
**Addis Ababa University**

**Addis Ababa Institute of Technology**

**School of Civil and Environmental Engineering**

# The Impact of Design-Bid-Build Procurement Method on Performance of Public Building Construction project in Addis Ababa

**By**

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**A Thesis submitted to School of Civil and Environmental Engineering Graduate Studies of Addis Ababa Institute of Technology in Partial Fulfillment of the Requirement for the Degree Masters of Science in Civil Engineering (Construction Technology and Management)**

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# DECLARATION

I declare that this thesis entitled **"The Impact of Design-Bid-Build Procurement Method on Performance of Public Building Construction Project in Addis Ababa"** is my original work. This thesis has not been presented for any other university and is not concurrently submitted in candidature of any other degree, and that all sources of material used for the thesis have been duly acknowledged.

Candidate:

Name: _____

Signature: _____

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# ABBREVIATIONS

AAiT – Addis Ababa Institute of Technology

BOT –Built Operate Transfer

CBE – Commercial Bank of Ethiopia

CM – Construction Management

DB – Design-build

DBB – Design-bid-build

DF – Variance between groups

ETB – Ethiopian Birr

HQ – Head Quarter

PDM – Project Delivery Method

RFI – Relative frequency index

RFP – Requisite for Proposal

RII – Relative Important index

# ABSTRACT

Occurrence of extensive delay and additional cost happen on construction projects were due to lack of availability of proper selection of project delivery methods made by project team members. For the project proposed, the project delivery chosen by a given client can affect the project performance outputs. This study sought the impact of DBB systems on project performance. Methodology used was questionnaires, interview and case study projects. The respondents were selected using purposive sampling. The result found that the selection criteria of procurement delivery system are identified and ranked namely certainty of final price, certainty of completion date, demand of quality, competition price, controllable variation, administration burden and risk allocation. In addition, currently there is lack of research in government building projects regarding impacts of DBB procurement system on project performance relative to DB. Thus, the comparison assessment undertaken between DBB and DB to recommends the better procurement system in government owned building projects of study area. A case study of both DBB and DB of public building projects in Addis Ababa were studied. The results shows that cost per $m^2$ of design bid build(DBB) is higher than design build of building projects because the DB cost per $m^2$ is reduced by maintaining lower initial contracted unit cost than DBB method. From analysis of case study projects, DB delivery system public building project are better than DBB building projects in terms of time and cost growth because DBB more subjected for design change, design error, variation order, error and discrepancies in design document and quantity increase which in turn causes cost and time overruns in public building project of study area. Therefore, it concludes that time and cost growth in design build is minimized than traditional design bid build of public building projects. It is recommended that client and other concerned bodies of stakeholders in the building construction project should be utilized and adopts alternative DB procurement methods to minimize the impact and problems of DBB procurement method on project performance.

**Keywords: Building Project, Design Bid Build Delivery Method, Project Performance**

# CHAPTER ONE

# INTRODUCTION

## 1.1. Back Ground

The delivery of construction projects requires a necessarily balance of quality, schedule and budget, which meeting or attaining client objectives for their projects. The main existed challenges and wide spread problems encounter on construction project are schedule and budget overruns. Research conducted on design bid build project delivery model indicated that a decision criterion of traditional delivery greatly affects the performance objective of building projects.

The performance of building construction procured by design bid build or traditional method can be impacted by several factors and need to be identified. However by how much degree of these factors affect performance of building typically requires an analysis through data collection.

In reality, project delivery system of conventional for a for building facilities is most of the time planned during pre-implementation phase according to project management team's previous experience and familiarity without taking into account proper influencing factors. However, selection has taken while the client organization still has little sort of information in relation to the objective output of the construction for the fact that plans are not complete and adequate to be consistent basis for decision about the project delivery of public building project so that this situation undoubtedly indicates the substantially significance for decision making which is easy, inclusive, rational, and objective for specific projects.

The traditional system was specified from other alternative in their scope of duty project team members, in the mechanism of risk allocation and the sequence of design and execution activities of project delivery types. The influencing factor for this system is also different from the others as well as relied on the proposed projects. Hence, giving consideration of how the specified factors affect building performances of project is a vital.

Moreover ,According to Shafik and Martin (2006) from day to day complexity of construction projects, needs an essential planning and strategy of procuring systems, which will ensure that everybody along the chain of project delivery is able to fulfilling quality standards of the contracting organization, project completion on time and under budget. However, there is an

increasing trend towards choosing a proper project delivery strategy to manage a project; there is a decreasing absence of common understanding of a required strategy.

This research is useful for building project providers when they candidate for the procurement system and the practice be gear to clients and their supervisor on their primary building priority. It is apparent that Building infrastructure in our country contingent on traditional design bid build recently and the adaptation of other system is rare. Thus, to improve the associated problems and measure its performance, the inclusion of specific decision parameter of the system framework has become substantially important and provides a solid foundation for introducing rational impacting decision route at initial project cycle stage of proposed construction.

In addition to this, construction of projects delivered through traditional project delivery methods four stages such as planning stage, detailed design stages, procurement stages and construction stages. In addition in completion of construction phase of a project provides duration and budget performances.

The past studies suggest that the decision of particular method of a planning phase has a correlation with the data available during the construction phase of a project. The parameter variable of this research was project completion performance of both cost and time metrics. The study undertaken that delivery decision system of has an effect on successful project performance.

It has concerned that conventional contract represents the commonly used types of project delivery systems for both vertical and horizontal construction in Ethiopia. Although the alternative types of delivery in the local industry may be gradually emerging into a situation where several delivery options are commonly considered and used, the industry has not yet shifted fundamentally to others. Hence, the majority of government owned vertical projects in the Addis Ababa are delivered and constructed by respective government agencies now a day using the this kinds of project delivery method.

This system has also defined as “traditional or conventional” delivery method. In this type of delivery system the owner enters in to an agreement once with the consultant and others with contractor. In this case, the designer responsibility is to offer complete design documentations whereas the duty of contractors are needed to execute a projects, where other parties namely

client , usually solicited in a fixed price bid, is required to construct the project in according with the design plan and specifications.

Moreover, one of the main essential decisions made by every client embarking on a construction project is choosing the existed method for building project needs a necessary understanding of selection factors available.

Prior research conducted by Ghadamsi and Braimah (2016) point out that the construction infrastructure poor performance has occurred due to wrong decision factors considered by construction organization at the age of pre-execution stage. Thus, incorrect procuring decision of DBB or conventional types of construction delivery practice has fundamentally leads to project overruns meaning that budget and schedule planning against that of actual performance output in government owned building projects.

However, there is still a general agreement that construction delivery is a complex process, and any conclusion about how good or bad the delivery system may be, cannot bring much confidence except if it is evaluated in terms of some critical factors that influence the project performance outcome of a given project. Furthermore, previous research also mentioned that one major challenge faced by project developers is deciding which method and its selection criteria to adopt among the available construction delivery options to improve project performance.

However, with this stated methods the poor performance like absence of timely project completion or a calendar days of completion against the planned duration, budget overruns and poor workmanship quality of the completed projects as the existed problems (Lema, 2006).Moreover, a study conducted by Lema, (2006) also towards addressing this methods poor performance has largely been restricted to the increase and encouragement of other types namely alternative or innovative deliver model, which involves design and build (DB), construction management method etc., to solve the poor performance of traditional system. Even though various alternatives to this traditional method have come into use in recent years in the capital city of Addis Ababa, for example DB Head Quarter (HQ) project of Commercial Bank of Ethiopia, this traditional Design-Bid-Build is still preferred by many owners of building projects.

Accordingly, in the local construction industry of Ethiopia, the construction of many facilities is growing fast as compared to a few years back. Although that is true certain building

construction projects are performed below the intended quality and exceed the budget and completion time set. For example, research conducted by Aschalew (2017) found that 74.3% of public building construction projects in Addis Ababa experienced cost overrun and the least and the highest time overrun is found to be 10% and above 250% respectively. Among the many reasons for such poor performance, the selection route or systems are the one and basic part that needs emphasis.

In the local situation of Ethiopia, Abebe and Girmay, (2003), mentioned that the consequences of extensive delay and additional cost and their related claims plus disputes have been caused by improper selection of project delivery method. Previous research also underlined that due to the use of incorrect decision factors to deliver indicated projects or poor delivery system choice has been identified as major potential causes of schedule and cost overruns. That means that among extensive reasons causing such kinds of poor construction performance associated with the dominantly adopted traditional or DBB delivery method in building projects.

Hence one of the ways are critically adopting the appropriate and correct selection factors during planning phases are substantially important for enhancing it and meeting the specified building project outputs.

Pre-construction route process of project delivery for the given public sector construction projects is a tedious process and has a considerable direct influences on project objective outcomes (Izhar *et al*., 2019). The use of such system result outcome may be led to potential overrun of calendar days of completion against the planned schedule and budget overruns or low quality if not correctly chosen at right time.

In the Ethiopian context, there are few studies done on problems of research. Previous studies, for instance, Lema, (2006) confirmed that there is a direct links or relationships between the type of chosen system and acute problems of schedule and budget overruns in studying the project. Hence, processes of specific project delivery method have been approved to enhance, the output objective in this study.

Obviously, the challenge of our local construction industries is determining how to improve the performance and one of the ways to achieve expected projects performance procured by traditional method. For instance, parameters such as criteria performance of cost, schedule and

quality at the time of delivery approach during pre - execution have been taken by concerned parties and delivery route success factors such as complexity, cost before commencement, probability time, risk minimization, accountability or burden, and degree of control by the client considered (Rajeh *et al*., 2014).

For this research, seven routes of selection factors which currently used for this contract system were identified based on literature review and experts interview whose have good theoretical knowledge and practical experience in different building delivered by conventional methods and proved to be critical and recognized as very important.

Finally, procurement methods significantly affect project performance, thus it is vital for concerned bodies when selecting the appropriate system for a specified projects. Alternative DB system is a new project procurement types. Now, there is a lack of DB research specially related to the delivery in the area of buildings projects. Therefore, this research assess the impact and problems of DBB method relatively with DB methods by considering case study building projects to identify the potentially important delivery option to achieve project goals for executing a public building.

## 1.2. Problem Statement

Most of the time, the substantial acute problems seen on government owned building construction delivered by traditional or Design Bid Build method in Addis Ababa ended with overruns of planned duration, cost overrun. Moreover, former research also confirmed that public construction sector over handed or delivered by this methods ended with poor performance like absence of timely project completion, budget overruns and poor quality of the completed as the main problems (Lema, 2006).

However, since the usage of alternative delivery method does not appear particularly in public buildings, still now traditional delivery ended with cost and time overruns so that continued to be major challenge in construction industry (Rahel, 2016). Among many factors, lack of contractors input in design stage of DBB method is common source of claims, change orders and variations that face a given project to cost and time overruns. Problems of DBB method can be minimized through utilization and adaptation of alternative methods such as DB methods to enhance the perception of project performance objective of public building in study area.

## 1.3. The Objectives/ Aims of the Study

### 1.3.1. General Objective

The ultimate objectives of this study is the impact DBB system on project performance of in public building construction of Addis Ababa through comparison assessment o f DBB systems with DB to see if there is a better project procurement method for constructing a building projects. Case studies of DBB and DB public building construction projects in the Addis Ababa would be utilized.

### 1.3.2. Specific Objective

The specific objectives of the research are:

1. To identify selection factors affecting the choice of DBB project system in public building
2. Assess the impact of DBB on projects performance in terms of outcomes of time and cost of public building in Addis Ababa.
3. To recommend better delivery methods.

## 1.4. Research Question

1. What are traditional or DBB contract decision route variables that inform client and their advisors as right delivery methods in public building construction in Addis Ababa?
2. How are the least collaborative (DBB) procurement systems superior in performance to the more collaborative (DB) and vice versa in study area?

## 1.5. Significance of the Study

- It is significant because contractual that increase the adaptation of construction and knowledge at the time design stage can be utilized for making key projects decisions in public building construction projects so that clients and their consultant supervisor be gear to their building primary priorities;
- Also, helpful for stakeholder of construction project for decision by simply reliant on the link between selection delivery system and building project performance so that the amount of affects on performance fundamentally at planning phase enable stakeholders

to pay attention when the candidate for appropriate system of procuring the intended projects.

- Finally, the result of this study also helpful and valuable to the existing body of knowledge of construction management regarding project delivery decision issues that enhance project performance

## 1.6. Scope of the Study

For the scope of this study, the research is done in order to focus and narrow down the topic to the specific area and subject of study.

## 1.7. Limitations of the Study

- Public building construction of projects that constructed and completed in the past were taken for study;
- This study limited to design bid build contract and design build of delivery and
- The area of this study is limited to Addis Ababa

## 1.8. Structure of the Study

This research involves five chapters:

- The first chapter deals with an overview of introduction parts which touch background, research problems and ultimate objectives.
- The second chapter is the literature review part which tries to address prior different material to have a various concept and overview on the subject matter to identify what have been done by the others and prepare a theoretical perspective of the study.
- Whereas third chapter is methodology which focuses on the strategy and study design of the research methods and
- The fourth chapter puts the obtained results and touches the discussion part which justifies the collected data of the study.
- Finally, the last chapter ended with recapitulating the conclusion and recommendations.

# CHAPTER TWO

# LITERATURE REVIEW

Prior related research studies carried out for the determination project performance indicated that performance of building projects are influenced by a wide variety of decision routes or selection criteria factors for a specified project delivery method such as specific project requirement, specific characteristics of projects, scope or circumstances of the owner, the successful formulation of the project team, typically during planning stage. The variety and complexity of these factors would create difficulties to ensure the success of project performance. Therefore, the main activity of the study is to investigate what factors are critically impacting the project performance by how much. This chapter discusses the general overview of project delivery methods or procurement methods in general and traditional methods in particular, prior research works and relative studies conducted in determining these factors and building performance criteria.

## 2.1. Definition of Project Delivery Systems and Procurement

Recent work studies conducted by Martin *et al.* (2016) mentioned the meaning of project delivery system which also described by the following terminologies, "procurement method "or "procurement route" and "project delivery method" project delivery systems". Based on these terminologies into mind, the study of this research has been used procurement method or delivery methods.

"Procurement and contract delivery system is the manner a project employer or client in concert with project decision makers and financiers decide the assignment of accountability to respective project stakeholders to the construction process so that both system is often determined fundamentally during basic planning phase of construction project" (Abraham, 2015).

Given that the procurement parameters and weighting facts to be applied are mainly contingent on different variable of the indicated building, the atmosphere in which the project is implemented, the developer of facilities involved and their wishes and capability, there cannot be any one possible decision criteria that can be applied for all engineering projects. Therefore, a

decision route has to be determined for a specific project contingent on the parameters for that project.

Procurement is the practice of providing engineering and construction services in which the service provider was chosen by client organization. They uses professionals such as contractors, design consultants to carried out the project stages starting from pre planning to execution phase or real end products so that the process have direct impacts on the project last objectives . This phase of construction process comes before the project execution, and at the later stages or after the project pre-planning. In construction industry, this process is always comes at early stage relative to other phase. Therefore, it is understood to have a high effect on project performance. However, design bid build procurement process is different from other delivery systems.

There are many parameters that can be used to give the definitions of project delivery systems for variety of facilities. However, there are variety types of parameters to explain project delivery systems; each option can be distinctively defined. Since no one can extremely noted about perfectiveness of one delivery method than the others options the situation exceed another depending on the necessarily requirements of a concerned projects and depending on the clients requirements and capabilities. Accordingly, three particular parameters were used to make the linking of each method of delivery systems peculiarly notified as pointed out by Mahdi and Alreshaid, (2005).

- Are the scheme and development of a project integrated or isolated?
- Are decision criteria of client is the work of construction cost?
- Is total construction cost the only decision criteria for client?

The client contracts responsibilities and risks to design professionals, builders and specialists, and retains some risks in-house. The main differences among delivery methods for example such as conventional contract (DBB),DB,CM,BOT lie in: contract formation and, most crucially, the parties to whom the various responsibilities and risks are relatively assigned; the incentives to meet the contract requirements; the assignments to carry out contract administration and other project management provisions.

