	20
38.	Reluctance by tenderers to ask questions that might reveal competitive edge	54	2.70	1.337	38	54	2.70	0.675	34
39.	Tight tender times	60	3.00	1.414	34	58	2.9	1.29	31

40.	Multiple "notices to tenderers" and question/answer steps and short time for amendment	56	2.80	1.033	36	50	2.50	0.972	37
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Table 4.10b shows a summary of the rankings of the factors causing design and contract documentation deficiency concerning their severity and occurrence by the Consultants group.

**Table 4.10b RII and Ranks of Factors Causing Design and Contract Documentation Deficiency by Consultants**

Factors		Consultants							
		Severity				Occurrence			
		RII %	Mean	Standard deviation	RANK	RII %	Mean	Standard deviation	RANK
1.	Lack of time for design reviews	70.97	3.55	1.207	14	60.00	3.00	0.894	27
2.	Leaving design issues to be sorted out in the construction process	64.52	3.23	1.230	32	59.35	2.97	0.836	28
3.	Lack of qualified consultant's staff	65.16	3.26	1.527	31	50.32	2.52	0.996	37
4.	Erroneous and conflicting information from the client	72.26	3.61	1.145	12	60.65	3.03	0.875	24
5.	Lack of time available for checking and correlating all the	67.10	3.35	1.199	26	60.00	3.00	0.683	26

	information on all design documents								
6.	Insufficient and missing input information from the client	78.06	3.90	0.831	1	66.45	3.32	0.945	8
7.	Increased statutory regulations, approvals and requirements	60.00	3.00	1.125	35	53.55	2.68	0.945	34
8.	Copying and modifying from previous work to minimize time and cost	69.03	3.45	1.480	17	63.23	3.16	1.036	19

9.	Ineffective/inadequate use of new technology	61.94	3.10	1.165	33	61.29	3.06	1.181	23
10.	Increase in the overall complexity of projects	58.71	2.94	1.124	36	55.48	2.77	1.023	33
11.	Slow payments' system for design services	76.77	3.84	1.157	5	72.26	3.61	0.955	4
12.	Lack of experience on similar projects	56.13	2.81	1.046	39	48.39	2.42	0.923	39
13.	Designer's unfamiliarity with construction materials and techniques that will be used in the project	56.77	2.84	1.157	38	45.16	2.26	0.855	40
14.	Number of staff in each specialization (Architect, Structural Engineer etc.)	58.06	2.90	1.221	37	58.06	2.90	1.221	30
15.	Increase in current work load of the designer	67.74	3.39	1.453	23	63.87	3.19	1.078	18
16.	Insufficient design reviews with relevant parties	77.42	3.87	1.024	4	65.81	3.29	1.006	12
17.	Change in project requirements by stakeholders at later stages	70.32	3.52	1.180	16	60.65	3.03	0.948	25

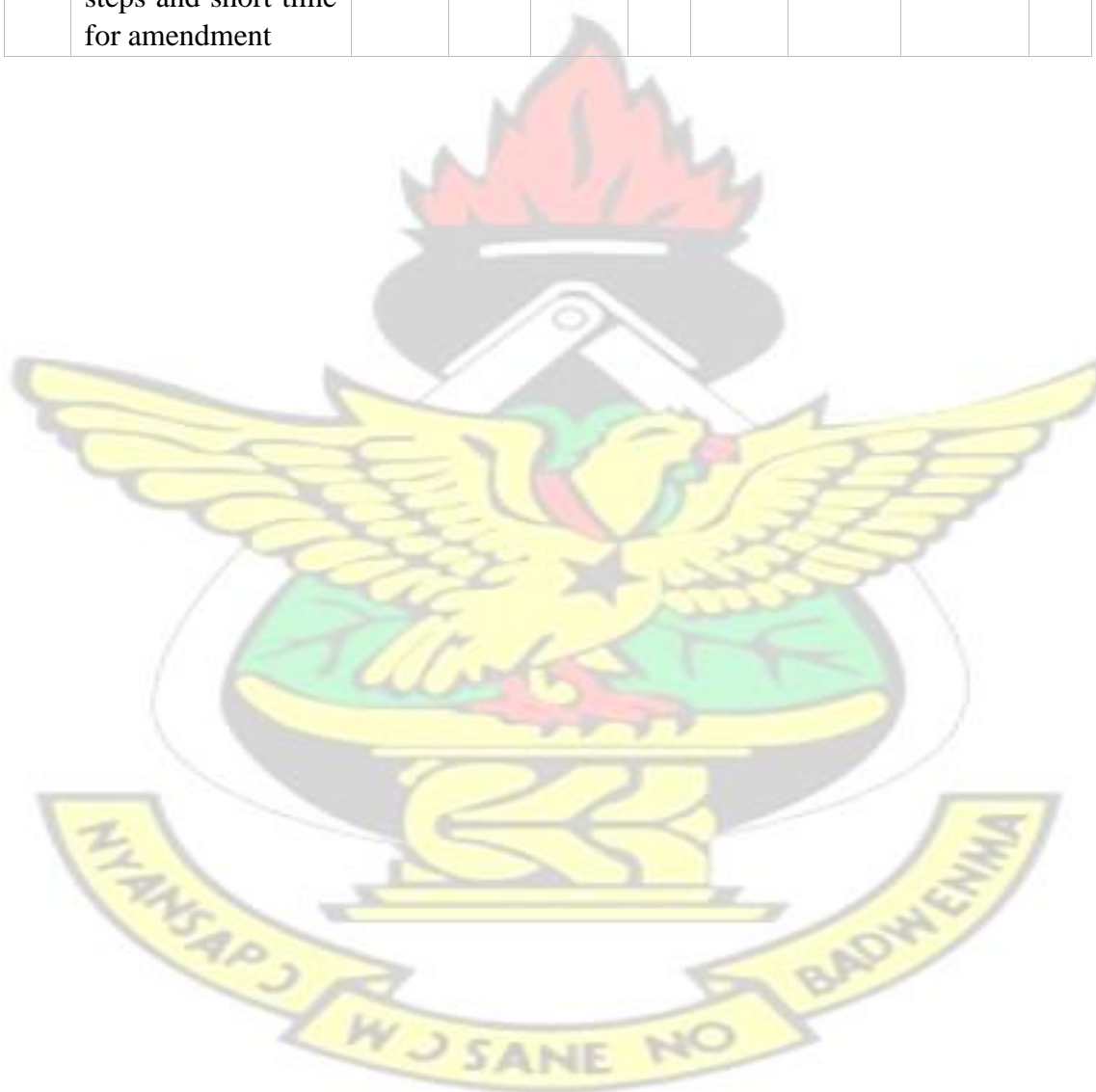
<b>18.</b>	Lack of client reviewers for each project	67.10	3.35	1.082	24	65.81	3.29	0.938	10
<b>19.</b>	Lack of data integration across design disciplines	65.81	3.29	1.296	29	58.71	2.94	1.063	29
<b>20.</b>	Inadequate design coordination between design disciplines	75.48	3.77	1.257	8	62.58	3.13	1.088	21
<b>21.</b>	Reduced design fees levels	65.81	3.29	1.24	27	62.58	3.13	0.957	20
<b>22.</b>	Inaccurate time estimates or tight design schedule	73.55	3.68	0.909	11	65.81	3.29	0.864	9
<b>23.</b>	Poor workload planning	68.39	3.42	1.119	20	61.94	3.10	1.044	22

