Addis Ababa University
School of Graduate Studies

Alternative Project Delivery Methods for Public Constructions: Cases in Oromia Region

By

Lema Mosissa

September 2006

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Civil Engineering

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EXECUTIVE SUMMARY

This thesis work is undertaken to identify the existing project delivery methods in Oromia region, to evaluate alternative delivery methods and to assess opportunity for their applicability to the local situations. This is to provide a useful supplement to the existing methods so that all stakeholders in the construction industry will benefit.

Accordingly, four project delivery methods based on their relevance to the local situation in Oromia region of Ethiopia have been evaluated; their merits, demerits, and requirements identified. These methods are: *the design-bid-build (DBB), the construction management (CM), the design-build (DB),* and *the design-build-operate-transfer (BOT) methods.*

The criteria used for selecting (or evaluating) the appropriate method(s) among the alternative delivery methods were: *project time certainty, controlling project cost, ensuring project quality, and reduction of owner's administrative burden.* These are sometimes called *project objectives*. These evaluation criteria (project objectives) have been decided based on the literature survey and test interviews made at the early phase of the thesis work.

So as to draw reliable inference, data was collected from four clusters of stakeholders in the construction industry, namely; public owners, contractors, consultants, and reputed professionals. The research design was based on exploratory survey, desk study, and descriptive approaches. Besides, the research instruments used were questionnaires, interviews, discussions and document reviews. The participants include eight public owners, seventeen contractors, twenty consultants, and another twenty reputed professionals. The respondents were selected using random sampling, except public owners for which purposive sampling was used.

As one of the core responsibilities of the thesis work, assessment of the prioritization of these project objectives by the concerned bodies has been conducted. Accordingly, it is revealed that public owners in Ethiopia's Oromia region wish to ensure project time certainty in the first place. Their second critical requirement is to attain project cost certainty. Thirdly, they want to reduce the administrative burden to them. Finally they indicate that they want to attain a quality project.

This study, as one of its findings, reveals that the current construction projects delivery method in Oromia region is the traditional Design-Bid-Build (DBB) method. It is also noted the innovative project delivery methods have never been used**.**

The DBB method has been short of meeting the above mentioned project requirements set by the public owners in the study area. Hence, there is a positive attitude towards the application of the innovative project delivery methods with the public offices.

It has been thought that the local construction industry in Ethiopia is a cost-driven industry. Taking Oromia region as a study area this thesis work, however, shows that public owners wish the industry to be a time-driven one. This is because public owners have come to understand that when the project time is controlled, reduced or maintained the overhead costs and the consultancy fees can be dramatically reduced. They have also come to understand that if project time is maintained or reduced, the cost overrun due to price escalation and inflation can be minimized. Hence, the cost is issue is regarded as a second priority in selecting among different project delivery methods.