The necessary and basic subject matter of all concerned systems in construction is the built of a framework which clearly creates the roles, responsibilities and relationships of the concerned

stakeholders in a project. Construction procurement or project delivery system is an important factor or parameter for construction stakeholders that contributes to achieve or meet and realize the total strategic objective or plans of the client or owner, thus to the project accomplishment or performance and confirm and establish worth for the client's.

Hence, it is vital to consider the proposed goal or strategies necessary to be critically suited to deliver the required project requirements (CWMF, 2008). It is paramount important to clearly identify project priority objectives and factor constraints in the selection process factors. Therefore, actions taken necessarily and appropriately considered and comparisons needs to be made concerning by client under which the most suitable of this method and how it meets project and be gear to clients and supervisor organization to their project construction priorities.

## 2.2. Different Types of Contract Methods

There are numerous different kinds of project delivery systems' in construction industry as defined in previous section. Procurement and contract delivery system is always determined during the basic planning phase or pre - design and execution phase of construction project (Fitsum, 2018). Generally, there are six types of procurement and contract delivery systems. These are;

- Force Account
- Design Bid Build (DBB)
- Design Build (DB) or Turnkey
- Finance / Build Operate System (BOT)
- Construction/Facility Management Consultancy, &
- Alliances and Outsourcing

Before discussing the effects of traditional route on project performance, it is very appropriate to discuss the concept and process of the different project delivery systems. In the building industry, procurement describes the activities undertaken by the client to obtain a building. However, the majority sorts of those methods are: conventional (design-bid-build), design and build, management contracting and built operate transfer. Among different category of these available types or category of construction delivery systems have been discussed in the following sections.

### 2.2.1 Design Bid Build Method

Design-bid-build has been the project delivery system used the most during the previous decades. There, the owner is able to communicate his/her needs to the designer, and design is continued until the facility is accurately depicted, so that the owner can verify the compliance of the design solution with needs. This has given the owner full control over design details but has separated design from construction.

According to Mathonsi and Thwala, (2012) the term "Design bid Build" also called method of delivery method "traditional" or conventional type for the reason that it has been in existence in past century and has been the only choice available for most owners of the building industry for over many years. Therefore, for such types the client or owner enters into an agreement with the design consultant (an architect or engineer) to really carry out the design work and make contract documents.

Subsequent to the completion of design and contract document, the contractor who realize the realize wish of client, is then calls for bid based upon the owner's criteria and the client enters into a contract with the successful contractor for the executing of the facilities relied on contract agreed between both parties. In this contract system the client is under two contractual responsibilities; one with consultant and the other with contactors according to their responsibilities. This conventional type of contract encompasses two separate parties for contract agreement. These means that the employer enters in to an agreement with two separate stake holders namely: consultant as designer and contractor as builder.

The duties of each party are for instance, the designer is required to provide complete design documentations whereas the client, usually solicited in a fixed price bid, is required to construct the project in according with the design plan and specifications. Accordingly, the contractor or builder is the responsible entity requires realizing the wish of owners by implementing the concerned projects.

### 2.2.2 Design Build Method

This is another one of a (PDM) in such a way that a clients contracts with single entity of designer and contracts with single entity of builder that performs construction work in

accordance with specifications and drawings for payment compensation, based on a predetermined or stipulated price, unit prices, or the cost of construction plus a fee.

The primary of the crucial characteristic of this alternative contract is that the owner approaches a contractor with a set of objectives requirements defining what the owner needs. The builder then responds with proposals, which will contain implementation work and design work. The scale of design activities included contingent on the amount of employer or client has previously commissioned such work from others. The builder organization scheme effort varies from one contract to another, ranging from the mere detailing of a fairly comprehensive design to a full design process including proposals, sketch schemes and production information.

On projects concerning commercial processes, focus to design development and well change, the compensation system or payment of lump sum cost are difficult to obtain so that for such cases happened the type of payment is fixed prices, relied on quantities, with first prepared adjustment requirements for the amount of variations(Gordon & Rees LLP, 2005).This offers the clients certain additional price protection in that the parts of implementation is being executed, in a sequenced manner, by contractors who are providing some form of fixed price for areas of work within their expertise (Gordon & Rees LLP, 2005).

Design-build is best suited for both vertical and horizontal infrastructure where the design and performance requirements are well defined and the type of detailed design and construction to be performed is widely offered by the industry. In those situations, the cost offered by the design-build contractor will be competitive as builders have a history of performance upon which to determine its price without including a large contingency. It is also beneficial when the owner needs to have an early commitment to an overall price for the project. Owners with special operations and maintenance requirements or other special needs may find another approach more suitable, particularly an approach which offers the owner greater control over defining detailed design features.

Define the design and build delivery technique as an arrangement where one contracting organization takes individual accountability, usually on a lump sum fixed price basis, for the bespoke scheme and execution of a client's project (Masterman, 2002). In this design build project delivery method, the client inters into contract with contractor for both design and execution of construction projects.

Projects implemented by using DB delivery system are often called Turnkey Projects because a single builder is accountable to hand over the completed projects and let the Project owner to turn the key and gets in.

The design-build firm that habitually subcontracts to the builder always takes larger risks than in traditional types. The designer's responsibility in the alternative method differs extensively from the designer's responsibility in the DBB system, wherever the designer's major attention is to keep his own and the attention of the client. In DB, the designer is a working with of the builder organization and is likely to benefit the design-build members.

As mentioned earlier, one of the chief benefits of the design-build system is the possibility for the employer to agreement with a single contractor company. The scheme players is responsible for giving the client with all aspects required to deliver the facility beginning from design stage to execution, involves equipment selection. In such types of system, the risks related among design and construction management and control are transferred to the design-build body. Moreover, the client contingent on the design-build team for coordination, quality and budget control, in addition to schedule managing. Design-build as system emerged to gratify the client's recent needs to accomplish projects faster and at lesser expenses (lema 2006).

Although the DB delivery method has existed since medieval times, during the master builder was part architect, part engineer and part constructor supervising the building of palaces and cathedrals, this method is thought as the newest delivery method, for the reasons mentioned earlier.

### 2.2.3 Build - Operate – Transfer Method

Build - Operate - Transfer is a kind of procurement and contract delivery system that encourages Public Private Partnership (PPP) in which a private company is substantially contracted to finance, design, construct, and operate for a certain period (usually 10 years) and transfer. BOT contractors look to project financiers for the realization of projects through equity contributions or credits (Fitsum, 2018).

The Typical BOT types is the practice whereby a concerned bodies of administration grants a concession to a project development company to design and operate what would typically be a public organization project, for a given some period of time known as the concession period.

BOT project contains a potentially complex contractual arrangement. Typically, the operation phase between completion and transfer gives the builder a chance to substantiate the performance of the concerned infrastructure of the services and works, and train the employer advisor on how to manage the facility afterwards.

This delivery system is advantageous because of three major factors:

- It minimizes owners' lack of financial resources
- It devoid of considerable risks from the project owners and
- The proposed project is well operated and transferred with free of charge or minimum compensations to project owners.

### 2.2.4 Construction Management Method

Construction Management is one of project delivery system typically, in which construction management provision in such delivery system contains the supervision works associated with construction activities undertaken at the time of Basic Planning stage, Design stage & Construction execution stage and its completion stage that given for the successful completion of projects. It extremely different from other types of delivery method is that, when it is involved or works from planning to completion of construction projects, while all the others types embrace only during the implementation phase after major decisions was made during the basic planning phase of the construction practice.

## 2.3. Project delivery System and Project Performance

The impact conventional projects relative to alternative method, Collins (2009) investigated whether the industry practitioners were either satisfied or not when projects procured by traditional by comparing with design build one. This author was taken into account variables regards to its ability to construct within budget, complete within time and also make a project which is able to situate the test of time and also satisfy the function for which it was proposed. The test comprises projects accomplished between 2000 and 2007. This study analyzed data from those included projects to determine the impact of traditional on construction budget and schedule as well as quality performances relative to innovative DB systems and results indicated that traditional projects was greatly impacted by budget overrun because of variation and price

fluctuations than design build and in terms of schedule design build is better than traditional. Finally this find revealed that regarding amount of satisfaction or quality performance both the systems exceed the others.

Several studies attempt to assess the impact of DBB delivery on project success. For example, Nirajan Mani (2006), who done his research entitles Impact of design cost on project performance of traditional projects has been noticed that, when using this types of contract method, there is no contractual relationship connecting the consultant and builder. The metrics used by this author were growth in cost and time. The objectives was finding the impact of design cost on cost growth and schedule growth by using multiple regression methods to know the extent of these variables effects on the two metrics performances. The result was revealed that there were negative correlations between the total design costs with entire metrics intended. Furthermore this author has been suggested that if any difficulty arises during the construction phase regarding design, the contractor proceeds with change orders and errors in design and a lack of communication between the consultant and the contractor can have a negative impact on the project cost and schedule.

Furthermore, Marie (2015).conducted case study of one DB hospital building projects and one DBB of similar projects. The methodologies used by the author were case study researches. The comparisons performance criteria used for comparisons were cost and schedule. The case study results revealed that DB building projects shows $ 30 M under budget and 90 calendar days ahead of schedule, whereas DBB case study projects went slightly over cost and schedule by exceeding original contracts. The authors further suggest that the parameters such as rework of design, change orders design error and quantity increase were less in DB than DBB during construction.

## 2.4. Owners Needs and Factor Consideration

Recent studies reveal that success of projects influenced by a variety of selection criteria of delivery methods. Prior conducted studies by Moore, (2000) classified and lists the important factors of consideration areas into three during selection of procurement systems. Contingent on his studies conducted it first indicated the project consideration which includes scope, schedule, cost uniqueness and the second category of concern indicated client consideration which contains

ability, familiarity, desire involvement, desire for control and the final area of consideration is team selection consideration that involves factors such as laws, availability and experience, relationships, players team building and risk avoidance. However, Moore, (2000) also finally summarizes that there is no best delivery system of facilities except the one that's best for specific projects and for the advantages of project team members or clients.

The project client's acceptance for cost and/or schedule risk, and client involvement in the detailed design selection process and level of project oversight during design and construction, are essentials parameters in deciding the correct project delivery models. Also Gordon & Rees LLP (2005) has noticed the appropriate parameters in choosing typical delivery model as follows:

- Identify and understand the objectives and the requirements of clients and projects;
- tolerances for risk
- understand different delivery approach, the associated risks, their merits and demerits
- discussion the above points with clients

In this section the way in which any specific project should be chosen is now considered. Due to the building construction projects are getting complex from time to time and the principles of selecting a different kinds of procurement systems is now substantially extensive, selection route or criteria critically needs to be carried out in a very disciplined and project objective mode and based on the basis of the project strategy and project brief. This brief needs to involve the client's primary and secondary objectives in terms of functionality, quality, time and cost.

The question always arises by concerned bodies were; what is the paramount important choices route for specified projects? The answer to this question may depend on the complexity of the project and the amount to which builders are undertaking any new, refurbishment or developmental work.

As it has been established that clients require discrete solutions in order to properly satisfy their procurement needs, no attempt has been made to make recommendations as to the suitability of particular procurement methods for specific types of projects or categories of clients. The principles governing the routes of PDM as it has been established that clients require discrete solutions in order to properly satisfy their procurement needs, no attempt has been made to make

recommendations as to the suitability of particular procurement methods for specific types of projects or categories of clients.

According to Masterman (2002) referred the suitability of separated procurement systems for use to ensuring that the client's attention is focused to meet the following project criteria:

- on projects where competitive bids are required in order to ensure financial accountability and minimize tender costs,
- Where there is a client requirement to make certain high standards of quality and functionality can be achieved;
- on complex projects where the design needs to be under the direct control of the client;
- Where design changes may need to be made during the currency of the works and the employer is prepared to accept the duration and price implications of such changes.

Moreover, Masterman (2002) also identified that cooperative procurement systems are suitable for use to ensuring that the client's attention is focused to meet the following project criteria:

- where the collaboration of the contractor is needed fundamentally at feasibility stages of a project in order to contribute to the design, build ability, methods of construction, costing, programming material procurement, etc.;
- Where modest savings of time are required;
- Where there is the situation of the negotiated and cost-reimbursable systems, the client is prepared to accept a cost penalty in order to gain the advantages that are associated with these methods and
- When circumstances of continuity and serial contracts, the client has more than one similar project to implement within a given period.

Finally, for the condition of construction projects listed below, employing alternative delivery system would be appropriately considered when the objective of the specific types of structure fulfilled the following parameters (Murdoch and Hughes, 2000):

- The experience of owner with the construction,
- The relative significance of client objective ,
- The technological or size and complexity of the project,

- The need to make variations to requirements as execution proceeds,
- The patterns of responsibility and communication and
- The needs of on time start on site.

Masterman (2002) also cited construction management contracts suitability for use in projects where; client objective is to have flexibility to integrate design amendments at the stage of execution time, certainty of achieving completion dates is required and takes priority over construction costs, client wishes to be objectively involved in overall management, facilities is of high value and complexity and thus requires the exercise of complicated construction and management techniques in order to ensure success, commencement of construction needs to be accelerated in order to inducing speedy completion, early instruction is needed from a management contractor or construction manager on design, build ability programming, construction methods, procurement of plant and materials. Where the developer typically that the client's attention is focused to meet in design and manage and desires to appoint a single organization to be accountable for the scheme and supervision of the works.

## 2.5. Stages of the Traditional Approach and Contractual Relationships

### 2.5.1. Stages of the Traditional Approach

Gordon & Rees LLP (2005) cited stages of the traditional approach as planning or conceptual phase, engineering & design phase, procurement/bid phase, execution phase (construction & commissioning).

1. Planning Stage

As referred by Gordon & Rees LLP (2005) in above section, in planning stage the clients prefer or select consultant expert professionals to investigate feasibility of projects which is prepared in conjunction with the project owner's operations, planning and financial staff. In these phase the assigned designer engineers helps the owner by establishing the feasibility of the facilities so that the basic performance parameters which typically involves the project description, preliminary general arrangement drawings, and performance requirements.

2. Design Phase

Ones the planning phase has accomplished the second step is design stage in which design consultant professional prepare the design documents i.e. in the traditional approach (and under ideal circumstances) the design documents are typically prepared to the 100% complete level such that a contractor can estimate, with reasonable precision, the quantity of material, equipment and labor required to complete the engineering facility as noted by Gordon & Rees LLP (2005).He further argues that the design phase on larger or complex projects may be further broken down into a preliminary design period (typically up to 30% design completion) and the detailed design development period (30% to 100%).

Addition to the above, also construction bid documents also prepared by design professional which includes the owner - general contractor agreement, general conditions, general requirements and other documents during design phase. It is very vital that the owner's legal counsel be part of the contract drafting team, and to support with the decision-making process leading up to phase 3. Once the contract terms are established, the opportunity to transfer risks is minimized. Throughout phase 2, the owner has the opportunity to select the drawing of the design features. The owner's participation may be extensive, or minimal, but the owner has the ability to become as involved in the design development, and other details, as it desires.

3. Procurement/Bid Phase

Once the second phase is accomplished, the agency seeks to procure a contract for the construction phase so that the plans and specifications are accomplished and received by the by concerned bodies of experts, the design consultant assists the clients in advertising and obtaining offers for construction of the engineering facility and the clients issues the bid documents.

Various methods of bidding approaches are available, primarily either negotiated bids with pre-qualified contractors, or lowest responsive and responsible bid. different pricing approaches are typically also existing, including fixed price, guaranteed maximum price, cost-reimbursable, unit price, and others, or combinations of these approaches.

Furthermore, Gordon & Rees LLP (2005) mentioned that the consultant professional must also provides guidance the owner on the suitable price mechanism, contingent on the specified goal of clients and tolerance for risk.

Gordon & Rees LLP (2005) also noticed that where the contract documents and specifications are prepared as 100% detailed designs, the specified pricing mechanism is typically fixed price. Using the low bid approach, the owner receives the final bids on a fixed date. Generally, the lowest fixed price responsive and responsible bid is the successful bid, concluding in a signed contract and a notice to proceed to next phases of project with that general contractor.

4. Construction Stage

During phase 4 construction, the design professional is typically retained by the owner to provide oversight services: to monitor the general contractor's quality and performance; to provide engineering assistance; review shop drawings; respond to contractor request for information (RFI); measure work in place for contractor payment application review; provide design interpretation when required, etc.