<b>24.</b>	Lack of funds for staff on the job training	67.74	3.39	1.116	22	64.52	3.23	1.023	16
<b>25.</b>	Absence of high cost experienced design team to projects	68.39	3.42	1.205	21	56.13	2.81	0.910	32
<b>26.</b>	Lack of time available for continuous and effective communication between parties	67.10	3.35	1.142	25	56.77	2.84	0.934	31
<b>27.</b>	Allocation of staff to more than one project at the same time	75.48	3.77	1.283	9	64.52	3.23	1.055	17
<b>28.</b>	Absence of an experienced overall design manager	65.16	3.26	1.483	30	53.55	2.68	1.107	35



29.	Increase design staff members rather than increasing the number of hours of work to overcome the problem of limited time	52.90	2.65	1.142	40	49.68	2.48	0.890	38
30.	Selection of designers on the basis of reputation instead of efficiency	65.81	3.29	1.101	27	90.97	4.55	8.683	1
31.	Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)	75.48	3.77	1.383	10	74.19	3.71	1.006	3
32.	Last minute changes by the client	75.48	3.77	0.990	7	68.39	3.42	0.923	6
33.	Defensive approach to variations and claims for additional cost or time	68.39	3.42	0.992	18	65.16	3.26	0.930	14
34.	Unstable client's requirements	77.42	3.87	0.991	3	69.03	3.45	1.028	5
35.	Unwillingness to pay fees commensurate with the design of highquality services	78.06	3.90	1.012	2	74.19	3.71	0.864	2
36.	Long waiting for the client decision	68.39	3.42	1.057	19	65.81	3.29	0.973	11
37.	Inadequate client's communication /relationship with design team members	76.77	3.84	1.186	6	65.16	3.26	1.094	15

<b>38.</b>	Reluctance by tenderers to ask questions that might reveal competitive edge	70.32	3.52	1.092	15	68.39	3.4194	1.23218	7
<b>39.</b>	Tight tender times	71.61	3.58	1.177	13	65.16	3.26	0.965	13
<b>40.</b>	Multiple "notices to tenderers" and question/answer steps and short time for amendment	61.29	3.06	0.854	34	52.90	2.65	0.839	36



#### 4.4.1 MOST SEVERE FACTORS

The top ten (10) most severe factors causing design and contract documentation in Northern Ghana were identified from tables 4.9 and 4.10a through the agreed rankings of all respondents as shown in table 4.11

**Table 4.11 RII and Ranks of the Most Severe Factors Agreed by Clients and Consultants.**

Most severe Factors		Category	Severity								
			Clients				Consultants			Overall Response	
			RII %	deviation	Standard	RANK	RII %	deviation	Standard	RANK	RII %
1.	Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)	CF	92	0.966	1	75.48	1.383	10	79.51	1.332	1
2.	Unwillingness to pay fees commensurate with the design of high-quality services	DF	82	0.738	6	78.06	1.012	2	79.02	0.947	2
3.	Last minute changes by the client	DF	88	0.516	3	75.48	0.990	7	78.54	0.932	3
4.	Insufficient design reviews with relevant parties	CF	80	1.287	11	77.42	1.024	4	78.54	1.081	4
5.	Inadequate client's communication /relationship with design team members	CF	74	1.160	18	76.77	1.186	6	76.10	1.167	5
6.	Slow payments' system for design services	DF	72	1.075	20	76.77	1.157	5	75.61	1.129	6
7.	Inadequate design coordination	DF	76	1.135	16	75.48	1.257	8	75.61	1.215	7

	between design disciplines										
8.	Insufficient and missing input information from the client	DF	66	1.059	27	78.06	0.831	1	75.12	0.916	8
9.	Change in project requirements by stakeholders at later stages	DF	90	0.527	2	70.32	1.180	16	75.12	1.135	9
10.	Erroneous and conflicting information from the client	DF	80	1.054	9	72.26	1.145	12	74.15	1.123	10

## COMMENTS/ DISCUSSION

The most severe factors as outlined in table 4.11 are discussed and compared according to the various rankings as follows:

### **Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)**

The “Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)” is ranked first overall, Clients and Consultants groups rated it 1st and 10<sup>th</sup> respectively with RIIs of 92% and 75.48%. This is a clear reflection that the selection process for designers is not appropriate which is often driven by price rather than competence required for a successful outcome. It means that the lowest bid strategy in the selection of Consultants can be very detrimental the delivery quality of design and contract documentation in the sense that it might lead to the selection of incompetent Consultants. This is supported by the study of Zidan (2013) and Queensland (2005).



### **Unwillingness to pay fees commensurate with the design of high-quality services**

The Unwillingness of Clients to pay fees to correspond with the design of high-quality services was ranked 2nd among the top 10 most severe factors affecting design and contract documentation quality in Northern Ghana by all the respondents with a RII of 79.02%. In the group's responses, Clients placed it in the 6<sup>th</sup> position with a RII of 82% whilst Consultants on the other hand with a RII of 78.06% placed it 2<sup>nd</sup>. This means that Consultants feel the fees they receive from Clients are not good enough to motivate their staff to put out their best performance to prevent deficiencies in design and contract documentation. This is in line with Slater and Radford (2012) who stated reduced consultancy fees was among the top six factors causing inadequate architectural documentation. The studies of Love *et al.* (2012) and Flentje *et al.* (2012) also affirms this claim.

### **Last minute changes by the client**

The last minute changes usually brought by the client which is a Client related factor was ranked third by the Clients with a RII of 88% whilst the Consultants at a RII 75.48% was placed in the 7<sup>th</sup> position. The overall ranking was done at a RII of 78.54% (Std. Dev. 0.932) making it the third most severe factor affecting the quality of design and quality documentation of construction projects in Northern Ghana. This an indication that Clients are fully aware of the consequence of late changes they cause in the documentation process.

### **Insufficient design reviews with relevant parties**

Rated 4<sup>th</sup> on the most severe factors was “Insufficient design reviews with relevant parties” with an overall RII of 78.54% (Std. Dev. 1.081). Clients ranked it 11<sup>th</sup> with a RII of 80% which is lower (less severe) than that of the Consultants who placed it 4<sup>th</sup> with a RII of 77.42%. This is consistent with Dosumu and Iyagba (2013) who in a survey arrived at “Lack of reviews in design,

constructability and value engineering” as among the significant factors causing errors in contract documents. Therefore, design reviews should be of great concern to both Clients and Consultants if the desired quality is to be achieved.

### **Inadequate client's communication /relationship with design team members**

“Inadequate client's communication /relationship with design team members” was ranked fifth by all response to be among the most severe factors causing deficiencies in design and Contract documentation with a RII of 76.10%. It is ranked by Clients in the 18<sup>th</sup> place with a RII of 74% and is considered more severe by the Consultants at a rank of 6<sup>th</sup> with a RII of 76.77 as compared to that of the Clients. It is clear that Consultants are the more affected by the ineffective nature of the channel of communication from the Clients end. When communication is effective, there is coordination and as such, deficiencies that would have resulted due to this factor are preventable.