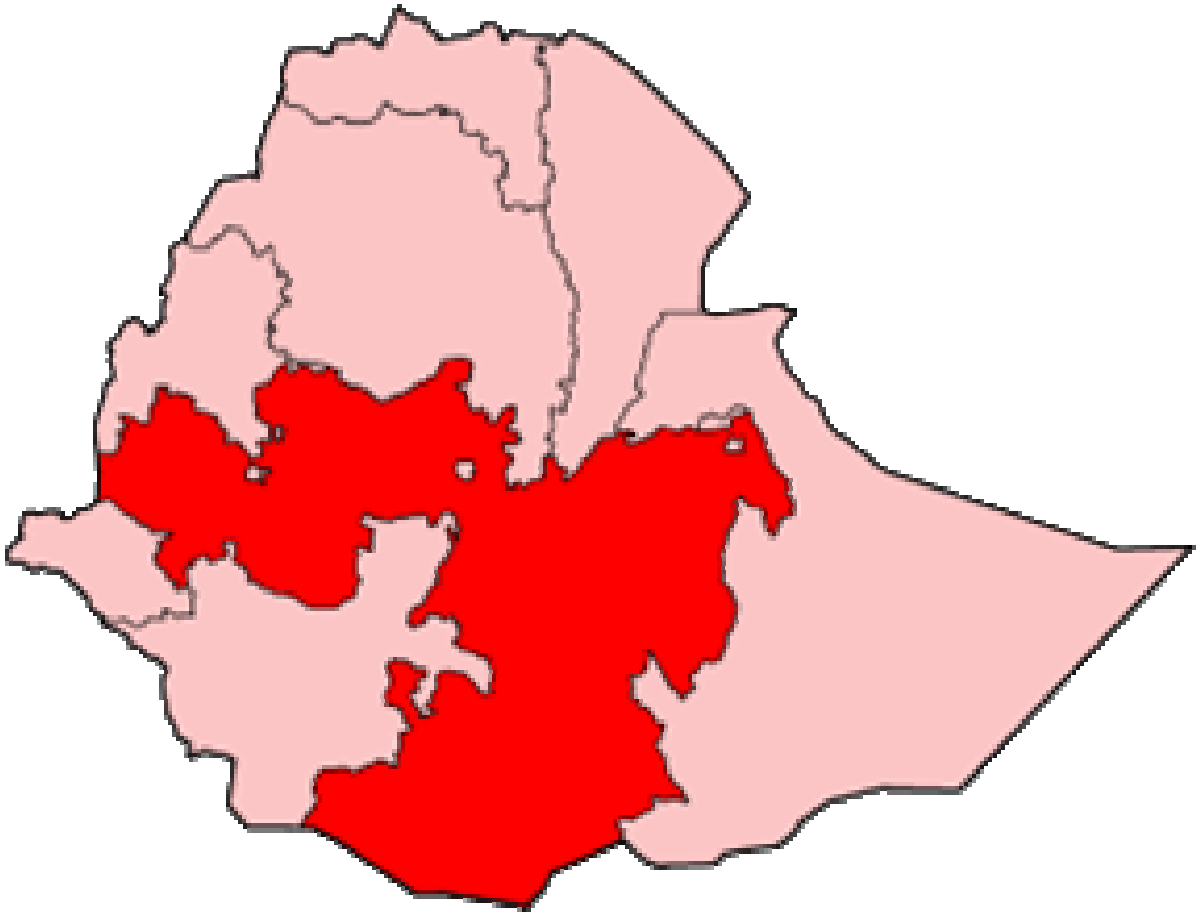
It has been argued that the local contractors lack financial, managerial, and sometimes technical capabilities to run construction projects under innovative delivery methods. Based on the assessment of the local construction industry, however, the innovative methods DB, CM-at-Risk, and CM-at-Fee can be effectively applied in the study area. This could be accomplished by *partnering* between consultants and/or contractors and *proper contractor and/or consultant selection.*

Partnering maximizes the effectiveness of each of the partner's resources, and proper contractor/consultant selection avoids selection of a contractor/consultant that is not fit for the job to be undertaken.

The traditional DBB method can also be employed in situations when the public owner wants to involve in several aspects of the project and when time is not a constraint.

It can, however, be argued that the transition from the traditional method to the innovative methods needs time and involvement of everyone in the construction industry. And, this paradigm shift ought to be advocated through short trainings, tailor-made short courses, workshops, research and construction magazines, and any other relevant means.

Map 1: Post-1991 Map of Ethiopia, Highlighting Oromia Region-Study Area



1. INTRODUCTION

1.1 Background

Since the demise of the *Derg* regime in May 1991 (1974-1991), Ethiopia has adopted and instituted Federal Government Structure. Oromia is one of such Federal States and is located, approximately, between 3^o and 15^o N latitude and between 33^o and 40^o E longitude (Map1). The land area is about 353,007 square kilometers [18].

Based on figures from the Central Statistical Agency of Ethiopia (CSA) published in 2005, Oromia regional state has an estimated total population of 26,553,000, consisting of 13,249,999 men and 13,303,001 women. The region, thus, has an estimated density of 75 people per km^2. The economy is highly dependent on agriculture though construction industry is believed to contribute certain percentage of the overall capital budget.

There are generally two ways of accomplishing construction projects: (1) construction by *contracts*, and (2) construction by *force account*. Construction by contract whereby the owner hires an independent body to execute the construction project is the predominant method of accomplishing civil engineering projects in Oromia region of Ethiopia. The alternative to the contract method is construction by *force account*, where the owner maintains the labor force, furnishes all materials and equipment, and exercises direct management of both design and construction of works.

Government establishments in Oromia region use the *force account* method, mostly, due to three major reasons: (i) where contractors are not interested, for instance due to security problems, to take contracts in remote rural areas (ii) where the cost of the project by contractors becomes exorbitant due to lack of infrastructure, and (iii) due to unavailability of capable contractors.

Globally, innovative project delivery methods, where a contractor offers broader service packages, are increasingly used in the infrastructure sector. Nevertheless, completion of a construction project on time, within budget, and in a form that meets the owner's needs most effectively is one of the pitfalls in Oromia/Ethiopian construction industry.