Phase 4 typically ends at project final completion. Depending on the contract definition, substantial completion may be considered the end of phase 4, instead of final completion. Each contract is different and depends on the owner's needs and use for the facility. This traditional approach generally offers the owner reasonable security of pricing and presents an orderly approach to the project.

However, it is a linear approach whereby one phase is concluded prior to the next phase beginning and requires a lengthy investment of time and money before the owner obtains its facility for revenue purposes (Gordon & Rees LLP, 2005). Although the design professional prepares a budget estimate as part of phase 2, not until the construction contract is awarded does the owner know the anticipated cost of the project.

Hence, this traditional approach generally offers the owner reasonable security of pricing and presents an orderly approach to the project on the other ways, DBB has a sequential method and typically does not have opportunity for substantial schedule compression as indicated in Figure 1 design-bid-build approach.

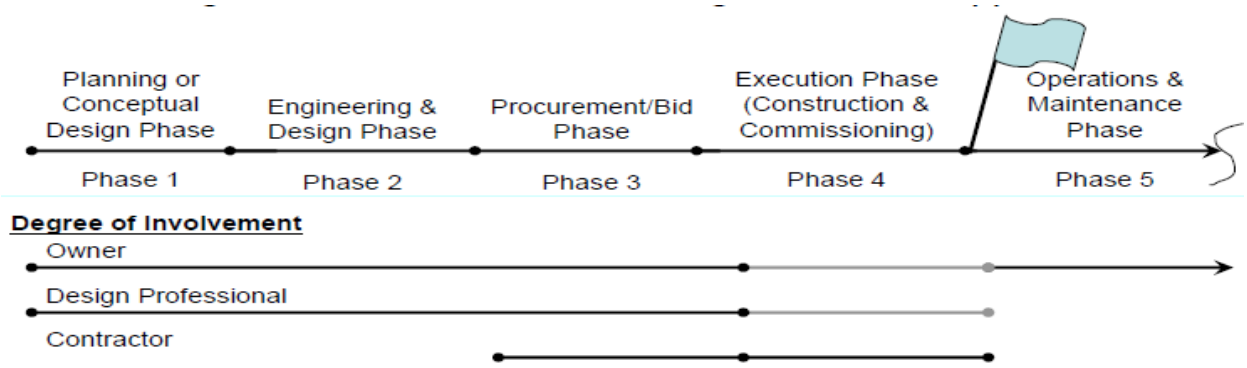


Figure 1: Phases of the Design-Bid-Build Approach (Gordon & Rees LLP, 2005).

As shown in figure 1 above, it is apparent that, in a traditional contracting scheme, design professionals are obligated to exercise their professional judgment so as to work for the owner's best. Because there are no ties between the consultant and the contractor, design professionals are free and likely to exercise their judgment independent of the wishes of the contractor. However, in the design-build scheme, however, there is no longer an independent architect to oversee the process in the same way.

## 2.5.2. Design-Bid-Build Method Contractual Relationships

Design-Bid-Build (DBB) – The traditional project delivery method typically comprises three sequential project phases: Accordingly, The design stage completed by designer of a given project completed; the bid stage carry out and a successful contractor is selected then execution phase is realized, when the project is built by the selected (typically low bid) contractor. This sequence usually leads to a sealed bid, fixed-price contract. The following are three commonly used versions of the DBB procurement method of delivery:

- DBB method—competitive sealed bidding (open bidding)
- DBB method—competitive sealed proposal
- DBB method— invitational bidding (closed bidding)

It is mentioned as shown in Figure 3; the typical contractual relationships in DBB method are explained and discussed as follows. Typical characteristics of the DBB approach include the following:

1 Three linear phases are design, bid and build.

2 Three main players' client, consultant and contractor.
3 Two distinct contracts are client to consultant and client to contractor.
4 Clients gives the adequacy of the plans and bill of quantity to the contractor:
5 The builder is accountable body to execute the project as designed.
6 The consultant duty is to design to the professional standard of care.
7 Clients are responsible for any gaps among the plans and bill of quantity and the client requirements for performance.

Under this kind of delivery method, the owner selects a consultant organization firm to scheme contract documents which consisting of project drawings (design) and job specifications. Depending on the project size and complexity, the project drawings typically consist of seven main design disciplines: civil, architectural, structural, mechanical, electrical, plumbing, and telecommunications. After once the design is fully completed, the project drawings become the contract documents and the project is awarded to the low bidder.

Such sort of delivering a project, the client organization agency receives bids and awards a contract for the design of a project. Once this phase is completed, the agency seeks to procure a contract for the construction phase. Supporters of this method also argue that it allows the contractor to work directly with the project design partner to construct the most cost-effective project possible using the resources and techniques available to that team.

It has been suggested that DBB type of contracts involve a clear separation between the construction and design stages where the constructor is responsible only to implement substentially what has been provided by designer who is appointed from client and due to the widespread using such sorts of system is called as traditional,(Murdoch & Hughes, 2008).

Lema (2006) mentioned that in the DBB method the clients contracts independently with a designer and a contractor as sketch shown in Figure 2 below for design-bid-build contractual relationship. This requires design completion prior to procuring construction. The contractor that wins the award is legally bound to produce the project at a certain price, schedule, and acceptable level of standard care.

Moreover, a contractor is preferred contingent on the bid cost and enters into a agreement with the employer to build or implement the project critically as set in agreement with the plans. Two

variations of the traditional (DBB) method exist in construction industry: design-bid build using single prime bidding and design-bid-build using separate or multiple prime bidding. Hence, this Traditional approach generally offers the owner reasonable security of pricing and presents an orderly approach to the project.

There is typically a large pool of builder organization that is familiar with completing public sector projects using this method. Figure 2 below shows design-bid-build contractual relationship. In the DBB method, the scheme and development are accomplished by two isolate entities as shown in the following Figure 2. An Architect carried out proposes or develop drawings and specifications of the project. Once the detailed design is accomplished, the project is situating to bid at some stage in the contract procurement phase. The owner selects a contractor based on different selection parameters, for instance, low bid, lump sum, or best value. Then, the builder that is awarded the bid starts to accomplish the project.

Nirajan Mani, (2006), who done his research entitles Impact of design cost on project performance of design bid build projects has been noticed that, when using this types of contract method, there is no contractual relationship connecting the consultant and the builder. The author has suggested that if any difficulty arises during the construction phase regarding design, the contractor proceeds with change orders. Errors in design and a lack of communication between the designer and the contractor can have a negative impact on the project budget and schedule.

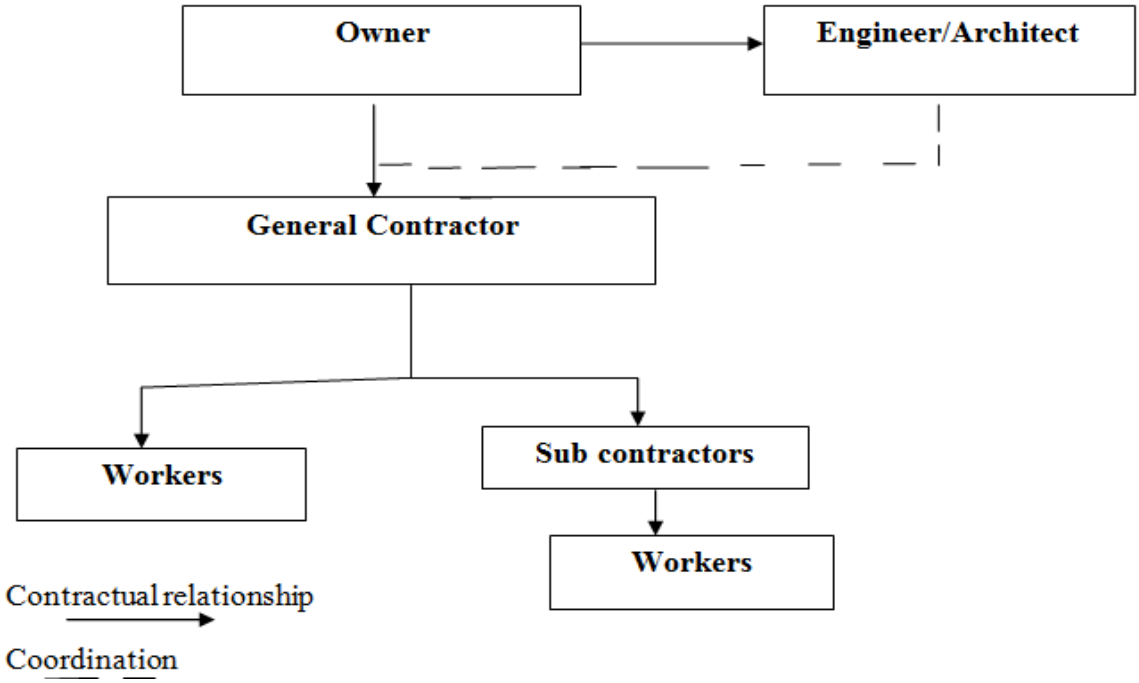


Figure 2: Contractual Relationships in DBB Contract Method (Fernane, 2011)

## 2.5.3. Advantages and Disadvantage of Design-Bid-Build

**Table 1 Merits and Demerit of DBB delivery system (Mekonnen, 2013)**

| Merit | Demerit |
|---|---|
| Contractors bid competitively, relied on complete design documents | DBB execution stages are sequential and possibly will require more time |
| The owner selects the builder depending on specified qualifications or capability. | The owner is at risk for final construction cost |
| The design parties are active in construction supervision. | Additional cost for supervision |
| Design and construction roles are clearly defined, and obligations and liabilities clear. | There is shared responsibility for project delivery |
| the involvement of clients in scheme development | design error encounter is the risk of owners rather than the builders |
| Greater certainty of means and methods to be used by contractor on the project | Design and construction are sequential, typically resulting in longer schedules |

| | |
|---|---|
| System is familiar to most organizations | Construction costs unknown until contract award |
| Owner controls design and construction | No contractor input in design, planning, or value engineering. |
| Design changes easily accommodated prior to start of construction | It requires a much longer time to completion for the overall project |
| Design is complete prior to construction award | Many risks remain with the owner |
| The construction cost is fixed at contract award (until Change Orders) | Limited ability to work with highly qualified contractors for certain projects |
| Low bid cost, maximum competition | Projects are awarded on the basis of a single factor that is cost |
| The owner controls design / construction quality | The owner does not have access to contractor knowledge and experience. |

Generally, the advantages of this system can be also less vulnerable for changes and claims due to either high degree of certainty or the clear state of accountability, provide opportunity to get lower price of contract, getting higher quality both in design and construction, provide more flexibility to the client in term of control the design and choosing of specific specialist; and clear and well tested and practiced approach.

On the other hand, disadvantages can be also difficulties in managing the relationships among different actors, client possess weaker role with respect to its ability to communicate with contractors, relatively take longer period of time where the design must be executed before commencement of the project, low build ability because of inability of contractor to influence the designs; and client is banded through several contracts with different parties which could increase the potential of defects occurring typical characteristics of the DBB approach include the following: three linear phases – design, bid, and build.

## 2.5.4. Traditional Delivery Payment Options in Building Projects

From previous or past works, one of the study undertaken in Ethiopian building construction project by Addis, (2014) categorized contract types. This classification encompasses lump sum contract, BOQ, lump sum and scheduled contract, cost plus.

A construction agreement or contract is a contract in particular negotiated for the assembly of an asset or a combination of assets that are strongly consistent or mutually dependent with regard to their design, plan, expertise and occupation or their ultimate purpose or use (Addis, 2014). The risk shared between the entities is decided by the contract sorts used.

1. Lump sum contracts

A lump sum contract, sometimes called stipulated sum, is the most basic form of agreement between a contractor and a client. These sorts of contract or a stipulated sum contract typically requires that the builder of a construction be in agreement to offer specified objectives of a product indicated in the stipulated or fixed price.

These kinds of facilities contract are typically used for buildings. In such kinds of contract, the clients have essentially assigned all the possible risk to the contractor, who in turn can be expected to ask for a higher markup so that to take care of unforeseen contingencies. A contractor under in such kinds of contract agreement potentially responsible for the proper job execution and substantially offers its own means and methods to complete the given work.

Research study conducted by Bolumole, (2017) consistently emphasized the effectiveness of contract types assigned under conventional system for housing projects in South Africa. One the methodology adopted for the study to measure perception of respondents has been a four point likert scale. The result obtained reveals that 60.2% of the respondents and agreed that lump sum (mv=2.67) under the conventional or traditional contract procurement strategy best meets construction clients, consultants and contractors satisfaction, while 37.5% of the respondents replied that the lump sum is less effective at meeting stakeholder satisfaction, while a further 2.3% of the respondents perceived lump sum contract as not effective.

This type of compensation usually done by calculating labor costs, material costs, and adding a specific amount that will cover contractor's overhead and profit margin. If the actual costs of labor and materials are higher than the estimate, the earnings will be reduced. If the actual costs are lower, the contractor gets more earnings from the work. Either way, the cost to the owner is the similar. such kinds of compensation system is appropriate if the scope and calendar day of the concerned building facilities are adequately clear and consent to the contractor to entirely estimate project price.

According to Addis (2014), such kind of payment is more suitable for works for which contractors have prior construction experience. Furthermore, he further argued and noted that the past familiarity encourage the contractors to tender a more reasonable or rational bid. One of the disadvantages of a builder in such types of compensation is the responsibility of cost risks imposed on him because in fixed lump sum the work to be carried out is already adjusted in the stipulated contacts. It has been suggested that this type of payment is not appropriate for complicated foundations, excavations of uncertain nature, and projects liable to unpredictable risk and variations.

2. Measurement contracts or Bill of Quantity (BOQ)

In such sorts of compensation the bill of quantity contracts such that the job item to be accomplished is broken into versatile parts, most of the time by construction quantity surveyor or respective engineers. This type is based on estimated quantities of items which are calculated in the building in addition to their unit prices.

The end payment of the intended infrastructure depends upon the quantities vital to accomplish the work. For example, painting of building projects is normally done on a square foot basis. Unit price contracts are rarely used for an entire major construction project, but they are frequently used for agreements with subcontractors which involve accurate identification of variety kinds of items, but not their numbers, in the contract documents. For instances, this sort of compensation encompasses small risk to the stakeholder parties since the payment is according to the quantity of work required and therefore it is most of the time favored by most parties concerned and participated in the Ethiopian building construction projects (Addis, 2014).Therefore, in this case they are also habitually used for maintenance and repair work of a building.

3. Cost plus contracts

Mastermann (2002) points out that under this kinds of payment option, a builder is employed often contingent on a competition of the fee element of the project solely, to typically accomplish the wish and scope of the owner and designer, with reimbursement being made by the payment of the actual, (prime), cost of the mechanism and a fee to face the builders overheads and profit.

Such sorts of payment option is an agreement which encompasses the buyer's consent to pay the complete cost for material and labor in addition to the amount for contractor overhead and profit. This compensation type is favored where the scope of project is extremely uncertain or indeterminate in addition to the sorts of labor, material, and equipment being similarly uncertain in nature.

Now at this time, the contractor's profit is set at a fixed amount. If actual costs a given project is lesser than the estimate, the owner keeps the savings or earning. If actual costs are privileged than the estimate, the owner must pay the extra amount of cost. The merits of such kinds of payment system is that, in commonly as known, the proposed facilities will result in the building that was envisioned, even if costs run high. The builder is less likely to cut corners or argue for less expensive materials because his profit is not in jeopardy.

These kinds of contracts take many forms, the most common being and cost plus a percentage. There are two types' forms or of cost plus contract; these are: cost plus fixed fee and cost plus a percentage. A lot of organizations in construction sectors or clients prefer cost plus fixed fee because then the amount of earn the contractor will earn cannot raise, thereby substantially removing any inducement for the builder entity to escalating the budget of the proposed vertical or horizontal construction in hopes of rising his profit.

According to Esmaeili et al. (2014), "Cost plus a fee is a form of reimbursable contract terms, wherein the owner agrees to reimburse the contracted party for actual costs of work plus a fee, which may be either a fixed value or percentage-based fee". There is typically no maximum for reimbursements, so the owner accepts the main associated risk of cost overruns on the project. Furthermore, this author has pointed out that cost plus fixed fee reimburses a project parties for the direct cost of work, plus a fixed fee that does not change with an increase in the cost of work. Cost plus percentage fee reimburses a project parties for the direct cost of work, plus a variable fee that is calculated as a proportion of that concerned cost of work.

