Addis Ababa University
College of Business and Economics
School of Commerce
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PERFORMANCE ASSESSMENT OF DESIGN BID BUILD (DBB) PROJECT DELIVERY METHOD

IN

40-60 SAVING HOUSES CONSTRUCTION PROJECT

By

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A Project Work Submitted to College of Business and Economics, Addis Ababa University School of Commerce, in Partial Fulfilment of the Requirements for the Award of a Master's Degree in Project Management

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A project work submitted to the School of Graduate studies at Addis Ababa University College of Business and Economics in Partial Fulfilment of the requirement for the Degree of Master of Arts of Project Management

Statement of Declaration

I hereby declare that the project work presented in this document is my original work and that it has not been submitted partially; or in full for any educational qualification in any other university/institution. All sources of materials used for the thesis have been acknowledged accordingly

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Statement of Certification

This is to certify that Hirut Walelign has carried out this project work on the topic entitled "Performance assessment of Design Bid Build (DBB) project delivery method in 40-60 Saving Houses Construction Project' under my supervision.

This work is original in nature and it is sufficient for submission for the partial fulfilment for the award of Degree of Masters of Arts in Project Management

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ADDIS ABABA UNIVERSITY SCHOOL OF COMMERCE
GRADUATE PROGRAM

Project work for MA in Project Management

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List of Acronyms

AEC: Architectural Engineering and Construction

BOQ: Bill of Quantities

CM: Construction Manager

CMaR: Construction Manager at Risk

DB: Design-Build

DBB: Design-Bid-Build

IHDP: Integrated Housing Development Program

IPD: Integrated Project Delivery

MoUDC: Ministry of Urban Development and Construction

MoUDH: Ministry of Urban Development and Housing

PMI: Project Management Institute

RII: Relative Importance Index

Abstract

Design Bid Build (DBB) project delivery method is a traditional project delivery commonly applied within the Ethiopian construction industry. It is prone to several integration issues amongst main construction parties as the owner issues two separate contracts for the consultant and the contractor. The 40/60 construction project, suffer from lack of full team integration, high degree of inefficiencies and reworks, loss of significant project information between stakeholders which leads to several disputes, claims and change orders which ultimately led to cost and time overruns. The main objective of this study was to assess the performance of Design-Bid-Build project delivery method in 40-60 Saving Houses Construction Project. The study evaluated the level of integration among parties in the project, identified major integration issues and assessed the overall performance of the project. A paper based questionnaire was distributed to 161 respondents (48 client, 28 consultant, 88 contractor and 2 gov't body professionals) involved in the project; where 151 papers (45 client, 25 consultant, 79 contractor and 2 regulatory body professionals) were returned. An in-depth interview was conducted with 7 professionals, (4 from client, 2 from consultant and 1 from contractor) to obtain detailed data on the subject matter. The level of integration among project parties was found to be very minimal in 40-60 Saving Houses Construction Project. Relative importance index (RII) was used to analyse and rank the integration issues found in the project. The top five major integration issues ranked by respondents were lack of coordination among parties, lack of effective communication among major construction parties, lack of standard design and specification, lack of inclusive decision making process among parties and lack of integrated planning and scheduling among parties. Earned Value Analysis (EVA) was performed for all branches, which resulted that the project has been significantly over budget and behind schedule. Based on analysis result from questionnaire data, both the cost and schedule performance of the project were poor where the quality performance has been found to be fair. The study finally recommended the project parties to work as an integrated team for better and enhanced project output and for the client to consider employing other project delivery methods that promote integration amongst project parties.

Keywords: Integration, DBB Project Delivery method, Construction Project Performance

CHAPTER 1 - INTRODUCTION

1.1. Background of the study

Among the public construction projects in Ethiopia, Addis Ababa 40/60 saving houses construction project, is one of the mega projects in the city, which is mandated to play a significant role in creating jobs for citizens and supplying houses. The 40/60 housing project is part of the Integrated Housing development program (IHDP) along with 10/90 and 20/80 housing projects. It was launched on July 2012, with the main objective of constructing and transferring quality houses for registered middle-class section of the Addis Ababa population of the capital city; who can afford 40% of the house cost, where the majority of the house cost (60%) is facilitated through a bank loan arranged by the government from Commercial Bank of Ethiopia (CBE) (Derbe, 2016).

Project delivery system can be referred as the entire construction process; from project planning through its design and construction, where the owner have a way to contractually work together with the designer and the builder of the project. It forms an execution framework in terms of design sequencing, procurement and construction and defines the roles and responsibilities of the parties involved in a project (Ashi & Chakra, 2019).

In construction, integration can be explained as defining of working practices, methods and behaviours that create and promote an efficient and effective collaboration culture where information is freely exchanged between teams of the project (Baiden, et al., 2006).

According to Hardin & McCool (2015), The main types of delivery methods utilized in projects today are Design-Bid-Build (DBB), Design-Build (DB), Construction Manager at Risk (CMaR) and Integrated Project Delivery (IPD).

The most common traditional project delivery method, which is widely applied in Ethiopia, is Design-Bid-Build (DBB) project delivery method, where the client first contracts a consultant for the design work and then separately contracts the contractor for the execution of the construction (Asaminew, 2013). In Design-Bid-Build project delivery system the selection process of organization focusses on their individual capacity than their collective ability to effectively work together or integrate. This results in fragmentation of the construction project participants and thus separates the design and construction data. The fragmentation of the project delivery method frequently lead to adversarial relationships, lack of transparency and mistrust between project teams, which results in blame culture, where the team members rather choose to minimise their level of poor performance exposure than working in cooperation and collaboration (Baiden, Price and Dainty, 2006). This is the case for 40-60

Saving Houses Construction Project where DBB method is employed and separate contracts are provided for consultants and contractors (Derbe, 2016).

The project delivery method chosen in a project has a massive impact on team integration and project performance. It shall be noted that although no project delivery is perfect by itself, one might be found better fit than another based on the unique nature and requirements of a project (Ding, et al., 2018). This shows project delivery systems that are being utilised shall always be checked for their effectiveness. Thus, it is the focus of this study to assess the performance of DBB prject delivery method in 40-60 Saving Houses Construction Project.

1.2. Statement of the Problem

Design Bid Build (DBB) project delivery method is prone to several integration issues amongst main construction parties as the owner issues two separate contracts for the consultant and the contractor (Hardin & McCool, 2015).

One of the main causes for integration issues in DBB project delivery method, is that there exists no communication whatsoever between the design consultant and the contractor during design phase which typically leads to errors or gaps found in the design, ranging from as simple as paint colour missing to as serious as major structural component missing, once the contractor has already began to build the project. Such issues could seriously affect the project performance as they lead to several design clarification/modification requests during construction which can take up the project cost and time and create rough relationships between the consultant and the contractor since the errors/gaps found have to be justified to the client, and increased litigation due to lack of teamwork and integration (Hardin & McCool, 2015).

The Ethiopian construction industry is fragmented as a result of the exclusive practise of the traditional project delivery approach (Design-Bid-Build). The degree of commitment, trust and awareness developed among stakeholders in DBB is very negligible in most public construction projects in Ethiopia which led to fragmentation among the construction parties involved (Wubshet, 2014). A report by MoUDH (2014) shows that, there exists no integration in Ethiopian housing construction projects among construction parties, in order to provide ample project cost, quality and standard approval procedure amongst them. Public projects, like 40/60 housing construction project, are expected to meet the growing housing demand of the public and thus are supposed to be executed within limited time and budget. However, till date, the 40-60 saving houses construction project is prone to significant integration issues among the construction parties to achieve a common goal (Fortune, August 18, 2013). Poor project performance; specifically frequent time and cost overruns, and quality issues, are the main headaches of such public projects. According to Baiden, Price and Dainty, 2006, The poor performance seen in projects today can be attributed to the inability of project

participants to work effectively while DBB project delivery method treats design phase as a separate activity to the construction phase. Careful selection of project delivery methods are key for the success of the project in terms of achieving its performance objectives. However, there are only few researches that assess the performance and integration issues of employed project delivery methods in local projects.

Therefore, it is the focus of this study to evaluate the level of integration, identify associated integration issues and assess the overall project performance of DBB project delivery method employed in 40-60 Saving Houses Construction Project.

1.3. Research Questions

1. What is the reason for selecting the Design Bid Build project delivery method over other delivery methods in 40/60 housing construction project?
2. What is the achieved level of integration of main construction parties achieved from the implementation of Design-Bid-Build project delivery method in 40/60 housing construction project?
3. What are the existing integration issues among main construction parties resulting from the implementation of Design-Bid-Build project delivery method in 40/60 housing construction project?
4. What is the achieved performance of 40-60 Saving Houses Construction Project in Design-Bid-Build Project Delivery method?

1.4. Objective of the Study

A. General Objective

The general objective of this research is to assess the performance of Design-Bid-Build project delivery method in 40-60 Saving Houses Construction Project.

B. Specific Objectives

The specific objectives of the research paper are:

1. To examine the reason for selection of DBB project delivery method over other available methods in 40-60 Saving Houses Construction Project
2. To evaluate the level of integration of main parties achieved by the Design-Bid-Build project delivery method in 40-60 Saving Houses Construction Project
3. To identify major integration issues existing in Design-Bid-Build project delivery method in 40-60 Saving Houses Construction Project
4. To assess the performance of 40-60 Saving Houses Construction Project in Design-Bid-Build project delivery method

1.5. Significance of the Research

The relevance of the study is to present the performance assessment of DBB project delivery method in 40-60 Saving Houses Construction Project. The findings of the research are expected to contribute a to several stakeholders in understanding the integration issues involved with DBB project delivery method and its overall performance on the ground. The primary significance of this study is to provide insight of the issues associated with the DBB project delivery method to the **public body/ client or the government**. It is also believed that the study serves as a point of reference for other **researchers** to conduct further studies on the project delivery method. **Policy makers** will also be able to benefit from this document as it provides insight on the problems associated with DBB delivery method which serves as a reference while developing policies and guidelines.

1.6. Scope of the Study

Due to limited time constraints the thematic scope of the study, was limited to the effectiveness of the integration of main parties (Client, Consultant and Contractors) in Design-Bid-Build project delivery methods and its effect on the performance (schedule, cost and quality) of Addis Ababa 40-60 Saving Houses Construction Project. The study was spatially limited to the sites of 40/60 construction projects located in Addis Ababa, Ethiopia.

1.7. Limitation

Due to the limited amount of time, the study couldn't accurately measure the quality performance of DBB project delivery in 40-60 Saving Houses Construction project due to the reason that the project has not been completed during the time study was conducted. However, the researcher ensured that respondents gave relevant information concerning the level of quality of the project according to survey questions.

1.8. Definition of Terms

For the purpose of this study the frequently used terms and variables shall be defined as follows:

- **Project Delivery Method:** in construction project is defined as an overall contractual processes utilized by which a project is designed, constructed, and/or maintained
- **Parties' Integration:** is simply defined as bringing of major construction participants (client, consultants and contractors) involved in the execution process of the construction project to work together by creating a common goal and unified culture.
- **Level of Integration:** is a variable defined as degree of integration that exist among the construction parties (client, consultants and contractor) in real life of construction projects.
- **Construction Project Performance:** is defined as the degree of success, of construction project execution, in attaining pre-defined objectives.

- **Design Bid Build Project Delivery Method:** is the traditional type of project delivery, where the client issues two separate contracts for contractor and consultant, method employed in the project under study.

1.9. Short Description of the Study Project

Addis Ababa 40-60 Saving Houses Construction Project is one of the mega projects in Addis Ababa, playing a significant role in changing the image of the city, creating jobs and supplying houses to middle income citizens of Addis Ababa. It is one of the projects run under the IHDP by the Addis Ababa city government along with 10-90 and 20-80 housing. The project was launched on July, 2012, by the city government of Addis Ababa. The main objective of the project is to construct quality houses and transfer them to registered middle-class segment of the city residents. A payment modality has been facilitated by the government where residents are expected to pay 40% of the cost of the house while the rest 60% will be paid through a bank loan for several years is facilitated by Commercial Bank of Ethiopia.

The 40-60 saving houses construction project includes 14 construction project sites. The typologies for the housing blocks range from B+G+7, B+G+8, B+G+9, B+G+10, 2B+G+12, 2B+G+13, 2B+G+15 and 2B+G+18. Accordingly there are 4 main central branch offices which manage more than one project sites and 8 main consultants consulting more than one lot and one project and 152 contractors (Grade 1-3) and government bodies conducting periodical visit on the status of the projects.

1.10. Organization of the Study

The study is organized into five chapters. The first chapter is an introductory chapter to the study comprising of the introduction of the study background, statement of the problem, main research questions and objectives of the study, significance of the study, scope and delimitation of the study, short description of the study area and lastly the organization of the study. The second chapter deals with citing of journals, books, reports, conference and seminar articles, previous research papers & published empirical and theoretical papers. The third chapter depicts the methods and procedures used in gathering of the relevant information for the study. It includes research approach and design, population of the study and sampling techniques, data sources and data collection techniques, and data analysis methods employed in the study. Chapter four presented the analysis results, the findings of the collected data for the study and discussion of the findings. Where, the last and fifth chapter, is a conclusion chapter that depicts the conclusions drawn on the study and recommendations forwarded.

CHAPTER 2 - LITERATURE REVIEW

2.1. Introduction

This chapter summarizes the most relevant previous researches conducted to date related to the objective of this research. Most of the literatures reviewed are related to construction project in general its characteristics and overall performance indicators, major parties involved in construction project, types of project delivery methods for construction project and integration of parties in construction project.

2.2. Theoretical Review of the Research

2.2.1. Construction Project

The construction industry is amongst the major industries that play a significant role in the development of a nation. This can be further explained by the measurement for economic growth of a country, which is mostly evaluated by the amount of development of the physical infrastructures like buildings, roads, bridges, etc. All construction project developments require involvement of numerous parties, various procedures, distinct phases and stages of works and a great deal of investment from either public or private sectors. Each input is invested in the project to realize the successful completion of the project as per the set objectives. (La Hart, 2007)

According to the Project Management Institute (PMI) has defined a project as "A temporary endeavour undertaken to create a product or service" (PMI, 1996; PMI, 2000). This definition is thought to be appropriate for the construction project in this research. Construction is defined as the action of building something typically a large structure.

Each construction project is unique, however there are main characteristics that are similar to construction projects in different settings. Construction projects require high degree of coordination among parties and across each phase of the project. They consist of multiple, smaller components, rather than being a large project, where they include a variety of teams and professionals that come together to complete that specific project. (La Hart, 2007)

The construction industry, implements extremely fragmented and sequential project delivery system whereby projects are incepted by client, designed by consultants and implemented by contractors in a very fragmented manner (Egan, 2011). The right setup shall be selected for construction projects within departments for the success of the project.

2.2.1.1. Phases of Construction Project

Most construction projects follow a linear path, from idea to completion. The phases of the construction can be broadly classified as the pre-construction phase, construction phase and post-construction phase. A diverse series of steps must be taken to ensure the completion of the project. Pre-construction phase, in the case of DBB project delivery method, includes a wide range of activities such as; hiring consultant, planning, design, permitting and entitlements, and the bidding process for contractors. The length of time and its complexity for each phase of the project varies as we deal with different needs of a project (Derbe, 2016).

I. Pre- Construction Phase

The pre-construction phase is a broad category which includes every task on a construction project prior to the commencement of the physical construction. It is the most important phase where most of the work is done. It can, generally, be thought as the period of time where project plan is formed, design is created, permission is secured and labour and supplies are assembled. The pre-construction phase includes:

A. Strategic Plan Development: It is the first step where the owner begins to work with the project manager and it begins with a recognition for a new facility need. Once the project manager is chosen; feasibility study, which includes conceptual analysis, and technical and economic feasibility studies, will be performed and strategic plan, which functions as an organizational document, will be developed (Charles, et al., 2005).
B. Design: This step occurs shortly after the start of the project. It is completed by architects and engineers. Architects develop concepts of the client into paper through application of modern design principles. Engineers help ensure the design and construction is safe and feasible. Design phase has two main stages: Preliminary design (typically up to 30% of design completion) and detailed design (typically from 30% -100% design completion) (Charles, et al., 2005).
C. Permitting and Entitlements: Permit for the design and commencement of the construction is secured during this stage. Design approvals must be obtained during this stage (Charles, et al., 2005).
D. Bidding for General Contractor: In the traditional (DBB) project delivery method, where the contractor is not hired at the start of the project, the general contractor who will be in charge of the construction project will be selected during this stage. The general contractor will be selected through a bidding process that is overseen by the project manager and client (Charles, et al., 2005)

E. Procurement: This is final stage of the pre-construction stage, where resources and elements necessary for the completion of the project are secured. It includes securing raw materials and any equipment needed for the commencement of the construction (Charles, et al., 2005).

II. Construction Phase

The construction is the phase where the physical construction commences through transfer of the planning and design principles into engineering practicalities. This phase includes manufacturing, civil works and installation, and delivery and testing of the components of the construction project. This process occurs linearly, where one portion of the construction process must be completed before another one begins. (Bennet, 2003)

III. Post-Construction Phase

During this phase, the physical construction of the project is completed but handing over to the owner will begin. (Bennet, 2003)

A. Close-out and Commissioning: Building equipment and systems will be validated in coordination with operations personnel and third parties. Documentation, manufacturing requirements, and systems, equipment and operations are integrated, checked and balanced, validated and accepted.
B. Operation, Maintenance and Retirement: Periodic and non-periodic maintenance will be performed during the utilization of the building facility. This stage will go on until the end of the building life representing the end of the project's life cycle. (Bennet, 2003)

During this study, the pre-construction and construction phases are considered to evaluate the performance in terms of parties' integration throughout the process. However, the post-construction phase is not included. Before starting the construction phase, and even before selection of the designer, the client is faced with two major decisions regarding the relation among the different parties and the contractors' payment arrangement (Bennet, 2003). Design Bid Build is a linear approach whereby one phase of the project shall be completed before commencing the next phase which requires a lengthy investment of time and money before the owner obtains its facility for revenue purposes. The design task, for instance, shall be completed by the consultant before selection of the contractor for the construction. Hence, this implies that the major construction parties' work is dependent on the output of the other in this sequential process which in turn affects the performance of the project.

2.2.1.2. Major Parties Involved in Construction Project

The major parties involved, in the construction industry are the client, financing the project, the consultants, who design and supervise the works, the contractor, who implement the project, and government regulatory bodies, who regulate the construction industry. Accordingly, in this research, the major parties who participate in the construction industry in DBB project delivery are elaborated as follows:

I. Clients/Owners

Clients (public or private) are the owner parties whose needs must be fulfilled by the project solution. They are the sponsors of the project execution by coming up with the investment needs such as project idea, capital, land etc. Public sector clients are generally concerned with certainty of budget and quality and, above all else, ensuring public accountability as they are spending public money (Baiden, et al., 2006). Government institutions, in addition to the public sector client, mostly take interest in the project in Ethiopia. 40-60 saving houses construction project is one of the mega projects which is run under the Ministry of Urban Development and Housing (MoUDH). The duties and responsibilities of the client organization of 40-60 Saving Houses Construction Project are:

i. Hiring consultants for the development of design and specification
ii. Design Management
iii. Awarding contractors
iv. Supervise construction progresses
v. Oversee all contract relationships; (CA, 2014-2016)

II. Consultants

Consultants are one of the major construction parties that are involved in the design and supervision of the project. They usually develop the client's idea and change into economic and constructible artefact following the client's interest and secured fund for the project. They are responsible parties that ensure the satisfaction of client requirements, preparation of bill of quantities (BOQ) and contract documents. The duties and responsibilities of the consultants on 40-60 Saving Houses Construction Project are:

- Look after proper execution of project
- Supervise the project based on design documents that they are assigned on
- Issue payment certificates and contract administration, and
- Issue provisional and final acceptance certificate (CA, 2014-2016)

III. Contractors

Contractors are also one of the major parties that are responsible for transforming the drawings and specification prepared by the consultants into the desired physical structure. In 40-60 housing construction, contractors are hired after the design is completed. Once they are selected, they provide resources needed to execute the project and perform the project based on the execution plan in which the client and contractor have agreed up on and with approval of consultant. Contractors are also responsible in coordinating the sub-contractor to deliver the project on the scheduled time.

In 40-60 Saving Houses Construction Project, the contractors do not compete for contract award, rather they are assigned based on their technical and financial qualifications. The Ministry of Urban

Development and Construction (MoUDC) sets the contract price based on the design where contractors have no input on the price setting for the work (Derbe, 2016).