One method to avoid these pitfalls is to put together a team of people whose skills match the type of projects envisioned and who have a proven record of delivering such projects. Before this team is put together, the owner should decide how the members will interact with both the owner organization and with each other-*deciding on the project delivery method.*

This study, called "Alternative Project Delivery Methods for Public Construction: Cases in Oromia Region" attempts to demonstrate practices and methods that can be utilized by client organizations to secure products and services more successfully. The goal is, thus, to share and/or to adopt some of the most innovative or at least the most progressive methods used in the developed world. The details contained in this study are from data and information gathered mostly from building, roads, and water works projects in Oromia region – the focus area of the study.

A number of standard strategies can be used to accomplish the delivery of building and/or civil engineering construction projects. The most common and the ones that are covered in this research work are: the *design-bid-build (DBB*), the *design-build (DB)*, the *construction management (CM)*, and the *design-build-operate-transfer (BOT)* methods.

The research work intends to concentrate on publicly financed construction projects, as these are the ones that constitute a substantial proportion of civil engineering construction projects in Oromia. It is also not easy to get full information concerning privately owned works in the study area.

Public construction, sometimes called *public-works construction*, refers to those construction works which are initiated by an agency of the government – national, state, city, or other public-bodies – and are financed through special bond issues or by

appropriations [8]. Performance-based project delivery methods are thought to benefit all the participants by lessening the likelihood of unsatisfactory performance, increased cost, time overruns and claims.

Hence, it is the opinion of the researcher that well-performing project delivery methods, if well administered, will guide the satisfactory execution of public construction projects.

1.2 Brief Statement of the Problem

No project can be completed by a single individual. It requires a group of persons with specific duties to be performed by each. Usually, the owner participates during the design period to set criteria for design, cost and time limits for completion and to provide decision-making inputs to the design consultant.

The prevailing problem in Oromia, as indicated for instance in DAANDII, is that sometimes the final design fails to reflect the interest of the owner [29]. It is also mentioned that some of the regional government offices do not currently have experienced staff to evaluate and comment on the works planned, designed and specified by consultants.

In some public agencies the works designed by one consultancy firm needs to be reviewed by at least one other consultancy firm to check design errors and to evaluate the constructability of the designed works. Such lengthy procedures, apart from prolonging the time for the commencement of the actual construction, may make the cost more than the product itself is worth.

Moreover, Abebe and Girmay indicated that claims, in some projects, in Ethiopian construction sector have been observed reaching up to 200-300% of the project cost [2]. There are cases in which improper selection of project delivery method can be cited as one of the main causes of contract disruption and then claims.

So, it is the interest of the current research work to assess the existing situation and to identify the enduring problems, and to recommend feasible alternative methods of project delivery that can be practiced in the context of Oromia.

1.3 Research Objectives

The research has the following specific objectives:

- To identify the project delivery methods for public-works construction in Oromia and to define their merits, demerits, and requirements.
- To evaluate different project delivery methods and to assess the potential for their applicability to the local situation in Oromia.
- To determine alternatives to modify and to promote changes in the current infrastructure project delivery methods in Oromia in order to make the process more efficient with benefits to all stakeholders.

1.4 Significance of the Research

The broadening of the service packages is believed to enable the optimization of the process and the product as a whole in the construction industry, as well as to facilitate the development of the infrastructure sectors. Performance-based project delivery methods are thought to offer a way to develop the sector and to benefit all stakeholders.

According to Abebe, construction industry employs about 20% of the workforce and covers about 30% of the capital budget of the governments in developing countries [1]. Wubshet in his work, however, indicated that the construction industry accounts even for more than 50% of the capital budget in developing countries [33]. According to him, for instance, in Ethiopia (1997/98 to 2001/02), the industry accounted for 58.2% of the capital budget. It should be noted, in both cases, that the industry covers a fairly large portion of the government's capital expenditure and so it needs to be developed.

In the developed world, the excessive use of the DBB method has given reasons to investigate innovative project delivery methods. Although a proliferation of construction projects delivery methods are available, there is still considerable confusion about their application and use. Clarification of their differences is critical to understanding how they can best be utilized to enhance the project procurement process and leverage in-house expertise and project funding.

Based on literature reviews, the primary reason why innovative project delivery methods are selected by public-works owners is to shorten the duration on specific projects by merging the design and construction processes. Quality, cost effectiveness, and a single point of responsibility are also cited as reasons to pursue these innovative methods.

Further more, early collaboration on projects between designers and contractors usually enhances their relationship and often results in change order minimization because the process encourages the contractor to point out problems in the design or constructability issues early in the bidding or design process.