### **Slow payments system for design services**

This is considered the sixth most severe factor causing design and documentation deficiencies with a RII of 75.61%. Consultants ranked “Slow payments system for design services” 5<sup>th</sup> with a RII of 76.77% and it was ranked 20<sup>th</sup> by the Clients at a RII of 72%. It means that Consultants consider it more severe because they are usually affected and this is due to the bureaucratic nature of Ghana’s public service. When payment for services do not come as expected there is the likelihood of delay in the payment of salaries. Thus, the moral and motivation of the designers will go down and as such may not deliver to their full potential resulting in deficiencies in design.

### **Inadequate design coordination between design disciplines**

“Inadequate design coordination between design disciplines” have been considered to be the 7<sup>th</sup> most severe factors among the top 10 most severe factors affecting design and contract documentation in Northern Ghana with a RII of 75.61%. “Inadequate design coordination between design disciplines” was ranked 16<sup>th</sup> by the Clients with a RII of 76% whilst Consultants on the hand rated it 8<sup>th</sup> with a RII of 75.48%. It is an indication that Consultants are aware of the fact that the various disciplines of the Consultants team are not properly coordinated hence the consequence.

### **Insufficient and missing input information from the client**

“Insufficient and missing input information from the Client” has been placed overall as the 8<sup>th</sup> most severe factor to be contributing to the poor quality of design documentation in construction projects in Northern Ghana with a RII of 75.12%. The Clients considered it less severe by placing it 27<sup>th</sup> with a RII of 66%. However, Consultants, on the other hand, considered it to very severe by placing it 1<sup>st</sup> with RII of 78.06%. What it means is that input information or briefs provided by the Clients to the Consultants are woefully inadequate for them to work with and they are fully aware of the consequences thereof. This is in line with a Queensland (2005) report.

### **Change in project requirements by stakeholders at later stages**

The “Change in project requirements by stakeholders at later stages” was the 9<sup>th</sup> placed most severe factor with a RII of 75.12%. Clients have considered it to be very severe and have ranked it 2<sup>nd</sup> with a RII of 90% whilst Consultants, on the other hand, placed it 16<sup>th</sup> with a RII of 70.32. In this

instance, Clients are well aware of the consequences of not planning requirements at the early stages of the project.

#### **Erroneous and conflicting information from the client**

This factor is ranked as the 10<sup>th</sup> most severe factor among the top ten severe factors causing design and documentation deficiency in the construction industry in Northern Ghana with a RII of 74.15%.

The Clients and the Consultants respectively ranked it 9th and 12th with RIIs of 80% and 74.15%. this means that the Clients have alluded that the information they provide to Consultants are usually ambiguous and not clear enough to enable the deliver very good design and documentation.

#### **4.2.2 MOST FREQUENT FACTORS**

The following are factors identified as the top most agreed frequently occurring ones by the Clients and Consultants in order of ranking as derived from table 4.10:

Selection of designers on the basis of reputation instead of efficiency, Selection of designers on the basis of lowest price selection strategy (Lowest bid approach), Unwillingness to pay fees to commensurate with the design of high-quality services, and slow payments system for design services and Last minute changes by the client. The details of their rankings are as illustrated in table 4.12.

#### **COMMENTS/ DISCUSSION**

##### **Selection of designers on the basis of reputation instead of efficiency**

From table 4.10, the “Selection of designers on the basis of reputation instead of efficiency” was considered the most occurring factor that contributes to the poor quality of design documentation,



which is ranked 1<sup>st</sup> overall with RII of 86.83%. In the view of the Consultants, was also considered the most occurring factor by placing it 1<sup>st</sup> (RII 90.97%) whilst Clients, on the other hand, placed it 8<sup>th</sup> (RII 74). In view of this, it can be deduced generally that designers are selected not based on competency for public projects.

### **Selection of designers on the basis of lowest price selection strategy**

“Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)” with an overall RII of 79.51% and positioned 2<sup>nd</sup> among the most occurring factors that affect the quality of design and contract documentation. Clients on their part placed it the 1st most occurring factor with a RII of 96% and Clients placed 3<sup>rd</sup> with a RII of 74.19%, which shows a close agreement between the parties. The selection strategy of Consultants, therefore, should be of great concern to all. This is confirmed in literature Tilley *et al.* (2002) and Love *et al.* (2011).



**Table 4.12 RII and Ranks of the most Frequent Factors agreed by Clients and Consultants.**

Most Frequent Factors		Category	Occurrence								
			Clients			Consultants			Overall Response		
			Deviation RII %	Standard	RANK	RII %	Standard Deviation	RANK	RII %	Standard Deviation	RANK
1.	Selection of designers on the basis of reputation instead of efficiency	DF	74	0.949	8	90.97	8.683	1	86.83	7.542	1
2.	Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)	DF	96	2.300	1	74.19	1.006	3	79.51	1.475	2
3.	Unwillingness to pay fees commensurate with the design of high-quality services	CF	76	1.033	6	74.19	0.864	2	74.63	0.895	3
4.	Slow payments' system for design services	DF	72	0.966	10	72.26	0.955	4	72.20	0.945	4
5.	Last minute changes by the client	CF	72	1.075	11	68.39	0.923	6	69.27	0.951	5
6.	Insufficient design reviews with relevant parties	DF	74	1.160	9	65.81	1.006	12	67.80	1.046	6
7.	Lack of client reviewers for each project	CF	70	1.269	15	65.81	0.938	10	66.83	1.015	7
8.	Insufficient and missing input information from the client	DF	64	0.919	21	66.45	0.945	8	65.85	0.929	8
9.	Unstable client's requirements	TF	56	1.135	33	69.03	1.028	5	65.85	1.078	9
10.	Ineffective/inadequate use of new technology	DF	80	0.943	3	61.29	1.181	23	65.85	1.188	10

### **Unwillingness to pay fees commensurate with the design of high-quality services**

“Unwillingness to pay fees to commensurate with the design of high-quality services” has been rated as the 3<sup>rd</sup> most occurring factor causing design and contract documentation in Northern Ghana with a RII of 74.63% been the overall response. Clients and Consultants placed it 6<sup>th</sup> and 2<sup>nd</sup> with RIIs of 76% and 74.19% respectively. Consultants considered the factor most occurring than Clients because they are directly affected. This supported by the assertions of Tilley and Barton (2000) and Okonkwo (2014).

### **Slow payments' system for design services**

“Slow payments system for design services” is considered the 4<sup>th</sup> most frequent factor contributing to deficiency of design and contract documentation with an overall RII of 72.20%. This factor was ranked 4<sup>th</sup> by the Consultants with a RII of 72.26% and at a RII of 72% Clients placed it 10<sup>th</sup>. It is, therefore, an indication that Consultants, who are at the receiving end, consider this frequent which hampers their performance.

### **Last minute changes by the client**

All respondents agreed “Last minute changes by the client” as the 5<sup>th</sup> most occurring factor that affects design and contract documentation quality with a RII of 69.27%. Clients and Consultants ranked this factor as 11<sup>th</sup> and 6<sup>th</sup> with RIIs of 72% and 68.39% respectively. All respondents have accepted that Clients last minute changes during the design and documentation process have been frequent and, therefore, is critical. Clients should be much aware of their responsibility of making stable requirements to avoid changes at later stages.

### **Insufficient design reviews with relevant parties**

“Insufficient design reviews with relevant parties” is ranked as the sixth most occurring factor contributing to design and documentation deficiency with an overall RII of 67.8%. Clients rank it as 9<sup>th</sup> with a RII of 74% and 12<sup>th</sup> by the Consultants with a RII of 65.81%.