IV. Government/regulatory Bodies

Government bodies are also known as statutory bodies that look after the project's compliance with the regulations and general public's interest. They prepare a general development scheme and make sure that the project satisfies it, they look after the safety, legal and commercial issues associated with the project, and they look into the environmental, cultural and social effect that the project induces. The major statutory bodies involved in the building construction industry in Ethiopia includes; Municipalities (bodies with the mandate to follow legal issues of the urban housing construction), Ministry of Construction (the body issuing construction related license and has mandated to regulate and promulgate bylaws, codes and standards with the aim to promote efficiency, transparency, accountability as well as growth in the industry, and Ministry of Urban Development and Construction (MoUDC) (the party mandated to regulate works, urban and housing and promulgate bylaws, codes and standards to housing) (Derbe, 2016).

2.2.1.3. Construction Project Management

Project Management is the basic and most important task in every construction process. Construction management comprises of a group of activities (tasks) concerned with the successful achievement of the goals set during planning. It includes the activities planning, scheduling and maintaining progress of the construction project (Tesfaye, 2019).

The act of directing, regulating and supervising of a construction project, starting from inception to completion can be described as construction project management. The major goal, in a construction project management, is achieving the objectives set and satisfying clients' demands, in terms of the functionality, schedule and budget.

Each construction project is unique, however there are main characteristics that are similar to construction projects in different settings. The most important functions of a construction project management include:

- Project goals specification and setting plans (this includes defining scope, scheduling, budgeting, defining client requirements, and selection of project participants)
- Legitimate and coordinated management of the project plan, estimation, contract, and construction processes
- Development of effective communication plan between project parties and defining conflict resolution methodologies

- Manage construction human, material and equipment resources effectively and efficiently from acquisition to completion
- Creation and management of an integrated project team (Koutsogiannis, 2019)

2.2.2. Project Delivery Method

2.2.2.1. Background

According to Hardin & McCool (2015), The delivery method is the way in which the owner contractually works together with the designer and the builder. It is one of the first decisions an owner makes when deciding to build a structure. Project Delivery Method relates to the particular contractual arrangements for the approach implemented and utilized to accomplish the goals of a given project including: organization, risk allocation, assignment of responsibilities, pricing and payment obligations (Charles, et al., 2005).

There are different types of project delivery methods that could be used in different context and settings of a project. Prior to the selection of the appropriate method of delivery, project owners shall consider issues like: the type of the building, experience of designers, the risk level, schedule of the project, budget, when the contractor will be on board, ability to contract the designer and builder under the same agreement and the ability to legally share the risk among designer, builder and owner (Hardin & McCool, 2015).

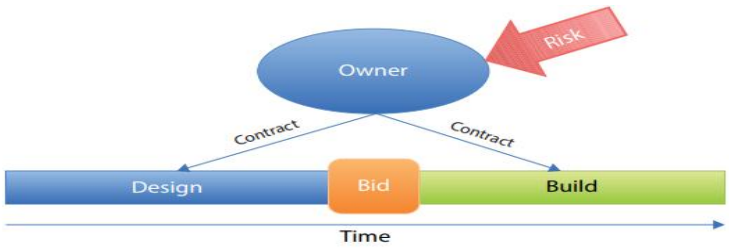
2.2.2.2. Types of Project Delivery Method

The most commonly used project delivery methods currently used are: Design-Bid-Build (DBB), Construction Management (CM at Risk/ Agent for), Design Build (DB), Integrated Project Delivery (IPD) and their variations. (Hardin & McCool, 2015).

I. Design-Bid-Build (DBB) Project Delivery Method

Design-Bid-Build (DBB) is the most traditional type of delivery method practiced today. In this method the owner has two contracts: one with the architect and one with the contractor. DBB is considered a linear process because there is no overlap of the architectural services and the contractor services (Hardin & McCool, (2015).

Figure 2.1: Design-Bid-Build Project Delivery Method



Source: (Hardin & McCool, 2015)

The public sector, in Ethiopia, exclusively utilize DBB project delivery method; where design and construction phase of the project is separated as the construction follows after the design is completed in a linear process (Derbe, 2016). The traditional project delivery assumes that clients are benefited from choosing project parties which are selected competitively for every project they engage on and risks and changes are minimized through detailed descriptions of specifications and contracts (Egan, 1998).

At best, there could be a simple construction process where the consultant is contracted earlier and then the contractor with the least price after design completion. However, this is mostly not the case in reality. Since the design is done without any communication between the designer and the contractor, it usually leads to miscalculated designs with serious constructability issues when construction process commences. For example, materials specified on the design and specification might not be available in the market, and even if it is available the time to procure the material might not be feasible. Another issue might be gaps and errors found in the design that could range from as simple as missing paint colours to as serious as missing a foundation. Such gaps in the design eventually seriously impacts the time and cost of the construction project as the contractor usually submits a clarification request to get explanation on the matter, which mostly takes considerable amount of time to respond to the clarification request. The costs associated with the added time, material and labour necessary to make the change. The owner 'owns' the risk associated with these gaps and is responsible for negotiating and paying the additional costs incurred due to the change in project document (Hardin & McCool, 2015).

DBB employs a separate contract system which is believed to be a challenge to utilize contractor's knowledge and skills during pre-construction phase. (Latham, 1994). Another challenge is that most contracting parties are forced to lower their quotes to win the project work which they later claim through change requests in hopes of compensation which is paralyzing the construction industry (Egan, 2011).

Advantages and Challenges of DBB Project Delivery Method

Advantages

- The major stakeholders (client, consultants and contractors) are familiar with the method;
- It's a simple competition where the low bidders are awarded the job;
- It is easily applicable anywhere as it has no legal barriers;
- The owner has full control over project documents and designs;

Challenges

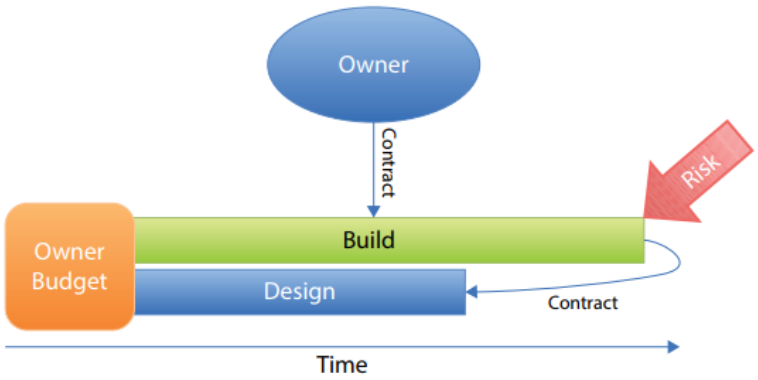
- There is limited or no communication whatsoever among the designers and the contractors during the design phase.
- The lack of communication among the designers and contractors typically leads to cost overruns and miscalculations
- The clarification requests and change orders may potentially create friction between the designers and contractors as errors made has to be justified to the owner.
- There may be increased litigation due to the lack of collaboration
- It is a slower delivery method, since full construction drawings must be completed prior to bid and construction.
- The owner bears the financial risk without knowing the overall price throughout the entire design and bid phase and retains the financial risks associated to changes during construction.
- Design professionals may not have sufficient construction experience to eliminate problems occurring in construction phase, where such risks are held by the owner.

II. Other Project Delivery Methods

A. Design-Build (DB) Project Delivery Method

This method is used when large engineering and construction firms, with the capability of performing all the engineering, design, procurement and construction themselves or teams are formed consisting of an engineering firm and a construction firm joining together (joint venturing) for the project's total execution (Charles, et al., 2005).

Figure 2.2: Design-Build Project Delivery Method



Source: (Hardin & McCool, 2015)

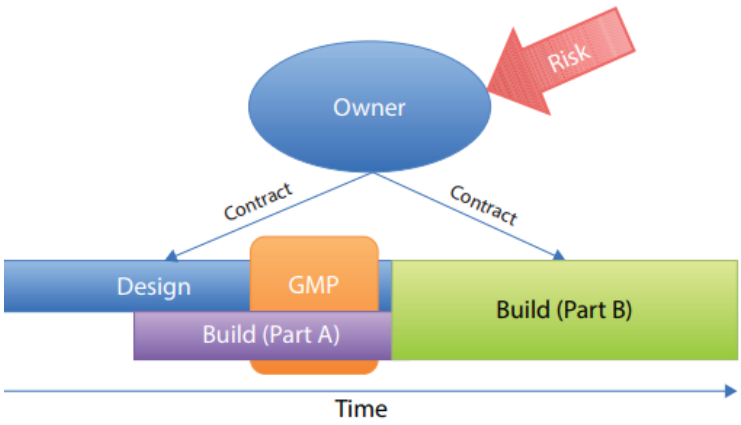
In Design-Build (DB) delivery method, the owner manages just one contract with the design-builder and no longer owns the risk as it is transferred to the design-builder. It is considered to be one of the best methods in promoting collaboration between designers and builders as they are contractually required to function as a team.

During this method, project requirements shall be defined and budget shall be set by the owner. The owner's project requirements would contain general requirements for function, form, and performance of the building as well as a schedule for project completion. The design-builder is to take performance requirements and 'design to the budget' as opposed to reacting to the design and 'budgeting to the design'. The design builder is responsible for managing the design process, obtaining the necessary permits for construction, and build the project on time and within budget.(Hardin & McCool, 2015)

B. Construction Manager

The Construction Manager (CM) method is similar to Design-Bid-Build (DBB) method where the owner still 'owns' the risk of the design and, in addition, has to manage two separate contracts. However, unlike DBB, the contractor is brought in during the design phase, which breaks the linear process of services. The owners agreement with the contractor has two parts: Part A (specifically for design phase services) and Part B (for construction services) agreements. (Hardin & McCool, 2015).

Figure 2.3: Construction Manager



Source: (Hardin & McCool, 2015)

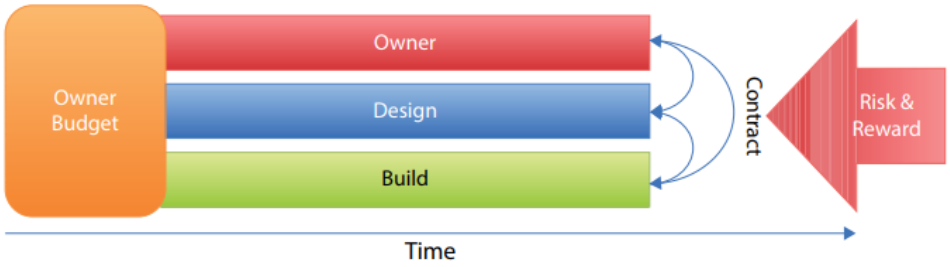
Depending on the circumstances and the owner's ability to assume risk, the outside construction manager might be assigned risk, the outside construction manager might be assigned as **'Agent for'** the owner with clearly defined areas of authority for committing the owner financially, authorising payments, proactively negotiating and approving changes, and resolving disputes. The other case is when the construction manager is asked to manage the project **'at Risk',** where it is required for the manager to agree to a not-to-exceed price for the work, thus being responsible for financial protection for the owner (Derbe, 2016).

C. Integrated Project Delivery (IPD)

The Integrated Project Delivery method utilizes a multiparty agreement among the owner, designer and contractor. It is similar to Design-Build (DB), however, the difference lies in the risk assumption.

In IPD, both the risk and reward is shared among the owner, architect, and contractor (Hardin & McCool, 2015).

Figure 2.4: Integrated Project Delivery Method



Source: (Hardin & McCool, 2015)

Integrated project delivery (IPD) is the latest project delivery method which ensures the integration of people, system and processes towards a collaborative practice through a multi-party agreement among client, consultant and contractor throughout the life of the project. It is the best method to optimize project outcomes, increase value to client, maximize efficiency and reduce waste throughout the design and construction phases of the project through a team based approach (Derbe, 2016).

2.2.2.3. Factors for Selection of Project Delivery Method

According to Derbe (2016), selection of the appropriate project delivery is subjective to the owner, however, the following factors would better guide the owner towards making the right decision in selecting the right project delivery method that best addresses the objectives and needs of the owner and the project. The factors to consider in selecting a project delivery method are:

- Objectives and needs of the owner and the project,
- Project costs and the acceptable risk level of exceeding the cost,
- Decision on design elements of a project and duration of a project,
- Understanding the different approaches, their risk profiles, their benefits and challenges.

Before selection of the appropriate delivery method owners shall answer the following questions to guide them in the selection process (Hardin & McCool, 2015).

1. The type of building
2. The available experienced designers on this type of structure
3. The risk associated with the project
4. The required project completion schedule
5. The amount of budget
6. The need for bringing the contractor on board during design phase
7. The possibility to legally contract the designer and builder under one agreement
8. The possibility to legally share the risk among the designer, the builder, and owner

2.2.3. Parties Integration

Integration can be attributed as the merging of various disciplines/organizations with different goals, needs and cultures into a unified and collaborative unit. Its approaches mandate for members of various organizations to work in one accord to achieve common and attainable project goals through accurate information sharing. This means that different organization cultures and processes have to be aligned in a collaborative manner.

Baiden, Price and Dainty (2006) defined 'integration' from the construction perspective, as collaborative working methods, practices and behaviours that promote a setting where free information exchange is promoted among the construction parties. 'Integrated construction project team' is described as a highly collaborative effective and efficient team that is responsible for the construction project processes.

For the case of this study Integration is considered as defined as bringing of major construction participants (client, consultants and contractors) involved in the execution process of the construction project to work together by creating a common goal and unified culture throughout the entire project phases (Mokbel, 2009).

Basing on the definition of integration, the situation where everything and everyone is working accordingly as a unit is considered to be fully integrated. It is the ideal solution for involved parties in a project to come to work together. Integration could be affected by certain aspects like a project type, project phase, parties involved, technology used and contractual arrangements/ project delivery methods (Derbe, 2016).

2.2.4. Integration in Different Project Delivery Methods

The level of integration among project parties can be affected by the type of project delivery method used in a project (Azhar, et al., 2013). Due to the disintegration following the issuance of two separate contracts to consultants and contractors, the Design-Bid-Build project delivery has several downsides that result in frequent disputes and claims among project participants. It mostly results in cost and time overruns and compromised quality outcomes.

A single entry is responsible for providing both design and construction services through a single contract agreement with the owner under Design-Build project delivery method. This approach facilitates the team efforts by allowing early participation of contractors to provide their input on constructability issues. DB method encourages collaboration among parties and it requires a trust among parties considerable amount of team building and alignment (Hardin & McCool, 2015).

The Construction Manager at risk results in high team integration since the opportunity for the CM to integrate with the designer is existent at a very early stage of the design phase. Due to this, the

contractor has the opportunity to provide information useful for cost estimation, design constructability assessment, scheduling, coordination and procurement (Zuber, et al., 2018).

Integrated project delivery method (IPD) integrates people, systems, business and practices into a process that connects the skills and insights of all participants to optimize efficiency through all phases of a construction project. It promotes a highly effective integration among the project parties which in turn contributes to overall success of the project (Azhar, et al., 2013).

The intention of the study focussed on the integration issues that result from implementation of DBB and its effect on the performance of 40-60 saving houses of construction project.

2.2. Empirical Review of the Research

2.2.1. Level of Integration among Parties

According to Baiden, Price and Dainty (2006), Integration among parties, in a construction project, implies the introduction of working practices, methods and behaviours that establishes a culture of efficient and operational collaboration of project participants throughout the construction project's life.

Baiden, Price and Dainty (2006), on an in depth literature based analysis, studied and summarized the dimensions of team integration into ten (10) categories. It has also developed a measurement for the level of integration among parties, in terms of the ten categories identified, to understand the degree of integration among parties in construction projects. It states that the level of integration is affected by the adopted team practices, which is set within the context of the project delivery method applied.

This study utilized the measurements of level of integration set by Baiden, Price and Dainty (2006) to evaluate the level of integration among parties in 40-60 Saving Houses Construction Project.

Table 2.1: Dimensions of team integration, their description and level of integration measured by dimension of team integration *(Baiden et al, 2006)*

No.	Dimensions of team integration	Level of Integration		
		Full achievement	Partial achievement	No achievement
3.1.	Single team focus and objective	All members have the same focus and work together towards team objectives	Members pursue individual objectives but in line with the overall project objective	Individually pursued objectives by members without regard or in isolation to others and project objectives
3.2	Seamless operation with no organizational defined boundaries	Members form a new single project team with no individual member identity or boundaries	Members operate as individuals but make efforts to collaborate with others on the project	Continued alignment and affiliation to individual organizations that make up the project team
3.3	Mutually beneficial outcome	Pursuance and attainment of project goals that benefits all members	Attainment of project goals in conjunction with other members whose involvement are necessary	Individually defined project objectives without compromise or consideration to others needs
3.4	Increased time and cost predictability	Openly accessible design and construction cost information gathering and management	Systematic follow up of design and construction cost information	Disjointed design and construction costs information gathering and application
3.5	Unrestricted cross-sharing of information	Availability and access to all project information to all parties involved in the project	Access to project information by a section or sections of the project team	Project information only available to members with responsibility to the specific work
3.6	Team flexibility and responsiveness to change	Requisite personnel join and leave the project team as their skills are no longer required or are needed	Retention of members no longer required and trained to adopt new requirements	Use of the same project team members even when they had outlived their effectiveness
3.7	Creation of single and co-located team	A single project team with all members located together in a common office	Individually operated sub-teams but co-located within a single environment	Individually located and operated teams
3.8	Equal opportunity for project inputs	Consultation of members for contribution at all phases of project before decisions are made	Contributions are welcomed but not explicitly invited from members in making decision on the projects	Little attempt to consult members in key project decision-making processes
3.9	Equitable team relationships and respect for all	All members are treated as having equal and significant professional capability needed on the project	Recognition of professional competence, but mainly in their respective field of expertise	Team members contribution restricted to their functional restricted to their functional project role
3.10	No blame culture	Collective identification and resolution of problems Collective. Responsibility for all project outcomes.	Cooperation of team members in resolving problems, but with ultimate responsibility resting with a single part	Individual members are singled out for problems that occur on out for problems that occur on corrective measure

Three levels of integration measurement: full achievement (if the dimension of team integration is fulfilled by teams fully), partial achievement (if the dimension of team integration is fulfilled by teams partially) and no achievement (if the dimension of team integration is not totally fulfilled by teams) were defined by Baiden, Price and Dainty (2006), which were conducted on CM and DB delivery methods in addition to DBB project delivery method. It indicated that the level of integration among parties in DBB is lower than that of CM and DB in different projects. Baiden, Price and Dainty (2006), did not study the effect of the level of integration on the construction project performance.

Therefore, in this research, the ten dimensions of level of team integration are adopted to evaluate the level of integration among parties in DBB project delivery method in 40-60 Saving Houses Construction Project.

2.2.2. Integration Issues in DBB Project Delivery Method

According to Latham, 1994, DBB project delivery method has continuously been ctiticized for its fragmented and disintegrated nature within the construction industry. Unless proved otherwise for responsibility of encountered problems, the client usually assumes the risks for cost and schedule overrunsof the project. The reason for this is that most contracted consultants and contractors usually do not admit to any responsibilities, risks or faults encountered, in most construction projects, where they rather blame eachother for being responsible.

DBB project delivery method does not encourage integration of parties into effective teams, as it follows a sequential process, the lack of collaboration could rise due to several factors as the poor team practices adopted throughout the project lifecycle (Tsai & Yang, 2010). Other than its sequential process method, prone to several integration issues, DBB by itself may not be a problem; where, even in DBB method, if parties made a significant effort to work in collaboration the overall performance of construction projects might be achieved. Hence, whenever the owner/client wants to assign the design work to design professionals and the construction to contractors, DBB project delivery method could be chosen as long as parties have no problem of integration throughout the project life and they make a tangible effort to work in a collaborative manner.

According to a study by Moore & Dainty (2001), effects of unintegrated project team efforts, processes and stages influences the project performance outcomes. It indicated that various strudies identified effective planning and control, commitment and personal competence for the project as key factors leading to realization of successful project outcomes.

The study conducted by Latham (1994), has shown that various studies identified personnel competence, commitment to project goals, effective planning and control, and effective communication between parties as the key factors for construction project success. It highligthed that

disintegrated project team efforts and processes has consquences that influence the project performance and optimal project outcomes. This indicates that optimal integration of the DBB project delivery system and project management effort from the jump, plays a crucial role in delivering expected project outcomes particularly in terms of achieving sustainability goals. Therefore, in theory, construction projects that employ DBB project delivery method can potentially achieve the desired project outcomes as far as project participants strive to ensure effective project management practices collaboratively. Thus, it has been found imperative to identify major integration issues in DBB project delivery method and their due effect on project performance in order to recognize the impact of employing the project delivery method.

Many empirical researchers have studied different integration issues affecting construction projects throughout the project life cycle. The following integration issues from several literatures are categorized based on personal or subjective judgment, including planning, collaboration and communication, management, productivity, contract, expertise, and responsibility and accountability. The combined integration issues in construction projects that potentially exist due to employment of DBB project delivery method has been merged and categorized in the study. The merging and grouping is done in relation to the context of the research to evaluate major integration issues in DBB project delivery method on 40-60 Saving Houses Construction Project.