Hence, the significance or merit of this study lies in making a contribution to the understanding of the importance of appropriate project procurement methods, as there seem to be some linkage between project delivery method and cost and time overruns and industry under-performance.

Thus, this thesis attempts to present a guidance to provide sufficient basis on alternative project delivery methods for public constructions.

2. LITERATURE REVIEW

2.1 General Overview

Outsourcing of capital investment projects to the private sector is not a new or recent practice in infrastructure projects. Hence, there are several methods and combinations of methods to deliver a construction project. Results from studies, however, indicate that there are no significantly new project delivery methods, but all are merely modifications or slight variations of existing or past methods [28].

It should be noted that alternative project delivery methods are developed in order to look for solutions to problems associated with the traditional method. Hence, this section of the research intends to identify how different authors have defined the term *project delivery method.*

At present, there are no industry-wide accepted definitions of project delivery methods, and many groups, organizations, and individuals have developed their own. In so doing, they have often used different characteristics to define the delivery methods, and this has resulted in a multiplicity of definitions, none of which is either entirely right or entirely wrong [25].

To help designers and contractors achieve quality projects that fulfill owner expectations and are delivered on time and on budget, the American Institute of Architects (AIA) and the Associated General Contractors of America (AGC), hereinafter referred to as AIA-AGC, formed a taskforce to produce a primer. It was mentioned that though the primer is intended to improve understanding for the mutual benefits of owners and the design and construction community, it is primarily addressed to owners who are unfamiliar with the various ways of procuring design and construction services.

Hence, it is important to offer basic definitions to help owners, consultants and contractors better understand the various options at their disposal. Some of the definitions are presented as follows:

That primer produced by AIA-AGC defines *"delivery"* as the method of assigning responsibility to an organization or an individual for providing design and construction services [25].

Other writers, for instance, Gould and Joyce define the term *"delivery method"* as the owners approach to organizing the project team that will manage the entire design and construction process [14]. According to Pakkala *"project delivery methods",* and sometimes also called *project delivery systems,* refer to the systems the owner uses for organizing and financing design, construction, operations and maintenance activities that facilitate the delivery of a good or service [24].

This chapter of the thesis, thus, highlights four project delivery methods that may be used by public owners contemplating alternative methods for project delivery, namely, the design-bid-build (DBB) method, the design-build (DB) method, the construction management (CM) method (both CM at Fee and at Risk), and the design-build-operate-transfer (BOT) method.
Each of the methods has distinct advantages and disadvantages for both the owner and the contractor. It should be noted that the intent here is not to promote one method over the other but to demonstrate and present the characteristics that should be considered to select the best one.

The four criteria used, for selection of project delivery methods, in the present research work are: *Cost Certainty*, *Time Certainty, Insuring Quality* and *Reduction of Administrative Burden to the Public Owner.* Selection of these criteria was based on the literature survey and test interviews made in the early phases of the research.

Each of the delivery methods has been described and demonstrated in line with these criteria in the subsequent sections.

2.2 The Traditional Approach - Design-Bid-Build (DBB) Method

2.2.1 Approach

The DBB system was developed during the Industrial Revolution period, which resulted in the creation of specialized professional movements of Architects, Contractors, and Engineers [24].

This approach has been the standard choice of project delivery systems for many years (*ibid*). In this model, an owner/client procures the services of a design consultant to develop the scope of the project and complete design documents, which are then considered as legal documents for use in selecting a contractor who builds according to the specifications developed by the design team.

That means, in the DBB project delivery method, the responsibility of a designer is to prepare complete construction document for the owner. The owner then receives bids from contractors based on the design documents and awards a construction contract to the lowest responsive, responsible bidder. The contractor builds the project, and upon completion, the owner assumes responsibility for the operations and maintenance of the project. The owner also provides all financing. Typically, in public organizations the proposal is in an open competition for a '*Lowest Responsive Price'* [3].

In the DBB method the owner contracts separately with a designer and a contractor. 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. A contractor is selected based on the bid price and enters into an agreement with the owner to construct the project in accordance 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*.

In the former case, the public owner first creates the project requirements, also known as *project program*. It is after this stage that the design team (design consultant) is selected on the basis of qualifications to design the project. The designer then creates one bid package from the design documents. Construction bids are received from general contractors and awarded to the *lowest, most responsive bidder*.

It is important to note that in this method the public owner contracts separately with the designer and the general contractor, and the general contractor holds contracts with subcontractors. Figure 1 demonstrates the DBB method using single prime bidding.