### **Lack of client reviewers for each project**

“Lack of client reviewers for each project” was ranked the 7<sup>th</sup> among the most frequent occurring factors leading poor quality design and contract documentation with an overall RII of 66.83%. Clients and Consultants placed 15<sup>th</sup> and 10<sup>th</sup> with RII of 70% and 65.81% respectively. This means that most Clients do not have the requisite knowledge to be able to review designs to ascertain whether they meet their requirements or not.

### **Insufficient and missing input information from the client**

“Insufficient and missing input information from the Client” has been placed overall as the 8th most occurring factor contributing to the poor quality of design documentation in construction projects in Northern Ghana with a RII of 65.85%. The Clients considered it less frequent by placing it 21<sup>th</sup> with a RII of 64%. However, Consultants, on the other hand, considered it to very frequent by placing 8<sup>th</sup> with RII of 66.45%. What it means is that input information or briefs provided by the Clients to the Consultants are woefully inadequate for them to work with and they are fully aware of the consequences thereof. This is in line with a Queensland (2005) report.



### **Unstable client's requirements**

“Unstable client's requirements” was ranked 9<sup>th</sup> overall among the top ten most frequent factors causing deficiencies in design and contract documentation in the construction industry in Northern Ghana with a RII of 65.85%. Consultants placed it 5<sup>th</sup> most occurring factor with a RII of 69.03% and that of the Clients as 33<sup>rd</sup> with a RII of 56%. In view of this, the Consultants feel that Clients requirements are often not stable this affects the success of their outcomes.

### **Ineffective/inadequate use of new technology**

With an overall RII of 65.85%, respondents placed the “Ineffective/inadequate use of new technology” at 10<sup>th</sup> as among the most occurring factors affecting design and documentation quality. It was ranked 3<sup>rd</sup> by the Clients with a RII of 80% and placed 23<sup>rd</sup> by the Consultants with a RII of 61.29%. This is an indication by the Clients that Consultants do not efficiently use design software, which often result in deficient designs.

#### **4.4.3 AGREEMENT ANALYSIS**

A non-parametric statistic known as Kendall's coefficient of concordance aids in evaluating the level of agreement between the two (Clients and Consultants) sets of ranks to the same set of possible causes of poor quality of design and contract documentation in Northern Ghana. This tool assists the researcher to find out whether there is a trend of agreement among the respondents on the 40 factors.

This range  $0.0 \leq W \leq 1.0$  shows the level of agreement among the Clients and Consultants. The concordance coefficients are computed by using data in table 4.10.

**Table 4.13 Showing Kendall's Rank of Concordance Coefficient**

		Clients	Consultants
Clients	Severity	1	0.232
	Occurrence	1	0.238
Consultants	Severity	0.232	1
	Occurrence	0.238	1

From table 4.13,  $W$  is 0.232 and 0.238 respectively for severity and occurrence. These indicate a fair level of agreements among the Clients and Consultants in their ranking of the factor in terms of severity and occurrence since they are greater than zero (0) hence there is no bias on how the ranking of the factors.

#### **4.5 PREVENTIVE METHODS FOR DESIGN AND CONTRACT DOCUMENTATION DEFICIENCY**

Identified from the review of the relevant literature were fifteen probable ways of preventing deficiencies in design and contract documentation put in the form of a questionnaire. All respondents towards achieving the objective of the study determined the level of importance of each identified method. Table 4.14 presents the 15 preventive methods and their RIIs and rankings of the various respondents.

**Table 4.14 RII and Ranks of the preventive methods for each group of respondents**

Preventive Methods		Importance					
		Clients		Consultants		Overall Response	
		RII %	RANK	RII %	RANK	RII %	RANK
1.	Communication between all parties in decision-making processes, from the inception of the project to completion.	98	1	94.84	1	95.61	1
2.	Adherence to established codes and standards in the industry.	90	5	93.55	2	92.68	2
3.	Spend sufficient time and money in project planning and design	92	4	91.61	3	91.71	3
4.	Continuing involvement of client in the design management	96	2	88.39	6	90.24	4
5.	Working cooperatively together, sharing the same vision and objectives for the project.	82	8	90.97	4	88.78	5
6.	Select all service providers on the basis of value and competency but not on the basis of lowest price alone.	94	3	86.45	9	88.29	6
7.	Implementation of quality management systems.	88	6	87.10	8	87.32	7
8.	Continuing professional development for ensuring that staff maintain up-to-date qualifications and competency standards.	84	7	87.74	7	86.83	8
9.	Payment of design fees commensurate with the design of high-quality services.	74	12	90.32	5	86.34	9
10.	Understand and encourage the role of technology in projects delivery by all stakeholders	80	9	85.16	11	83.90	10

11.	Identification and analysis of all risks and uncertainty inherent in the project and its circumstances.	78	10	84.52	12	82.93	11
12.	Training design and documentation personnel available across all disciplines to gain experience and competition.	66	15	85.81	10	80.98	12
13.	Framing contracting arrangement around goodwill and fair dealing in an open communication environment.	76	11	81.29	13	80.00	13
14.	Adoption of lean production principles to design management	68	14	79.35	14	76.59	14
15.	Continuing involvement of contractor with experience in the design process.	72	13	76.77	15	75.61	15

### COMMENTS/ DISCUSIONS

All the methods listed in the table above are all important ways of preventing the problems of design and contract documentation quality in construction projects; however, the discussion looks at the top most ranked preventive strategies.

#### **Communication between all parties in decision-making processes, from the inception of the project to completion.**

“Communication between all parties in decision-making processes, from the inception of the project to completion” is ranked as the topmost (1<sup>st</sup> and RII 95.61%) important method of preventing design and documentation problems in Northern Ghana. There was a total agreement between the Clients and Consultants who both placed it 1<sup>st</sup> with RIIs of 98% and 94.84% respectively. This is a clear acknowledgement of how important communication is. There is the need for effective communication for effective teams to



thrive. It was suggested by Dosumu and Adenuga (2013) that there should be good communication among the construction project team. This is also in line with Tilley (2005).

**Adherence to established codes and standards in the industry.**

The “Adherence to established codes and standards in the industry” would help designers to achieve their targets without hindrance. This has been ranked the 2<sup>nd</sup> most important preventive method with a RII of 92.68%. Clients rated it at a RII of 90% making it 5<sup>th</sup> whilst Consultants ranked it 2<sup>nd</sup> with a RII of 93.55%. It means that Consultants are more aware of the need to adopt established codes and standards by regulatory and professional bodies they belong. This was recommended by Chong and Low (2006) and is also supported by ACIF and APCC (2002).

**Spend sufficient time and money in project planning and design**

“Spend sufficient time and money in project planning and design” was ranked the 3<sup>rd</sup> most important method of preventing deficiencies or errors in design and documentation with a RII of 91.71%. The rankings of both groups of respondents were very close with Clients placing it 4<sup>th</sup> with a RII of 92% and that of Consultants was rated 3<sup>rd</sup> with a RII of 91.61%. Proper planning is very relevant in the delivery of any project as such requires more attention by spending enough resources at the early stages to avoid future problems. This is in line with a recommendation made by Abdel-Razek (1998) that improvement in planning and design at the stage of design enriches quality.