Among the integration issues related to project documents; insufficient working drawing details and poor design and specification were identified by Arain & Assaf (2006), frequent design modifications made on the project Huang, et al. (2008) which was mapped as 'lack of standard design and specification' in the study.

Integration issues among parties in a project ultimately affect the communication and coordination in a construction team. These issues were identified as; lack of teamwork among parties (Rahman & Kumaraswamy, 2005), Parties having different opinions on mutual needs (Huang, et al., 2008), Lack of open and honest communication; Lack of trust and reliability between parties (Huang, et al., 2008), Loss of significant information among parties; Failure to share significant information among parties; 'master' and 'slave' approach between parties (Rahman & Kumaraswamy, 2005), Lack of clearly defined of responsibilities of contracting parties (Derbe, 2016), Lack of opportunities for contractor engagement in decisions (Arain & Assaf, 2006). These issues were mapped as 'Lack of coordination among parties', 'Lack of effective communication among major construction parties', 'Lack of equitable team relationships, responsibilities and respect for all' and 'Lack of inclusive decision making process among parties'

Management related integration issues among parties were identified as Late approval of material specification (Arain & Assaf, 2006), Late approval of design modifications (Huang, et al., 2008),

Stringent/strict public sector rules/ regulations; Accountability concerns of public sector (Rahman & Kumaraswamy, 2005). These issues were mapped as 'Late decision making by client/consultant' and 'Bureaucratic client processes' for the study.

Contract related integration issues among parties were identified as Faulty/inadequate design information in the contract; Poor contract detail (Huang, et al., 2008) and Gaps found in the contract (Rahman & Kumaraswamy, 2005). These issues were grouped under 'Inadequate contract document' for the purpose of the study.

Technical/ Expertise related integration issues among parties were identified as Technical and financial incompetence of contractors (Arain & Assaf, 2006), Lack of client knowledge on project processes & integration issues (Rahman & Kumaraswamy, 2005), and Inadequate technical skill of the client (La Hart, 2007), These issues were grouped under 'Lack of required personnel, financial and physical resources by parties' for the study.

Integration issue among parties related to planning were identified as Lack of inclusion of all parties input in planning and scheduling phase (Huang, et al., 2008), Late engagement of contractors on the project with no project planning input (Magi & Prianka, 2014) and In accurate/ faulty planning (Huang, et al., 2008). These issues were mapped as 'Lack of integrated planning and scheduling among parties' and 'Late engagement of contractors' for the purpose of this study.

Integration issue among parties related to their responsibility and accountability were identified as Lack of commitment from client; Lack of commitment from consultant; Lack of commitment from contractor (Rahman & Kumaraswamy, 2005), Frequent design and specification changes with no accountability (Derbe, 2016), Inappropriate selection of construction material by the designer (Magi & Prianka, 2014), Faulty reporting among parties (Huang, et al., 2008), Frequent construction faults (Sebastiaan, 2014). These issues were mapped as 'Lack of commitment from major parties', 'Lack of accountability', 'Frequent project scope changes', and 'Lack of project ownership by parties' for the purpose of the study.

Productivity related integration issues among parties were identified as Mistakes and discrepancies in project (Magi & Prianka, 2014), Frequent reworks and modification leading to lag in the project (Huang, et al., 2008) which were grouped as 'High degree of inefficiencies and rework' for the purpose of this study.

2.3. International experience on parties integration in DBB project delivery method

Construction projects all over the world employed DBB project delivery method for its ease of use in different conditions. In order to draw from the experiences this section has provided integration issues and experiences, in DBB project delivery method, of international construction industries. Accordingly, following are experiences of UK, USA, China, Nigeria and Ethiopia on integration issues while employing DBB project delivery method.

2.5.1. The integration experience of United States of America (USA)

Design-bid-build project delivery method has been exclusively used in most construction project in the United States construction industry (AIA, 2007). The main drawback of using DBB in US' projects has been the very few opportunities it offers for team integration, since early involvement of contractor is not permitted during the design stage according to its structure. It was indicated by the American Institute of Architects (AIA, 2007), that DBB has a strict and rigid system that doesn't lend itself to parties'integration. In a later time, however, the USA construction sector used DBB project delivery method along with application of integrated project processes where owner, consultant, contractor, and sub-contractors committed to working as a team and understood the value of integration in the best interest of the project throughout the phases of design and construction.

The integrated project process is believed to realign roles, underlying motivation, and activity sequences for participants of the project to utilize every individual participants' best talents and abilities at the right time.

2.5.2. The integration experience of United Kingdom (UK)

The United Kingdom, has long been using DBB project delivery for several years, the UK taskforce showed that it is generally a sequential process as it reflects the input of designers, constructors and key suppliers in the United Kingdom.

The task force identified that integration of processes and teams is the best key driver for the desired change which facilitated to set the agenda for the whole construction industry. The key premise used behind the integrated project processes, by the UK construction task force, was that the designer, constructor and supplier team shall work together through project partnering provisions which helped them to achieve the levels of performance improvement targeted in their studies.

Although it was challenging for the construction industry in UK to develop their own integrated teams, while working with occasional and inexperienced clients, it was finally made possible by the UK construction industry. They have identified and designed a measurement toolkit for maturity of integration among project teams, which helped the construction companies to assess their position in

the industry. The toolkit provides information advices, guidance and training indicators which help the construction companies overcome project specific challenges (Derbe, 2016).
(http://icwtoolkit.com/toolkitguide/online-maturity-assessment/, 2015)
Collaborative working methods and approaches, are described as drivers, by the toolkit, for project team integration along with detailed processes, cultures, methods and tools required to enable project teams deliver desired value through integration and collaboration. It provides a framework for clients, consultants, contractors, advisers and supply chain partners on ways to achieve optimal performance and what to look for in their relationships.

2.5.3. The integration experience of construction parties in China

Design-bid-build (DBB) project delivery system has been the most predominantly used delivery method in China. Until the mid-1990's most construction projects adopted DBB; where over 95% of the domestic projects employed DBB project delivery method. So far, the Chinese construction industry has made more efforts to learn from foreign countries on new project management approaches due to the team fragmentation nature of DBB project delivery method (Bosen, 2006). Accordingly, the industry used DBB along with project management (PM) in order to create integration among construction teams. It was indicated that the education system of China gave more attention to 'construction project management'. Moreover, new laws, regulations and rules have been introduced that created a more integrated, standardized and manageable construction industry while utilizing the Design-bid-build project delivery method (Bosen, 2006; and Ya Jiang *et al*, 2006).

2.5.4. The integration experience of construction parties in Nigeria

The Nigerian construction industry is no different where the DBB project delivery method is uses as the predominant delivery method which is still being exclusively and widely used in Nigeria; specifically for housing projects. However, this project delivery method creates major disintegration among the construction parties (Benedict, 2012). The recommendation forwarded by Ibrahim *et al* (2014), states that application of project management techniques; employment of competent personnel and investment in knowledge management and continuous training and strictly following project management procedures in DBB delivery method to achieve integration among parties.

2.5.5. The integration experience of construction parties in Ethiopia

The Ethiopian construction industry has been practicing DBB project delivery method predominantly since 1987 (Wubshet, 2004). In DBB project delivery system, although the supervision consultant is the prime professional on behalf of the owner administrating most of the project work, the employer is the one taking responsibility of coordinating the various packages of the project phases. (Derbe, 2016). Construction projects are managed based on a previously prepared design by the designer leaving

coordination issues as the client's responsibility in the construction industry. The design-bid-build project delivery method fails to promote integration among parties and weakens contractual relationships (responsibilities) between different parties (Lema, 2006). Moreover, the integration practice among the major parties in Ethiopian construction industry is not practical. (Derbe, 2016). According to Wubshet (2004), there is minimal integration and poor information management among construction parties. Construction projects cannot be completed on time, budget and within expected quality. Thus the study aims to evaluate the level of integration and major integration issues in DBB project delivery method and their effect on performance of 40-60 Saving Houses Construction Project.

2.4. Conceptual framework of the research

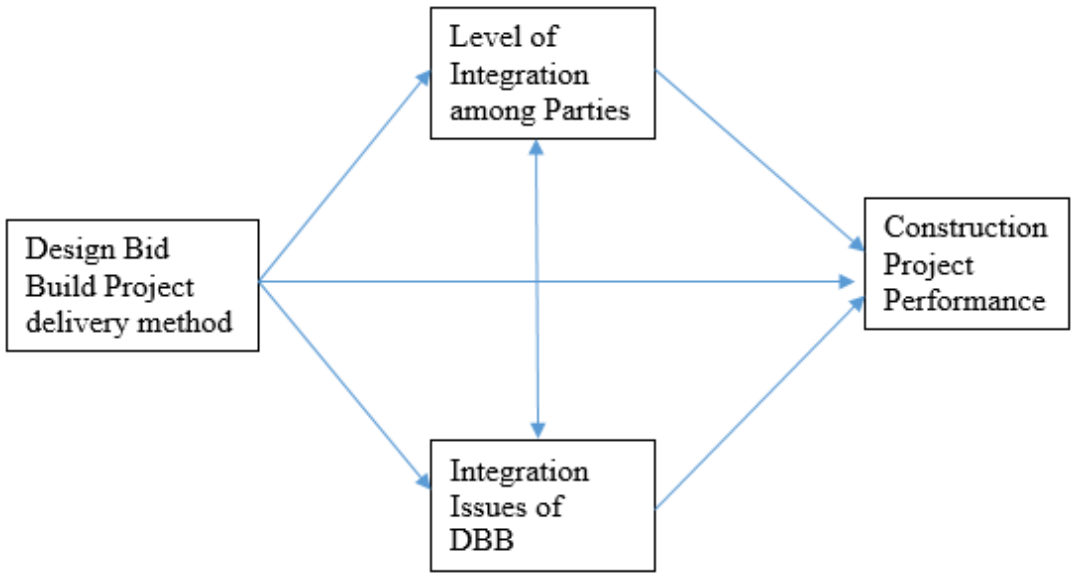


Figure 2.5: Conceptual framework of the study

2.5. Summary of Literatures Reviewed

Of the major industries, the construction industry is the main contributor to the development and growth of a country. The major construction parties are the client, consultant and contractors. According to literatures reviewed, the way a client chooses to contractually work with the consultant and the contractor is referred to as a project delivery system. It specifies and determines the link among the parties in terms of communications and relationships between them.

Project delivery method is one of the first decisions that an owner makes before starting a construction project in order to create a structured project delivery system with regards to contractual arrangements. There are different options for selection of construction project delivery methods. Selection of the right delivery method, can assist on successful completion of the project and achieving the objectives of the project. There is no universal solution for construction project delivery methods, however, one can

select the suitable project delivery method in consideration of the requirements and objectives set for the specific project context by assessing advantages and disadvantages of each delivery method.

Literatures explain that the type of project delivery method selected and employed by the owner affects the integration level of a construction project. Choosing the right type of delivery system for a particular project can increase the integration of teams and in turn help achieve the project objectives and successful completion of projects. The Design-Bid-Build project delivery method, also identified as the traditional project delivery method is almost exclusively used in most public projects in local and international construction industries. It is identified as traditional project delivery method since it is prone to several integration issues as the owner signs two separate contracts with the consultant and the contractor individually. DBB project delivery method imposes a significant contractual and organizational separation of design from construction. The contractor is not involved until later in the project, after design is completed, which mostly results in a design with several constructability issues, since contractor's input hasn't been incorporated.

The DBB project delivery method, employs a sequential/linear process among different parties. Due to this, literature indicates that there is a lower level of integration among parties as the chance of integration issues occurring among construction parties is higher compared to other project delivery methods. Moreover, literature revealed that this approach mostly deals with frequent design changes, disputes, clarification requests and ambiguity in responsibilities which ultimately affects the integration of efforts of various construction parties and impact the overall performance of construction projects.

According to the literature review, lack of commitment and poor communication by various parties, integration problems, lack of coordination among parties and client's knowledge gap on project processes, problems related to planning, collaboration and communication, management, productivity, contract, expertise, and responsibility and accountability are the identified integration issued that affect the level of integration among parties in different stages of the project. The literature has also shown that identification of integration issues can be a significant input in maintaining the integration among parties through the entire project phases. Moreover, the national and international practices of Design-bid-build project delivery method indicated that the delivery method fails to promote team integration in construction project. The international practice has showed that several integration problems could rise while using DBB project delivery method. However, the international practice has indicated that team integration could be enhanced by using DBB project delivery method in combination with 'construction project management'. Where, in the Ethiopian practice the potential integration issues affecting construction parties' integration are yet to be identified. This shows that the Ethiopian construction industry needs to identify these integration issues affecting the construction sector and

address them in addition to simply underlining the lacking of the DBB project delivery method in team integration.

In general, the literature reviewed has shown that the DBB project delivery method is prone to integration issues and problems affecting the smooth integration and coordination of construction parties. The literature review has shown that most existing literatures were conducted within the context of developed countries and those conducted within local context lack detail information on the relationship of integration with the performance of a project. Therefore, with the aim to enhance the practices of the construction industry, the level of integration achieved from DBB project delivery method, its major integration issues and further the effect of this integration issues on performance of 40-60 Saving Houses Construction Project has been studied in this document.

CHAPTER 3 - RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

The focus of the research is to examine the level of integration among major construction parties and assess the performance of Addis Ababa 40-60 Saving Houses Construction Project in DBB project delivery method. The level of integration between the major parties; local contractors, consultants, client and concerned regulatory body involved in 40-60 Saving Houses Construction Project that implements Design Bid Build (DBB) delivery method has been investigated. The result of the integration level and integration issues among the above mentioned parties on the performance of the 40-60 Saving Houses Construction Project in DBB delivery method has also be analysed and discussed. The choice of the mixed research method has been justified as an appropriate research strategy. The determination of the study sample and the techniques of data collection have also been described.

3.2. Research Approach

A mixed approach that utilizes both qualitative and quantitative data has been used in the research. The quantitative data included evaluation of the level of integration among major construction parties in 40-60 Saving Houses Construction Project using different-point scale measured with numbers and identification of major integration issues in DBB project delivery method. For qualitative method, effect of the integration issues in DBB project delivery method on performance of 40-60 Saving Houses Construction Project performance used analysis of project documents and in-depth interviews featured with qualitative elements.

3.3. Research Design

In this study, the research tried to answer questions pertaining the performance of Design-Bid Build project delivery method. Subsequently this study employed a descriptive research design.

3.4. Population, Sample size and Sampling Techniques

3.4.1. Population or Universe

The scope of the population of this particular study ranged in the main role players of the 40-60 Saving Houses Construction Project. Namely the consultants, contractors and clients (professionals from government side) working under these projects. The 40-60 saving houses construction project has 1 head office and 4 branch offices (which manage a total of 14 sites under the offices), 8 consultants (consulting more than one lot and one project site), 152 contractors (Grade 1-3, in the list of

contractors by MoUDC). There are also government bodies conducting periodical visits on the status of the project. The total population of this study included engineers working under the 40-60 Saving Houses Construction Project

Table 3.1: Total population for study

Sample frame	Head office	Branch-1	Branch-2	Branch-3	Branch-4	**Total**
Client's officials	20	21	16	12	14	83
Consultants' officials	-	17	15	3	12	47
Contractors officials	-	45	38	23	46	152
Government body officials	2	-	-	-	-	2
Total Population	22	83	69	38	**72**	**284**

3.4.2. Sampling Frame

The sample frame for this study are clients, consultants (in the list of consultants by MoUDC), contractors (registered Grade 1-3 in the list of contractors by MoUDC) and regulatory body; which participate in the construction of public mass housing construction projects under this study.

3.4.3. Sampling Unit

The sampling unit used for this study is **an Engineer official,** specifically working under the Client/government, Contractor and Consulting organizations involved in 40-60 Saving Houses Construction Projects under this study.

3.4.4. Sampling Size

The total population consisted of 284 members (152-contractors, 47-consultants' officials and 83-client's officials and 2 government officials) currently working under Addis Ababa 40-60 Saving Houses Construction Projectand overseeing the project. The sample size is determined based up on sampling technique of (Yamane, 1967). The formula is large enough to allow for precision and confidence level in general ability of the research. The formula for the calculation of the sample size is presented hereunder considering the total population, 95% confidence level and 5% precision level:

$$n = \frac{N}{1 + Ne^2}$$

Where n = sample size

N= number of population

e= acceptable sampling error %

$$n = \frac{284}{1+284(0.05)^2}$$

$$= \frac{284}{1+0.71}$$

$$= \underline{166}$$

The sample size for this study is 166.

Note: The sampling size included 166 engineers of which 88 are from contractors, 28 from consultants, 48 from client and 2 from government bodies. Questionnaire was distributed to all sample size and only 151 responses were obtained of which 79 were contractors, 45 were client professionals, 25 were from consultant professionals, and 2 from government bodies.

3.5. Sources of Data

Information was generated from collecting facts (datum), hence, the overall research process was aimed towards collecting credible data and generating information based on the analysis of these data. The research utilized both primary and secondary sources of data.

3.5.1. Primary sources of data

Primary sources of data have been directly collected from the construction stakeholders by means of structured and unstructured questionnaires and interviews.

3.5.2. Secondary sources of data:

Secondary sources of data were obtained from project reports, payment certificates, project contracts and project documents.

3.6. Data Collection Instruments

As explained earlier, the study will use both primary and secondary sources of data collection method. The main data collection instruments considered in the study are:

3.6.1. Questionnaire

The most useful data collection within the primary source is the questionnaire survey method (web & paper-based), which included both open and closed questions. The questionnaire design avoided tedious and useless information by using short and simple language questions (Appendix A). One hundred and sixty six (166) questionnaires were dispersed to the client, consultant, contractor and

government organizations involved in 40-60 Saving Houses Construction Project of which only 151 questionnaires were filled out and returned.

3.6.2. Interview

The study designed and used semi-structured interviews as a means to collect information basing on the research objectives. The interviews were conducted with 7 professionals, (4(four) from client, 2 from consultant and 1 from contractor) were interviewed to obtain detailed data on the subject matter. The interview data was written down as per the consent of the interviewees.

3.6.3. Observation

In this study direct observation was made to see what is actually done in the project sites (site progress and activities), to cross check with the other data collection instruments and to eliminate the subjective bias of respondent. In addition the information obtained under this method relates to what is currently happening in the project. Almost all buildings have completed the structural work and somehow completed the architectural works. However, the electrical and sanitary fixture installations haven't been done as the client solely decided that it has to be omitted from the contract.

3.6.4. Project Document Review

Project reports, payment certificates and contract documents were reviewed to evaluate the performance of the project.

3.7. Validity and Reliability

Validity and reliability has been seriously considered to test and measure the quality of the research. To ensure the validity of the research; correct data collection instruments & appropriate procedures were utilized to find answers to the research questions.

3.7.1. Cronbach's alpha (α) coefficient

Cronbach's alpha was calculated, using SPSS software, in order to measure of reliability or internal consistence of variables. Cronbach's alpha coefficient (ranging from 0-1) were determined using IBM SPSS 25 to test the reliability and consistency of the questionnaire survey. The Cronbach's alpha obtained for survey responses obtained on the level of integration among parties is 0.831, performance of 40-60 Saving Houses Construction Project is 0.802 and integration issues in DBB project delivery method is 0.803. Accordingly, a Cronbach's coefficient between range 0.8-0.9 shows that the survey result has good consistency and is therefore reliable for drawing results from it.

Table 3.2: Cronbach's alpha coefficient

No	Scale	No. of variables	Cronbach's alpha coefficient value from SPSS			
			Client Respondents	Contractors Respondents	Consultants Respondents	Total
1	Level of integration among major parties	10	0.858	0.811	0.818	0.831
2	Integration issues in DBB project delivery method	16	0.832	0.801	0.770	0.805
3	Performance of 40-60 Saving Houses Construction Project	3	0.888	0.745	0.862	0.802

3.8. Data Analysis Techniques

The study used different data analysis techniques to achieve the abovementioned objectives. The collected data has been tabulated, analysed and interpreted in terms of percentages in order to make it clear and easily understandable by viewers. The techniques used for quantitative data analysis include Descriptive analysis and Relative Importance Index (RII). Narrative analysis was used for qualitative data. Earned value analysis was also used to analyse cost and schedule performance of the projects. Kerzner (1998) considers earned value analysis as a relevant maturity differential in project management. That can clearly show what was planned, what was performed, and the actual costs. Consequently, earned value analysis was used to analyse cost and schedule performance of the projects. Overall, The statistic tool SPSS was used for quantitative data analysis.