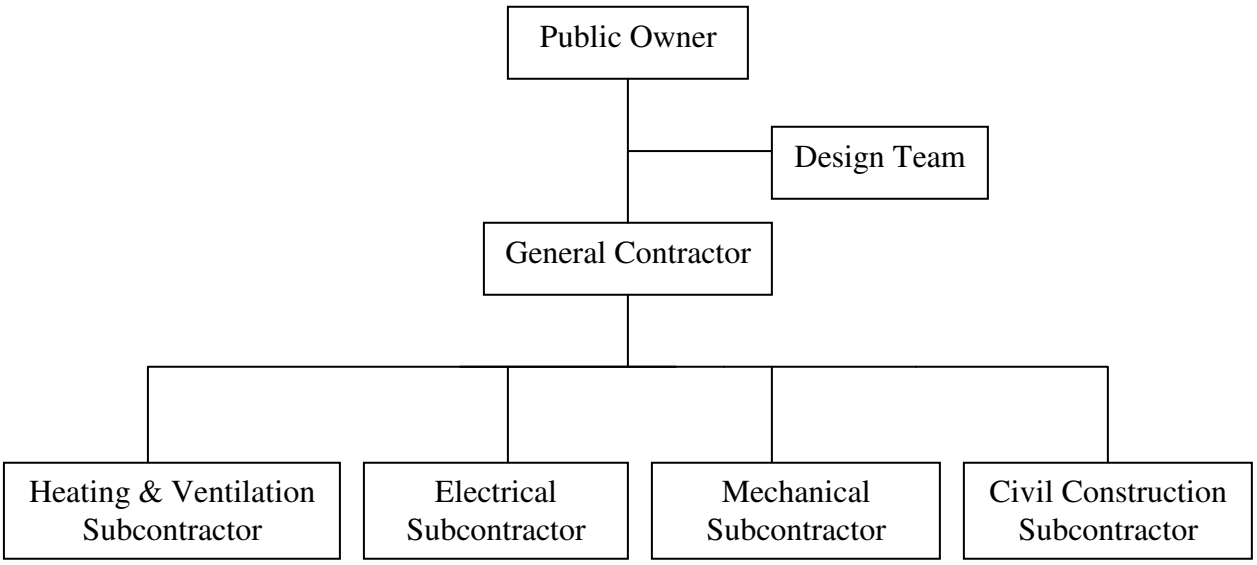


Figure 1. Contractual relationships in DBB using single prime bidding [28]

One comment on DBB using single prime bidding reads as follows:

"Employing single-prime bidding on less complex projects has ensured a single source of responsibility, and the method has been found to be worth the effort on most jobs" [28].

In the design-bid-build using separate (or multiple) bidding, the design team is first selected. Next, the design team creates bid packages for the required trades, for instance, heating and ventilation, electrical, mechanical, etc. Then bids are received from prospective prime contractors and awarded to the lowest, most responsible (responsive) prime bidders.

Periodic maintenance is commissioned separately or performed in-house. Figure 2 demonstrates the contractual relationships and the line of communication in the case of the DBB using separate or multiple prime bidding method [28]. The actual construction is executed by the respective prime contractors.