### **Continuing involvement of client in the design management**

“Continuing involvement of client in the design management” is considered the 4<sup>th</sup> most important method of preventing design and documentation deficiencies in construction projects in Northern Ghana with a RII of 90.24%. The Clients placed it 2<sup>nd</sup> with a RII of 96% and Consultants on the other side rated 6<sup>th</sup> with a RII of 88.39%. Since Clients are the financiers and end beneficiaries of the projects, it is necessary to engage them from inception to completion of the project to avoid mistakes that will lead to additional funds being required. Darwish (2007) supports this.

### **Working cooperatively together, sharing the same vision and objectives for the project.**

“Working cooperatively together, sharing the same vision and objectives for the project” has been ranked the 5<sup>th</sup> most important preventive method to the problems of design and documentation in Northern Ghana with RII of 88.78%. Clients and Consultants rated it 8<sup>th</sup> and 4<sup>th</sup> respectively with RIIs of 82% and 90.97%. Every project is unique and, therefore, have unique objectives to achieve. There is the need therefore for Consultants to buy into the idea and vision of the owner to make the project a reality for there is strength in unity. Johansen and Carson (2003) emphasizes the need for a working team approach to improve design management.

### **Select all service providers on the basis of value and competency but not on the basis of lowest price alone.**

“Select all service providers on the basis of value and competency but not on the basis of lowest price alone” was ranked sixth among the important strategies of preventing design and documentation deficiencies in construction projects with a RII of 88.29%. Clients

ranked it higher in the 3<sup>rd</sup> place with RII of 94% as compared to that of Consultants who placed it 9<sup>th</sup> with a RII of 86.45%. This means that Clients have come to realize that procurement of consultancy services on the grounds of lower price bid does not give them value for their money. This is supported by a claim by (Love *et al.*, 2011).

#### **Implementation of quality management systems.**

This factor was ranked the 7<sup>th</sup> most important design error preventive mechanism with a RII of 87.32%. Clients on their part ranked it 6<sup>th</sup> with a RII of 88% whilst Consultants placed it 8<sup>th</sup> with a RII of 87.10%. Ezeldin and Abu-Ghazala (2007) support this by an assertion that enactment of quality systems resulted in more consistent design production process.

#### **Continuing professional development for ensuring that staff maintain up-to-date qualifications and competency standards.**

“Continuing professional development for ensuring that staff maintain up-to-date qualifications and competency standards” was placed as the 8<sup>th</sup> most important methods of getting quality design and documentation with a RII of 86.83%.. Both Clients and Consultants found it to be equally important by ranking this factor 7<sup>th</sup> with RIIs of 84% and 87.7% respectively. Continuing professional development is a very important human resource development tool geared towards sharpening the skills of your staff to get the best out of them. Serpell *et al.* (2002) suggested that training people in the professional, management and supervisory level in the tools and concepts of quality would help improve quality in design and documentation.

#### **Payment of design fees commensurate with the design of high-quality services.**

“Payment of design fees commensurate with the design of high-quality services” was the 9<sup>th</sup> ranked most important methods of getting quality design and documentation with an overall RII of 86.34. Clients and Consultants ranked this factor as 12<sup>th</sup> and 5<sup>th</sup> with RII of 74% and 86.34% respectively. Therefore, payment of commensurate fees with the required effort for quality will go to help Consultants motivate their staff and give them the requisite skills. Chong and Low (2006) suggested that in as much as we are interested in reducing hidden defects in our design documentation, cost and other design concerns are equally important.

**Understand and encourage the role of technology in projects delivery by all stakeholders**

This is ranked overall as the 10<sup>th</sup> most important method of preventing design and documentation deficiencies in construction projects with a RII of 83.90%. it was ranked by Clients as 9<sup>th</sup> and that of Consultants as 11<sup>th</sup> with RIIs of 80% and 85.16% respectively. This is affirmed by Dossick and Neff (2010) and Craig and Sommerville (2006).

**4.5.1 SPEARMAN CORRELATION OF PREVENTIVE METHODS**

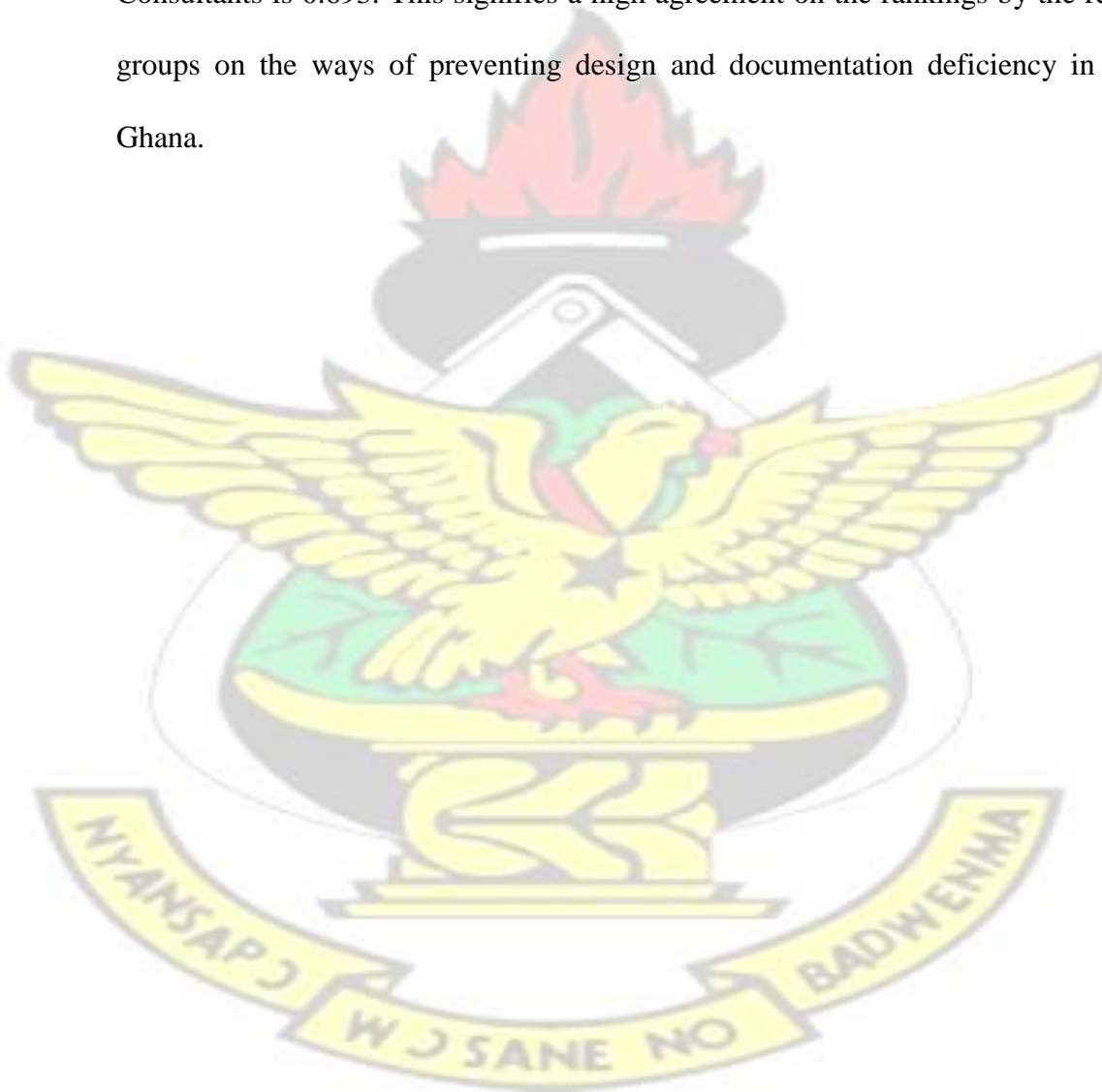
This is an inferential statistics method and was used to ascertain whether the differences in ranking of the two groups of respondents on the possible methods of preventing deficiencies in design and contract documentation were statistically significant or not. Using the rankings of the Clients and Consultants per table 4.14, the correlation coefficients are calculated and the results are as shown in table 4.15 below.