CHAPTER 4 - RESULTS AND DISCUSSION

4.1. Introduction

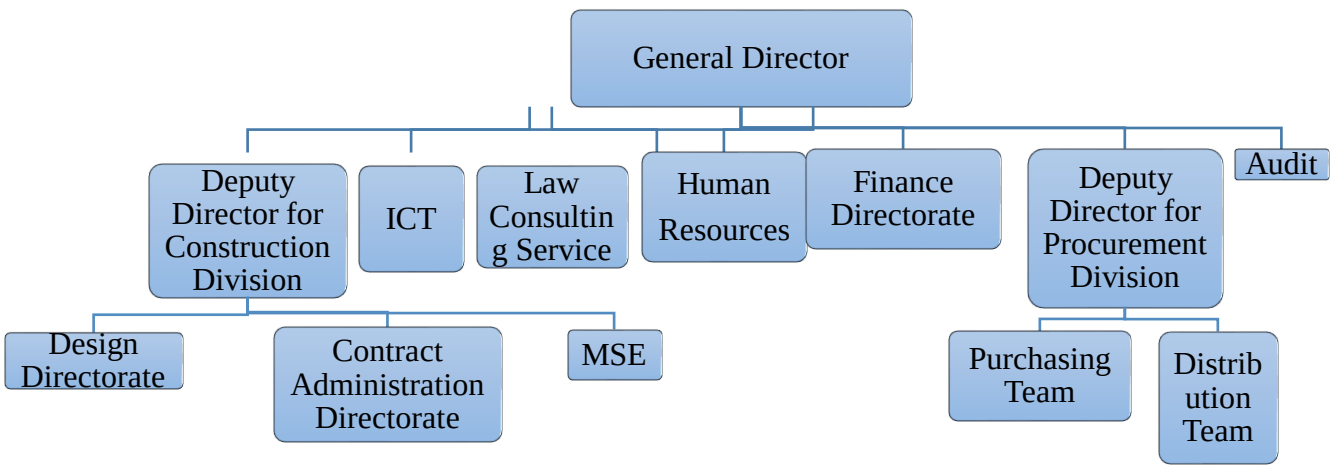
Under this chapter the results of survey and interview data has been discussed in detail. It incorporates results for the performance assessment of 40-60 Saving Houses Construction project after evaluation of level of integration among parties, and identification and ranking of integration issues in the project. Following an in-depth literature review, a list of measurement for level of integration and 16 integration issues in DBB project delivery method were identified. A structured questionnaire was prepared and shared to project professionals participating in 40-60 Saving Houses Construction Project. Accordingly, under this chapter, interpretation and discussions of the data is presented on the basis of the findings and limitations observed. The complete survey questionnaire used for data collection is provided under Appendix A and Interview questions under Appendix B at the end of this document.

4.1.1. General Project Information

The 40-60 Saving Houses Construction Project is one of the mega projects in Addis Ababa, playing a significant role in changing the image of the city, creating jobs and supplying houses to middle income citizens of Addis Ababa. It is one of the projects run under the IHDP by the Addis Ababa city government along with 10-90 and 20-80 housing. The project was launched on July, 2012, by the city government of Addis Ababa.

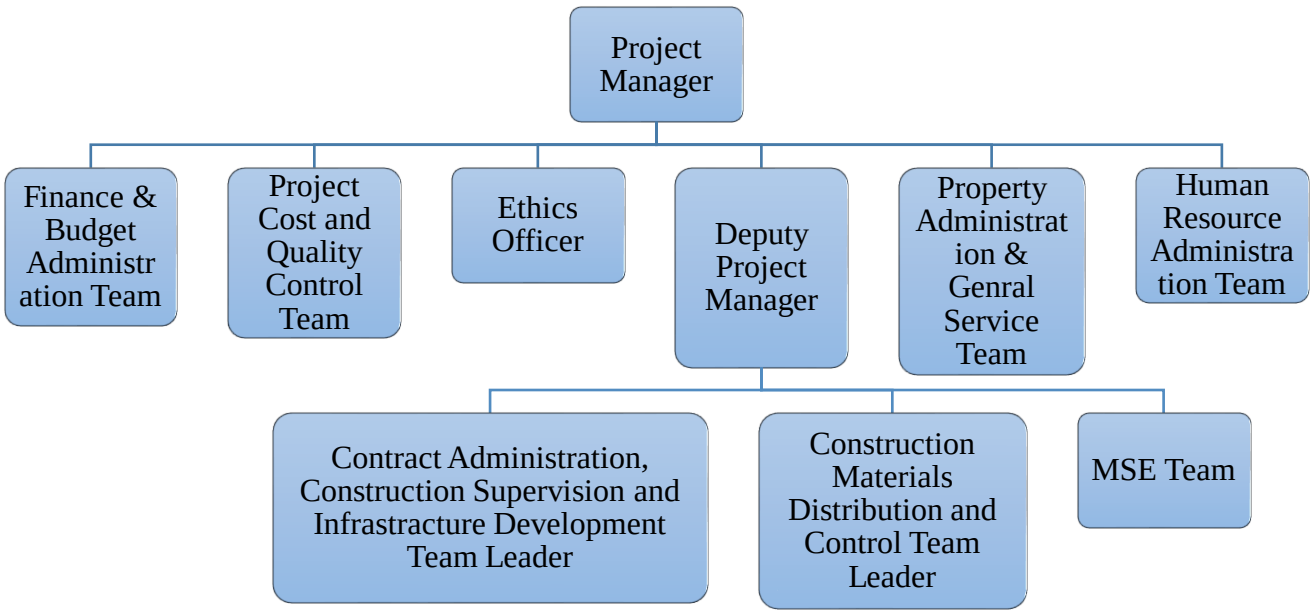
It was managed under the office ‘Addis Ababa Saving Houses Development Enterprise (AASHDE) from 2012-2019 which later the office was restructured and changed to Housing development Corporation which manages all the three IHDP program projects (10/90, 20/80 and 40/60 scheme housing construction projects) since October 2020.

Figure 4.1: Head office Organizational structure of40-60 Saving Houses Construction Project



As mentioned above under section 3.4.1, there are 4 main central branches (Branch 01- 04) consisting of 14 project sites including lots of Bole Bulbula (lot-1 and lot-2). Hence, this study has considered all sites including lots, which are a total of 14 project sites. The organization structure for the branch offices is described below on *Figure 4.2.*

Figure 4.2: Project branch office Organizational structure of40-60 Saving Houses Construction Project



Source: Brach offices

A. 40/60 Housing Construction Branch 01 Project Office

Branch one project office, of 40-60 Saving Houses Construction project, is located in Bole Sub city, Woreda 12 in Bole Bulbula, Addis Ababa. Five major sites are managed under this branch, namely Bole Bulbula site (1 and 2), Ehil Nigd site, Tourist site, Hintsa Akrabi site, and Asko sites. There are four consultants, and 27 contractors (Grade 1-3) participating in construction of 89 building blocks.

Table 4.1: Project sites and Total No. of Blocks in Branch 01 *(Source: Branch 01 Project office)*

No.	Project branch	Site	Typology	No.of Blocks	Total No. of Blocks
1	Branch 1	Asko	3B+G+12	1	13
			2B+G+13	12	
2		Ehil-Nigd	2B+G+12	5	6
3		Tourist	2B+G+18	11	11
4		Hintsa Akrabi	2B+G+13	8	8
5		Bole Bulbula- 1	2B+G+13	20	28
			B+G+7	8	
6		Bole Bulbula- 2	2B+G+15	15	23
			B+G+9	8	
				Total	**89**

B. 40/60 Housing Construction Branch 02 Project Office

Branch two project office, of 40-60 Saving Houses Construction project, is located in Bole Sub city, around Ayat, Addis Ababa. Four major sites are managed under this branch, namely Ayat site-1, Ayat Site-2, Ayat site-3 and Meri Loke. There are three consultants, and 53 contractors (Grade 1-3) participating in construction of 107 building blocks.

Table 4.2: Project sites and Total No. of Blocks in Branch 02 *(Source: Branch 02 Project office)*

No.	Project branch	Site	Typology	No.of Blocks	Total No. of Blocks
1	Branch 2	Ayat Site- 1	B+G+8 – 14	14	14
2		Ayat Site-2	B+G+8	20	38
			B+G+10	18	
3		Ayat Site -3	B+G+8	32	41
			B+G+10	9	
4		Meri Loqe	2B+G+13	14	14
Total No. of blocks					**107**

C. 40/60 Housing Construction Branch 03 Project Office

Branch three project office, of 40-60 Saving Houses Construction project, is located in Bole sub city, Woreda 09 in an area commonly known as Beshale. There is only one major site under this branch, one consultant and 27 contractors (Grade 1-3) where a total number of 58 building blocks are being constructed.

Table 4.3: Project sites and Total No. of Blocks in Branch 03 *(Source: Branch 03 Project office)*

No.	Project branch	Site	Typology	No.of Blocks	Total No. of Blocks
1	Branch 3	Bole Behsale	2B+G+13	15	**58**
			B+G+15	22	
			B+G+9	21	

D. 40/60 Housing Construction Branch 04 Project Office

Branch four project office, of 40-60 Saving Houses Construction project, is located in Bole sub city Woreda 10 in an area commonly known as Ayat 49 Mazoria. There are three major project sites, three consultants and 44 (Grade 1-3) contractors constructing a total of 81 building blocks.

Table 4.4: Project sites and Total No. of Blocks in Branch 04 *(Source: Branch 04 Project office)*

No.	Project branch	Site	Typology	No.of Blocks	Total No. of Blocks
1	Branch 4	Bole Ayat-1	B+G+10	8	**81**
			B+G+8	14	
2		Bole Ayat -2	2B+G+13	34	
			2B+G+15	15	
3		Summit	B+G+8	10	

4.1.1.1. Selection Process of Consultants and Contractors in the project

The client is responsible for selection of both consultants and contractors in the project. The selection process of both parties is a linear process where the consultant is selected first and the contractor follows.

I. Consultants' selection process

An open tender was floated for consultants through an invitation for bid which was evaluated with the value of 80% given for technical document and 20% for financial offer provided by the consultant. A minimum score of 70% is expected on technical evaluation in order for the financial document to be evaluated. The consultants that offer the lowest financial proposal were given a 100% financial score which is later converted to 20%. By combining the scores for technical and financial proposals of the consultant a total score was determined and ranked, where the highest scored consultants were selected for contract agreement.

II. Contractors' selection process

Contractors' in 40-60 saving houses construction project were contracted at a later time after the preliminary and final designs were completed. The contract type used with contractors is a fixed-unit price where the contractors are compensated for the amount of work they executed as per the set price on the contract agreement. In selection of the contractors, the three years financial turnover was the main criteria which was given 50% rank then the other criterions were work experience (weather general or specific) given 15% rank, good performance accounts given 15% rank, where any Grade 1-3 contractors were selected if the total score of the mentioned criterions resulted more than 70%. Up-to 18-story buildings were assigned to Grade-1, up-to 13-story buildings to Grade-2 and up-to 9-story buildings to Grade-3 contractors. In addition if client is convinced that contractors performed well in their assigned project, they were awarded other additional blocks.

Consequently, it is clear that the client issues two different contracts with the consultant and contractor in a linear process. From this, it was evident that the 40-60 Saving Houses Construction Project employed Design-bid-Build project delivery method. According to the interview data, DBB project delivery method is exclusively being utilized in 40-60 Housing construction projects due to the familiarity of the project parties with the method and that the client firmly believes that it is cost effective as it awards consultants with the lowest financial proposal and contractors on a fixed unit rate which might not be the case if other project delivery method were adopted.

4.2. Response Rate

The study focused mainly on the client, consultants and contractors involved in the construction of the 40-60 Saving Houses Construction Project. The total sample size was 166 engineers working in either of the organizations under study. Accordingly, a total of 166 questionnaires were distributed: of which 88 were distributed for contractors, 28 were distributed for consultants, 48 were distributed for client and 2 for regulatory body engineers working in the Ministry of Urban Development and Construction (MoUDC) who have concern in the follow up of 40-60 Saving Houses Construction Projects. Out of the total (166) distributed questionnaires, 151 professionals responded to the survey which were 45 (93.75%), 25 (89.3%), 79 (89.7%), 2(100%) from client, consultants, contractors and regulatory body, respectively. This yields an overall response rate of 90.9%, which has been found acceptable for the analysis of the data.

From *Table 4.5*, it is evident that the contractors make up the highest percentage (Grade-1 23.18%, Grade-2 18.54% and Grade-3 10.6%) of respondents, followed up by clients (29.8%) and consultants (16.56%). Ministry of Urban Development and Construction (regulatory body) have the smallest respondents makeup for 1.32% compared to other respondent's category. This shows that the main study organizations has adequately been represented by the respondents.

Table 4.5: The response rate of respondents by their respective category based on survey data

Respondents Category		Questionnaires			Overall Percentage of Respondents from Each Category Respondents from Total Returned
		Distributed	Total Returned		
			In No.	Percentage (%)	
Clients		48	45	93.75%	29.80%
Consultants		28	25	89.29%	16.56%
Contractors	Grade-1	35	35	100.00%	23.18%
	Grade-2	32	28	87.50%	18.54%
	Grade-3	21	16	76.19%	10.60%
Regulatory Body		2	2	100.00%	1.32%
Total		166	151	90.96%	100.00%

Accordingly, the details of respondent's response rate by project sites under the four branch offices and by category is summarized as follows on *Table 4.6.*

Table 4.6: The response from respondents in each project site based on survey data collected on the sites under the four branches

40-60 Project Sites	Representative Organization				Total
	Client	Consultant	Contractor	Regulatory Body	
Head Office	6	0	0	2	8
Asko	3	1	1	0	5
Ayat Site	11	6	18	0	35
Bole Ayat	8	5	19	0	32
Bole Beshale	6	1	13	0	20
Bole Bulbula	2	5	14	0	21
Ehil Nigd	3	1	2	0	6
Hintsa Akrabi	1	3	2	0	6
Meri Loke	1	1	5	0	7
Summit	1	1	3	0	5
Tourist	3	1	2	0	6
Total	45	25	79	2	151

4.3. Background of respondents

Engineer professional working under the different organizations (client, consultant, contractor and regulatory body) were considered for the questionnaire survey. According to the *Table 4.7*, majority of the respondents 144 (95.4%) hold bachelor degree and above qualifications.

Table 4.7: Highest educational qualification of respondents

Educational Level	Representative Organization								Total	
	Client		Consultant		Contractor		Regulatory Body			
	No	%	No	%	No	%	No	%	No	%
Advance diploma	0	0.0%	0	0.0%	7	8.9%	0	0.0%	7	4.6%
Bachelor Degree	38	84.4%	17	68.0%	59	74.7%	1	50.0%	115	76.2%
Masters Degree	7	15.6%	8	32.0%	13	16.5%	1	50.0%	29	19.2%
Total	45	100.0%	25	100.0%	79	100.0%	2	100.0%	151	100.0%

Moreover, years of establishment of respondents organizations in which they are working in have been considered in the study. As a result, according to *Table 4.8*, the Ministry of Urban Development and Construction has more than 20 years of establishment, where the employer (client) has less than 10

years of establishment (8 years since establishment), most consultants and contractors have more than 10 years of establishment. Thus it is believed that the responses obtained are based on the experiences acquired from the long period practices in their respective organizations.

Table 4.8: Organizations' experience (Year of establishment)

Organizational Experience (yrs.)	Representative Organization								Total	
	Employers		Consultants		Contractors		Regulatory body			
	No	%	No	%	No	%	No	%	No	%
0-5 years	0	0.0%	0	0.0%	4	5.1%	0	0.0%	4	2.6%
5-10 years	45	100.0%	6	24.0%	35	44.3%	0	0.0%	86	57.0%
10-15 years	0	0.0%	16	64.0%	32	40.5%	0	0.0%	48	31.8%
Above 15 years	0	0.0%	3	12.0%	8	10.1%	2	100.0%	13	8.6%
Total	45	100.0%	25	100.0%	79	100.0%	2	100.0%	151	100.0%

Furthermore, the general experience of respondents, as shown in *Table 4.9*, involved in the construction project were also considered for the questionnaire survey. Majority of the client (29), consultants (15), and contractors (54) professionals have more than 5 years of general experience (64.4%, 60% and 68.4% respectively). Out of which 5 (11.1%) of client, 3 (12%) of consultant and 13 (16.5%) of contractors respondents have more than 15 years of general experience. Out of total (151) respondents, 100 (66.1%) of them have more than 5 years of experience of which 21 (13.9%) have more than 15 years of experience. Both (2) regulatory body respondents have over 5 years of experience. This shows that organizations included in the study has several years of experience within the field.

Table 4.9: General experience of respondents

General Experience	Representative Organization								Total	
	Client		Consultant		Contractor		Regulatory Body			
	No	%	No	%	No	%	No.	%	No	%
0-5 years	16	35.6%	10	40.0%	25	31.6%	0	0.0%	51	33.8%
5-10 years	18	40.0%	10	40.0%	27	34.2%	1	50.0%	56	37.1%
10-15 years	6	13.3%	2	8.0%	14	17.7%	1	50.0%	23	15.2%
Above 15 years	5	11.1%	3	12.0%	13	16.5%	0	0.0%	21	13.9%
Total	45	100.0%	25	100.0%	79	100.0%	2	100.0%	151	100.0%

Thus, it is believed that the collected surveys are reflective of the prevailing situation in the construction industry with respect to the different construction parties' characteristics focused on parties' integration together with its implications on project performance. Therefore, the result obtained from the collected surveys is expected to have the wealth of knowledge and expert information that can help to draw reliable conclusions and recommendations

Furthermore, the position of respondents as well were considered for the questionnaire survey as shown on *Table 4.10*. Accordingly, more than 47% of the respondents hold senior positions. This included 33 resident engineers (21.9%), 28 project coordinators (18.5%) and 10 project managers. There are also 32 site engineers (21.2%) and 48 office engineers (31.8%). It is believed that respondents from these groups have a noble understanding of construction works and related integration issues, and thus provide reliable responses to the survey data.

Table 4.10: Position/Responsibility of Respondents

		Representative Organization								Total	
		Client		Consultant		Contractor		Regulatory Body			
		No	%	No	%	No	%	No	%	No	%
Respondents' responsibility	Site Engineer	3	6.7%	4	16.0%	25	31.6%	0	0.0%	32	21.2%
	Office Engineer	21	46.7%	9	36.0%	16	20.3%	2	100.0%	48	31.8%
	Resident Engineer	0	0.0%	0	0.0%	33	41.8%	0	0.0%	33	21.9%
	Project Coordinator	21	46.7%	6	24.0%	1	1.3%	0	0.0%	28	18.5%
	Project Manager	0	0.0%	6	24.0%	4	5.1%	0	0.0%	10	6.6%
Total		45	100.0%	25	100.0%	79	100.0%	2	100.0%	151	100.0%

4.4. Level of Integration Among Major Parties in 40-60 Saving Houses Construction Project

The ten dimensions of team integrations used to measure the level of integration among parties were; single team focus and objective, seamless operation with no organizational defined boundaries, mutually beneficial outcome, increased time and cost predictability, unrestricted cross-sharing of information, team flexibility and responsiveness to change, creation of single and co-located team, equal opportunity for project inputs, equitable team relationships and respect for all, and No blame culture which were ranked by respondents. Hence, a Likert scale of 5 [1-Strongly disagree, 2-Disagree, 3 Partially agree, 4-agree and 5-Strongly agree] has been used to evaluate the level of integration. Accordingly, the mean results obtained from the responses were interpreted as:

1 to 1.8 ---No integration among major parties
1.9 to 2.7 ---Very least integration
2.8 to 3.4 ---Partially integration
3.7 to 4.2 --- integrated, and
4.2 to 5--- Fully integrated

Consequently, the Mean result of the survey data, for level of integration among client, consultants and contractors according to the response of overall respondents has been provided on *Table 4.11* below.