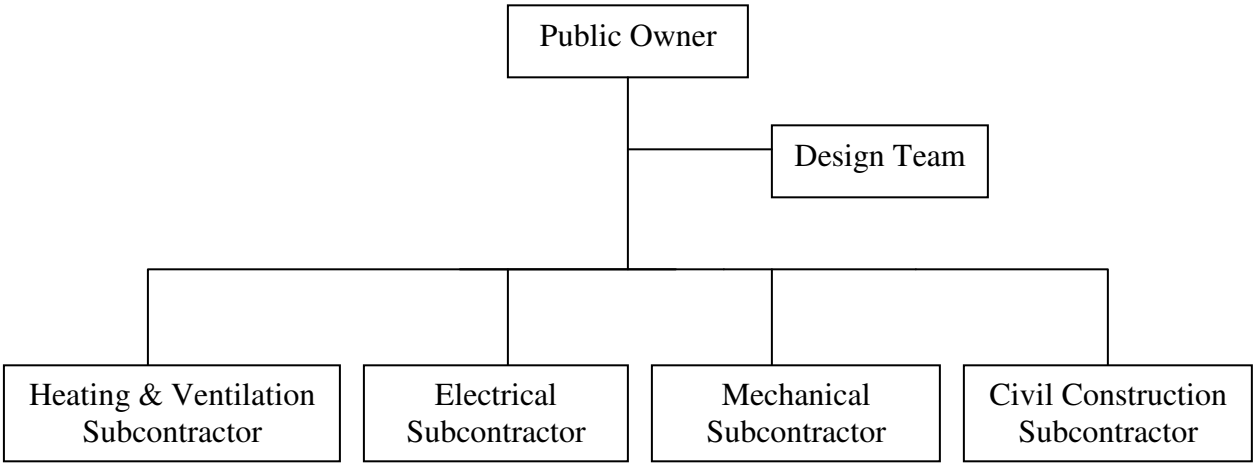


Figure 2. Contractual relationships in DBB using separate (or multiple) prime bidding

Literatures on the construction industry indicate that DBB is the most widely used project delivery method globally, and therefore, well understood. It was derived by the convention\belief that a public entity, having been furnished with a detailed set of previously purchased plans and specifications, can achieve the lowest cost for the public through open, competitive bidding and proper supervision.

In reality, as different writers justify, these goals are difficult to achieve on many projects. Often several parts of the project can not be constructed as designed due to obstacles encountered in the field or internal design inconsistencies, leading to delays in

the project and changes to the design for which the contractor is entitled to additional funds. Thus, the project designer's cost and schedule estimates prove to be inaccurate [6].

Additionally, some designers are not aware of the latest construction methods, and therefore, may not always provide the cost savings or benefits associated with the latest construction methods. Designers also have compelled to limit their inspection duties to periodic observation in design or construction. For these and other reasons, many government projects using the design-bid-build have gone significantly over budget, been significantly delayed, or have resulted in problematic facilities.

When the DBB method is used, a project evolves in a distinct stages and the owner coordinates and manages the entire process. Also, the method involves three role players in the project delivery process, namely, *the owner, the designer, and the builder,* in traditionally separate contracts. The phases of the works are conducted in linear sequence, one phase after the other.

Several literatures by those in the construction industry attest that for most of the 20th century, public works have been routinely built using the design-bid-build delivery method. This has included regulatory requirements such as competitive bidding, performance bonds, and employment of various other statutory requirements to protect taxpayers' investments.

The process minimizes the owner's obligations to fully address project objectives or definitions before proceeding, as this will occur during design development. The scope of work is defined by 100% complete set of construction documents. Risks are well defined and allocated by standard contracts [32].

Collections in recent studies on the DBB method, for instance, the study conducted by AIA-AGC, signify that the method is identified by the following defining (i.e. unique) characteristics [25]:

a) Three prime players, namely, owner, designer, and builder.

b) Two separate contracts, that is, the contract between the owner and the designer, and between the owner and the builder.
c) Final contractor selection is based on lowest responsive bidder.

Typical characteristics of the DBB approach include the following:

a) Three linear phases – design, bid, and build.
b) Well-established and broadly documented roles.
c) Carefully crafted legal and procedural guidelines.
d) A lowest responsible bidder that provides a reliable market price for the project.
e) Contract documents that are typically completed in a single package before construction begins, requiring construction-related decisions in advance of actual construction.
f) An opportunity for construction planning based on completed documents.
g) Complete specifications that produce clear quality standards.
h) Configurations and details of finished product agreed to by all parties before construction begins.

The DBB method also appears to be the most widely used project delivery method quantitatively, globally, except England which uses the *DB* and the *Design- Build-Finance-Operate* delivery method, sometimes referred to as *Public Private Partnerships (PPP)* [24]. The main alternative project delivery methods (alternative to the DBB method) are summarized and described in section 2.3.

2.2.2 Relationships

This refers to the contractual relationship (responsibility) between the different parties to a construction contract. Using the DBB method, construction is managed based on ready-made designs by a design team, leaving constructability issues to the client \ owner.

Design and potential deficiencies in it, delays and price effects, soil conditions, and weather risks also remain with the client. The designer acts merely as a consultant with no risks on design as long as his \ her conduct is professionally up to standard, with due respect for National or International Codes of Practices. During the tender process the contractor reviews risk issues to identify value opportunities (value engineering), in which a large number of risks can be excluded from the contractor's price.

2.2.3 Applications

Generally the DBB method is considered suitable for projects:

i. Which are small, single and less complex or highly constrained;
ii. When the owner wants to carefully settle upon a design before committing to funding construction;
iii. Where environmental, geotechnical, or regulatory issues leave no freedom for other options.
iv. Where it is appropriate to take advantage of existing design.