Cost plus percentage is actual costs reimbursed plus an agreed percentage to cover overheads and profit. There is little incentive to contractor to contain costs or complete quickly. It is therefore; understandable that cost plus fixed fee is actual costs reimbursed but the fee is a lump sum with the intention of trying to get the builder to finish more quickly. Cost plus fluctuating fee is actual

costs reimbursed but fee is on a sliding scale whereby the contractor receives a larger percentage if the costs are kept down. The percentage paid may be reduced in bands as the costs increase.

## 2.6. Project Performance

It is uncertain seeing that to what contributes to building project success. The building performance criteria parameters can also be categorized as those contingent on project objectives such as schedule and budget, project implementation (safety, change orders, claims and disputes, etc), and those subsequent to the implementation (life cycle cost, operation and maintenance characteristics, etc).

Hence, the researcher considers selection variables factor as independent variable and key project performance criteria as dependent variable. Therefore in this sub- section it is essential to investigate the building priority of conventional projects.

The phrase "Project performance" was defined as the degree to which a project meets the execution objectives and contract parties' requirements, primarily to do with the stipulated schedule, budget and customer satisfaction (specifications, aesthetics and workmanship) as mentioned by (PMI, 2004) as already described in chapter one of this research. This means the amount to which a given project implemented in good performance manner as well as when meets its programmed output.

It was reported that, not only developing countries but also most among developed countries attempt their very level best to enhance project's technical specification to accomplish the corresponding expected performance of the projects, through acquiring the intended performance of the three project assessing criteria variables involves schedule and budget quality as claimed by Ghadamsi & Braimah, (2016).

Several studies described and revealed that performance assessment criteria not be considered only as the achievement of project schedule, time and quality. There are also broader concepts that can be assessed taking different constraint relating to the goal of different stakeholders for a particular of concerned project. For instance, customer satisfaction, meeting specifications, health and safety, environmental responsiveness are among the concerns when evaluating successful achievement of project objectives (Aschalew. 2017)**.**

As mentioned that project performance criteria can be known or measured and assessed using a substantially a critical number of parameters such as time, cost, quality, health and safety, environment and others groups, but the 'iron triangle' of time, cost and quality are the three major performance evaluation dimensions for project performance. Furthermore, other new criteria include health and safety.

Generally, the three main project objectives of schedule, budget and quality were covered, and include an element about owner satisfaction. The following lists as categorized below described some of success criteria parameters:

- In terms of budget or cost they include unit cost and cost growth;
- In terms of duration or time they include construction speed, delivery speed and schedule growth,
- In terms of quality they include workmanship and owner satisfaction

Previous research study undertaken by Konchar, (1997) underlined that to measure facility performance of delivery process seven parameters such as budget, schedule, quality, and criteria such as external environment, owner scope and safety were available to be used by those developing a facility.

To get the concrete ideas it has been suggested that significant criteria that used for assessing project performance from perspective of concerned parties are schedule and budget. However, the other criteria such as safety, client satisfaction and communication are less important Konchar, (1997).

In this study the authors considers only traditional or DBB methods of project delivery were emphasized. Why the researcher solely investigated only this type of delivery system was due to the DBB method is the availability and familiarity of the client's with such common kinds of procurement for delivering construction projects in Addis Ababa. It was manifested that criteria used for assessing and measuring projects performance outcome of DBB in selected area of study were;

i. based on time criteria,
ii. based cost criteria

In this research studies one of the ultimate objective was to find the effect of traditional system relative with DB method on building project outcome criteria in public building construction in Addis Ababa.

The most universally cite among the project management triangle are on-time achievement (time), within agreed budget (cost) and non-defective workmanship as specified. Time, cost and quality necessarily interact. It was well understood in the industry and in the literature that tradeoffs occur flanked by optimizing performance for any of these parameters as shown in Figure 3 below. For example, accelerating completion of a project will usually involve extra cost, reducing cost will tend to lower quality, and increasing quality standards will take more time to deliver. In this research study the dependent variables taken are cost and time indicated in figure 3.

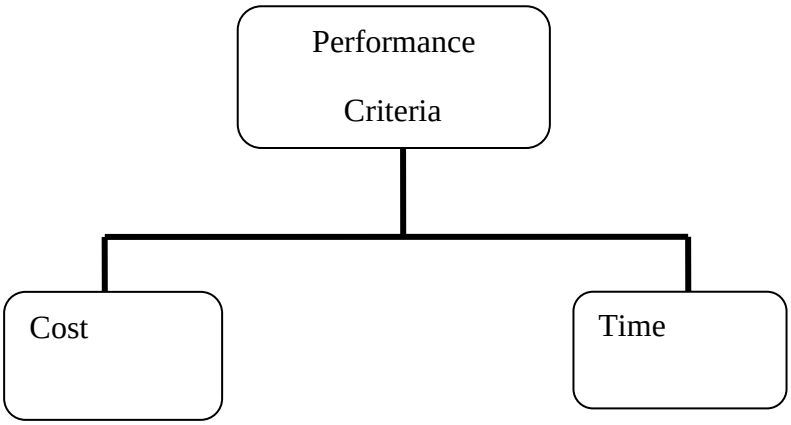


Figure 3: Performance Measuring criteria, Source: Own survey, (2020)

## 2.6.1. Cost measures

One of criteria used to measure a project is cost metrics that provided cost growth, which is an indication of project cost growth throughout the whole life of indicated projects. It can be expressed by the following formula

Cost growth (%) = (final project cost – contract project cost)/ contract project cost* 100……. (1)

Where: Contract project cost is includes design and construction costs.

### 2.6.2 .schedule measure

Schedule growth was expressed as the time growth over the life of a given projects. It was given by the following formula.

Schedule growth= (total time- as planned time)/ as planned time *100 …….. (2)

Where:

The as planned time was the time from contract design start date to the contract construction end date.

## 2.7. Design Bid Build Contract Selection Variables

Due to a variety of factors concerned and implicated in the delivery decision, researchers and practitioners have developed a number of selection factors variables contingent on the environmental situation of local building projects. Depending on literature review of previous research work for this section about construction delivery method selection were carried out to identify the DBB choice criteria and specifically since the study area of this research are public building construction projects in Addis Ababa and the characteristic of a project due to its unique features, have made project members decision maker to choose the appropriate method for a concerned project.

Project performance has been predicted as seen in several studies of prior literature. Ghadamsi & Braimah (2016) was carried out to determine the effect design bid build selection route on Project performance or budget, duration and quality of workmanship. A survey was conducted with owner organization, Consultant Company, and builder team members. The critical of finding of the study for projects considered is that out of twelve factors identified eleven of them contribute significant relationship with key variable parameter of performance objectives. In addition, the analysis of data indicated that cost, time and quality performance of a project was impacted either positively or negatively by individual success factor such as party's accountability, employer participation in projects, and cost estimation before commencement, ease of organization and reviewing projects, demand of efficient planning and project functionality, price competition, scheme complexity, employer control and required quality.

Collins, (2009) who undertaken his research entitles comparative performance assessment of the design-bid-build and design-build procurement methods in Ghana, claimed that there are no general agreements among the researchers and practitioners' on the world wide for the construction projects to rated about five to ten selection criteria of potential procurement systems. For instances, consider speed as criteria selection while others rated price competition level and quality level required for their projects. Such situation might arise due to deficient in of support of a distorted attention on improving one or two procurement sub-systems or selection factors, lack of attention to non-procurement related project conditions that also affect performance. In additions, Collins, has suggested and claimed that the considerations of decision criteria may not be practicable by the clients because of the limitations of time and available information.

Bolumole, (2017) identified that the considerable parameters affecting the choices of a conventional contract delivery route take account of delay and mistakes in producing design documents; client or owner inability to brief and make timely decisions; facility type, environment, scope and complexity; lack of communication and response; lack of regulation among project parties; and finally deficiency of availability of construction materials.

Because different clients have different needs and requirements, and construction projects vary considerably in every respect, no specific perfect contract delivery system can be suitable for every project. For example, previous study undertaken by George M. (2012) mentioned that "traditional contracts" ("design bid build") are suitable for projects where:

- High standards of quality and functionality are required.
- Design changes may be needed during the currency of the project.
- Complex and/or prestigious projects where design needs to be under the control of the Client.
- Competitive bids are required to ensure accountability and minimize costs.

According to Lema (2006) in his research entitles alterative project delivery method for public construction project in Oromia. The Studied results mentioned by authors, concluded and prioritized and ranked that, time certainty comes fist, cost certainty ranked as second which is

also followed by administration burden( parties responsibility) and finally level of quality was ranked at the forth among the public projects selection criteria.

However, first of all, this research identifies general criteria for selecting project delivery method. Secondly, it proceeded through specific criteria for choosing the project delivery (procurement method) in this research work cases, the DBB method specifically for public building projects in Addis Ababa. It have been suggested that because of the construction building distinctiveness, the identified particular selection criteria for study area vary from the universal choices criteria written in different literature.

In Nigeria, a research conducted by Adegoke and Opatunji (2019) whose goal was Factors influencing choice of construction procurement systems and associated risk by using questionnaire asked respondents to rank the factors that impact the choice of procurement process. The result founded by researcher indicated that under traditional method (design bid build) of type, the most important of studied results mentioned by authors, concluded and prioritized are the speed of getting the work delivered which was ranked 1st, with RII 0.79, flexibility ranked 2nd with RII 0.72, complexity ranked 3rd with RII 0.69. result founded by researcher indicated, the least important factors according the survey were responsibility ranked 7th, with RII 0.58, risk ranked 6th with RII 0.63 and quality ranked 5th with RII 0.64.

Based on literature of past research works cite above and semi structured interview with indicated sector experts in Addis Ababa, this study considered seven selection criteria which mainly affect the required result of traditional method projects. The selection criteria were including: certainty of final cost, certainty of completion date, the demand for quality level, risk optimization approach, administrative burden and maximum competition bidding and owner controllable project variation identified for investigation in context of set objective

In summary, the suitability of the selected of the above factors can improve the project performance to an enormous level. By conferring prior literature above, it becomes evident that assessing the influence of traditional procurement route criteria on project performance could enhance the success of government owned vertical projects in Addis Ababa.

As mentioned that, the selection process is possibly the most important especially for client decision in a construction project. This is for the reason that the use of wrong specified system to

deliver for execution purpose has extensively been accepted as a major source of lack of expected project Performance.

Hence, the selection process therefore is expected to have strong influence on the eventual performance of the construction project, which on its turn is determined by many aspects. It therefore is valuable to both practitioners and researchers to measure the effect of preferred factors on project output priority. Before these relations can be defined, the critical attributes on which criteria are preferred needs to be identified. Several researchers have attempted to arrive at a list of client requirements that might affect the preference of a procurement process.

Generally, the careful choice procurement process can help overcome many project challenges. Thus, by conferring different literature, it becomes evident that the construction sector clients or concerned bodies who assigned for the careful choice delivery systems primarily depends on work done by the stakeholder and the work that is contracted out to consultant and/or construction contractors, degree of control the agency maintains over how the work is done and the control transferred to contractors through contracting out and assignment of risks associated with the project work undertaken by the agency and contractors.

This calls into question that typically criteria of procurement process will have different effect on the cost and time of the project monitoring and control. Thus, it is apparent that preferring the suitable project delivery contingent on the project strategy is playing an important role for Successful completion of a project. The following sections detail several selection approaches that specifically target toward conventional method and serves as decision support parameter to assist owners in candidate the most sorts' project delivery. This research focused on identifying a group of factors that are typically considered by owners during selection as discussed below.

**a) Maximum competition bidding**: In context of this discussion, the effect of price competition on cost and time performance was ought to be investigated to insure the project success. Hence, competitive price is one of the existed decision criteria that project owners rely on a competitive choice against their contractors in traditional system because such criteria serves for candidate builders to submit their offers and then clients contingent on price related criteria to first-rate the top economically attractive proposal for the facilities.

According to Thomas et al. (2002), the DBB technique was an indispensable for the reason that of provide and allowing maximum competitive to employer sector, and thus enables them to pick the paramount value for their projects, which contributes positively to cost outcome.

In the case of construction industry of government projects in Ghana, the research conducted by Frederick (2013), mentioned that the low bid award system fosters competition between builders attempting to secure the project, where providing that the price competition can have both positive and negative effects on the cost and time performances respectively and this public sector owner is responsible to the public, an open competitive bidding process that is awarded contingent simply on price is extremely transparent, and an important criterion of public policy . As has been discussed so far, price competition are inherent flaws that allowing projects to be awarded based solely on such criterion has negative time and quality projects.

It is very vital to take into account this price competition as decision criteria due to offers priceless sort of information for stakeholder in construction which this in turn affects project success.

particularly for traditional project delivery methods for such selection criteria have considerable impacts on the duration, schedule and quality of the projects. Although much attention has been paid to this decision criterion, during conferring prior literature, it becomes evident that competitive low bid cost or maximum competition method has been highly criticized for its negative influence on disputes/claims, management, quality of the facility as well as construction project schedule or time as consistently emphasized.

Furthermore, prior research work undertaken by (Park et al., 2009) mentioned that these types of parameters plays an important role for project success and relates to the scope to which a contract method made for a project to be preferred with a competitive cost that positively influences cost performances and gives profit to the client organization. He further argues that project cost, or tendering price, is the most commonly used criteria for selecting a contractor. Generally there are various types of tendering for procuring projects.

In reality tendering approaches that are used for selecting a construction builder for a project can affect project performance. If the tendering procedure used is such that focuses on low tender

price, this could result in increased risk of in such way that actual cost exceed final cost on the project due to high cost of variation orders which impact directly project performance.

However, it has been suggested that builder expose a price competitive advantage that smoothly flowing from the construction method when preparing their bid price during tendering, in such way the client would want that this invitation be shared with other builders so that tendering is on an equal footing.

The traditional procurement route then offers slight inducement for the contractor to suggest design improvements and stimulates a "lowest bid wins" culture. This situation calls into question in which builder or contractor can change his mind to confidentially expect for variations and claims as a source of profit when competing on price alone.

**b) Demand of Quality:** The second key component for facilities delivered by traditional or conventional method is this criteria as it gives a chance for the employer organization to bridge the best design and supervision bodies between experts of consultants and the builder, higher degree of quality certainty in DBB projects is expected and to review and fully develop the design and specification thus allowing better documentation preparation to get good quality performances by owner and designer than others procurements (Abdul Rashid et al. 2006). It is generally felt in both vertical and horizontal construction implementation that providing high quality is the primary decision route to suffer in design and build contracts (Murdoch and Hughes, 2000).

Prior study undertaken by Ghadamsi and Braimah (2016), pointed out that in traditional or conventional system of delivery facilities, there is positive links between this criteria and quality outputs and negative links with cost outputs due to bridge of the design and supervision bodies offers by clients to fill any gap between designer and contractors.

quality level required as a criteria by concerned bodies of experts can have impacts on both cost and duration of the given projects .for instances, it is the role of best design and supervision bodies between experts of clients and the builder to get good quality projects and errors in high quality design between the designer and the contractors can have a negative impact on the project budget and schedule (Mani, 2006).

The implication is that when clients want to obtain high quality projects, quality may be expressed in many different ways. For example, in the construction sector, 'quality of design' is a commonly used term.

It has been suggested that because of quality level variables were used for the conventional or DBB decision routes so that clients gives a higher degree of quality project with more functional standards. On the opponent side, such types of project delivery system used have some influence on the aspects of on the projects outputs such as quality regardless of delivery method used as pointed out by Collins, (2009).

Based on this information, it has suggested that DBB factor decision route impact on expected quality is expected to have extensively positive effect on project success objectives.

**c) Controllable Variation:** If the possibility objective of work or scope cannot be defined adequately or if requirements are likely to change considerably during the project, such factor needs to be evaluated against the potential cost of changes.

It has been mentioned that both variation of design and execution stages can lead an owner projects to huge impacts such as claims and often lead to litigious disputes, hence, a client who wishes to reserve the right to alter requirements during the execution development should not use design and build (Murdoch and Hughes, 2000). Which means that those client wishes to control variation of facilities needs to consider conventional system so that control variation during design and execution is the primary decision route criteria to influence project performance in good manner.