Table 4.11: Level of Integration in 40-60 Saving Houses Construction Project according to overall respondents

No.	**Dimensions of team integration**	Strongly Disagree (1)	Disagree (2)	Partially Agree (3)	Agree (4)	Strongly Agree (5)	Total (N)	SD	Mean
1	Single team focus and objective	40	62	39	10	0	151	0.88	2.13
2	Seamless operation with no organizational defined boundaries	36	73	8	28	6	151	1.14	2.30
3	Mutually beneficial outcome	33	54	12	42	10	151	1.28	2.62
4	Increased time and cost predictability	41	36	37	32	5	151	1.19	2.50
5	Unrestricted cross-sharing of information	22	74	37	15	3	151	0.91	2.36
6	Team flexibility and responsiveness to change	51	33	38	22	7	151	1.21	2.34
7	Creation of single and co-located team	52	59	32	5	3	151	0.93	1.99
8	Equal opportunity for project inputs	46	55	38	8	4	151	0.99	2.13
9	Equitable team relationships and respect for all	22	63	26	33	7	151	1.12	2.60
10	No blame culture	38	33	59	18	3	151	1.05	2.44
								Overall Mean	**2.34**

Table 4.12: The extent of major parties integration for all project sites

No.	Dimensions of Team integration	Variable Mean from survey responses in 40-60 Saving Houses Construction Project Sites										Total Mean
		Asko	Ayat Site	Bole Ayat	Bole Beshale	Bole Bulbula	Ehil Nigd	Hintsa Akrabi	Meri Loke	Summit	Tourist	
1	Single team focus and objective	2.00	1.89	2.00	1.70	1.52	2.00	2.17	2.00	2.20	1.83	**1.93**
2	Seamless operation with no organizational defined boundaries	1.8	2.03	2.53	2.10	1.71	1.44	1.46	1.34	2.60	2.17	**1.92**
3	Mutually beneficial outcome	2.20	2.43	2.84	2.30	2.33	2.17	1.33	2.43	2.40	1.67	**2.21**
4	Increased time and cost predictability	1.60	1.57	2.25	2.10	2.70	1.90	1.84	1.83	2.17	2.14	**2.01**
5	Unrestricted cross-sharing of information	2.00	2.17	2.16	2.60	2.24	1.67	2.33	2.43	1.20	2.16	**2.10**
6	Team flexibility and responsiveness to change	2.31	1.86	3.60	1.50	2.14	1.67	1.67	1.70	1.60	2.00	**2.00**
7	Creation of single and co-located team	2.20	1.60	1.78	1.70	1.62	1.50	1.17	1.57	1.60	2.34	**1.71**
8	Equal opportunity for project inputs	2.20	2.14	1.74	1.85	1.86	2.00	1.76	2.00	0.80	1.67	**1.80**
9	Equitable team relationships and respect for all	3.40	2.60	2.78	2.75	1.67	1.50	1.67	2.43	2.20	1.89	**2.29**
10	No blame culture	2.20	2.49	2.41	1.90	2.10	1.83	1.80	2.43	2.20	1.76	**2.11**
Total Mean		**2.19**	**2.08**	**2.41**	**2.05**	**1.99**	**1.77**	**1.72**	**2.02**	**1.90**	**1.96**	**2.01**

Based on the survey data, the overall mean has been 2.34 which indicates that very minimal integration was achieved among the major construction parties (client, consultant and contractors). The level of integration has also been computed for individual sites, *Table 4.12*, as per the responses obtained from the survey results. As a result, the respective average mean for Asko site was 2.32, Ayat site was 2.17, Bole Ayat was 2.27, Bole Beshale was 2.05, Bole Bulbula was 1.91, Ehil Nigd was 1.78, Hintsa Akrabi was 1.57, Meri Loke was 2.09, Summit was 2 and Tourist was 1.90.

A. Single team focus and objective

The level of integration for 'Single team focus and objective' has been very minimal among major parties in all sites where there was no integration in Bole Beshale and Bole Bulbula sites, according to survey results. The extent of single team focus and objective was also lower for Tourist site and Ayat site compared to the others. The survey result is evident for the lack of single team focus and objective among clients, consultants and contractors in 40-60 Saving Houses Construction Project.

B. Seamless operation with no organizational defined boundaries

According to survey results, the level of integration for 'seamless operation of parties with no organizational defined boundaries' has been very minimal. Where it is at its lowest in Asko, Bole Bulbula, Ehil Nigd, Hintsa Akrabi and Meri Loke sites. The result is evident for existence of organizational boundaries among client, consultant and contractor organizations in 40-60 Saving Houses Construction Project.

C. Mutually beneficial outcome

The result of level of integration for 'mutually beneficial outcome' among major parties is relatively higher than the other dimensions. However, the overall result indicates that it is still not achieved among all parties where it is at its very lowest in Hintsa Akrabi and Tourist sites and highest in Bole Ayat site. This result indicates that there is low or lack of mutually beneficial outcome among client, consultant and contractor organizations in 40-60 Saving Houses Construction Projects.

D. Increased time and cost predictability

The survey result indicates that there is very minimal level of integration in terms of project time and cost predictability among major project parties in all site. Moreover, it is at its lowest in Asko, Ayat, Ehil Nigd, Hintsa Akrabi and Meri Loke Sites. This indicates that there is lack of integrated cost and time predictability among major parties, which subsequently is evident for the delay and cost overrun occurred in 40-60 Saving Houses Construction Project.

E. Unrestricted cross-sharing of information

The level of integration achieved from unrestricted sharing of information is very minimal where it is at its lowest in Ehil Nigd and Summit sites. The result indicates that there is limited cross-sharing of information among major parties in 40-60 Saving Houses Construction Project.

F. Team flexibility and responsiveness to change

In most projects, the level of integration from team flexibility and responsiveness to change, is at its very lowest. Where it is minimal in Asko, Bole Bulbula and Tourist. There is fair responsiveness to change and team flexibility among parties in Bole Ayat. The result is evident for the existence of change resistance among client, consultant and contractor professionals in most of the project sites.

G. Creation of single and co-located team

There is no level of integration in terms of 'creation of single and co-located team' in almost all project sites where it is minimally achieved in Asko and Tourist sites. This dimension is the least achieved amongst the ten dimensions explained, which is evident for the dispersed project teams.

H. Equal opportunity for project inputs

There is also no level of integration in terms of 'Equal opportunity for project inputs' in almost all projects where it has been minimally achieved in Asko, Ayat, Ehil-Nigd, and Meri Loke. The result indicates that major construction parties were not given equal opportunity for contributing project inputs.

I. Equitable team relationships and respect for all

The 'Equitable team relationships and respect' dimension for team integration, has been minimally achieved amongst major parties in the project, according to survey results. The level of integration is relatively higher in Asko, Ayat, Bole Ayat, and Meri Loke sites; where it is at its lowest in Bole Bulbula, Hintsa Akrabi, and Tourist sutes. This result is indicative that there is unfair team relationship among major parties in the project.

J. No blame culture

The last dimension of team integration, 'no blame culture' has also minimal level of achievement among major construction parties in 40-60 Saving Houses Construction Project where it is not achieved in Ehil-Nigd, Tourist and Hintsa Akrabi sites. This implies that parties blamed each other for faults and risks achieved in construction phases.

In general, According to the Baiden, et al., 2006 team integration level; the analysis result shows that none of the project sites achieved full integration nor were they totally fragmented as they have achieved minimum level of integration. The least achieved dimensions of team integration were Creation of single and co-located team, Equal opportunity for project inputs Single team focus and objective, and Seamless operation with no organizational defined boundaries. However, various teams on all projects exhibited relatively better degree of integration in relations to 'Mutually beneficial outcome', 'Equitable team relationships and respect for all'. Thus, the results calls for identification of major integration issues existing in 40-60 Saving Houses Construction Projects.

4.4.1. Opinion of respondents regarding influence of DBB project delivery method on level of integration

According to the survey, the majority 130 (86.1%) of the respondents from survey data believe that the employed project delivery method has influenced the level of integration among client, consultant and contractors in 40-60 Saving Houses Construction Project. Among the 130 respondents who believe that the employed project delivery has affected the project performance, 23 (28.48%) of them has provided their reasons. Where 107 of them has only agreed to the influence of DBB project delivery on the level of integration with no further explanation. This indicated that most of the respondents are aware of integration issues related to DBB project delivery method, which is evident that they provided appropriate information. 16 (10.6%) of the respondents do not believe that the employed project delivery method (DBB) has influenced the level of integration among major construction parties; where 5 (3.31%) of the respondents hasn't responded to the question. According to the perceptions of survey and interview respondents, the project delivery method is influencing the level of integration as:

1. The consultants and contractors in the project have lack of communication and trust among them due to the separate responsibilities and different contracts issued by the client which makes them feel like they are only obligated to their scope of the contract and they give little emphasis for the integration and communication among them.
2. The client usually changes the scope of the project which had significant change on the project documents like designs and specifications, which resulted in several types of different designs for a single typology building problems as changes and modifications are not well communicated and well addressed in a collaborative manner.
3. There is very high level of blame amongst project parties to avoid risks and faults encountered in the projects as parties identify themselves as an individual entity rather than as part of an integrated team.
4. Several letters are exchanged among the project parties and a significant amount of time is wasted for communication before decision is made on a problem in the project site, weather small or significant, since parties do not act as an integrated team.
5. The DBB project delivery method creates a working environment where the contractors respond to both the consultants and clients. This leads to an inconsistent management orders from client and consultants which leads to conflict among the parties.

4.5. Integration Issues of DBB project delivery method in 40-60 Saving Houses Construction Project

Questionnaire survey data was used for analysis in identification of major integration issues existing in 40-60 saving houses construction project. Moreover, the study used relative importance index (RII) to determine the relative importance of the integration issues within client, consultants and contractors existing in 40-60 Saving Houses Construction Project. A five point Likert scale was adopted [1-strongly disagree, 2disagree, 3-partially agree, 4-agree and 5-strongly agree] and transformed into relative importance indices (RII) as follows:

$$RII = \sum(W/A*N \quad \text{[Eq. 4.1]}$$

Where:

W is the weighting given to each factor by the respondents (ranging from 1 to 5)

A is the highest value (i.e. 5 in this case), and

N is the total of respondents (153 number of respondents in this case)

The value of RII had a range from 0 to 1 (0 not inclusive), the higher the value of RII indicates a higher extent of existence of the integration issue among parties in the project. The RII was used to rank the different integration issues among major construction parties in 40-60 saving houses construction project. These rankings made it possible to cross-compare the importance of the integration issues as perceived by all respondents (client, consultants, contractors and regulatory body). Data collected from 151 respondents was analysed using the RII.

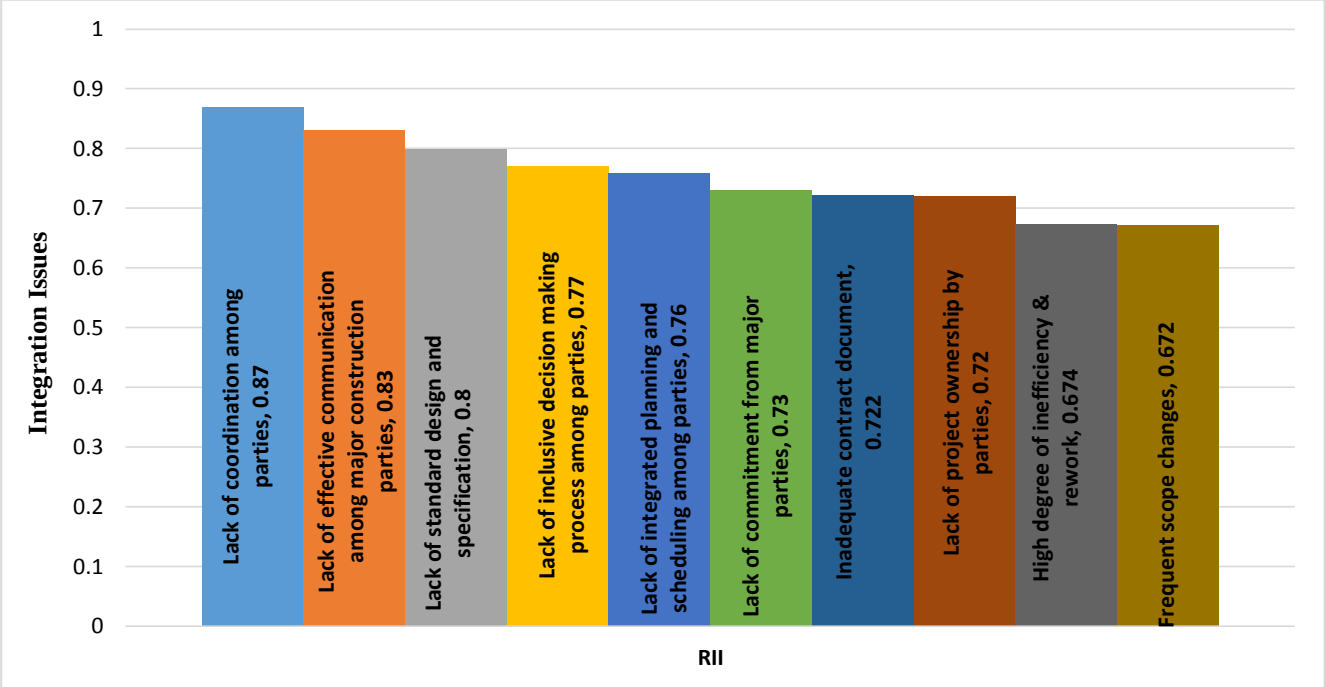
According to overall respondents, it has been identified that the integration issues; 'Lack of coordination among parties' (0.87), 'Lack of effective communication among major construction parties' (0.83), 'Lack of standard design and specification' (0.80), 'Lack of inclusive decision making process among parties' (0.77), and 'Lack of integrated planning and scheduling among parties' (0.76) are rated as the top five major integration issues existing in 40-60 Saving Houses Construction Project as they were at the top of the RII index list. They are followed by 'Lack of commitment from major parties'(0.73);, 'Inadequate contract document' (0.722), 'Lack of project ownership by parties' (0.72), 'High degree of inefficiency & rework' (0.674), and 'Frequent project scope changes' (0.672) which ranked from 6^{th} to 10^{th} major integration issues, respectively. 'Late engagement of contractors' (rank11), 'Bureaucratic client processes' (rank 12), 'Late decision making by client/consultant' (rank13), 'Lack of equitable team relationships, responsibilities and respect for all' (rank 14), 'Lack of required personnel, financial and physical resources by parties' (rank 15) and 'Lack of accountability' (rank 16). The RII value for the list of integration issues from an overall and individual parties' perspective is shown in T*able 4.13.*

Table 4.13: Importance indexes for list of integration issues in 40-60 saving houses construction project and ranks as per the overall respondents' survey data

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project						Mean	SD	RII	Rank
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total				
2	Lack of coordination among parties	5	3	5	62	76	151	4.33	0.900	0.87	**1**
1	Lack of effective communication among major construction parties	9	4	7	65	66	151	4.16	1.053	0.83	**2**
3	Lack of standard design and specification	6	10	17	65	52	150	3.98	1.046	0.80	**3**
4	Lack of inclusive decision making process among parties	4	17	28	48	54	151	3.87	1.106	0.77	**4**
9	Lack of integrated planning and scheduling among parties	4	23	11	70	43	151	3.83	1.088	0.76	**5**
10	Lack of commitment from major parties	5	13	43	56	34	151	3.67	1.025	0.73	**6**
7	Inadequate contract document	6	26	21	65	32	150	3.61	1.123	0.722	**7**
13	Lack of project ownership by parties	5	27	22	64	31	149	3.60	1.108	0.72	**8**
14	High degree of inefficiency & rework	10	26	38	52	25	151	3.37	1.147	0.674	**9**
11	Frequent project scope changes	12	27	30	59	23	151	3.36	1.174	0.672	**10**
15	Late engagement of contractors	16	26	38	57	14	151	3.18	1.149	0.64	**11**
6	Bureaucratic client processes	20	22	43	51	15	151	3.13	1.185	0.63	**12**
5	Late decision making by client/consultant	21	40	28	55	7	151	2.91	1.172	0.58	**13**
16	Lack of equitable team relationships, responsibilities and respect for all	33	38	43	27	10	151	2.62	1.199	0.52	**14**
8	Lack of required personnel, financial and physical resources by parties	67	25	26	16	17	151	2.28	1.410	0.46	**15**
12	Lack of accountability	49	40	44	14	4	151	2.23	1.086	0.45	**16**

4.5.1. Top Ten Integration Issues in 40-60 Saving Hoses Construction Project Ranked by overall respondents

Figure 4.3: Top ten integration issues in 40-60 saving houses construction project



4.5.1.1. Lack of coordination among parties (RII=0.87)

According to the overall survey respondents, 'lack of coordination among parties' was the higher rated integration issue in 40-60 Saving Houses Construction Project. This implied that the parties involved in the project lack single team focus and objectives where they mostly prioritize their individual interests and objectives. According to the interview data, the lack of coordination among parties is the most significant integration issue which has been a challenge to the project performance. In most project sites, the consultant orders the contractor to add a specific work or omit a specific work despite the contract agreement, without notifying the client. Mostly the client finds out about this, later on, after it has been executed when the contractor requests compensation for the executed work. This leads to a lengthy letter exchange among these parties and if agreement is not reached, or if the client is not convinced about the change, the contractor is ordered to rectify the work. In all of this process, the client is subjected to all the costs associated with the extended time. This implies that the client professionals are not fully aware of what is going on the site, which also indicates that there is lack of communication amongst the parties. Such issues related to lack of coordination and effective significantly affected the schedule which inevitably affected the cost and the quality. This finding is consistent with (Derbe, 2016) and (Wubshet, 2014)

4.5.1.2. Lack of effective communication among major construction parties (RII=0.83)

The lack of effective communication among major construction parties has been ranked as the second integration issue in 40-60 Saving Houses Construction Project. Communication among parties is vital

for successful completion of construction projects. However, the most common means of communication for the project parties is through letter, which takes up a considerably long period of the project time before a decision is made. Parties do not give attention to communication amongst them unless a problem occurs in the project that requires their presences. Accordingly, the result implies that the major parties in the study project have poor communication among them which backs the result obtained in level of integration where parties have very minimal integration in unrestricted cross-sharing of information. These finding is consistent with (Derbe, 2016), who identified lack of communication as a major integration issue in DBB project delivery method.

4.5.1.3. Lack of standard design and specification (RII=0.8)

According to the result from over all respondents, lack of standard design and specification has been ranked the third integration issue among project parties. Design and specification are substantial documents that guide every process related to planning and management of the construction parties by incorporating project information; however, a most of the building constructions are using faulty and varying design and specification. The reason for this is that there is a lack of coordination among the parties during design stage since consultants are given full responsibility for preparation of the design. The experience and knowledge gap among client and consultant professionals is also another issue in the project which affects the design and specification. Accordingly, the result implies that there is a lack of standard design and specification in 40-60 Saving Houses Construction Project which explains the very minimal integration in 'increased time and cost predictability' dimension of team integration.

4.5.1.4. Lack of inclusive decision making process among parties (RII=0.77)

'Lack of inclusive decision making process among parties' has been ranked as the fourth integration issue existing in 40-60 Saving Houses Construction Project. The client mostly make decisions without communicating with the other parties. Most client's management team are assigned by political merit than professional merit, where they make political decisions on their own like changing the typologies of the buildings and expect the other parties to be on board with the decision after it has already been made. Such decisions create a hard working conditions and gives less emphasis for professionalism. This implies that decisions in the project are decided without incorporating the involved parties which backs the result obtained in the level of team integration where parties achieved very minimal integration in 'equitable team relationships and respect for all'.

4.5.1.5. Lack of integrated planning and scheduling among parties (RII=0.76)

Based on the survey data, 'lack of integrated planning and scheduling among parties' have been identified as the fifth integration issue among major parties. Planning and scheduling is done by the consultant for all projects which is then approved by the client professionals who are inexperienced to evaluate such complex schedules. The contractors are involved at a later time after design is claimed to

be completed, and planning and scheduling has been done. Therefore the plans and schedules set do not incorporate inputs from the contractor, who is the primary party responsible for the execution and success of the project. This implied that the planning and scheduling set for the project is not a collaborative result which backs the finding in level of integration, where very minimal integration is achieved on ‘ equal opportunity for project inputs’ among parties. This result is consistent with (Derbe, 2016) who identified lack of integration management among contracting parties by clients as a major integration problem in DBB project delivery method.

4.5.1.6. Lack of commitment from major parties (RII= 0.73)

The sixth rated integration issue in 40-60 Saving Houses Construction Project by overall respondents is ‘lack of commitment from major parties’. This implies that there is an imbalance of commitment among individual parties. Lack of commitment among parties could result in catastrophic project outcomes as it affects both the project and the personal interest of parties. Most consultant professionals are not present on site to supervise the contractor’s work, and thus contractors are obliged to wait for them to give them permissions for continual of the work. In most cases, the consultant professionals give the permission over the phone without proper evaluation of the executed work. This in turn affects the total project performance as a whole. In addition the consultants assume and think that delay is a continual job security for them since their contract payment arrangement is a monthly salary paid per block per month. Most contractors, on the other hand, hire incompetent and low-priced sub-contractors to execute parts of the construction work for their personal gain to be more profitable. Conversely, the client is not proactive in terms of material procurement and supply which affects the schedule. Most modification designs submitted by the consultant for approval is not given proper attention as it take a long time before its reviewed and approved by the client professionals, this is also the same for payment requests submitted by the contractor. This implies that project parties are not integrated and they do not feel responsible for their share and they lack commitment for their job.