2.3 Innovative project delivery methods

Some of the main criticisms of the traditional (design-bid-build) method of project delivery are lack of innovation (introducing new items without additional cost and time), delayed completion periods, and cost overruns [18].

Since, in the DBB method, the client bears most of the risks of the design and the construction aspects, there need to be better practices to assure the client's requirements are met, including quicker project completion times, and cost effective solutions. Development in a project delivery system has provided different innovative delivery methods to cater for such demands.

The main goals of these innovative project delivery methods, thus, are to produce projects that have better quality, bring cost savings to the client, transfer risks, and complete projects faster than the traditional method (the time gap between design and construction is avoided or minimized).

Some facts that promote these innovative (i.e. alternative) delivery methods can be seen from a study conducted by Chuck Dahill, which has indicated that public owners in the USA are increasingly considering using alternative project delivery methods [11].

According to this study a majority (57%) of the interviewee said that they pursue alternative project delivery methods to reduce costs. More than a third (38%) also cited the need to shorten project schedules. Although only 5% of the public surveyed identified claim reduction as the primary reason to pursue alternative project delivery methods, a majority views these methods as effective tools to reduce the level of risk they assume on construction projects. Two-third (66%), more than for any other method, considers the DB to be effective in reducing project risks.

Some of these innovative project delivery methods include: *design-build, design-build-operate-transfer, construction management* as an agent and as a risk-taker (at-risk), and all these are explained in the following section.

However, literatures demonstrate that changing from one delivery method to another usually takes time, experience, and well-developed new approaches. The next section deals with three of the internationally recognized innovative construction projects delivery methods.

2.3.1 Design-Build (DB) Method

2.3.1.1 Approach

The design-build system was used in the olden days, for instance, during the construction of the pyramids [24]. But, the method is still considered to be one of the innovative methods in the construction industry. This is because the approach was not scientifically acknowledged by then (in the olden days), and its *Conditions of Contract* have not been realized until the 1970s.

Design-build (DB) method is a project delivery method in which the owner\client selects an organization that will complete both the design and the construction of a project under one agreement. Upon completion, the owner is responsible for operations and maintenance of the project. The owner is also responsible for all the financial aspects.

In a study conducted at Pennsylvania State, USA, sponsored by the Construction Industry Institute (CII), the design-build delivery system was identified as offering, on average, the best project performance [21]. Design Build Institute of America (DBIA) also indicates that compared to the design-bid-build and construction management-at-risk delivery methods, the trend for adopting the design-build approach is increasing since 1995, when only 5% of the projects were delivered via the design-build method.

In 2001, the number of design-build projects accounted for more than 30% of the construction in the United States. And, different market sectors are increasingly shifting to the design-build approach and, hence, in healthcare, design-build accounted for 15% of the medical institutions in 1997 and currently is accounting for 46%. By 2010, the US Department of Commerce projects that half of the non-residential construction projects will be delivered through the design-build approach (*ibid.*)

Choosing the DB method can have several advantages for public owners. First, the design-builder is a single source of responsibility and it generally results in the project

being designed and constructed in a shorter period of time. Because they are together by choice and form one team, the designer, the builder and the subcontractors will work well together.

Errors and omissions in the construction documents are the design-build team's responsibility and [that] risk is not passed on to the owner. The main model utilized and the different structural relationships between organizations are presented in figure 3.

But, two major tradeoffs need to be considered with the DB, i.e., (i) the owner's loss of control during design and (ii) lack of designers' representation of the owner's interest. The DB method also puts tremendous pressure on an owner to know and clearly define criteria and quality at the very start. Failure to do so can result in a disappointing outcome or can result in a facility inconsistent with the owner's needs or expectations.

While the DBB is still the delivery method most frequently used, many owners now favor methods that facilitate communication earlier in the process and greater collaboration between the parties. In response, architects, engineers, construction managers, contractors and specialty disciplines are forming more strategic alliances and offering cohesive teams.