Controllable project variation criterion is paramount important aspect to be considered by owner when selecting or candidate a conventional or traditional strategy. So, all stages of construction process are accomplished prior to tendering processes.

It has been emphasized that variation orders have been negative impact on cost and time as well as project performance, for example, cost overrun and time overrun have been caused by project variation orders such that it hinders construction project success as Ogunsanmi, (2013) confirmed.

According to Murdoch and Hughes (2000) "There are three rationales for altering the specification. First, the client may desire to alter what is being executed. Second, the consultant may need to modify or refine the design because of an error happened or accomplished in past works. The last one is, changes may be needed as a reaction to external factors.

Although it is quite clear that a construction contract imposes obligations on the contractor to execute the work, it is often overlooked that this also provides the contractor a right to do the work and that right cannot lightly be taken away. If a client wishes to make changes to the specification as the work proceeds, or wishes to allow the design to be refined for whatever reason, then clauses will be needed to ensure this. However, the procurement decision affects the extent to which the contract structure facilitates changes.

**d) Certainty of final project cost:** In the construction industry, using the DBB project delivery method, the initial estimated cost of the construction is generally fixed after the design of the project is completed. Owners contingent on this variable when deciding to choose for traditional system due to the fact that price certainty is critically needed before the execution of project is begin. It has been mentioned that such types of DBB variables route provides great sort of information particularly for the agreement of builders and owners so that probability of final project cost effects positively the time certainty of a given facilities (Xiao and Proverbs, 2003).

In the Greek construction industry, the study entitles "risk sharing in traditional construction contracts for building projects" conducted by Kordas (2015), has been manifested the issue of cost certainty as a paramount important for client requirements for the fact that in typical conventional delivery system, the variables of price certainty can be computed at initial stage of execution phase so that can be known by experts.

An assessment for the need for price certainty prior to commencement of construction by the client needs to be undertaken in conventional system. For example, if price certainty is required, then drawing is required to be accomplished before construction phase commences so that design alter substantially minimized.

Conventional system of delivery facilities plays an important role for the client's organization in terms of cost certainty variables due to an estimation of price probability earlier to beginning of

construction by the client necessarily undertaken (Abdul Rashid *et al.,* 2006). In addition cost uncertainty occurring as a consequence of variations either by clients or contractors.

Furthermore, the scope changes and flexibility was the two process to accommodate changes in the form of variations leads to cost uncertainty in conventional procurement methods as well as in this cases builders were looking for opportunities to make profit and additional revenue by suggesting variations. Ghadamsi and Braimah, (2016) study found that this decision route factors has a positive effect on project performance in terms of cost in case of conventional system of delivery facilities.

A research conducted by Anyir (2018) mentioned that the clients often associating hard bids beating the budget as proof that DBB provides lower overall project cost. However, it is essential to compare delivery methods on an equitable basis. Many DBB projects come in over cost this scenario presents challenges when the design is complete and ready for construction.

In this contract types, the expected cost of projects tend to be known after bid competition and before the contractor commences work, enabling clients to have some certainty with the project cost. Thus, taking into account in the proper types of existed selection process could avoid project failures and is therefore expected to positively influence project performance.

**e) Certainty of completion date:** The relation between selection on expected delivery time and project success is expected to be positive. Time certainty was one of factors basically dependent on budget and the consequence project builder assign to cost, so that conclusion was drawn that the degree of budget performance is positively affected by certainty of completion date for the facilities (Xiao and Proverbs, 2003). Assuming the quality and costs of the project remain the same, a project that is completed before the delivery time will be perceived as more successful than a project exceeding the delivery time. Simply put the shorter the actual delivery time, the higher the perceived project success.

However, actual delivery time cannot be measured before the selection procedure takes place. It assumed to be, therefore, be based on a contractor's expected delivery time, which can be controlled for by looking whether expected delivery times are met in previously executed projects.

**f) Administrative Burden**: Due to the matter of client wishes to control projects; administrative burden was taken to be important selection factors for traditional methods specifically.
Due to the fact that in traditional procurement most administration is performed by the client's consultant, administration burden is substantially reduced through the alternative delivery methods such as CM, DB, especially during design stage (Koppinen & Lahdenperä 2004). (Lema, 2006,) who done his research entitles alterative project delivery method for public construction project in Oromia and one of his objective were identifying selection variables of procurement methods and ranked this criteria on the fifth criteria variables.

The existed project delivery methods in Ethiopia, the client will appoint a separate consultant to take on the contract administration works and stand for burdens in all aspects of the project. Moreover, the owner agency assigns his own staffs to supervise the project intended.

In DBB, it is easy to demonstrate genuine competition which provides transparency of the expenditure of public funding. The client can better insist on a certain quality level and manage it, and the designers prefer working in this environment. However, client administration requires more resources, as there is more quality testing to be done and directly related to the degree of client and other concerned stakeholder involvement and control over the procurement process. Some clients may prefer to have a single point of responsibility, and hence reduce their exposure to risk. If the clients have in-house expertise to manage the diversified responsibilities created in a project, traditional and management systems will be more suitable.

A research work undertaken by (Dobre, 2016) stated that owner's familiarity with the construction practice; in-house expertise for project management has a considerable impact on the level of how much outside expertise is required. He further argues that administrative burden positively influence influences selection criteria so as consultant are responsibly follows the executing works.

According to Abdul Rashid *et al*. (2006), under the DBB method, the building owner will employ an experts of consultants to act on his behalf to create construction drawings, prepare bill of quantities and tender document and to manage the tendering processes in such a way that to select a contractor for a considered projects. This means that contractors are selected to realize the wish of client and in this case the consultant are responsibly follows the executing works based on the prepared drawing and designs for concerned projects.

The responsibility, and therefore the risk, for the performance of the design team remains with the client. The Contractor, meanwhile, is responsible for the building works. Because design and construction are separated in this procurement route, the overall project duration tends to be quite long. However, this approach is more preferable because it provides clear liability and better design and construction control by the client for intended construction.

**g) Risk Allocation/Avoidance:** This is one of the variable criteria in such that client's organization wishes to convey the risks of price and time slippage to the builder or contractor at the time of choosing specific project delivery method (Thomas et al.2002). He also illustrated that taking risk into account during project delivery selection process to avoid project failures was important so that risk is allocated between concerned parties and the most important criteria, expected to be considered.

According to Capital Works Management Framework risks are events, both identified and unpredicted, that might happen at the time of the delivery of a building project and this selection criteria usually adversely affect the project out comes as well as most of the time, ones risks happened to the project, it negatively impacts the project duration, cost, etc (CWMF, 2008). For instance, if a project has a mainly tight timeframe for completion, delays to the construction or facility development will be a risk to securing the timely completion of the project.

Moreover, Capital Works Management Framework (CWMF,2008) has been pointed out that responsibility for managing a particular risk allocated to clients, consultants and contractors according to the existed agreement with risk, on the other hand, optimizing risk allocation between the clients, consultants and contractors contributes positive value for project outcomes where as improper risk allocation may lead to critically project cost overruns (as contractors can reasonably be expected to make allowances in their tenders for the risks for which they are responsible) and increase the likelihood of contractual disputes and litigation. Thus, in the context of this research, the key to reduce risk is to understand the project requirements by all the participants.

## 2.8. Local Studies (Ethiopian Context)

As previously explained that a proposed construction projects by the following general phases:

i. Feasible – starting with the identification of the need to build a facility, it includes project formulation, feasibility studies, strategy design, and approval. A go/no-go decision was made at the end of this phase.
ii. Planning and design – in this phase, the facility is conceptualized and parameters for monitoring and controlling the project are generated. It includes base design, cost and schedule, contract terms and conditions, and detailed planning. Major contracts are let at the end of this phase.
iii. Construction – represents manufacturing, delivery, civil works, installation, and testing at the time where the facility is to be built. The facility is substantially completed and after final testing and necessary maintenances, it will be in full operation at the end of this phase.
iv. Operation, maintenance and retirement – this phase is the utilization of the facility with periodic or non periodic maintenance until its retirement that represents the completed project's life cycle.

### 2.8.1. Existing Construction Delivery Methods in Local Building Project

DBB and DB are the basic types of existed in local infrastructure and others are the modifications of DBB and DB. The integration of drawing and execution stage of a building project directly depends on project delivery method.

The DBB delivery system is the most available kinds of delivery system in the local infrastructure of Ethiopia since the 1987 (Abraham A. 2015). Once the parties of project client or owner sector organization did get ready the basic planning that identified and specified construction project programs, they call upon the involvement of design and/or supervision consultants either by tender or by negotiating contracts. This consultant will carry out the design together with the basic and essential tender documents which will be the foundation for tendering to select contractors or builder.

For such sorts of delivery system, projects are divided into different packages interfacing to each other. Though the design and supervision consultant will be the prime professional who is the

supervisor or advisor for the clients or employer organization and largely the administrator of the construction contract; the employer takes the responsibility of coordinating the various project packages and their respective interfaces.

Besides, designers have not been required to guarantee results but rather methods. That is, they are held responsible fundamentally through the usage of their superior knowledge and sufficient competency and proficiency to design with a practical level or scale of technical skills.

As a result, contracts and courts paying attention to professional duty of care, not results or project ultimate goals, contractors or builder are also responsible to implement or build works with due care and diligence and complete them so that the process realize the wish of employers with the contract agreement, but they are not held responsible for design any deficiencies. Since the 1980, this traditional approach has been become less accepted due to the following factors (Wubishet 2013):

1. Severe Adversarial relations between the design plus contract administration consultant and the contractor.
2. Fragmental contract for the project owner.
3. Project owner responsibility for the risks related with the design and contract administration consultant.
4. Lack of impartibility of the design and contract administration services.
5. The inability of design and contract administration consultants to cope up with new construction technologies and constructability issues of their designs.
6. The indirect contractual obligation assigned to the Design and contract Administration Consultants

It's mentioned by Lema (2006) that the critical tribulations coupled with the traditional approach of delivering projects as:

1. The scope of the intended facilities is changed very often due to deficiency of timely, sufficient finance to the government agencies;
2. No true competition during the builder selection for tender awards are based on price;
3. Procurement procedures are time-consuming and
4. Excessive time overruns;
5. The actual budget is habitually over the expected budget

6. Quality is compromised;
7. In the process when of disputes happened, legal process are time-consuming and archaic

Further, he states that, the DB delivery system is a response to problems associated with the DBB delivery systems. It is a habitual phenomenon that because of the process approach is innovative in nature and it overlaps the scheme stage with that of construction to compress the duration of intended projects. In the 1970s, large firms began to offer the collaboration of design drawing and production of construction by single entity of contractor so that the services were provided to project clients with a single source for project delivery. At the beginning, this process of alternative system was restricted to complex projects such as industrial, big plants and big infrastructural constructions.

## 2.8.2. Design Build (DB) Projects in Public Building in Addis Ababa

In 2019 budget year, the Addis Ababa city administration has launched the construction of multipurpose public projects. The following mega projects of ongoing projects designs build public projects being constructing in the city are:

1. Adwa museum project
2. Addis Ababa library
3. Grand palace parking project
4. Meskel square project
5. Renovation of municipality building project (Mayor office renovation)

### 1. Adwa Museum Project

The grand Adwa center (Adwa museum zero Km project) which is one of design build project is being constructing next door to Addis Ababa municipality building (mayor Office). The project is awarded to china Jiangsu international contractor. The client of DB Adwa center zero km project is Addis Ababa construction bureau as well as the Ethiopian Construction Design Supervision Works Corporation (ECDSWCo) are consultant or employer representative of this indicated grand palace parking projects. The designer of Adwa center project is Eskinder Architect PLC. The initial cost is 4.6 billion birr where as the built up area if this project is 121,300 sq.m. The projects contain four floors and contain one basement and now its progression is 40 %.

This project is named after the battle of Adwa historically where the victory of Ethiopian patriots over the Italian invasion at the end of 19 the century, Adwa center is believed to serve as a landmark that shows the significance of unity of this country.

This Adwa center used for multipurpose. Through completion it contains a big conference hall that can accommodate around 2000 people, cinema halls, and library sport areas and also includes recreational center. Furthermore as per the agreements the indicated project center contains cafes, restaurants and parking areas.

**2. Addis Ababa new library**

The construction of the new Addis Ababa city library project is located in Arat kilo near parliament, Sheger Park and office of prime minister. The Addis city library is expected to add beauty to the indicated city is funded by Addis Ababa construction bureau is awarded to the contractors. Now the intended facility is being constructing by Varnero construction companies and will be finalized in 2021.the construction of 5 story building with underground complex accommodate 5000-6000 persons at a time. The gross built up area of the library is 38500 $m^2$. The initial cost of the stated project is 1.1 billion Birr contains car parking, restaurant.

**3. Grand Palace Heritage Parking**

The other public building project in study area is grand place heritage project have 4B +G+4. The client of this grand palace parking is Addis Ababa construction bureau. The consultant or employer representative of the grand palace park is Addis Ababa institute of technology (AAiT). The foreign contractor named China Jiangsu International Economic and Technical Group is being constructing this ongoing projects. However, the designer of the multifunctional building complex for grand palace heritage parking project is Architectural and engineering consultancy plc which is now its percentage of progression is 72%. The initial cost is 1583952500 billion Birr and has gross built up area 51630 sq.m.

**4. Meskel Square Project**

The other DB project which is mega projects is launched by Addis Ababa construction bureau is meskel square. BKW CAPE which is a consultant of a project follow up is the representative of client. This project is awarded to China foreign contractor CCCC. The initial cost of the meskel

square project is 1,621,440, 000 billion Birr has gross built up area 22,500 sq.m and is currently ongoing as per the schedule.

**5. Renovation of Municipality Building Project**

Renovation of municipality building project (Mayor Office Renovation) is the other DB delivered projects. The initial cost of the project is 1.8 billion Ethiopian birr. The renovation project is managed by a newly formed mega projects construction office. The idea of the project is to have high standard municipality. In previous time the renovation of the indicated scope includes fence construction, the renovation of lobby, a plan to expand the office for the seek of more space, but failed to start at that time.

## 2.8.3. DBB versus DB Performance in Local Construction Industry

A construction contract is a contract specifically negotiated for the construction of an asset or a combination of assets that are closely interrelated or interdependent in terms of their design, technology and function or their ultimate purpose or use. Construction contracts are formulated in a number of ways for rendering services from consultants or contractors.

According to Abraham A. (2015), various contract types might be utilized in construction projects depending on the type of delivery system. The forms of contract should suit to the selected project delivery system. Accordingly, there are different types of contracts for the execution of civil engineering works.

One years ago, Filimona, (2018) conducted study on assessment of project delivery methods (case study Bahirdar-Zema river bridge design-bid-build road project and Koka-Adulala design-build road project) through which the quantitative finding of the study reveals that an extra time and cost has been recorded to the Bahirdar Zema DBB Road Project, whereas the qualitative aspect reveals ease of contract administration and transference of project design risk to the contractor in Koka – Adulala DB Road Project.

It is clear that from the above paragraphs cost savings and schedule saving were the two most common merits respondents suggested that there is a general positive reaction in using an alternative project delivery method over the conventional method.

Furthermore, Rahel Tariku, (2016) done research entitles project delivery systems and their effects on cost and time overrun on Ethiopian Roads Authority projects (ERA), the study were done by distributing a questionnaire to construction industry experts including, consultants, engineers, construction managers, general contractors, Majority of the respondents in the questionnaire implement both traditional and innovative delivery method; with this she proceeded a thorough discussion of research findings and address the fundamental research question through which she finally illustrated that, from their experience 88% reveals that cost is substantially increased from contract amount and almost in all projects there were time growth in DBB. In DB projects experienced by the same professionals majority of them says projects were completed with allocated budget and minimized clients burden and risk on comparison to DBB. Though DB performs better in timely completion, 42% reveals the existence of time overrun in DB projects too and finally half of the responses show quality maintenance in DBB.

In local building construction projects of Addis Ababa, the survey conducted by Hirut (2017) revealed that design bid build project delivery, in comparison to New Head Quarter DB project of CBE, had a mixed impact on project cost depending on the project type, complexity, and size. These authors for the purpose of further investigation interviewed by using questionnaires with project manager, the construction lawyer and other engineers who are engaged in the project took parts. The responses of design-build project managers further indicated that project delivery approach in this case study design-build better than design-bid-build in terms of controlling schedule and potentially reducing project costs. Thus, this project delivery approach was perceived to be reducing project cost and schedule than other characteristics of the project delivery types.