**Table 4.15 Showing the Rank Correlation Coefficient (Using SPSS)**

	Clients	Consultants
Clients	1	0.693
Consultants	0.693	1

From the table, the correlation coefficient for the 15 remedial methods for Clients and Consultants is 0.693. This signifies a high agreement on the rankings by the respondent groups on the ways of preventing design and documentation deficiency in Northern Ghana.



## **CHAPTER FIVE**

### **SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATION**

#### **5.1 INTRODUCTION**

This chapter presents the final part of the study where conclusions are drawn from the major findings of the analysis and recommendations made to address these findings towards achieving the objectives of the study.

#### **5.2 SUMMARY OF FINDINGS**

The survey achieved an overall response rate of 61.2%. It also showed that majority of the respondents had a considerable level of experience in the construction industry and 96.15% in one way or the other encountered deficiencies in design and contract documentation in Northern Ghana and that Consultants were mostly responsible. Therefore, avoiding or preventing these problems will go a long way to help all the stakeholders involved in saving limited resources such as money and time in trying to address this problem.

In the quest to find answers to the questions raised in this research, the data were analysed as follows.

##### **5.2.1 To identify the factors that affect the quality of design and contract documentation of construction projects in Northern Ghana.**

The survey found a fair agreement amongst the two groups of respondents Clients and Consultants in the rankings of the causes of design and contract documentation in Northern Ghana in terms of severity ( $w = 0.232$ ) and occurrence ( $w = 0.238$ ).

Based on the rankings of the various factors and the analysis of the study using Relative Importance Index (RII), it is found that the under listed were the most severe factors agreed by Clients and Consultants that causes deficiencies in design and contract documentation in Northern Ghana:

1. Selection of designers on the basis of lowest price selection strategy (Lowest bid approach
2. Unwillingness to pay fees commensurate with the design of high-quality services
3. Last minute changes by the client
4. Insufficient design reviews with relevant parties
5. Inadequate client's communication /relationship with design team members
6. Slow payments' system for design services
7. Inadequate design coordination between design disciplines
8. Insufficient and missing input information from the client
9. Change in project requirements by stakeholders at later stages
10. Erroneous and conflicting information from the client

Again Using the Relative Importance Index, the survey also found that both the Clients and the Consultants agreed that the following factors are the most frequent occurring factors Causing design and documentation deficiencies in Northern Ghana:

- ❖ Selection of designers on the basis of reputation instead of efficiency
- ❖ Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)
- ❖ Unwillingness to pay fees commensurate with the design of high-quality services
- ❖ Slow payments' system for design services
- ❖ Last minute changes by the client

- ❖ Insufficient design reviews with relevant parties
- ❖ Lack of client reviewers for each project
- ❖ Insufficient and missing input information from the client
- ❖ Unstable client's requirements
- ❖ Ineffective/inadequate use of new technology

### **5.2.2 To assess the extent to which the quality of design and contract documentation affects the performance construction projects.**

From the rankings of the severity of impact by both Clients and Consultants, the following effects are found to have much negative impact (according to their level of severity) on the performance of projects in Northern Ghana in terms of cost and time due design and documentation deficiencies:

- ❖ Projects abandonment
- ❖ Delays (Time overrun)
- ❖ Cost overrun
- ❖ Payment claims
- ❖ Variation/Change orders

### **5.2.3 To identify preventive measures in managing design and contract documentation deficiencies and improving the performance of construction projects.**

Per the rankings of the respondents on the level of importance of the identified preventive measures, the following methods are set up in order of their importance to help prevent or reduce design and documentation deficiencies in Northern Ghana:



- ❖ Communication between all parties in decision-making processes, from the inception of the project to completion.
- ❖ Adherence to established codes and standards in the industry.
- ❖ Spend sufficient time and money in project planning and design
- ❖ Continuing involvement of client in the design management
- ❖ Working cooperatively together, sharing the same vision and objectives for the project.
- ❖ Select all service providers based on value and competency but not because of lowest price alone.
- ❖ Implementation of quality management systems.
- ❖ Continuing professional development for ensuring that staff maintain up-to-date qualifications and competency standards.
- ❖ Payment of design fees commensurate with the design of high-quality services.
- ❖ Understand and encourage the role of technology in projects delivery by all stakeholders
- ❖ Identification and analysis of all risks and uncertainty inherent in the project and its circumstances.
- ❖ Training design and documentation personnel available across all disciplines to gain experience and competition.
- ❖ Framing contracting arrangement around goodwill and fair dealing in an open communication environment.
- ❖ Adoption of lean production principles to design management
- ❖ Continuing involvement of contractor with experience in the design process.

From the analysis, it is found that there was a high agreement on the rankings by the respondent groups on the ways of preventing design and documentation deficiency in Northern Ghana through a correlation analysis conducted.

### 5.3 CONCLUSIONS

Based on the finding of the study, it has been concluded that there indeed exist deficiencies in designs and contract documentation of construction projects in Northern Ghana and that consultants are mostly responsible for it. This usually results in the abandonment of projects, delays in the completion of projects, cost overruns; payment claims arising due to corrections and variation of works and this has a dire consequence of the performance of construction projects.

It is concluded that there was a reasonable agreement between the Clients and the Consultants and hence there is no apparent bias on how the factors were ranked.

Based on the factors regarding the most severe and the most frequent occurring, it is established that, the following factors are the most critical:

- ❖ Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)
- ❖ Unwillingness to pay fees commensurate with the design of high-quality services
- ❖ Last minute changes by the client
- ❖ Insufficient design reviews with relevant parties
- ❖ Slow payments system for design services
- ❖ Insufficient and missing input information from the client

Therefore, much attention is required for these factors

The study also revealed that the major stakeholders (Clients and Consultants) are beginning to appreciate the effects of deficiencies in design and contract documentation on construction projects in Northern Ghana. The Clients and the Consultants had a positive agreement on the way the ranking of the importance of the preventive methods were done and thus a good degree of objectivity can be ascribed to their observations. Owing to this, the following conclusion was arrived at to be the best ways of preventing design and contract documentation deficiencies on construction projects in Northern Ghana.

- ❖ Communication between all parties in decision-making processes, from the inception of the project to completion.
- ❖ Adherence to established codes and standards in the industry.
- ❖ Spend sufficient time and money in project planning and design
- ❖ Continuing involvement of client in the design management
- ❖ Working cooperatively together, sharing the same vision and objectives for the project.
- ❖ Select all service providers based on value and competency but not because of lowest price alone.
- ❖ Implementation of quality management systems.
- ❖ Continuing professional development for ensuring that staff maintain up-to-date qualifications and competency standards.
- ❖ Payment of design fees commensurate with the design of high-quality services.
- ❖ Understand and encourage the role of technology in projects delivery by all stakeholders

## 5.4 RECOMMENDATIONS

From the conclusions, it is evident there are deficiencies in design and documentation in construction projects in Northern Ghana and that the degree of the adverse effects of this on project time and cost are eminent. Therefore, stakeholders (notably Clients and Consultants) of projects should realize the need to tackle these critical factors and the effects thereon in a timely manner.