4.5.1.7. Inadequate contract document (RII= 0.722)

‘Inadequate contract document’ has been rated as the seventh integration issue amongst project parties. A contract document is the agreement signed among parties which defines the roles, responsibilities, detail description of expected work to be done, including designs, specifications, procedures and many other details that guides the relationship among parties. The result implies that the contract document used in 40-60 Saving Houses Construction Project lacks significant information or has undefined terms. This results in serious litigation, claims and disputes among parties.

The interview data indicated that the missing data and some inconsistent information found in the contract document has been a serious challenge for proper project management which has affected the performance of the project as individual parties define inconsistent terms in favour of themselves. The

contract agreement made between client and consultant was raised as an example. Where the contract specifies monthly payment shall be made to the consultant based on the number of blocks they supervise in one section, where it is also specified in another section that payment shall be made based on the number of professionals they hired where it limits one supervisor for two blocks. In practice, consultants assign one supervisor for four or five blocks which compromises the quality of supervision and during payment they claim that they shall be compensated for the number of blocks they supervised. This frequently leads the client and consultant to dispute, however, payment is still made according to the claim.

4.5.1.8. Lack of project ownership by parties (RII= 0.72)

'Lack of project ownership' has been ranked the eights most significant integration issue. This implies that project parties in 40-60 Saving Houses Construction Project are somewhat negligent to project requirements. This may seriously affect the performance of the project as parties do not feel like they are responsible and common vision is not shared among them. This could also be an implication for lack of inclusive decision making which may drive parties to lack interest in project ownership.

Interview data explained that some project parties do not fulfil their contractual responsibilities in ownership. Most consultant supervisors do not take their job seriously as they are mostly absent from the site where contractor professionals mostly fail to strictly follow the design provided to them from the client as they decide by themselves to design problems encountered on the site which significantly affects the project performance as they are subject to several reworks.

4.5.1.9. High degree of inefficiencies and rework (RII= 0.674)

The result has shown that 'high degree of inefficiencies and rework' is the ninth significant integration issues among parties in 40-60 Saving Houses Construction Project. This result implies that there is high technical incompetence or limited personnel experience which could either be an outcome of knowledge gap or lack of effective project information communication among parties. Most consultant professionals do not fulfill their responsibility of closely supervising the construction work executed by contractors as per their contract agreement. Another issue is that there are notable differences between the architectural and structural drawings which leads to faulty construction outcomes. Most client professionals aren't experienced enough to supervise the consultants and contractors which contributes to the high degree of inefficiency. This significantly affects both cost and time performance of the project. This finding is consistent with (Derbe, 2016) where he explained that technical incompetence and limited personnel experience of contractors as a major integration problem.

4.5.1.10. Frequent project scope changes (RII= 0.672)

The tenth ranked significant integration issue is 'Frequent project scope changes'. This implies the contract signed among parties is subject to frequent changes and modifications which may affect the integration among parties. According to information obtained from project documents, the client has made significant scope changes in height of the building where B+G+7 typologies were changed to B+G+8, B+G+9 to B+G+10, 2B+G+12 to 2B+G+13 and 2B+G+13 to 2B+G+15 with the reason put to serve the purpose of more houses in a small land. However, according to interview data, this changes that are made over 5 years ago are still creating a problem in site as the change wasn't made in collaboration with other parties and the necessary documents like drawings and specifications hasn't been properly updated based on the scope change made by the client.

4.5.2. Top Ten Integration Issues in 40-60 Saving Hoses Construction Project Ranked by Individual Parties

The different parties (client, consultant, contractor and regulatory bodies) has ranked the integration issues, as per their perception as shown on Appendix C. According to the response given by the client and consultant, 'lack of coordination among parties' is the first ranked integration issue which has been the second significant integration issue for contractors and regulatory bodies where they ranked 'inadequate contract document' and 'lack of effective communication among major construction parties' as the most significant integration issue.

The second most significant integration issue among parties in the project has been decided by client, consultant as 'lack of effective communication among major construction parties' where according to contractors 'lack of coordination among parties' was ranked second.

The regulatory body has equally ranked 'lack of effective communication among major construction parties; lack of coordination among parties; lack of standard design and specification; lack of inclusive decision making process among parties; lack of commitment from major parties; Frequent project scope changes; lack of project ownership by parties; and high degree of inefficiency & rework' as the second most significant integration issues where 'Bureaucratic client processes' was ranked tenth.

The contractor ranked 'lack of integrated planning and scheduling among parties' as the third most significant integration issue, which was ranked fifth by the client, sixth by the consultant, and not at all in the top ten for regulatory body. The consultant ranked 'lack of standard design and specification' as the third most significant integration issue among parties; where the other parties (client and contractor ranked it fourth.

Table 4.14: Top ten integration problems from individual parties' perspective in Addis Ababa 40-60 saving houses of construction projects (Appendix C)

No	**Top ten major integration issues in DBB project delivery method among major parties in 40-60 Saving Houses Construction Project according to individual parties**							
	Top ten integration issues from client perspective	**Rank**	Top ten integration issues from consultant perspective	**Rank**	Top ten integration issues from contractor perspective	**Rank**	Top ten integration issues from Regulatory body perspective	**Rank**
1	Lack of coordination among parties	**1**	Lack of coordination among parties	**1**	Lack of effective communication among major construction parties	**1**	Inadequate contract document	**1**
2	Lack of effective communication among major construction parties	**2**	Lack of effective communication among major construction parties	**2**	Lack of coordination among parties	**2**	Lack of effective communication among major construction parties	**2**
3	Lack of inclusive decision making process among parties	**3**	Lack of standard design and specification	**3**	Lack of integrated planning and scheduling among parties	**3**	Lack of coordination among parties	**2**
4	Lack of standard design and specification	**4**	Lack of commitment from major parties	**4**	Lack of standard design and specification	**4**	Lack of standard design and specification	**2**
5	Lack of integrated planning and scheduling among parties	**5**	Lack of inclusive decision making process among parties	**5**	Lack of project ownership by parties	**5**	Lack of inclusive decision making process among parties	**2**
6	Lack of project ownership by parties	**6**	Lack of integrated planning and scheduling among parties	**6**	Frequent project scope changes	**6**	Lack of commitment from major parties	**2**
7	Inadequate contract document	**7**	Lack of project ownership by parties	**7**	Inadequate contract document	**7**	Frequent project scope changes	**2**
8	Lack of commitment from major parties	**8**	Inadequate contract document	**8**	Late decision making by client/consultant	**7**	Lack of project ownership by parties	**2**
9	Late engagement of contractors	**9**	Frequent project scope changes	**9**	Lack of equitable team relationships, responsibilities and respect for all	**9**	High degree of inefficiency & rework	**2**
10	High degree of inefficiency & rework	**10**	Bureaucratic client processes	**10**	Bureaucratic client processes	**10**	Bureaucratic client processes	**10**

The client rated ‘lack of inclusive decision making process among parties’ as the third most significant integration issue where consultant ranked it as fifth most significant integration issue and the contractor hasn’t rated it in the top ten. The consultant ranked ‘lack of commitment from major parties’ as the fifth most significant integration issue, which was ranked eighth by the client and hasn’t been ranked in the top ten by the contractor. ‘Lack of project ownership’ has been ranked as the sixth most significant integration issue by the client, where it was ranked seventh by the consultant and fifth by the contractor. The client and contractor both ranked ‘inadequate contract document’ seventh, where it was ranked eighth by the consultant.

‘Late decision making by client/consultant’ was ranked eighth most significant integration issue; where it was not rated in the top ten by the client and consultant. ‘High degree of inefficiency and rework’ was ranked tenth by the client and not rated as top ten integration issue by the client and contractor. ‘Bureaucratic client processes’ were ranked tenth most significant integration issue by the consultant, contractor and regulatory body, where it was not rated by the client as shown on the *Table 4.16* above.

Moreover, the ranking of integration issues were found to be different as explained above based on the varying individual perception among respondents. The regulatory body rated eight integration issues under the same rank. On some integration issues responsible parties were not acknowledging the issues as the top integration issues which indicates that the parties did not recognize the issues identified by other parties that relate to them. This implied that higher ranked integration issues for one party might not be the same for other. The integration issue, ‘high degree of inefficiency and rework’ that was identified as top ten by the client was not ranked in the top ten by consultant and contractor. The integration issue, ‘bureaucratic client processes’, identified by consultants and contractors, as tenth integration issue was not ranked in the top ten by the client. The integration issue, ‘late decision making by the client/consultant’, identified by the contractor as the eighth integration issue among parties was not ranked by either the client or consultant respondents in the top ten. This shows that there is significant communication issue among the parties which is evident for very minimal level of integration for the dimension ‘no blame culture’.

4.6. Project Performance assessment of 40-60 Saving Houses Construction Project in Design Bid Build project delivery method

4.6.1. Project schedule performance

According to the information gathered from contract documents obtained through the contract administration teams in 40-60 Saving Houses Construction Project, all project sites under the four branches has been delayed by an average of 300 percent. This data is evident that the schedule performance of the project is very poor and seriously delayed.

Table 4.15: Projects' schedule performance

No.	Project branch	Project site	Contract start date	Contract duration (in days)	% comp-leted	Time-overrun until (May 25,2021)	
						No. of days	%
1	Branch 1	Asko	9/26/2013	570	88.71	2228	391%
2		Ehil-Nigd	3/09/2013	540	95.73	2281	422%
3		Tourist	12/30/2015	570	83.1	1403	246%
4		Hintsa Akrabi	19/11/2013	570	93.31	2205	387%
5		Bole Bulbula- 1	5/26/2014	570	93.9	1986	348%
6		Bole Bulbula- 2	5/29/2015	570	84.15	1618	284%
7	Branch 2	Site- 1	6/21/2014	570	94.43	1960	344%
8		Site-2	6/21/2014	570	94.01	1960	344%
9		Site -3	6/14/2014	480	94.48	2057	429%
10		Meri	2/25/2014	480	97.36	2166	451%
11	Branch 3	Bole Behsale	5/31/2015	730	72.5	1456	199%
12	Branch 4	Bole Ayat-1	6/21/2014	570	85.11	1960	344%
13		Bole Ayat -2	4/24/2015	810	67	1413	174%
14		Summit	5/21/2015	420	85.66	1745	415%

(Source: Contract Administration Team: 40-60 Saving Houses Construction Project)

4.6.2. Project cost performance

Earned value analysis was performed to evaluate the cost performance of the project by taking consultant's monthly payment, client employee salaries per month, Security payment for sites and material stores and miscellaneous costs (like fuel, overtime payments, stationaries and the likes used for operations) expended on the project shown under Appendix E- Project costs incurred due to project delay. Accordingly the EVA is shown on Table 4.16 below.

Table 4.16: Earned value analysis for 4-60 Saving Houses Construction Project (Calculated from the summarized data under Appendix E)

No.	Project Branch	Budgeted cost of work performed	Earned value of work performed	Actual cost of work performed	Cost Performance		Schedule Performance	
					Cost Variance (EV-AC)	CPI (EV/AC)	Schedule Variance (EV-PV)	SPI (EV/PV)
1	Branch-1	59,470,162.23	53,084,535.05	213,689,575.96	**- 160,605,040.91**	**0.25**	**-6,385,627.18**	**0.89**
2	Branch-2	45,562,493.52	43,190,345.55	182,312,495.82	**-139,122,150.27**	**0.24**	**-2,372,147.96**	**0.95**
3	Branch-3	37,436,703.84	27,328,793.80	102,404,767.49	**-75,075,973.69**	**0.27**	**-10,107,910.04**	**0.73**
4	Branch-4	47,966,878.17	36,618,347.11	166,861,020.52	**-130,242,673.41**	**0.22**	**-11,348,531.06**	**0.76**

Note: The calculated cost only included consultant's monthly payment, client employee salaries per month, Security payment for sites and material stores and miscellaneous costs (like fuel, overtime payments, stationaries and the likes used for operations).

Table 4.16 clearly shows that both cost and schedule performance of the project in all branches were significantly low. The negative results of the cost and schedule variance indicates that the project is seriously over budget and behind schedule.

According to the data obtained from project branch office finance teams, until May 25, 2021, the project has exceeded the contract amount by ETB 502,837,335.08 due to the payments that has to be paid monthly by the client, without considering material inflation costs, and rework and modification costs, which is ongoing as the project hasn't reached completion yet. This data is evident for the poor cost performance of the project and it is consistent with (Hardin & McCool, (2015)) that the owner/ client bears the financial risks associated to changes during construction.

The current performance of 40-60 Saving Houses Construction Project has been rated among all respondents. The performance indicators rated were schedule, cost and quality performance of the projects according to the respondents' perception. Accordingly, a Likert Scale of 5 [1- Very poor, 2- Poor, 3- Fair, 4- Good, and 5- Very good] was used to evaluate the schedule, cost and quality

To evaluate the responses given, average mean, the responses were combined into one measure (project performance level)

The equivalent performance level rating scale has been calculated from the formula:

Rating scale= (Highest scale-Lowest scale)/ Highest scale …….[Eq: 4.3]

Where: Highest scale is 5 and the lowest scale is 1 according to the Likert measurement used.

The rating scale used then is = (5-1) / 5 = 0.8

Accordingly, the mean results were interpreted as:

1 to 1.8 --- Very poor performance

1.9 to 2.7 --- Poor performance

2.8 to 3.4 --- Fair performance

3.5 to 4.2 --- Good performance, and

4.3 to 5--- Very good performance

The obtained mean of survey data, for performance level as rated by client, consultants and contractors and regulatory body has been provided on *Table 4.18* below.

Table 4.17: The rate of performance of the project by overall respondents

Project Performance Indicators	Very Poor	Poor	Fair	Good	Very Good	Total	Mean
Schedule performance	6	93	49	3	0	151	2.32
Cost performance	5	84	56	2	4	151	2.44
Quality performance	10	18	75	47	1	151	3.07
						Overall mean	**2.61**

From the result, it is evident that the overall performance of 40-60 Saving Houses Construction Project is rated low by the total respondents as its overall mean was calculated to be 2.61 (found on second range (1.9-2.7)), which indicates that it has an overall poor performance. The data on *Table 4.18*,

indicates that both the schedule and cost performance has been rated poor, where the quality is believed to be fair according to overall respondents. This indicates that the project is not performing as per the planned schedule and cost, where the quality is fair.

Table 4.18: The performance of 40-60 Saving Houses Construction Project for all project sites

N	Project Performance Indicators	Variable Mean from survey responses in 40-60 Saving Houses Construction Project Sites										**Over all Mean**
		Asko Site	Ayat Site	Bole Ayat	Bole Beshale	Bole Bulbula	Ehil Nigd	Hintsa Akrabi	Meri Loke	Sum mit	Tour ist	
1	Schedule performance	2.00	2.34	2.44	2.55	2.14	2.00	2.33	2.43	2.60	2.33	2.32
2	Cost performance	2	2.46	2.47	2.54	2.33	2.35	2.40	2.33	2.71	2.60	2.42
3	Quality performance	3.00	3.26	3.25	3.40	2.76	2.90	2.95	3.17	2.90	3.00	3.06

The performance of the project as rated by respondents from specific sites has been summarized on *Table 4.19.* According, to the results from the analysis of respondents data, all sites have poor schedule performance based on the contract duration as explained under on *Table 4.20*. All project sites have poor cost performance. The Quality performance of most sites is rated to be fair except for some sites specifically Bole Bulbula which has been rated poor. According to interview results, Bole Bulbula site has significant ground water problems on six buildings that has been affecting the buildings due to failure to install sub-surface drainage system which floods the basements of these buildings during winter season. The reason for uninstallation of the sub-surface drainage system was due to a letter order from consultant which omitted the work regardless of the installation of the system on other project sites based on the contract requirement. This is evident for the quality issue to be a result of lack of coordination among project parties and lack of inclusive decision making process among parties. It is also an implication of lack of standard design and specification documents for an individual typology building.

CHAPTER 5 – SUMMARY OF MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

In this chapter summaries of findings conclusion, recommendation and suggestions for future researches has been explained in detail.

5.1. Summary of findings

- The 40-60 Saving Houses Construction Project have four main branches, fourteen project sites, eight consultants, and 151 contractors currently participating in the project. The selection process of consultants considers the lowest financial proposal in an open tendering and that of the contractors are recruited based on their work experience, good performance accounts and either general or specific work experience. The hiring of both parties follow a linear process which indicates that the project employs Design-Bid Build project delivery method.
- The level of integration among the major parties in 40-60 Saving Houses Construction Project was evaluated based on a Likert scale of five; through the mean of responses for each dimensions of team integration, based on questionnaire survey and interview. Overall 151 responses out of 166 distributed questionnaires were obtained; which comprised of 79 contractor professionals, 25 consultant professionals, 45 client professionals and 2 from regulatory bodies. In order to ensure the reliability of the survey data, Cronbach's alpha coefficient was used to test the reliability of the questionnaire survey. The Cronbach's alpha for survey of level of integration among parties by taking overall respondents, the α-values, was 0.831. Since the value is greater than 0.7, the questionnaire survey was considered to be reliable.
- A weighted average mean was used to determine the level of integration where a mean result rating scale was identified ,where: mean between 1-1.8 was interpreted as no integration, 1.9-2.7 very minimal integration, 2.8-3.6 partial integration, 3.7-4.5 integration and 4.5-5 very high integration level among major parties in the project. Accordingly, based on the analysis result there was very minimal integration in all team integration dimensions; namely single team focus and objective (mean = 2.13) , seamless operation with no organizational defined boundaries (mean =2.30), Mutually benefited outcome (mean= 2.62), increased time and cost predictability (mean= 2.50), unrestricted cross-sharing of information (mean = 2.36), team flexibility and responsiveness to change (mean =2.34), creation of single and collocated team (mean = 1.99), equal opportunities for project inputs (mean =2.13), equitable team relationships and respect for all (mean =2.6) and no blame culture (mean = 2.44).

- 86.1% (131) of the respondents agreed that employment of DBB project delivery in 40-60 Saving Houses Construction Project has influenced the level of integration among major parties in a project. Major reasons forwarded for this were; the lack of communication and trust among consultants and contractors that resulted due to the separate responsibilities from individual contracts; the project parties feel like they are only obligated to their scope of the contract where they give little emphasis to integration amongst them. The other explanations given for the influence of DBB on level of integration among parties were; significant scope changes by the client, high level of blaming faults and risks encountered on the project on each other as parties identify themselves as an individual entity rather than as part of an integrated tam; and that the project delivery method creates a working environment where contractors respond to two parties (client and consultant) which leads to inconsistent management orders resulting in conflict.
- The integration issues in DBB project delivery were also identified and ranked by using RII (relative importance index by using a five point Likert scale [1-strongly disagree, 2disagree, 3-partially agree, 4-agree and 5-strongly agree]. The Cronbach's alpha for the integration issues in DBB project delivery method from overall respondents was found to be 0.805 which is greater than seven indicating the reliability of the survey data. Accordingly the top 10 rated integration issues in 40-60 Saving Houses Construction project are
- According to overall respondents, the top ten ranked integration issues in 40-60 Saving Houses Construction project were 'Lack of coordination among parties' (0.87), 'Lack of effective communication among major construction parties' (0.83), 'Lack of standard design and specification' (0.80), 'Lack of inclusive decision making process among parties' (0.77), and 'Lack of integrated planning and scheduling among parties' (0.76), 'Lack of commitment from major parties'(0.73);, 'Inadequate contract document' (0.722), 'Lack of project ownership by parties' (0.72), 'High degree of inefficiency & rework' (0.674), and 'Frequent project scope changes' (0.672) which ranked from 1st to 10th major integration issues, respectively.
- The integration issues based on individual organizations (consultant, contractor and client) has also been presented; where the client and consultant both rated 'lack of coordination among parties' as the first integration issue where the contractor and regulatory body rated 'lack of effective communication among major construction parties' and 'inadequate contract document', respectively, as the first integration issue in 40-60 Saving Houses Construction Project.
- The cost, schedule, and quality performance of the 40-60 Saving Houses Construction Project was evaluated based on a Likert scale of five, through the mean of responses for each

performance indicator. The Cronbach's alpha for the survey of performance of the project was 0.802, which was found acceptable and reliable as the value is greater than 0.7. A mean was obtained from overall respondents as schedule performance (2.32 - poor performance), cost performance (2.44 – poor performance) and quality performance (3.07 – fair performance)

- According to data obtained from project documents, the project had a significant time overrun from the contract completion date specified in the contract. The time overrun ranges between a minimum of 46.77 months to a maximum of 76.03 months. The cost overrun had in turn affected the cost as monthly payment responsibilities had to be paid even after contract elapsed date since the project hasn't been completed. Due to this the monthly recurring payments were identified as consultant payments (paid monthly by the number of blocks under supervision), client employee salary payments, security service payments and overhead costs. The contractor payment hasn't been included in the analysis since the contractor is only compensated on amounts of work executed within that month according to the contract
- According to the Earned value analysis (EVA) performed, both calculated cost (CV) and schedule variances (SV) were found to be negative for all four branches.