### 2.8.4. Selection Variables for Existed Delivery System in Ethiopia

According to Lema (2006) in his research entitles alterative project delivery method for public construction project in Oromia. The Studied results mentioned by authors, concluded and prioritized and ranked that:

1. probability of completion date comes fist,
2. certainty of final price ranked as second which is also followed by
3. Administration burden( parties responsibility) and

4. Finally demand of quality was ranked at the forth among the public projects selection criteria.

On the other hand, Ethiopian Roads Authority ( ERA) under its modernization process identify and set-out the subsequent five criterion/issues to assess and choose or decide on an appropriate project delivery method for road projects, which will be tendered out in its successive road sector development program.

1. flexibility – to change/modify the design, to instruct additional works depending on available funds ;
2. speed – time required for detail design for DBB type vs. Concept design for DB type of contract;
3. value of money (cost) - finishing the project with the proposed budget;
4. safeguarding of public values (road life time) – availability of warranty period beyond the defects liability period particularly for DB type of contract and
5. size of the complexity of local industry – availability of experienced professional in the local engineering projects

A survey conducted by Rahel (2016), indicated about selecting appropriate types of project delivery decision criteria from industry professionals and listed as certainty of completion date puts first priority, certainty of price second priority and according to professionals response risk minimization get third, followed by level of expertise on the owner side and the needed quality level, and finally she argues that consideration substantially be given to selection of suitable PDM to ensure project success and which can help in achieving project objectives.

## 2.8.5. DBB problems in Building Projects

According to Abraham A. (2015), DBB is the most practiced type of delivery system in the local of different projects of Ethiopia. However, with DBB methods poor success like absence of timely project completion, cost overruns and poor quality of the finished products as the main problems (Lema, 2006). There are several issues and so-called problems associated with the traditional approach Such as frequent poor performance (Lema, 2006).

In today's construction environment, public sector owners are finding themselves under increasing pressure to improve project performance, complete projects faster, and reduce the cost of administering their construction programs.

Poor project performance with traditional delivery of building projects are:

i. Delays in meeting project duration
ii. Increase in total cost of the project, resulting in bankruptcy of companies.
iii. Decrease in construction quality

The tribulations can be managed and controlled by influencing the current and adopting the latest procedures and variety process of DBB to improve project and enhance performance. The reason DBB method has been known suggested that for its poor performance like absence of on schedule timely project completion, budget overruns and poor functionality. Among many factors for such the lack of availability of the following terms could also some factors leads to such problems.

- Traditional procurement process is slow and has not been justified by contingent on procurement route during planning stage of building construction
- There are lacks in the traditional procurement processes except stakeholder previous familiarity for decision making

## 2.9. Identification of Research Gap

Some works have compared the traditional method with respect to other methods, using some parameters of performance such as cost and times. Some research works have also conducted to identify and determine the factor for deciding the most appropriate system factors or delivery method approach (e.g. Lemma, 2006).

The scholars did not considered on the extent of influence of DBB procurement system process on project performance particularly by considering government owned construction projects procured through DBB types in Addis Ababa.

In Ethiopian construction industry in general and building industry in particular, the DBB procurement system is the most commonly utilized project delivery system. Most of the time building construction project ended with cost and time overruns because of time gap between

design and construction associated with of this DBB types. The time gap problems leads a given projects to increase in quantity, variation, change order, design error, many claims, errors and omissions in design documents results to building cost and time overruns. To minimize the acute problems the adaptation and utilization of alternative DB methods which isolates the lack of integration in DBB method is paramount important. very few previous research studied the performance difference of traditional delivery system and alternative delivery system in Ethiopian roads authority. However, no one identify the level of impact of DBB procurement system on project performance relative with DB methods in public building projects in Addis Ababa.

The different types of traditional system have different methods and process of designs and constructions. It described a different systems and a different organization structure in term of roles, responsibility and the authority of each members in the team.

However, it‘s still uncertain on how far do the single of types of delivery system and how extent of the influence on the specified output of a building project in term of cost and time output. Therefore, it is essential to understand today‘s practice procurement method and to identify the most specified variables of DBB relative with DB to achieve project performance success in building construction and the impact of each methods on project performance is needed.

## 2.10. Summary of Literature Review

Literature relevant to the construction delivery methods and project performance based on objectives of the study was discussed. The project delivery system is a key factor in enabling successful implementation of a building project. The right method may help avoid problems and be the key to the attainment of project-specific special goals.

Contingent on prior literature as well as both developed and developing of other country projects and a number of influencing factors of conventional system obtained from interviews with experts. Construction project delivery specifically DBB, the degree of project output in terms of budget, schedule were discussed.

The findings of the review presented vital and important information regarding these procurement issues. The main types of contract strategy applicable with design bid build method

are: unit price/bill of quantity, lump sum and cost-plus contract. the intervening variables identified based on building project characteristics and client priority the criteria used were certainty of final price, certainty of completion date, demand for quality performance, controllable variation, administrative burden, the level of competition and risk allocation However, the most common and preferable criteria used in this research study for measuring and evaluating project performance was time and cost which was used as output variables.

Relying largely on DBB method as the main option to delivering construction projects .but contingent on solely this method has been contributes to the overruns performance objective. The review of the literature also stated that there are no specific criteria that can help client to choose the specific methods.

The chapters reviews the existing literatures on available types of method particularly in local industry were either design bid build (traditional) or design build**.** The past review undertaken was ERA locally and Developed continents those who applying DB and CM at risk broadly and there is improved performance of projects which are procured by innovative delivery method than traditional types and vise versa.

The project performance to confirm both the gap in literature and the need to assessing project performance criteria, and the influence of the conventional on project output were reviewed. The findings of the review offered important and valuable information on both independent variables and project performance. The most popular and common method currently in use is DBB, but, no single method of procurement can be suitable for every project.

# CHAPTER THREE

# RESEARCH METHODOLOGY

After literature was reviewed the gaps are identified in chapter two. In these section the over view of methodology were discussed in this chapters. Case study projects collected for data analysis were public building projects that were contracted, designed, and constructed under DBB and DB delivery methods. In order to answer the presented research question in chapter one, the authors provided a thorough description of the research methods. The research methodology chosen is based entirely on the research question and goals. Hence the subsequent section was deals with design approach, data sources, data collection instrument and data analysis at end of this chapter have been presented.

## 3.1. Research Design

The approach followed in this research was first done with problem identification which has been done through reading intensively and critically the literature review, informal discussion with experts exists in the sector; and then the research design was formulated.

Accordingly, at the initial stage, informal discussion was conducted with relevant local experts to verify and arrange literature and past studies in the perspective of the construction situation of Ethiopia particularly study area.

In addition to these the respondents were professionals actively involved in construction projects in different capacities and the information obtained from experts required in depth knowledge and sound experience on procurement options and project performance in construction. Lastly, the reason for motivating the researcher to this particular study were the relevant data for this study can be easily accessed since the majority of the consulting and contracting firms are located in the study area.

Research activities were aimed at defining the theoretical basis, formulating more clearly the research questions and consisted of the following steps:

- First of all preliminary activities were aimed at identifying the main existed system namely in these case design bid build types and study area was specified;

- Literature reviews to obtain an insight of the problem and research gap and was used as criteria for developing and analyzing the primary data;
- Development of the research methodology, both research strategy and data collection;
- Preparation of a questionnaire survey and interview and case study projects based on research objectives;
- Finally analysis of the gathered data and presentation of the results was activities done step by step.

In this study, mixed method approach with the concurrent mixed method was employed mainly for the following reasons.

- It builds the strength of both data namely quantitative types and qualitative kind for the study;
- It provides extensive data using both data collection instruments;

Sometime adopting one type of method may not be enough to address the research questions. Collecting more data's using every possible instrument become crucial to answer the research questions.

Regarding the design the researcher adopted Concurrent mixed methods design to collect both quantitative as well as qualitative data's. The main reason for adopting this design was because;

- It helps the researcher to collect both data simultaneously;
- Both data are analyzed separately and this helps the authors to check the reliability of one source of data from the other source of data's

## 3.2. Data and Information Sources

Seven variable factors have been determined as procurement data and two performance variable identified. The samples were drawn from construction of projects undertaken in study area which is government owned building facilities constructed in Addis Ababa. these facilities as we know they are managed by the Federal Project Office, which is under the Ministry of Urban Development and Housing construction and Addis Ababa City Administration Construction Bureau. However, the Housing projects are administered separately by Addis Ababa Housing Development and Administration Bureau. The study area was selected based on the preliminary

study of the existing problems, that are problems related to time and cost overruns and owner's dissatisfaction with completed construction projects and knowledge of the area which somehow helped the researcher get easy access to available information.

The Purposive kind of sampling technique has been used as the suitable method for this research. The criteria used were relied on the requirement to make sure that stakeholder with the significant awareness as well as experience was participated and that the intended outcomes are widely accepted and applicable. The expert's engaged were those actively implicated in building projects in different capacity and the information obtained from experts required in depth knowledge and sound experience on procurement options and project priority outcomes in concerned building.

Hence, based on the research ultimate goal purposive sampling design has been used. The rationale behind restricting the research author to choose Addis Ababa geographical area for the sample was two reasons implied the focus to public building construction industry. Firstly, the flexibility of the researcher to make contact with directly potential intended organization namely contractor, owners and consultants so that improves faith for receiving a higher response rate implied the focus on those organizations. Secondly, the experience of organizations construction practitioners, working inside the building construction for long period of time, within traditional building procurement implied that the specific target group choice.

A total of 63 questionnaires were given by researcher to the administration directors of the concerned building organizations (consisting of owner, builder and consulting firms). 58 valid survey questionnaires were received for analysis with a response rate of 83% which is scientifically sufficient. The above response rate represents reasonably high compared to 20-40% for surveys of construction organizations (Furtrell, 1994).

## 3.3. Data Collection Instruments

The information gathered through both case study and questionnaires was supplemented and verified by explanations based on literature review. The researcher used secondary sources of data collection mechanism for this study. This was obtained from the available literature; journals, textbooks, articles, document reports.

### 3.3.1. Questionnaire

Primary data was collected through questionnaires which were administered to the respondents by the researcher. A questionnaire is a data collection instrument that sets out in a formal way the questions designed to elicit the desired information relating to the field of inquiry were used. These instruments were also piloted on public offices, contractors, consultants and relevant experts.

### 3.3.2. Interviewing

to enable the researcher specify and gather contract on the completed DBB and DB government owned projects in Addis Ababa, preliminary interview was undertaken with project consultants, contractors and clients.

The purpose of the interview was to provide validation and clarity to survey results and to gain additional insight into matters relating to the DB and DBB projects. Interview were conducted to further clarify the survey and to find out if there were any exceptional practices and problems.

### 3.3.3. Case study

For this research work, a case study was chosen due to delivery system chosen in this case DBB and DB to see the relative impacts or effects of each delivery types on performance goals to forward recommendations. For rating the results, there is no design build completed building projects in Addis Ababa recently as that of most available DBB. Therefore, for comparison purpose the researcher took case study projects one from DBB the other one from DB.

Generally, two case studies are assessed for attainment of performance objectives (i.e. cost, time). One of government building case studies was procured using DBB and the other one using DB. The case studies were compared to give imminent into the better project procurement system to construct public buildings.

In the preliminary survey, DBB and DB completed building construction projects were identified for case studies and the list of their owners or clients was compiled and those consultants and project managers employed for the executed projects were identified based on their experience.

## 3.4. Method of Data Analysis

First in this thesis work, based on research objective, based on literature with indicated sector experts, the study considered seven criteria which mainly affect the when selection criteria. Apparently, these criteria were selected based on literature survey and test interviews made in project experts. The criteria are ranked and analyzed by using statistical package for social science software and average index technique contingent on the priorities set by the client organizations in the study area.

Second information data from case studies of DBB and DB projects were collected through interview to in depth clarify the survey with project participant), primarily data projects then analyzed.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## 4.1. General Overview

The results of data analysis are summarized in line with the major focus areas included in objective of the study. The study sets out to determine the conventional types decision factors in Addis Ababa public building construction.

It attempts to specify the conventional or DBB route factors to cope up with these specific factors influences the project outcomes (performance). The present study therefore determines the priority that the respondents give for the variables involved in the literature review (certainty of final cost, certainty of completion date, demand of quality, allowing maximum competition bidding, convenient variation control, risk allocation and administration burden) have been taken as critical and the most common influencing variables specifically for traditional system.

Moreover, the research , attempt to identify criteria to assess and measure the project performance that specifically used in Addis Ababa building construction and to identify relevant hypotheses and developing a framework to link between variable criteria input and project success output as influenced by these specific traditional method of project use in the study area contingent on the survey results.

### 4.1.1. Study Population

More respondents were required from the Addis Ababa administration construction bureau, Federal project office and saving houses which are undertaken in indicated organization. Accordingly, the situation raising the quantity would not alter the fundamental nature of the reply. The outputs of the research are presented and analyzed in the subsequent sections as shown in Table 2 below.

**Table 2 Study Population and Response Rate of Respondents**

| Type of respondents | No. of responder | No. of questionnaire sent | No. of returned | No. of response | Percentage response (%) |
|---|---|---|---|---|---|
| Client | 5 | 12 | 12 | 11 | 92 |
| Consultant | 8 | 21 | 21 | 19 | 90 |
| Contractors | 12 | 24 | 24 | 23 | 96 |
| professionals | 11 | 6 | 5 | 5 | 100 |
| Total | 45 | 63 | 62 | 58 | 93 |

### 4.1.2. Respondents Experience

As regards the working experience, a respondent with 67% of the respondent had building construction work experience greater than (10) ten years. From their experience they stated to inform the amount of effect of traditional route decision factors on project output of public government owned building in study area. Accordingly, among respondents 23 % of the respondents company had building construction work related experience between five to ten years and 10% of the respondents company had building construction work experience of less than five years. The following Figure 4 shows the working experiences of the respondents in percentage.

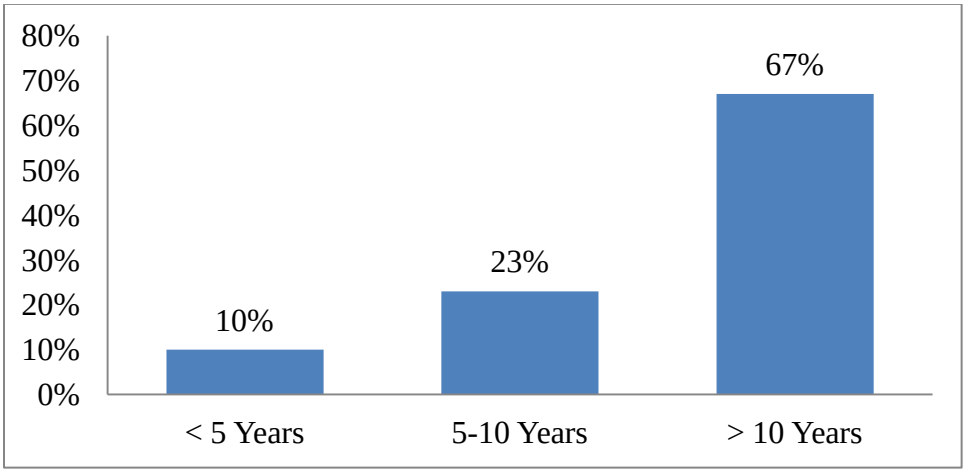


**Figure 4 Respondents Work Experience**

### 4.1.3. Participation of Respondents by Building Types

DBB is widely used for all buildings. The kinds of buildings undertaken by the participants were shown in Figure 5 below. The results show that the respondents were involved with office

buildings, health buildings, educational buildings, industrial buildings and others types of projects with 52%, 32%, 12%, 16% and 3% respectively as shown in Figure 5 below.