The study, therefore, recommends the following approaches to help avoid/prevent deficiencies in design and contract documentation in Northern Ghana. These are:

- ❖ Clients must ensure that the selection of consultants is based on merit. The time required for the selection process should be adequate to allow detailed evaluation of consultants' bids and to do due diligence and background checks. Competency, valuable experience should be the main priority for the selection process to ensure value for money. This will lead to an enhanced quality delivery.
- ❖ Clients must ensure that consultancy fees are proportionate to the required service quality. It should be recognized that, insufficient fees would increase the probability of inadequate design and documentation and substantial contractual claims. Moreover, by enhancing design fees, designers would be able to dedicate valuable resources to projects thereby enhancing quality service delivery.
- ❖ Only Prompt changes should be tolerated if the need be. Clients are advised to make

early any change they want to add to or remove from their requirements in other not to disrupt the consultants work when they are at the final stages of the design



process. However, Clients must ensure a better articulation of requirements to receive better response from consultants.

- ❖ Ensure timely and regular payments for design service providers so that they are

able to motivate themselves and concentrate on the job to give out their best thus enhanced quality. This can be achieved by ensuring that adequate funds are readily available to pay consultant when due.

- ❖ Consultants should make sure there is an adequate review of design and

documentation with all stakeholders involved. By this engagement, Clients and sometimes end users if properly involved in the review of designs would allow them to make the necessary missing input and corrections thereof, before there is finality to the design and documentation process.

- ❖ The client must make sure that briefs are adequate, clear, precise and concise to

enable the Consultants have clear picture of what is required of them. This is achievable by engaging a highly experienced person with the technical expertise in putting project briefs together.

**Other important preventive methods suggested from literature are:**

- ❖ Effective communication between design team members would enhance design quality. A collaborative working environment is required for effective delivery of quality by promoting high levels of collaboration and communication between members of the design team.

- ❖ Proper coordination between design disciplines such as architectural, structural, electrical drawings as well as documentation and bill of quantities would help prevent or drastically reduce the errors/deficiencies in design and contract documentation. This is achievable by the appointment of an experienced design coordinator or design manager.
- ❖ The effective use of design and documentation software should be encouraged and do proper cross-checking of their output since it is garbage in garbage out. Users of software should acquire adequate training to get indepth skill in the use of design and documentation software. This can help reduce the design time whilst minimizing the level of deficiency to the barest minimum.
- ❖ Finally, Clients should allow adequate time for the design and documentation process and review. If enough time is given, the consultants would be able to go through the work and rectify any deficiency found in the designs and documentation before the actual project starts.

### **5.5 RECOMMENDATION FOR FUTURE RESEARCH**

Due to time and resource constraint a survey was conducted in Northern Ghana, it is thus recommended that future studies should consider undertaking a study on design and documentation quality on a national scale to get a deeper insight of the Ghanaian situation. It is also recommended that a case study be conducted on some selected major building

construction projects in Ghana regarding the quality of design and contract documentation.

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## **APPENDIX: QUESTIONNAIRE**

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**COLLEGE OF ART AND BUILT ENVIRONMENT**

**DEPARTMENT OF BUILDING TECHNOLOGY**

**SURVEY QUESTIONNAIRE FOR**

**ASSESSING THE QUALITY OF DESIGN AND CONTRACT  
DOCUMENTATION AND ITS IMPACT ON CONSTRUCTION PROJECTS  
PERFORMANCE IN NORTHERN GHANA.**

Dear Sir/Madam,

I am a postgraduate student of the Kwame Nkrumah University of Science and Technology (KNUST) undertaking a research on the above subject area for a Master of Science degree in Construction Management. The research seeks to achieve the following objectives:

- To identify the factors that affect the quality of design and contract documentation of construction projects in Northern Ghana.
- To assess the extent to which the quality of design and contract documentation affects the performance construction projects.
- To identify preventive measures in managing design and contract documentation deficiencies and improving the performance of construction projects.

I would be very grateful if you could spare part of your valuable time in filling this questionnaire. Information supplied by you will be treated as strictly confidential and will be used for only academic work. I shall be happy to provide you with the results of the study once completed if you wish.

Thanks in advance for your cooperation and assistance.

Yours faithfully,

ABU FATAWU

(MSc Researcher) Email – [fatactiongh@yahoo.com](mailto:fatactiongh@yahoo.com) Tel: 0205825180/0242038172

**SUPERVISOR: MR. J.C. DANKU**

**QUESTIONNAIRE**

**NOTE: Contractors are only required to answer sections A and B**

**SECTION A: GENERAL INFORMATION**

**Please tick (✓) or click in the box as shown ☒ where appropriate**

1. Which of the following category of respondent's do you fall under?

☐ Client ☐ Consultant ☐ Contractor

2. If working as a contractor, what class is your company?

☐ D1k1 ☐ D2K2 ☐ D3K3 ☐ Please specify if other.....

3. Respondents professional background

☐ Architect ☐ Civil/Structural Engineer ☐ Quantity surveyor



☐ Please specify if other.....

4. Highest Educational qualification of respondent

☐ HND ☐ First degree ☐ Masters ☐ other please specify.....

5. What type of building project(s) is/are currently or recently executed by your organization?

☐ Public ☐ Private ☐ Both

6. How many years of experience do you have in the construction industry?

☐ 0-5 years ☐ 6-10 years ☐ 11- 15 years ☐ above 15 years

7. Have you ever encountered any problem regarding error/deficiency in design and contract documentation?

☐ Yes ☐ No

8. If yes, who was responsible for it?

☐ Client ☐ Consultant ☐ Both

## SECTION B: IMPACT ON PROJECT PERFORMANCE

In your professional opinion, to what extent do the following effects of Design and Documentation Deficiency affects the performance of construction projects. Rate according to a Likert scale of 1-5 as indicated in the table below:

Please tick (✓) or click in the box as shown ☑ where appropriate

Effects of Design and Documentation Deficiency		Severity				
		1	2	3	4	5
		No effect	Low severe	Fairly severe	Severe	Very severe
1.	Disputes (Conflicts) among parties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.	Payment claims	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Projects abandonment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Delays (Time overrun)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Cost overrun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Rework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Arbitration/Litigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Suspension of works	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Client/owner dissatisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Loss of confidence in consultants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Variation/Change orders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### SECTION C: Factors Causing Design and Documentation Deficiency

From your experience, please determine the severity weight and frequency of occurrence of the under listed causes of design and documentation deficiency/error in the construction industry. The scale of weighting in the research survey ranges from 1-5 as shown in the table below:

Please tick (✓) or click in the box as shown ☑ where appropriate

Factors Causing of Design and Documentation Deficiency	Severity					Occurrence				
	1	2	3	4	5	1	2	3	4	5
	No effect	Low severe	Fairly severe	Severe	Very severe	Never	Rarely	Occasionally	Frequently	Constantly