5.2. Conclusions

DBB project delivery method was the only method employed in all projects sites of 40-60 housing construction project. This was found to be due to the strong belief of the client that this method is cost effective as selection of consultants is based on the low financial proposal where the contractor is assigned by the organizational capacity on a fixed unit price contract.

However, based on the study DBB project delivery method affected the level of integration in which it was found to be very minimal among project parties. The result was evident that DBB project delivery method creates an environment where project parties feel as though they are only responsible to fulfilling their individual agreement rather than considering themselves as part of an integrated project team.

The top ten ranked major integration issues that influenced the performance of the project in DBB project delivery are; lack of coordination among parties, lack of effective communication among parties and lack of standard design and specification, Lack of inclusive decision making process among parties', and 'Lack of integrated planning and scheduling among parties', 'Lack of commitment from major parties', 'Inadequate contract document', 'Lack of project ownership by parties', 'High degree of inefficiency & rework', and 'Frequent project scope changes' .

The cost (CV) and schedule (SV) variances were found to be negative, which indicated that the 40-60 Saving Houses Construction Project is significantly behind schedule and over budget. The schedule

performance, of all 40-60 Saving Houses Construction Project sites, is found to be very poor with 150-300% of extended time from the contract end date until recent; which still hasn't been completed. All project sites has extended a minimum of five years in contrast to the contract allotted schedule. The cost performance has been drastically affected by the schedule overrun; which led to serious cost overrun of the planned project cost of a single block. The project has a fair quality performance in most project sites.

In general, it has been found that the level of integration among the major parties (client, consultant and contractor) and the performance of the construction project was low under DBB project delivery method in 40-60 Saving Houses Construction Project. Despite the clients' belief that the delivery method is cost effective, as lowest bidders are considered for consultants and fixed unit rate provided for contractors, it was found by the study that the delivery method employed was not cost effective in 40-60 Saving Houses Construction Project. In contrast, the client assumed every risks related to cost and schedule which is considered to be a major disadvantage.

5.3. Recommendations

1. All the major project parties (client, consultant and contractors) participating in the construction of 40-60 Saving Houses Construction Project shall work together to develop the collaboration and coordination among them in order to fulfil their contractual responsibilities.
2. All parties must work as an integrated team for better and enhanced project output and for their individual development, in terms of project management skills and experiences.
3. All stakeholders must be involved in all of the project phases; especially during the design phase of the project as it is the phase where project objectives are set, and creating such room for participation of parties helps project teams to be on the same page regarding required processes and it in turn creates an environment where parties proactively participate for the success of the project.
4. The client shall avoid making significant scope changes prior to having detailed discussion and communication among the major parties and without making sure that all participants are on board with the scope change needed by the client.
5. The client shall give extra attention to evaluating contract documents, developing lessons learned document from each site to make sure that new projects do not face the same problems that are challenging to the success of the project
6. The client shall consider employing other project delivery methods, like Integrated Project Delivery (IPD) method that enhance the integration level of parties and that somehow minimizes the total risks assumed by the client and share the risks among all parties.

7. The regulatory body should work on promoting integration and coordination of project teams through documents, trainings and meetings with all project parties involved in 40-60 Saving Houses Construction Projects.

5.4. Suggestions for future study

1. Further study is recommended on treatment mechanisms of the integration issues in 40-60 Saving Houses Construction Project in order to enhance the integration among parties in DBB project delivery method; in terms of avoiding or diminishing the integration issues among parties in the project.
2. Further study is recommended upon completion of the project to evaluate overall performance of the DBB project delivery method on 40-60 Saving Houses Construction Project.

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Appendix A: Questionnaire

Addis Ababa University College of Commerce

College of Business and Economics

Research Topic: Performance Assessment of Design Bid Build Project Delivery Method in 40-60 Saving Houses Construction Project

- This questionnaire is prepared for client, contractor and consultant organizations participating in 40-60 Saving Houses Construction Project.

Dear respondent,

First, I would like to thank you in advance for your time and effort in this research. This questionnaire is a part of an academic research titled 'Performance Assessment of Design Bid Build Project Delivery Method in 40-60 Saving Houses Construction Project, which is conducted as partial fulfilment of Masters of Arts in Project Management. The main objective of the research is to assess the performance of Design-Bid-Build project delivery method in 40-60 Saving Houses Construction Project.. It is divided into five sections; please make sure that you have given complete information.

ORIENTATION FOR PARTICIPANTS REGARDING THE INTERVIEW QUESTIONS:

- Please note that your response is anonymous and will be treated in absolute confidentiality. The data obtained will only be utilized for educational and research purpose
- Please make sure that you have given the information required as fully as possible, since detailed responses will allow me to clearly understand the subject matter.
- Please make sure to return this questionnaire by hand, via email or by mail to the following address: Ms. Hirut Walelign

Post Graduate Candidate, Project Management
College of Business and Economics
Addis Ababa University College of Commerce
Addis Ababa, Tel.: +251 911 40 75 35 Email: hirayeamo@gmail.com

SECTION 1: PERSONAL AND ORGANIZATIONAL PROFILE OF RESPONDENT

1.1. Project name: _____

1.2. Project site: _____

1.3. Organization: _____

1.4. Position: _____

1.5. Representative Organization: Client/Employer ☐ Consultant ☐
Contractor ☐ Regulatory Body (MoWUD) ☐
Other ☐ (please specify) _____

1.6. For consultants and contractors only

A. Company's/organization's year/s work experience in housing construction projects/and similar building construction project related works:_____

1.7. Organization's/ company's category (Grade): 1 ☐ 2 ☐ 3 ☐

1.8. Educational Level:

Advance Diploma ☐ Master Degree ☐

Bachelor Degree ☐ PhD ☐

1.9. General Experience

0- 5 Years ☐ 10-15 Years ☐

5-10 Years ☐ Above 15 Years ☐

1.10. How long have you worked in Housing construction project?

0-5 Years ☐ 10-15 Years ☐

5-10 Years ☐ Above 15 Years ☐

1.11. Respondent responsibility in the Company

Site Engineer ☐ Project Coordinator ☐

Office Engineer ☐ Project Manager ☐

Resident Engineer ☐ Other ☐ _____

SECTION 2: TYPE OF PROJECT DELIVERY EMPLOYED

2. 1. Which project delivery method is used in 40-60 Saving Houses Construction Project?

Traditional/Design-Bid-Build (DBB) ☐ Design-Build ☐

Construction Management ☐ Integrated project delivery (IPD) ☐

Other ☐ (Please Specify) _____

2. 2. Do you believe that the employed project delivery method on 40-60 Saving Houses Construction Project has influenced the level of integration among major parties (client, consultant and contractor?)

Yes ☐ No ☐ Kindly elaborate your answer.

_____

_____

_____

SECTION 3: LEVEL OF INTEGRATION AMONG PARTIES IN DBB PROJECT DELIVERY

3.1. Level of Integration is defined as the degree of integration that exist among the construction parties (client, consultants and contractor) during the life of construction projects. Ten (10) dimensions of team integration are listed on the table below. Please rate the listed dimensions of team integration by putting a tick mark (√) to indicate the level of integration practice among major parties (client, consultant and contractor) in the case of 40-60 Saving Houses Construction Projects based on the list provided. **Data Measurement Key**: 1-Strongly disagree; 2-Disagree; 3-Partially agree; 4-Agree; 5-Strongly agree

No.	Dimensions of team integration	Level of Integration				
		1	**2**	**3**	**4**	**5**
3.1.	Single team focus and objective					
3.2	Seamless operation with no organizational defined boundaries					
3.3	Mutually beneficial outcome					
3.4	Increased time and cost predictability					
3.5	Unrestricted cross-sharing of information					
3.6	Team flexibility and responsiveness to change					
3.7	Creation of single and co-located team					
3.8	Equal opportunity for project inputs					
3.9	Equitable team relationships and respect for all					
3.10	No blame culture					

SECTION 4: PERFORMANCE OF 40-60 Saving Houses Construction ProjectIN DBB PROJECT DELIVERY METHOD

4.1. How do you rate the performance of 40-60 Saving Houses Construction Project with respect to the contract?

Project Performance Indicators	Evaluation Criteria				
	Very Poor	Poor	Fair	Good	Very Good
Schedule Performance					
Cost Performance					
Quality Performance					

4.2. Do you believe that the level of integration among major parties (client, consultant and contractor) in 40-60 Saving Houses Construction Project has affected the project performance?

Yes ☐ No ☐

Please Explain,

_____

_____

_____

4.3. Below listed are identified integration issues resulting from implementation of DBB project delivery method on construction projects, based on literatures reviewed. Please indicate your level of agreement on the existence of the listed integration issues relating to DBB project delivery method in 40-60 Saving Houses Construction Project.

Data Measurement Key: 1-Strongly disagree; 2-Disagree; 3-Partially agree; 4-Agree; 5-Strongly agree

No.	**Integration Issues in DBB Project Delivery Method**	**Existence in 40-60 Saving Houses Construction Project**				
		1	**2**	**3**	**4**	**5**
4.3.1	Lack of effective communication among major construction parties					
4.3.2	Lack of coordination among parties					
4.3.3	Lack of standard design and specification					
4.3.4	Lack of inclusive decision making process among parties					
4.3.5	Late decision making by client/consultant					
4.3.6	Bureaucratic client processes					
4.3.7	Inadequate contract document					
4.3.8	Lack of required personnel, financial and physical resources by parties					
4.3.9	Lack of integrated planning and scheduling among parties					
4.3.10	Lack of commitment from major parties					
4.3.11	Frequent project scope changes					
4.3.12	Lack of accountability					
4.3.13	Lack of project ownership by parties					
4.3.14	High degree of inefficiency & rework					
4.3.15	Late engagement of contractors					
4.3.16	Lack of equitable team relationships, responsibilities and respect for all					

Thank you!!!

Interview Questions and interpreted responses

Note: The following questions were presented to four client, 2 consultant and 1 contractor professionals. The responses given were interpreted and re-stated accordingly.

1. What type of project delivery method do you use on 40-60 Saving Houses Construction Project?

   All interviewed professionals has described that DBB project delivery method is being utilized for all sites under the 40/60 housing construction project. Three of the four client professionals has explained that DBB project delivery method was selected since it is believed by the client organization that it is the most cost effective project delivery method. Where one client, all consultant and contractor professionals has responded that DBB was selected for its ease of use and familiarity of the delivery method among professionals in the project.

2. Has the employed project delivery affected the level of parties' (client consultants and contractors) integration? How?

   All but one professional agreed that the employed project delivery method in 40-60 Saving Houses Construction Project has affected the level of integration among parties. One client professional stated that the consultants and contractors in the project have lack of communication and trust among them due to the separate responsibilities and different contracts issued by the client which makes them feel like they are only obligated to their scope of the contract and they give little emphasis for the integration and communication among them. The consultant and contractor professionals interviewed in general explained that several letters are exchanged among the project parties and a significant amount of time is wasted for communication before decision is made on a problem in the project site, weather small or significant, since parties do not act as an integrated team. One contractor professional added that DBB project delivery method creates a working environment where the contractors respond to both the consultants and clients. This leads to an inconsistent management orders from client and consultants which leads to conflict among the parties.

   In addition, 2 professionals from client and consultant organizations believe that the level of integration among parties is not only affected by the project delivery method but by the attitude, inexperience, poor management skills and lack of commitment among contracting parties.

3. What is the level of integration among major parties (client, consultants and contractor) in 40-60 Saving Houses Construction Project? Please Explain…

   Among the total interviewees, five professionals (3 client, 1 consultant and 1 contractor) believe that there is very minimal level of integration among parties in the project, in summation, they explained that it is a result of the situation where the employed project delivery method issues separate responsibilities and contracts which ultimately led parties to identify themselves as an individual entity

rather than as part of an integrated team and are committed to their section of the contract than as to the whole project.

In contrast, two professionals (client and consultant) believe that partial level of integration has been achieved among parties, where the parties are coordinating on some level in executing the work despite the employed project delivery method.

4. What are the integration issues of DBB project delivery method in 40-60 Saving Houses Construction Project?

According to the contractor professional, the lack of coordination among parties is the most significant integration issue which has been a challenge to the project performance. In most project sites, the consultant orders the contractor to add a specific work or omit a specific work despite the contract agreement, without notifying the client. Mostly the client finds out about this, later on, after it has been executed when the contractor requests compensation for the executed work. This leads to a lengthy letter exchange among these parties and if agreement is not reached, or if the client is not convinced about the change, the contractor is ordered to rectify the work.

Two client professionals stated that the missing data and some inconsistent information found in the contract document has been a serious challenge for proper project management which has affected the performance of the project as individual parties define inconsistent terms in favour of themselves. The contract agreement made between client and consultant was raised as an example. Where the contract specifies monthly payment shall be made to the consultant based on the number of blocks they supervise in one section, where it is also specified in another section that payment shall be made based on the number of professionals they hired where it limits one supervisor for two blocks. In practice, consultants assign one supervisor for four or five blocks which compromises the quality of supervision and during payment they claim that they shall be compensated for the number of blocks they supervised. This frequently leads the client and consultant to dispute, however, payment is still made according to the claim.

Another client professional added that 'some project parties do not fulfil their contractual responsibilities in ownership. Most consultant supervisors do not take their job seriously as they are mostly absent from the site where contractor professionals mostly fail to strictly follow the design provided to them from the client as they decide by themselves to design problems encountered on the site which significantly affects the project performance as they are subject to several reworks.'

A consultant professional explained that the major integration issue is the frequent scope changes made by the client. According to interview data, the client has made significant scope changes in height of the building where B+G+7 typologies were changed to B+G+8, B+G+9 to B+G+10, 2B+G+12 to 2B+G+13 and 2B+G+13 to 2B+G+15 with the reason put to serve the purpose of more houses in a

small land; this changes that are made over 5 years ago are still creating a problem in site as the change wasn't made in collaboration with other parties and the necessary documents like drawings and specifications hasn't been properly updated based on the scope change made by the client.

5. How do you rate the performance of the 40-60 Saving Houses Construction Project in terms of time, cost and quality? Please Explain...

   All interviewed professional has rated the performance of the project to be poor in terms of time and cost but rather good in quality. They explained the reason to be the significant cost and schedule overruns encountered in the project. In addition, a consultant professional added that the performance of the 40-60 Saving Houses Construction Project is a result of several factors as there are several stakeholders which are difficult to manage and act in one accord.

6. Do you believe that DBB project delivery method is effective for 40-60 Saving Houses Construction Project? Please Explain…

   Five (3 client, 1 consultant and 1 contractor professionals) of the total interviewees responded that DBB project delivery method hasn't been effective for 40-60 Saving Houses Construction Project. They explained that the method is not compatible with the nature of the project as it slows down communication and coordination among parties. They believe that the project can benefit from employing modern project delivery methods like DB and IPD project delivery methods that ultimately promotes a unified culture among parties which contribute to the overall success of the project.

   In contrast, two professionals (1 client and 1 consultant) believed that DBB project delivery method is effective by itself but has been misused by the parties within the project. Of which, one explained that with the right project management practice and great emphasis given to communication planning and management among parties effectivity and efficiency could be achieved. They added that DBB project delivery method, by itself, is not a means to an end.

7. Do you believe that better integration could be achieved if delivery methods other than DBB were employed? If yes, which methods, and Explain why?

   Five of the total interviewees agreed that better integration could be achieved by employing other project delivery methods that promote integration among parties. Of which three of them believed that project delivery methods like Design-Build (DB) and Integrated Project Delivery methods (IPD) to enhance the performance of the project. One consultant professional added that 'if risk is shared amongst the parties then these parties will work together with full ownership for every project task. The problem with DBB is that risk is totally assumed by the client regardless of the responsible party. This can be better addressed by DB and IPD project delivery methods which involves all parties in the risk sharing which creates an environment for better coordination and communication amongst them responsibly.

Two of the interviewees believed that although DBB could be prone to several integration issues, it is an effective project delivery method if employed properly. One professional stated that 'the question should not be about employing other project delivery methods to enhance integration among the parties, rather the project parties shall focus on effectively employing project management skills with major focus on communication amongst themselves.'

Appendix C: Analysis of importance index and rank of integration issues in DBB project delivery method by different parties

A. Analysis of importance index and rank of integration issues by client

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project						Mean	RII	Rank by client
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total			
1	Lack of coordination among parties	1	1	2	18	23	45	4.36	0.87	1
2	Lack of effective communication among major construction parties	2	3	15	25	45		4.36	0.87	2
3	Lack of inclusive decision making process among parties	1	2	6	15	21	45	4.18	0.84	3
4	Lack of standard design and specification	1	1	5	21	17	45	4.16	0.83	4
5	Lack of integrated planning and scheduling among parties	2	7	3	22	11	45	3.73	0.75	5
6	Lack of project ownership by parties	8	6	19	10	43		3.72	0.74	6
7	Inadequate contract document	1	6	10	17	11	45	3.69	0.74	7
8	Lack of commitment from major parties	2	5	13	16	9	45	3.56	0.71	8
9	Late engagement of contractors	6	4	10	19	6	45	3.33	0.67	9
10	High degree of inefficiency & rework	6	9	9	15	6	45	3.13	0.63	10
11	Bureaucratic client processes	8	9	9	14	5	45	2.98	0.60	11
12	Frequent project scope changes	6	8	14	16	1	45	2.96	0.59	12
13	Late decision making by client/consultant	8	12	8	15	2	45	2.80	0.56	13
14	Lack of equitable team relationships, responsibilities and respect for all	10	16	11	8	45		2.38	0.48	14
15	Lack of required personnel, financial and physical resources by parties	21	7	9	4	4	45	2.18	0.44	15
16	Lack of accountability	18	13	9	4	1	45	2.04	0.41	16

B. **Analysis of importance index and rank of integration issues by consultant**

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project						Mean	RII	Rank by consultant
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total			
1	Lack of coordination among parties	1	0	1	12	11	25	4.28	0.86	**1**
2	Lack of effective communication among major construction parties	2	1	0	15	7	25	3.96	0.79	**2**
3	Lack of standard design and specification	1	3	3	10	8	25	3.84	0.77	**3**
4	Lack of commitment from major parties	1	1	8	9	6	25	3.72	0.74	**4**
5	Lack of inclusive decision making process among parties	0	5	4	10	6	25	3.68	0.74	**5**
6	Lack of integrated planning and scheduling among parties	1	3	5	13	3	25	3.56	0.71	**6**
7	Lack of project ownership by parties	1	4	5	11	4	25	3.52	0.70	**7**
8	Inadequate contract document	2	4	3	11	4	24	3.46	0.69	**8**
9	Frequent project scope changes	1	4	6	11	3	25	3.44	0.69	**9**
10	Bureaucratic client processes	1	4	7	10	3	25	3.40	0.68	**10**
11	High degree of inefficiency & rework	3	3	6	10	3	25	3.28	0.66	**11**
12	Late engagement of contractors	3	5	7	8	2	25	3.04	0.61	**12**
13	Late decision making by client/consultant	3	7	5	10	0	25	2.88	0.58	**13**
14	Lack of equitable team relationships, responsibilities and respect for all	5	6	8	4	2	25	2.68	0.54	**14**
15	Lack of required personnel, financial and physical resources by parties	11	2	2	5	5	25	2.64	0.53	**15**
16	Lack of accountability	8	4	8	3	2	25	2.48	0.50	**16**

C. **Analysis of importance index and rank of integration issues by Contractor**

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project						Mean	RII	Rank by contractors
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total			
2	Lack of effective communication among major construction parties	5	3	4	34	33	79	4.33	0.87	**1**
1	Lack of coordination among parties	3	2	2	31	41	79	4.16	0.83	**2**
3	Lack of integrated planning and scheduling among parties	1	13	3	33	29	79	3.98	0.80	**3**
4	Lack of standard design and specification	4	6	9	33	26	78	3.87	0.77	**4**
9	Lack of project ownership by parties	4	15	11	33	16	79	3.83	0.77	**5**
10	Frequent project scope changes	5	14	15	32	13	79	3.67	0.73	**6**
7	Inadequate contract document	3	16	8	37	15	79	3.61	0.72	**7**
13	Late decision making by client/consultant	10	20	15	29	5	79	3.60	0.72	**8**
14	Lack of equitable team relationships, responsibilities and respect for all	18	15	23	15	8	79	3.37	0.67	**9**
11	Bureaucratic client processes	9	10	27	27	6	79	3.36	0.67	**10**
15	Lack of accountability	23	21	27	7	1	79	3.18	0.64	**11**
6	Lack of commitment from major parties	2	7	22	30	18	79	3.13	0.63	**12**
5	Lack of inclusive decision making process among parties	3	10	18	22	26	79	2.91	0.58	**13**
16	Lack of required personnel, financial and physical resources by parties	34	16	15	6	8	79	2.62	0.52	**14**
8	High degree of inefficiency & rework	3	14	17	25	20	79	2.28	0.46	**15**
12	Late engagement of contractors	7	17	20	29	6	79	2.23	0.45	**16**