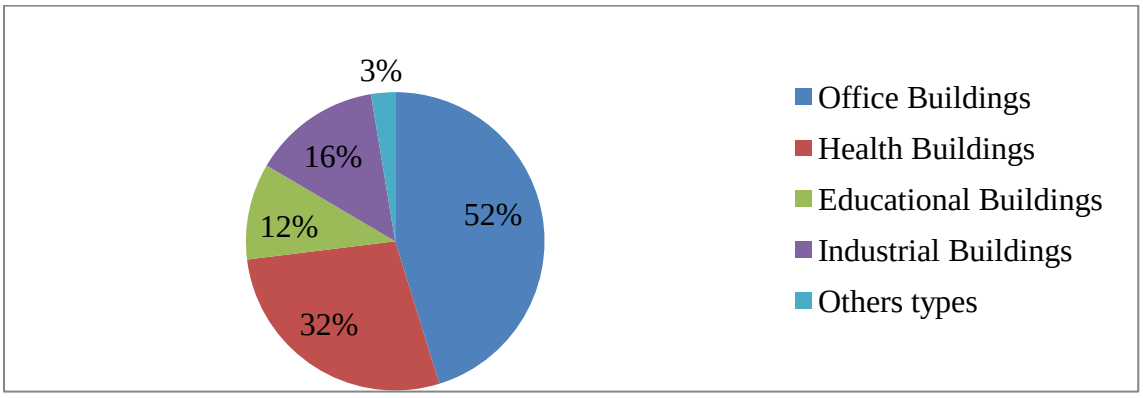


**Figure 5 Types of Projects, Respondents Involved With**

## 4.2. Questionnaire Survey Responses

### 4.2.1. Respondents' Perception on Traditional Method problems

Survey questionnaire were asked respondents to point out their opinion about the phenomena of problems usually happened because of the applied traditional or DBB method. These project expert members replied their perceptions that because of adopting this method for public projects, the chronic problem related with the system was slowness of its procurement practice and its bureaucracy. Furthermore, usually other problems related with this approach in government owned building projects of Addis Ababa as reflected and pointed out by these concerned stakeholders was listed as follows.

1. overruns due to schedule estimated against actual one,
2. The actual budget is usually against planned budget

### 4.2.2. Respondents' Perception on Incorrect Selection of Traditional project as Main Causes of Project Performance Problems

All of the professionals reflect similar view that on the issue stated in section 4.2.2 above. It is reflected by respondents that the issue is one of the major causes of stated problems in public building construction projects in Addis Ababa due to DBB decision factors during pre-execution

phase of procuring building projects chosen properly. To address this, respondents were asked to whether they believe building project success was influenced by the type of this construction variable route of traditional projects which the most common type of delivery method in Addis Ababa.

### 4.2.3. Existed payment Options for Public Building Executed by Traditional in Addis Ababa

Public building in Addis Ababa on most of projects employed the bill of quantity (BOQ) contracts from traditional (DBB) as they are effective contract types. The contract can be between the client and the consultant or the client and the contractor. Most respondents'(80%) identified unit rate contract as the most widely used types of contract payment in the Addis Ababa public building projects as seen in Figure 6.

The result was shown that lump sum is identified as the second most popular contract types used by the respondents (20%). But, the other forms of contracts are seen as not important by the respondents in their building construction projects as seen in figure 6 below. Hence, according to the respondents, in study area public construction projects are substantially executed using either unit rate or lump sum contract and sometimes a combination of the two contracts is used.

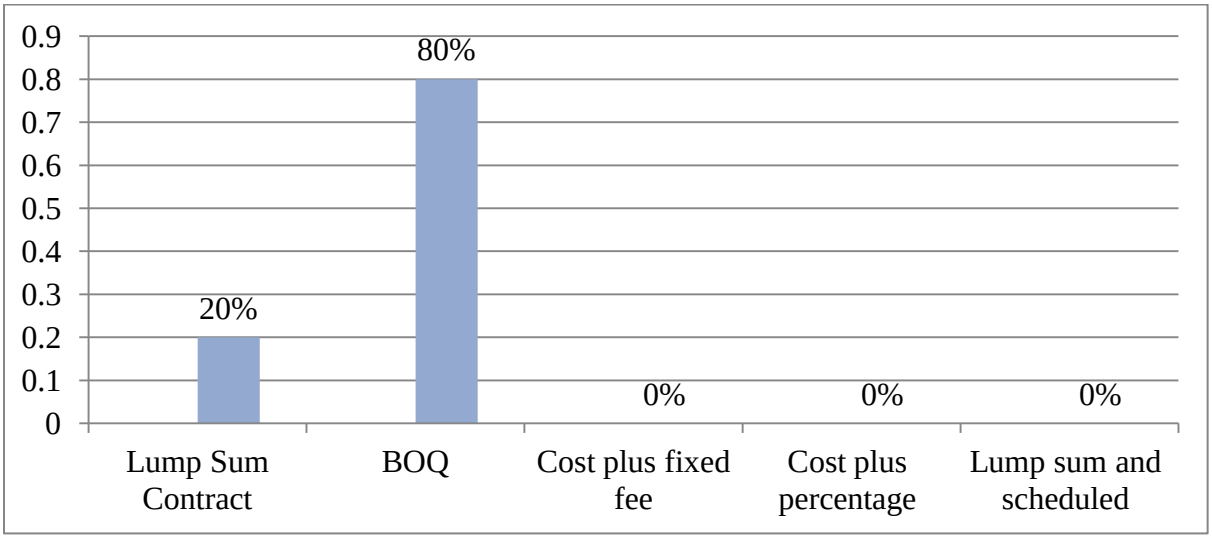


**Figure 6 Types of Contract Mostly Used in Addis Ababa Public Building Construction Projects**

## 4.3. Project Procurement Method Selection

The results of this section was to conduct the decision route of project delivery systems which stakeholders use to implement their building projects and the methods they need employ to select the correct route so as to ensure a successful outcome during both design and construction process.

To determine ways in which the projects delivered contracts to achieve outcome of budget, schedule, and this study was sequentially identified factors of decision route used for s using conventional method and ranking the appropriate of these strategy in accordance with characteristics of recently completed traditional projects by project party's members.

Accordingly, there are many identified primary project decision criteria from the literature review that affect government owned traditional project success. To see in detail this study conducted interview survey with local experts. They critically agreed that all decision routes were proved and confirmed to be critically used in all projects rather than project to project basis.

Before decided of such decision route, these all entire factors have to be analyzed as well and critically identified and then tested for appropriateness and applicability of studied area.

Thus, certainty of final price, probability of completion date, client demand for quality, maximum competition bidding, project controllable variation, risk allocation and administrative burden were analyzed. Here, Table 3 shown below indicated the respondent response on selection factors for government owned building projects in Addis Ababa

**Table 3 Importance of Existed selection criteria in Building Projects**

| Selection Variables | Mean score value | Rank |
|---|---|---|
| 1.certainty of final cost before commencement | 4.53 | 1 |
| 2.certainty of completion date | 4.52 | 2 |
| 3.demand of quality | 4.47 | 3 |
| 4. competition price | 4.42 | 4 |
| 5.controllable variation | 4.31 | 5 |
| 6. risk allocation | 4.06 | 6 |
| 7.administration burden | 4.00 | 7 |

It is noted that all these factors evaluated in table 3 above average mean of greater than 4 and less than 4.53, which indicates that the factors are all agreed with respondents and enhance they all of variable are important.

As the survey result as shown in Table 3 indicated that level of agreements on the importance of decision factors. The respondents required to put their responses using Likert scale of 1 (not important) to 5 (strongly important) the first necessary factor accounts the mean of 4.53 and the second factor or certainty of knowing completion date accounts 4.52, the third factor or demand of functionality workmanship quality by organization mean obtained was 4.47, the fourth selection variable accounts 4.42, fifth decision criteria mean value was 4.31, risk factor average evaluated was 4.06 and finally the result represent the administration burden variable accounts 4.00. Interviews case study projects with 13 experts involve project managers and site engineers for the purpose of validating were carried out and each of decision factors were discussed as follows.

1. **Certainty of final cost before commencement**

   Certainty of final cost before commencement is the most important used by clients as a choice criteria project delivery system. As shown in Table 13 this parameters ranked 1st by project stakeholders as factors to be considered for selection of a given procurement system. This finding is similar to that of (Ghadamsi and Braimah, 2016). The author found that certainty of prices decision factors during planning phases of facilities when clients candidate for selecting procurement systems and has ranked first by project team members.

2. **Certainty of completion date**

This criteria has ranked 2nd by survey respondents. The result is the same with (Lema,2006) who illustrated that degree of certainty project has completed on date established by owner and builder when signing the stipulated agreement so that such criteria is one of important factor for candidate a given construction procurement system in study area of proposed projects. The result finding is close with (Xiao and Proverbs, 2003) who illustrates that this was the most important factors influencing selection in the third position

3. **Demand of quality**

The third Ranke success factors when clients candidate for procuring delivery method, is quality needed. These criteria are important factors influencing selection variables to be considered on their building and ranked the third very important factors to be considered. The result is similar with that of (Mani, 2006). High quality level required as sub factor criteria and puts third position when candidate of traditional system by concerned bodies of experts.

4. **Competition price**

This influencing factor take forth position competitive price variables for choosing a builder to execute their building. So it is very important factors to be considered. This is because under such types of selection criteria the construction estimates are first set by client estimator and then bids are invited from the contractors in which lowest bidder wins the tender and was starting the execution stages. In this situation they are competing on price alone, since they are all pricing the same description of the works. This find is all most similar Thomas et al. (2002), in the DBB method offers the advantage of these criteria to clients, and thus enables them to prefer the best price for their projects, which ranked in fifth sub factor position by experts.

5. **Controllable variation**

Holds fifth position criteria to be considered to control variation during the construction process which decided during pre execution phase when client candidates for a wish of managing variation in design bid build and other alternative construction delivery system by following up through owner reprehensive. This study found that this success indicator was positively impacted by requirements or decision of keeping variation of local building projects. The result is reinforced by Ogunsanmi, (2013), who mentioned that this factor was the significant influencing parameter need to be taken by client for the objective of managing of variation order which result in reduced actual budget and schedule of projects.

6. **Risk allocation**

This criteria has holds six rank by all stakeholders par pated in questionnaire survey. This is one of the variable criteria in such that client's organization wishes to convey the risks of price and time slippage to the builder or contractor at the time of choosing specific project delivery method. The result found was the same with (Thomas et al.2002) who illustrated that taking risk into account during project delivery selection process to avoid project failures was important so

that risk is allocated between concerned parties and the most important criteria, expected to be considered.

7. **Administration burden**

The last selection criteria of government building projects in Addis Ababa is administration burden by clients as influencing factors of project delivery methods. the result founded was close similar with (Lema, 2006,) who done his research entitles alterative project delivery method for public construction project in Oromia and one of his objective were identifying selection variables of procurement methods and ranked this criteria on the fifth criteria variables.

## 4.4. Achievement of project objectives in DBB based project delivery

Respondents were asked to indicate their assessment of the objective achievements of their projects based on the ranks provided. The value was weighted as follows: 1= "extremely low", 2 = "Less", 3 = "moderate", 4 = "High" and 5 = "extremely high". The implication was indicated that the average value approximating "three" to "five" which this surveyed value index is suggesting the respondents' are in agreement with the statement or issue. The reverse is also true. The mean scores statistical information "one" or "two" suggest that on the issue, the assessment of the surveyed data was not in agreement shown in the following Table 4.

**Table 4 Achievement of project objectives in DBB system**

| **Project objectives** | **1** | **2** | **3** | **4** | **5** | **Mean** |
|---|---|---|---|---|---|---|
| Meeting project cost target | 6 | 7 | 11 | 6 | 4 | 2.93 |
| Meeting project time target | 9 | 11 | 8 | 4 | 2 | 2.38 |

Results obtained from Table 4 above indicated that the survey results of achieving project target cost was ranked a mean value of 2.93, well below moderate ranges(3) which reflected the government owned building projects does not frequently meets their intended objectives in the case of cost target.

Furthermore, the project team members were asked whether the government owned building projects delivered by conventional system achieved the expected time objectives. The result

survey has average the mean value of 2.38, well below moderate, which reflects the executed facilities by respective stakeholders does not meets the expected time objectives. This finding is in line with the finding of (Aschalew,2017) which verified that 74.3% of studied facilities government owned building construction projects in Addis Ababa have been experienced budget overrun and planned schedule exceeds actual value which have been found to be minimum of 10% and maximum value of 250%.

Therefore, from the results finds shown in Table 4 one can conclude that the main disadvantage related with traditional project delivery methods are planned duration and budget does not meets the actual value. this study finding is also the same with (Lema, 2006) results in which public construction sector procured by this systems in Oromia regional state ended with poor performance like absence of planning against actual output of finished products in indicated local construction industry.

## 4.5. Interview Results

The objective of an interviews are to assess the effect or impact of design bid build procurement methods and to identify the preferred delivery systems in government owned building projects in the study area. Conduct an interview with key personnel from client (Addis Ababa Construction bureau), builders and consultants in order to obtain necessary data regarding the behavior of the procurement systems they use and their advantage and disadvantage they observed throughout the development of the project. The interview questions provided for focus groups of respondents are attached in appendix ii.

### 4.5.1. Responses on Impacts of DBB method and Preferred System of project procurement system for Public Buildings

An interview was carried out with regard to impact of DBB methods on project works. They response that on project delivered by traditional methods were the of time overrun and cost overrun, which result in increase in final time and cost of project, as well as result in tying down of owner capital because of non-completion of the project, claims and dispute between stakeholders were the impacts most of the time observed. Moreover the questions were asked give the respondent on the issues that resulted in cost or schedule changes from the original

award on the projects where a DBB project was used. They responses that due to builder is not involved in design stages of traditional DBB systems, there are errors or omissions of design which result in additional cost and time by design problem.

Furthermore, interviews participants were asked to assess DBB and DB from the angle of claims, cost, and time. They believed that from the angle of cost it is lower in case of DB projects because the systems bring a reduction of change orders so that the overall costs of the projects saving money over DBB projects. The second reason is the ability for schedule acceleration of DB projects provides saving related to time value of money. The third interesting area of cost reduction is better in DB than DBB as mentioned by interview participants is because of the intensity of communication and planning among the designer and construction team, the level or degree of detail required in design is document is reduced. Interview with DB and DBB participants revealed that in traditional DBB method due to it isolates the contractor from the design process, there is high potential for project cost increase and conflict between design document and constructability of the intended projects. Furthermore, they revealed that the main problems of DBB project is more exposes to design change, change in quantity than DB projects. There are more many reasons, why project duration tends to be reduced when design-build delivery is used. The interview revealed that the main reason for why design-build can save time over the traditional DBB projects is the ability for design and construction to partially overlap.

Finally interviewees noted that design-build, can effectively be a three-phase process: first, there is a period of design only when preliminary design considerations are addressed; second, preliminary construction activities get underway as some plan details are finalized, a final plan set has been released for construction, and all permits have been secured; third, construction only continues to completion after the plans have been finished. Lastly, they told that the design-builder noted that the burden to maintain the schedule still lies in the hands of the contractors when scope changes occur, and this is also a factor in minimizing time. All of the project personnel interviewed for this case study agreed that using design-build has facilitated a noticeably quicker project and changes occur less frequently because the risks and responsibility for keep on schedule is the duty of contractors.

## 4.6. Case Study Projects

The objective of this case study project is to specify the impact of design bid build relative to design build on project performance. For the reason of the case study, the subsequent documents were observed for in-depth investigation. Particular interest of analysis was to examine whether these projects meet targeted completion time, completed with original cost, and any recorded quality issues. In addition to this, contract management issues related to claims were also assessed. The entire interest of case study analysis the problem faced and impact of existing project procurement system and possibility of adopting and utilizing appropriate methods such as DB to minimize and solve problems of performance.

i. Contract document for project schedule
   - ✓ Contract document
   - ✓ Monthly Report
   - ✓ Design Documents

ii. Actual completion report
   - ✓ actual completion schedule
   - ✓ Final price

iii. Archival Records documents that indicates
   - ✓ Variation order, EOT with their reason
   - ✓ issue related with claims

For both design build and design bid build projects, data were collected from archival documents, discussion with participants in the Addis Ababa city administration construction office and reports. Particularly, the performance comparison of both case study projects were analyzed by consideration of parameters such as contract amount , original cost , final cost, original schedule, final schedule, and purpose of the project, name of the consultant ,contract are included in the desk studies. The desk study's findings are mainly the project delivery methods with respect to design bid building and design build projects.