Designer Related Factors											
Design Process		1	2	3	4	5	1	2	3	4	5
1.	Lack of time for design reviews	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Leaving design issues to be sorted out in the construction process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Lack of qualified consultant's staff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Erroneous and conflicting information from the client	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Lack of time available for checking and correlating all the information on all design documents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Insufficient and missing input information from the client	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Increased statutory regulations, approvals, and requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Copying and modifying from previous work to minimize time and cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Ineffective/inadequate use of new technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Increase in the overall complexity of projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Slow payments' system for design services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Lack of experience on similar projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Designer's unfamiliarity with construction materials and	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	techniques that will be used in the project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Number of staff in each specialization (Architect, Structural Engineer etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Increase in current workload of the designer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Insufficient design reviews with relevant parties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Change in project requirements by stakeholders at later stages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Lack of client reviewers for each project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coordination among design team		1	2	3	4	5	1	2	3	4	5

19	Lack of data integration across design disciplines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
20	Inadequate design coordination between design disciplines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Time and cost of design</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
21	Reduced design fees levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
22	Inaccurate time estimates or tight design schedule	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Design Management</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
23	Poor workload planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
24	Lack of funds for staff on the job training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
25	Absence of high cost experienced design team to projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
26	Lack of time available for continuous and effective communication between parties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
27	Allocation of staff to more than one project at the same time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
28	Absence of an experienced overall design manager	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
29	Increase design staff members rather than increasing the number of hours of work to overcome the problem of limited time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>Selection criteria and bidding philosophy</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
30	Selection of designers on the basis of reputation instead of efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
31	Selection of designers on the basis of lowest price selection strategy (Lowest bid approach)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Client Related Factors</b>											
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
32	Last minute changes by the client	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	Defensive approach to variations and claims for additional cost or time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	Unstable client's requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	Unwillingness to pay fees commensurate with the design of high-quality services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



36	Long waiting for the client decision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
37	Inadequate client's communication /relationship with design team members	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Factors Relating to Tendering Procedures</b>											
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
38	Reluctance by tenderers to ask questions that might reveal competitive edge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39	Tight tender times	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	Multiple "notices to tenderers" and question/answer steps and short time for amendment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### SECTION D- Preventive Methods

From your experience, please determine how important each of the following preventive/remedial methods is by rating them on Likert scale of 1-5 as shown in the table below: **Please tick (✓) or click in the box as shown ☑ where appropriate**

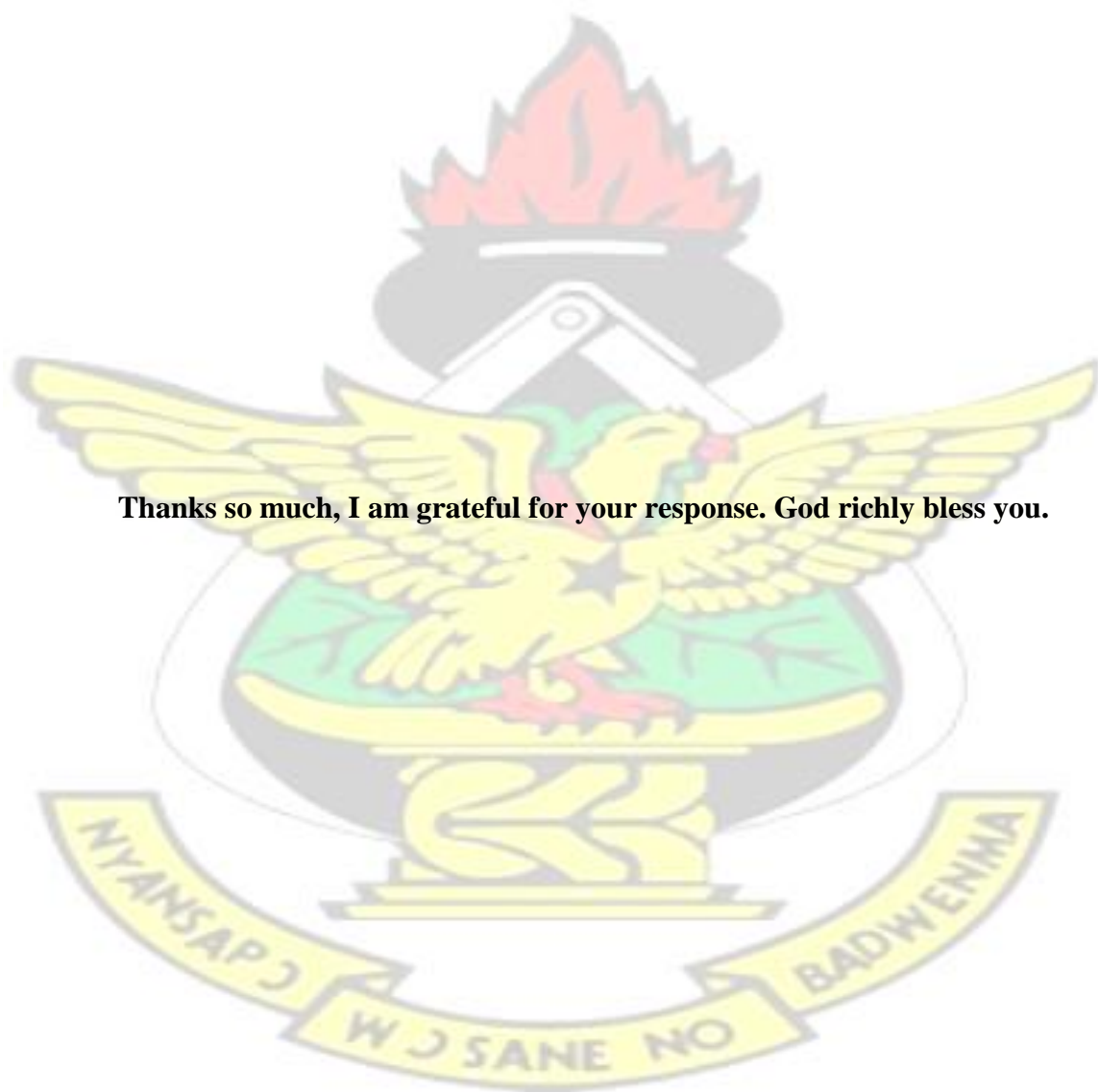
Preventive Methods	Relative Importance				
	Not important	Low important	Medium important	Important	Very important

		1	2	3	4	5
1.	Spend sufficient time and money in project planning and design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Understand and encourage the role of technology in projects delivery by all stakeholders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Continuing involvement of client in the design management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Working cooperatively together, sharing the same vision and objectives for the project.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Communication between all parties in decision-making processes, from the inception of the project to completion.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Framing contracting arrangement around goodwill and fair dealing in an open communication environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Continuing involvement of contractor with experience in the design process.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Select all service providers on the basis of value and competency but not on the basis of lowest price alone.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9.	Continuing professional development for ensuring that staff maintains up-to-date qualifications and competency standards.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Implementation of quality management systems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Identification and analysis of all risks and uncertainty inherent in the project and its circumstances.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Training design and documentation personnel available across all disciplines to gain experience and competition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Payment of design fees commensurate with the design of high-quality services.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Adoption of lean production principles to design management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Adherence to established codes and standards in the industry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Any Comments Please:**



KNUST



**Thanks so much, I am grateful for your response. God richly bless you.**