D. **Analysis of importance index and rank of integration issues by Regulatory body**

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project						Mean	RII	Rank by regulatory body
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total			
1	Inadequate contract document	0	0	0	0	2	2	5.00	1.00	**1**
2	Lack of effective communication among major construction parties	0	0	0	1	1	2	4.50	0.90	**2**
3	Lack of coordination among parties	0	0	0	1	1	2	4.50	0.90	**2**
4	Lack of standard design and specification	0	0	0	1	1	2	4.50	0.90	**2**
5	Lack of inclusive decision making process among parties	0	0	0	1	1	2	4.50	0.90	**2**
6	Lack of commitment from major parties	0	0	0	1	1	2	4.50	0.90	**2**
7	Frequent project scope changes	0	0	0	1	1	2	4.50	0.90	**2**
8	Lack of project ownership by parties	0	0	0	1	1	2	4.50	0.90	**2**
9	High degree of inefficiency & rework	0	0	0	1	1	2	4.50	0.90	**2**
10	Bureaucratic client processes	0	0	1	0	1	2	4.00	0.80	**10**
11	Lack of integrated planning and scheduling among parties	0	0	0	2	0	2	4.00	0.80	**10**
12	Late engagement of contractors	0	0	0	2	0	2	4.00	0.80	**10**
13	Late decision making by client/consultant	0	0	1	1	0	2	3.50	0.70	**13**
14	Lack of required personnel, financial and physical resources by parties	0	0	1	1	0	2	3.50	0.70	**13**
15	Lack of accountability	0	1	1	0	0	2	2.50	0.50	**15**
16	Lack of equitable team relationships, responsibilities and respect for all	0	1	1	0	0	2	2.50	0.50	**15**

Appendix D- Analysis of Correlation coefficient between different respondent parties

A. Correlation coefficient between client and consultant

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project According to clients								Existence in 40-60 Housing Construction Project According to Consultants								Rank difference d=(client-consultant)	d^2
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank	1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank		
2	Lack of effective communication among major construction parties	2	0	3	15	25	45	0.87	2	1	0	1	12	11	25	0.86	1	1	1
1	Lack of coordination among parties	1	1	2	18	23	45	0.87	1	2	1	0	15	7	25	0.79	2	-1	1
4	Lack of standard design and specification	1	1	5	21	17	45	0.83	4	1	3	3	10	8	25	0.77	3	1	1
3	Lack of inclusive decision making process among parties	1	2	6	15	21	45	0.84	3	0	5	4	10	6	25	0.74	5	-2	4
13	Late decision making by client/consultant	8	12	8	15	2	45	0.56	13	3	7	5	10	0	25	0.58	13	0	0
11	Bureaucratic client processes	8	9	9	14	5	45	0.60	11	1	4	7	10	3	25	0.68	10	1	1
7	Inadequate contract document	1	6	10	17	11	45	0.74	7	2	4	3	11	4	24	0.69	8	-1	1
5	Lack of integrated planning and scheduling among parties	2	7	3	22	11	45	0.75	5	11	2	2	5	5	25	0.53	15	-10	100
15	Lack of required personnel, financial and physical resources by parties	21	7	9	4	4	45	0.44	15	1	3	5	13	3	25	0.71	6	9	81
8	Lack of commitment from major parties	2	5	13	16	9	45	0.71	8	1	1	8	9	6	25	0.74	4	4	16
12	Frequent scope changes	6	8	14	16	1	45	0.59	12	1	4	6	11	3	25	0.69	9	3	9
16	Lack of accountability	18	13	9	4	1	45	0.41	16	8	4	8	3	2	25	0.50	16	0	0
6	Lack of project ownership by parties	8	6	19	10	43		0.74	6	1	4	5	11	4	25	0.70	7	-1	1
10	High degree of inefficiency & rework	6	9	9	15	6	45	0.63	10	3	3	6	10	3	25	0.66	11	-1	1
9	Late engagement of contractors	6	4	10	19	6	45	0.67	9	3	5	7	8	2	25	0.61	12	-3	9
14	Lack of equitable team relationships, responsibilities and respect for all	10	16	11	8	0	45	0.48	14	5	6	8	4	2	25	0.54	14	0	0
																		$\sum d^2$	226
																		$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$ Spearman rank coefficient	0.91

B. Correlation coefficient between client and Contractor

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project According to clients								Existence in 40-60 Housing Construction Project According to Contractors								Rank difference d=(client-consultant)	d^2
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank	1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank		
2	Lack of effective communication among major construction parties	2	0	3	15	25	45	0.87	2	3	2	2	31	41	79	0.83	2	0	0
1	Lack of coordination among parties	1	1	2	18	23	45	0.87	1	5	3	4	34	33	79	0.87	1	0	0
4	Lack of standard design and specification	1	1	5	21	17	45	0.83	4	1	13	3	33	29	79	0.80	3	1	1
3	Lack of inclusive decision making process among parties	1	2	6	15	21	45	0.84	3	4	6	9	33	26	78	0.77	4	-1	1
13	Late decision making by client/consultant	8	12	8	15	2	45	0.56	13	3	10	18	22	26	79	0.58	13	0	0
11	Bureaucratic client processes	8	9	9	14	5	45	0.60	11	2	7	22	30	18	79	0.63	12	-1	1
7	Inadequate contract document	1	6	10	17	11	45	0.74	7	3	16	8	37	15	79	0.72	7	0	0
5	Lack of integrated planning and scheduling among parties	2	7	3	22	11	45	0.75	5	3	14	17	25	20	79	0.46	15	-10	100
15	Lack of required personnel, financial and physical resources by parties	21	7	9	4	4	45	0.44	15	4	15	11	33	16	79	0.77	5	10	100
8	Lack of commitment from major parties	2	5	13	16	9	45	0.71	8	5	14	15	32	13	79	0.73	6	2	4
12	Frequent scope changes	6	8	14	16	1	45	0.59	12	9	10	27	27	6	79	0.67	10	2	4
16	Lack of accountability	18	13	9	4	1	45	0.41	16	7	17	20	29	6	79	0.45	16	0	0
6	Lack of project ownership by parties	8	6	19	10	43		0.74	6	10	20	15	29	5	79	0.72	8	-2	4
10	High degree of inefficiency & rework	6	9	9	15	6	45	0.63	10	18	15	23	15	8	79	0.67	9	1	1
9	Late engagement of contractors	6	4	10	19	6	45	0.67	9	23	21	27	7	1	79	0.64	11	-2	4
14	Lack of equitable team relationships, responsibilities and respect for all	10	16	11	8	0	45	0.48	14	34	16	15	6	8	79	0.52	14	0	0
																		$\sum d^2$	220
																		$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$ Spearman rank coefficient	0.92

C. Correlation coefficient between Client and Government Body

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project According to clients								Existence in 40-60 Housing Construction Project According to Government body								Rank difference d=(client-consultant)	d^2
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank	1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank		
2	Lack of effective communication among major construction parties	2	0	3	15	25	45	0.87	2	0	0	0	0	2	2	1.00	1	1	1
1	Lack of coordination among parties	1	1	2	18	23	45	0.87	1	0	0	0	1	1	2	0.90	2	-1	1
4	Lack of standard design and specification	1	1	5	21	17	45	0.83	4	0	0	0	1	1	2	0.90	2	2	4
3	Lack of inclusive decision making process among parties	1	2	6	15	21	45	0.84	3	0	0	0	1	1	2	0.90	2	1	1
13	Late decision making by client/consultant	8	12	8	15	2	45	0.56	13	0	0	0	1	1	2	0.90	2	11	121
11	Bureaucratic client processes	8	9	9	14	5	45	0.60	11	0	0	0	1	1	2	0.90	2	9	81
7	Inadequate contract document	1	6	10	17	11	45	0.74	7	0	0	0	1	1	2	0.90	2	5	25
5	Lack of integrated planning and scheduling among parties	2	7	3	22	11	45	0.75	5	0	0	0	1	1	2	0.90	2	3	9
15	Lack of required personnel, financial and physical resources by parties	21	7	9	4	4	45	0.44	15	0	0	0	1	1	2	0.90	2	13	169
8	Lack of commitment from major parties	2	5	13	16	9	45	0.71	8	0	0	1	0	1	2	0.80	10	-2	4
12	Frequent scope changes	6	8	14	16	1	45	0.59	12	0	0	0	2	0	2	0.80	10	2	4
16	Lack of accountability	18	13	9	4	1	45	0.41	16	0	0	0	2	0	2	0.80	10	6	36
6	Lack of project ownership by parties	8	6	19	10	43		0.74	6	0	0	1	1	0	2	0.70	13	-7	49
10	High degree of inefficiency & rework	6	9	9	15	6	45	0.63	10	0	0	1	1	0	2	0.70	13	-3	9
9	Late engagement of contractors	6	4	10	19	6	45	0.67	9	0	1	1	0	0	2	0.50	15	-6	36
14	Lack of equitable team relationships, responsibilities and respect for all	10	16	11	8	0	45	0.48	14	0	1	1	0	0	2	0.50	15	-1	1
																		$\sum d^2$	551
																		$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$ Spearman rank coefficient	0.47

D. Correlation coefficient between Consultant and Contractor

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project According to Consultants								Existence in 40-60 Housing Construction Project According to Contractors								Rank difference d=(client-consultant)	d^2
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank	1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank		
2	Lack of effective communication among major construction parties	1	0	1	12	11	25	0.86	1	3	2	2	31	41	79	0.83	2	-1	1
1	Lack of coordination among parties	2	1	0	15	7	25	0.79	2	5	3	4	34	33	79	0.87	1	1	1
4	Lack of standard design and specification	1	3	3	10	8	25	0.77	3	1	13	3	33	29	79	0.80	3	0	0
3	Lack of inclusive decision making process among parties	0	5	4	10	6	25	0.74	5	4	6	9	33	26	78	0.77	4	1	1
13	Late decision making by client/consultant	3	7	5	10	0	25	0.58	13	3	10	18	22	26	79	0.58	13	0	0
11	Bureaucratic client processes	1	4	7	10	3	25	0.68	10	2	7	22	30	18	79	0.63	12	-2	4
7	Inadequate contract document	2	4	3	11	4	24	0.69	8	3	16	8	37	15	79	0.72	7	1	1
5	Lack of integrated planning and scheduling among parties	11	2	2	5	5	25	0.53	15	3	14	17	25	20	79	0.46	15	0	0
15	Lack of required personnel, financial and physical resources by parties	1	3	5	13	3	25	0.71	6	4	15	11	33	16	79	0.77	5	1	1
8	Lack of commitment from major parties	1	1	8	9	6	25	0.74	4	5	14	15	32	13	79	0.73	6	-2	4
12	Frequent scope changes	1	4	6	11	3	25	0.69	9	9	10	27	27	6	79	0.67	10	-1	1
16	Lack of accountability	8	4	8	3	2	25	0.50	16	7	17	20	29	6	79	0.45	16	0	0
6	Lack of project ownership by parties	1	4	5	11	4	25	0.70	7	10	20	15	29	5	79	0.72	8	-1	1
10	High degree of inefficiency & rework	3	3	6	10	3	25	0.66	11	18	15	23	15	8	79	0.67	9	2	4
9	Late engagement of contractors	3	5	7	8	2	25	0.61	12	23	21	27	7	1	79	0.64	11	1	1
14	Lack of equitable team relationships, responsibilities and respect for all	5	6	8	4	2	25	0.54	14	34	16	15	6	8	79	0.52	14	0	0
																		$\sum d^2$	20
																		$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$ Spearman rank coefficient	0.99

E. Correlation coefficient between Consultant and Government body

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project According to Consultants								Existence in 40-60 Housing Construction Project According to Government body								Rank difference d=(client-consultant)	d^2
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank	1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank		
2	Lack of effective communication among major construction parties	1	0	1	12	11	25	0.86	1	0	0	0	0	2	2	1.00	**1**	0	0
1	Lack of coordination among parties	2	1	0	15	7	25	0.79	2	0	0	0	1	1	2	0.90	**2**	0	0
4	Lack of standard design and specification	1	3	3	10	8	25	0.77	3	0	0	0	1	1	2	0.90	**2**	1	1
3	Lack of inclusive decision making process among parties	0	5	4	10	6	25	0.74	5	0	0	0	1	1	2	0.90	**2**	3	9
13	Late decision making by client/consultant	3	7	5	10	0	25	0.58	13	0	0	0	1	1	2	0.90	**2**	11	121
11	Bureaucratic client processes	1	4	7	10	3	25	0.68	10	0	0	0	1	1	2	0.90	**2**	8	64
7	Inadequate contract document	2	4	3	11	4	24	0.69	8	0	0	0	1	1	2	0.90	**2**	6	36
5	Lack of integrated planning and scheduling among parties	11	2	2	5	5	25	0.53	15	0	0	0	1	1	2	0.90	**2**	13	169
15	Lack of required personnel, financial and physical resources by parties	1	3	5	13	3	25	0.71	6	0	0	0	1	1	2	0.90	**2**	4	16
8	Lack of commitment from major parties	1	1	8	9	6	25	0.74	4	0	0	1	0	1	2	0.80	**10**	-6	36
12	Frequent scope changes	1	4	6	11	3	25	0.69	9	0	0	0	2	0	2	0.80	**10**	-1	1
16	Lack of accountability	8	4	8	3	2	25	0.50	16	0	0	0	2	0	2	0.80	**10**	6	36
6	Lack of project ownership by parties	1	4	5	11	4	25	0.70	7	0	0	1	1	0	2	0.70	**13**	-6	36
10	High degree of inefficiency & rework	3	3	6	10	3	25	0.66	11	0	0	1	1	0	2	0.70	**13**	-2	4
9	Late engagement of contractors	3	5	7	8	2	25	0.61	12	0	1	1	0	0	2	0.50	**15**	-3	9
14	Lack of equitable team relationships, responsibilities and respect for all	5	6	8	4	2	25	0.54	14	0	1	1	0	0	2	0.50	**15**	-1	1
																		$\sum d^2$	539
																		$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$ Spearman rank coefficient	0.49

F. Correlation coefficient between Contractor and Government body

No.	Integration issues in DBB project delivery method	Existence in 40-60 Housing Construction Project According to Contractors								Existence in 40-60 Housing Construction Project According to Government body								Rank difference d=(client-consultant)	d^2
		1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank	1 (Strongly disagree)	2 (disagree)	3 (partially agree)	4 (agree)	5 (Strongly agree)	Total	RII	Rank		
2	Lack of effective communication among major construction parties	3	2	2	31	41	79	0.83	2	0	0	0	0	2	2	1.00	**1**	1	1
1	Lack of coordination among parties	5	3	4	34	33	79	0.87	1	0	0	0	1	1	2	0.90	**2**	-1	1
4	Lack of standard design and specification	1	13	3	33	29	79	0.80	3	0	0	0	1	1	2	0.90	**2**	1	1
3	Lack of inclusive decision making process among parties	4	6	9	33	26	78	0.77	4	0	0	0	1	1	2	0.90	**2**	2	4
13	Late decision making by client/consultant	3	10	18	22	26	79	0.58	13	0	0	0	1	1	2	0.90	**2**	11	121
11	Bureaucratic client processes	2	7	22	30	18	79	0.63	12	0	0	0	1	1	2	0.90	**2**	10	100
7	Inadequate contract document	3	16	8	37	15	79	0.72	7	0	0	0	1	1	2	0.90	**2**	5	25
5	Lack of integrated planning and scheduling among parties	3	14	17	25	20	79	0.46	15	0	0	0	1	1	2	0.90	**2**	13	169
15	Lack of required personnel, financial and physical resources by parties	4	15	11	33	16	79	0.77	5	0	0	0	1	1	2	0.90	**2**	3	9
8	Lack of commitment from major parties	5	14	15	32	13	79	0.73	6	0	0	1	0	1	2	0.80	**10**	-4	16
12	Frequent scope changes	9	10	27	27	6	79	0.67	10	0	0	0	2	0	2	0.80	**10**	0	0
16	Lack of accountability	7	17	20	29	6	79	0.45	16	0	0	0	2	0	2	0.80	**10**	6	36
6	Lack of project ownership by parties	10	20	15	29	5	79	0.72	8	0	0	1	1	0	2	0.70	**13**	-5	25
10	High degree of inefficiency & rework	18	15	23	15	8	79	0.67	9	0	0	1	1	0	2	0.70	**13**	-4	16
9	Late engagement of contractors	23	21	27	7	1	79	0.64	11	0	1	1	0	0	2	0.50	**15**	-4	16
14	Lack of equitable team relationships, responsibilities and respect for all	34	16	15	6	8	79	0.52	14	0	1	1	0	0	2	0.50	**15**	-1	1
																		$\sum d$	541
																		Spearman rank coefficient	0.49

Appendix E- Project costs incurred due to project delay

A. Consultant payments

No.	Project branch	Site	Typology	No. of Blocks	PDM	Contract start date	Contract duration (months)	% comp-leted	Elapsed time till date (months)	Consultant payment per block per month (ETB)	Total number of blocks	Total consultant payment from contract end date to current (ETB)
1	Branch 1	Asko	3B+G+12	1	DBB	9/26/2013	19	88.71	74.27	16,401.32	13	15,834,927.75
			2B+G+13	12								
2		Ehil-Nigd	2B+G+12	6	DBB	3/09/2013	18	95.73	76.03	10,547.00	6	4,811,541.40
3		Tourist	2B+G+18	11	DBB	12/30/2015	19	83.1	46.77	23,234.00	11	11,952,344.07
4		Hintsa Akrabi	2B+G+13	8	DBB	19/11/2013	19	93.31	73.50	16,401.32	8	9,643,976.16
5		Bole Bulbula- 1	2B+G+13	20	DBB	5/26/2014	19	93.9	66.20	10,160.00	51	34,302,192.00
			B+G+7	8								
6		Bole Bulbula- 2	2B+G+15	15	DBB	5/29/2015	19	84.15	53.93			
			B+G+9	8								
7	Branch 2	Site- 1	B+G+8	14	DBB	6/21/2014	19	94.43	65.33	10,077.07	52	34,235,165.81
8		Site-2	B+G+8	20	DBB	6/21/2014	19	94.01				
			B+G+10	18								
9		Site -3	B+G+8	32	DBB	6/14/2014	16	94.48	68.57	10,077.07	41	28,330,372.28
			B+G+10	9								
10		Meri	2B+G+13	14	DBB	2/25/2014	16	97.36	72.20	11,152.00	14	11,272,441.60
11	Branch 3	Bole Behsale	2B+G+13	15	DBB	5/31/2015	24.33	72.5	48.53	10,715.00	58	30,162,010.67
			B+G+15	22								
			B+G+9	21								
12	Branch 4	Bole Ayat-1	B+G+10	8	DBB	6/21/2014	19	85.11	65.33	11,588.63	22	16,656,724.19
			B+G+8	14								
13		Bole Ayat -2	2B+G+13	34	DBB	4/24/2015	27	85.66	47.10	11,054.50	49	25,512,680.55
			2B+G+15	15								
14		Summit	B+G+8	10	DBB	5/21/2015	16	67	58.17	12,246.50	10	7,123,380.83
	Total consultant payment paid by the client from contract end date until recent (ETB)											**229,837,757.31**

B. Overhead costs incurred due to project delay

No.	Overhead Costs	Branch-1	Branch-2	Branch-3	Branch-4	Total
1	Salary for client employees per month (ETB)	919,407.01	462,380.00	538,788.00	765,491.44	2,686,066.45
2	Security service payments per month (ETB)	334,400	350,000.00	246,838.71	374,127.00	1,305,365.71
3	Other fees per month (ETB)	179,931	132,854.13	131,608.75	144,906.60	589,300.48
Total Overhead costs per month (ETB)		67,703,054	1,433,738	945,234	917,235	1,284,525
4	Average project delay duration (month)	58.63	69.07	48.97	61.3	59.49
Total Overhead costs in ETB (due to project delay)		84,060,059.53	65,284,170.58	44,913,963.02	78,741,384.95	272,999,578.08

Source: Project Branch office finance teams

- Schedule, on average is delayed of 62.76 months (5.23 years)
- Total cost overrun incurred due to project delay is ETB 502,837,335.08 (Five Hundred Two Million Eight Hundred Thirty Seven Thousand Three Hundred Thirty Five Birr and eight cents)

Note: The total cost overrun calculated only included consultant's monthly payment, client employee salaries per month, Security payment for sites and material stores and miscellaneous costs (like fuel, overtime payments, stationaries and the likes used for operations)The contractor's payments are issued based on the executed work which hasn't been included in analysing the costs associated with the time overrun.