The purpose of comparison was to see the impact of DBB contracts procurement on project performance relative to DB contracts in government owned public buildings. The reason why this study was limited to single case study projects is the limitation of completed DB projects particularly in government building projects.

**Case Study 1 Comparison of Cost per Meter Square on DB Vs DBB**

**Table 5 the cost per $m^2$ for the DB and DBB projects**

| Delivery method | Project name | Gross built up area($m^2$) | Cost (ETB) | Cost/ $m^2$ | Average cost/ $m^2$ for DB &DB |
|---|---|---|---|---|---|
| DB | Adwa Museum | 1213000 | 4,600,000,000 | 37922 | 41083 |
| DB | Addis Ababa New Library | 38,500 | 1,100,000000 | 28751 | |
| DB | Mayor Office Renovation | 50,000 | 1,800,000000 | 36000 | |
| DB | Grand Palace Heritage Parking | 51,630 | 1583952500 | 30679 | |
| DB | Meskel Square | 22,500 | 1,621,440,000 | 72064 | |
| DBB | Bole Hospital | 31,000 | 1,600,000,000 | 51613 | 50815 |
| DBB | AAU Forum Building | 14200 | 900,000,000 | 63380 | |
| DBB | Office building & theater center | 10,000 | 502,897,261 | 50090 | |
| DBB | medical science dormitory building | 13,200 | 700,000,000 | 53030 | |
| DBB | Lideta Police Commission building | 5,500 | 197,806,207 | 35965 | |

As shown in table 5, it assessed to indicate that which delivery method has greater or lesser cost per square meter so that recommendation can be forwarded. The above table 5 highlighted the estimated costs of particular building projects in Addis Ababa. The results shows that cost per $m^2$ of design bid build(DBB) is higher than design build of building projects because the DB cost per $m^2$ is reduced by maintaining lower initial contracted unit cost. Hence, the initial cost of DB is higher than DBB projects; however, the DB cost per $m^2$ is reduced by maintaining lower initial contracted unit cost than DBB procurement methods. The result showed above compared some cost per $m^2$ rate of DB projects which is lesser than DBB project such that the average cost /$m^2$ of DB is 41083 Birr/ $m^2$ less than cost per $m^2$ of DBB building projects which is 50815 Birr/ $m^2$.

As indicated in table 5, however, the observed differences between DB and DBB project is that the initial costs of all DB project case studies are higher than DBB building projects. This is because risks of uncertainties are all absorbed by DB builder so, typically cost of DB projects is superior which is expected to compensate the uncertainties as well as DB project is known and identified early.

**Case Study 2. Police Commission Building Project Vs Addis Ababa City Integrated Land Administration Project**

**Police Commission Building Project (Design Bid Build) in Addis Ababa**

The project is located in Addis Ababa. Contract administrators for this case study projects are Addis Ababa City Administration Police Commission and the Consultant or Designer was Gereeta Consult Plc under the supervision of Addis Ababa City Administration & Construction Authority. The contractor employed for this building project was Afro Tsion Construction PLC. 730 days by commencing the work at Nov 2010 GC, hence, the contract finishing day to be august 2012 GC. However, the project delayed by 525 days. The project procurement type is lowest bidder and type of contract was unit rate where as delivery method was DBB systems. The contractual and actual cost and time data of this case study project was shown in Table 6 below.

**Table 6 Time and cost growth in Addis Ababa Police Commission Project**

| Units | Contractual | Actual | cost and time growth |
|---|---|---|---|
| Days | 730 | 1255 | 72% |
| ETB | 99,444,398.79 | 154, 171,263.34 | 55% |

**i Variation to contract price**

- ✓ Variation order 1: due to change in quantity of 3934 meter square marble cladding to 10863 meter square.

- ✓ Variation order 2: for change from 70mm aluminum partition wall to 120mm floor electrical box due to inability of holding 120mm electrical boxes of 70mm partition wall.

- ✓ Variation order 3: specification change due to mismatching the proposed requirements of electrical item leads to additional cost

- ✓ Variation order 4: design changes of roof structure of 18m assembly hall which leads for additional costs. One of the problems encountered on Addis Ababa Police Commission was design changes observed so that structural design of the 18meter assemble hall's truss design failed after re-checked with the contractor's structural designer then to remedy the problems the rechecking is discussed with consultant and for modification it takes six months with additional costs.

- ✓ Variation order 5. Error in design documents result in additional quantity of reinforcements, formworks and quantity of concrete increased by 100% from the initial contract amount which led to 7% increases project budget.

**ii Variation to contract duration**

- ✓ EOT1:230 cal days
- ✓ EOT2:180 cal days
- ✓ EOT3: 85 days

**iii Reasons for duration changes**

- ✓ Extension of time 1: delay due to site work design changes, especial fence and drainage design. In design of drainage change which takes more than 8 months for modification.
- ✓ Extension of time 2: delay of re-design of roof structural assembly hall by designer due to initial design failure
- ✓ Extension of time 3: delay of additional marble production

**iv claims**

In general, as analyzed above all variation in this DBB projects are because of design change and quantity changes arises from design and specification error due to lack of integration between parties undertaking the projects.

In this case studies there were claims for time and cost in this project, so that, after price adjustments it was compensated. Therefore, as indicated above the change orders are due to design change and errors that causes projects for additional schedule as well as additional costs or all the above causes overruns impacts.

**v Challenges and impacts of DBB procurement methods of case study project**

- ✓ design changes result to cost and time overruns
- ✓ variation results to project overruns
- ✓ errors and discrepancies in design document to project overruns
- ✓ increasing quantities result to project overruns

**Addis Ababa City Integrated Land Administration Project (Design Build)**

The owner needs to employ this DB contract types to gain the advantages of saving time, cost and to achieve the required quality levels. The scope of this project is constructing integrated land administration in tan sub - cities of Addis Ababa which is similar packages of blocks through DB contracts.

The project is located in Addis Ababa contains ten similar packages of blocks which is constructed in ten (10) sub-cities of Addis Ababa. The building end user is ten sub-cities Land Administration Developments for the purpose of office building. The contract of this building projects are lump sum contract and procurement type was negotiation. The contract was signed between Addis Ababa City Integrated Land Administration (client) and as client representative, Addis Ababa city administration work urban development and Defense Construction Enterprise (contractor) through Negotiation. Defense Construction Enterprise took the design and construction contract to execute the indicated projects within 365 days by commencing the work at September 2012 GC. Hence, the contract finishing day was September 2013 GC. But the proposed projects concluded at 135 days by exceeding the contract periods. The following table indicates the extent of time and cost growth of DB case study projects in Table 7 below.

**Table 7 Time and cost growth in Integrated Land Administration Building**

| Units | Contractual | Actual | cost and time growth |
|---|---|---|---|
| Days | 365 | 500 | 36.9% |
| ETB | 150,000,000.00 | 166,750,000.00 | 10.8% |

**i Reasons of Time and Cost Overruns in Addis Ababa City Integrated Land Administration Building Project (Design Build)**

- ✓ Late design by contractor and lack of experience particularly, in building sectors. The time given for design as per the agreement is six month. But, design builder accomplished the design process until the project is ended.
- ✓ Design approvals of were delayed which is one of the causes of time and cost overruns.
- ✓ Project scope is not clearly understood by both parties which result in design builder for additional time.

**ii Claims**

The clients prefer the new DB types of delivery method because of fulfilling the following of key performance criteria (time, cost) for this case study.

- ✓ With regards with cost, there is no variation and dispute in this project that means there is no additional cost other than price adjustments.
- ✓ Even if the proposed building is begun earlier than the full sets of the schematic drawings are completed, the design builder claims for additional time. Hence, 135 days of extension of duration was approved and granted for design builder.

## 4.6.1. DBB versus DB Case Study Finding and Discussions

The result found indicates that average comparison cost per meter square of DBB building project is higher than DB projects. The finding is similar with that of Fernane (2011) who indicated that the DBB cost per square foot is higher than DB building projects.

As shown in the above case study, the cost growth increases for DBB building projects by 55% and for DB project the cost increases by percentage of 10.8%. The cost overrun recorded on projects due to different impact of the procurement method on project outputs. Hence, the comparison analysis in terms of cost performance shows that DB project is better than DBB projects in terms of cost. In terms of time as indicated in case studies, the percentage increase in time growth when the project is delivered by DBB is 72% and when project DB is 36.9%, which indicate that DB is better than that of DBB in terms of time performance. These results are the same with Marie (2015) who carried out case study of one DB hospital building projects and one DBB of similar projects. The comparisons performance criteria used for comparisons were cost and schedule. The case study results revealed that DB building projects shows $ 30 M under budget and 90 calendar days ahead of schedule, whereas DBB case study projects went slightly over cost and schedule by exceeding original contracts.

Case study results also the similar with result obtained from interview indicated that cost and time growth was minimized in DBB than DBB methods. Furthermore, in local roads case study project founded by Filimona, (2018) obtained similar results (case study Bahirdar-Zema river bridge design-bid-build road project and Koka-Adulala design-build road project). Finding of the study reveals that an extra time and cost has been recorded to the Bahirdar Zema DBB Road Project.

# CHAPTER FIVE

# CONCLUSIONS AND RECOMMENDATIONS

## 5.1. Conclusions

Based on the ultimate goal of this study, the research focused on the impact of design bid build method on project performance. This study was conducted to see the impact of DBB on project performance relative with DB, to identify the selection criteria of delivery methods, to assess the impact of DBB on projects performance in terms of outcomes of time and cost of public building in Addis Ababa, to recommend better delivery methods. Therefore, it is possible to conclude that the following:

1. Based on the results found the identified and ranked selection criteria of delivery methods in Addis Ababa public building are certainty of completion date, certainty of time, demand of quality, controllable variation, maximum competition price, risk allocation and administrative burdens.

2. Based on case study results it concludes that cost per $m^2$ of traditional design bid build is greater than design build of building projects.

3. Project with design bid build impacted project performance because it subjected for design changes and errors, variation order, error and discrepancies in design document and quantities increasing which in turn causes cost and time overruns in public building project. We can see in Addis Ababa Police Commission Building Project case study is a good example**.**

4. Based on results of case study the issues that resulted in cost or schedule changes with DB projects results from late in design, late approval because of project scope is not clearly understand by parties of clients and their representative as well as design builders. We can see in Addis Ababa City Integrated Land Administration Project is a good example.

## 5.2. Recommendations

In view of the findings, this study and the guidance from the literature review. While there are other factors crucial for successful completion of a given project, from the results, the concerned stakeholders should pay more attention in addressing any short comings in delivery method to enhance project outcomes. In this regard, the current study makes the following recommendations.

1. The study recommends that the method of delivery to be candidate for a given project should based on the nature and overall goal of the project to enhance as well as ultimate owners objectives to dictate the right selection criteria, which reduce poor project performance outcome of the building projects at pre-construction stage of the proposed projects.

2. Due to lack of completed DB contract, in the coming study, more DB projects should be adopted which will increase the number of case studies that can for statistical analysis could be conducted to provide more clarity to the potential advantage of design build for public buildings.

3. This research has conducted by considering projects that are completed during my research work. So there is no possibility to see the occurrence of movement of budget and schedule overrun during project was ongoing phase. Therefore future researcher should have to include building projects that are not complete or during progress of work.

4. It is recommended that owners and other stakeholders in the construction industry and particularly those in the building sector should be utilize and adopt DB procurement methods to minimize the impact and problems of DBB procurement method on project performances.

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# Appendix I: Questionnaire

Dear respondent,

I am Student of Masters of construction Technology and Management, (COTM), at Addis Ababa University Institute of Technology. As partial fulfillment of the program, I am undertaking a research on the topic "**The impact of design bid build procurement method on performance of public building construction project in Addis Ababa".** The research outcome could be helped as an input for decision makers, professionals, academician and other interested groups to play their respective role for the achievement of project objectives.

**Section A: General Information**

1. Company Name _____Project name_____

   Original contract cost---------- Final contract cost----------

   Original project start date---------- --Project completion date----------

2. Category/class of organization:_____
3. Type of organization: □ Client □ Consultant □ contractor □ others_____
4. Please indicate your years of experience of working in public building construction projects

   □ Less than 5 □ years 5-10 year □ More than 10 years

5. Please indicate the type of your vertical project type

□ Educational Buildings □ Office Buildings □ commercial Buildings
□ health Buildings □ Industrial Buildings Others_____

6. Value of executed projects in the last five years (in million Birr)

   □ 10 – less than 2 □ 20 – less than 50M

   □ 50 – less than 100 □ More than or equal 100

7. Which type of payment was used mostly in Addis Ababa public building construction?

□ Lump sum □ Unit rate □ cost plus others_____

8. Do you believe building project output influenced by the type of construction delivery method chosen such as conventional system?

   □ yes □ No

**Section B: Influences of project traditional criteria on project success objectives in public building project**

1. Please tick for item a-g the item that best describes your perception of priorities for that project in Addis Ababa public building projects delivered by DBB system context (based on traditional decision routes that are applicable in public building construction in Addis Ababa).

a. Certainty of completion or achievement date: (there was an early or fixed completion time of essence to the success of the project).

□ not important □ less important □ moderate □ important □ strongly important

b. Certainty of final price: (there was the need for a fixed price for the project before contract and an assurance that the price is unlikely to change significantly during the currency of the project).

□ not important □ less important □ moderate □ important □ strongly important

c. Control variation: (there was the need to control additional variations during design and construction).

□ not important □ less important □ moderate □ important □ strongly important

d. Risk avoidance /Allocation: (there was the required for the client organization to optimize risks of cost and time to owner and contractors group).

□ not important □ less important □ moderate □ important □ strongly important

e. Competition bidding: there is a required to allow for the project to be delivered under a competition bidding that gives value for money to the client).

□ not important □ less important □ moderate □ important □ strongly important

f. Administrative burden: the intended building facilities allows for the project to be delivered under a duty of client that gives value for money to the client organization.

□ not important □ less important □ moderate □ important □ strongly important

g. The need of quality: there was a need and allows for the project to be delivered under the need of quality that gives value for money to the client.

□ not important □ less important □ moderate □ important □ strongly important

Others_____

**Section C .Criteria and extent of project performance by traditional system**

1. a. Which of the following parameter of facilities priority connected or associated criteria are in use for assessment of public construction projects performance in your organization? Decide on all that is applicable.

   1 strongly disagree □ 2 disagree □ 3 Neutral □ 4 agree □ 5 strongly agree □

- cost □ □ □ □ □
- Time □ □ □ □ □
- Quality □ □ □ □ □
- health and safety □ □ □ □ □

b. In your opinion, how do you understand budget, schedule as output/performance objectives? Circle your choices.

□ strongly disagree □ disagree □ Neutral □ agree □ strongly agree

c. For project procured using conventional indicates on scale of 1 to 5 the amount by how each following outcomes had been experienced. 1=extremely low frequency, 2=Low, 3=moderate, 4=High, 5= extremely high frequency, please tick appropriate box.

| **Achievement objectives** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Project meets on or before schedule target | □ | □ | □ | □ | □ |
| Project meets on or below budget | □ | □ | □ | □ | □ |

1. For your project undertaken, the major problems related with using the most existed traditional methods in Addis Ababa government owned vertical projects.

   □ Schedule overruns □ budget overruns □ Poor quality

   □ other pleases (specify) _____

## Appendix II - Interview

The objective of an interviews are to assess the effect or impact of design bid build procurement methods and to identify the preferred delivery systems in government owned building projects in the study area.

i. Type of Organization ----------
ii. Project Name----------
iii. Type Project procurement system (DBB/DB)----------
iv. Contractor ----------
v. Consultant organization----------
vi. Owner of building----------
vii. Original cost building----------
viii. Final Cost of Project----------
ix. actual schedule----------
x. gross square meter----------

1. What is the impact of DBB on building project performance relative with DB building projects?
2. How you compare DBB and DB from the angle of claims, cost, and time?
3. How would compare the original bid contract terms (cost and schedule) to projects of the same scope that were delivered by DBB systems?
4. How would you compare the final bid contract terms (cost and schedule) to building scope was delivered by design bid build types?
5. Can you give examples of issues that resulted in cost or schedule changes from the original award on the projects where a DB project was used?
6. Can you give examples of issues that resulted in cost or schedule changes from the original award on the projects where a DBB project was used?