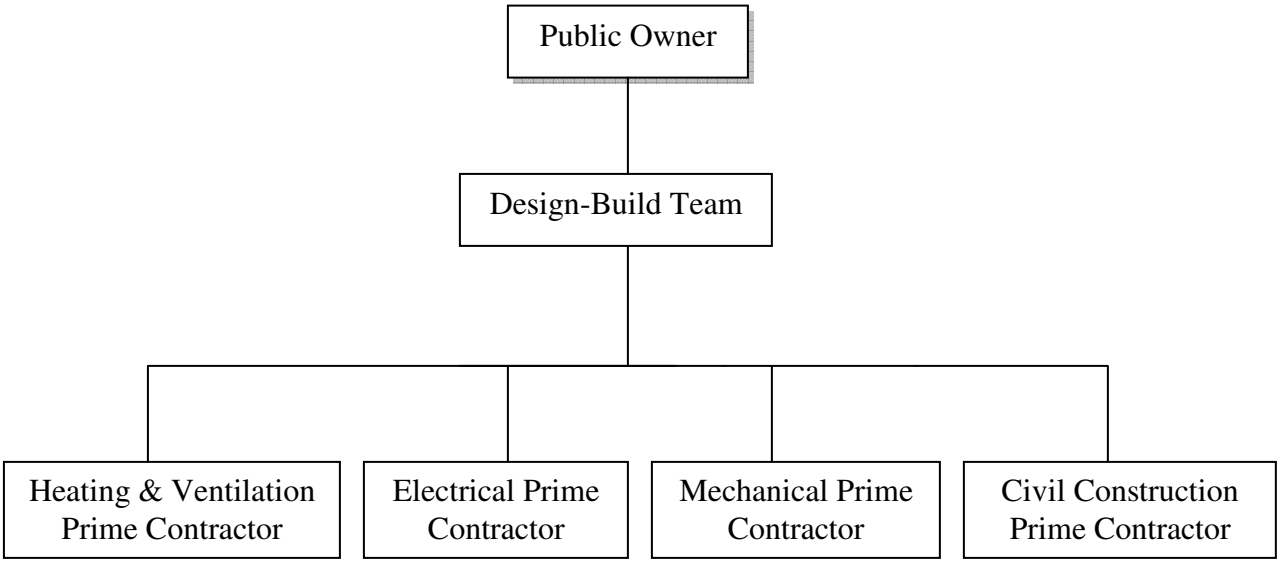


Figure 3. Contractual relationships and line of communication (DB method) [21, 28]

Although the DB delivery method has existed since medieval times, when 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.

Public owners are attempting to incorporate the DB method as a means to complete projects more quickly [9]. With the responsibility of design and constructions being under one contract, owners enjoy a sense of one-stop shopping.

According to Marwa, in Pennsylvania State, USA, the educational institution sector is providing more opportunities for the design-build delivery method. Government agencies are also shifting towards the use of design-build delivery system. This shift was promoted by changes in regulations on the state level that can facilitate the procurement of design-build teams [21].

As mentioned earlier, one main advantage of the design-build delivery method is the possibility for the owner to contract with a single entity. The design team is responsible for providing the owner with all aspects required to deliver the facility starting from design services to construction, including equipment selection. In this method, the risks associated with *design* and *construction* management and *control* are transferred to the design-build entity. Moreover, the owner relies on the design-build team for coordination, quality and cost control, in addition to, schedule monitoring. The design-build as a project delivery method emerged to satisfy the owners' recent requirements to complete projects faster and at lower costs.

Sanvido and Konchar conducted an empirical research study whose goal was to compare the different delivery systems that are widely used in the United States. Accordingly, construction management at risk, design-build, and design-bid-build were the three main delivery approaches compared in the research. The data collection phase was achieved using a survey that gathered data for 351 projects [21].

The scores reported through the results of the research indicated that projects delivered using the design-build approach performed better than those delivered through the construction management or the design-bid-build delivery systems. Specifically, the analysis revealed that the design-build (DB) projects (construction projects delivered under the DB method) experienced less cost and schedule growth.

2.3.1.2 Relationships

In general, risk should be allocated to the party, who can best manage them. Design-build method assigns a much greater risk to the contractor, who is responsible for design, construction risks, and often site risks.

The design-build firm that usually subcontracts to the contractor often assumes greater risks than in DBB. The designer's role in the DB method differs significantly from the designer's role in the DBB method, where the designer's main interest is to protect his own and the interest of the owner. In DB, the designer is a co-worker of the contractor and is expected to benefit the design-build team.

The special case of the design-build method of delivery is the *Turnkey System*. In this system, a single contractor acquires and sets up all necessary premises and equipment, and brings a project to a state of operational readiness. The contractor also *finances* the project and is generally paid upon completion of the project, instead of the usual practice where payment is made in accordance with the progress of construction [6].

2.3.1.3 Applications

Generally, DB is considered applicable in projects [25]:

a) Where early completion and utilization of the facility are of significant value.
b) Where construction objectives are well-defined, and well-understood.

c) Which are large and technologically complex, and offer the most opportunities for innovation. This maximizes the scope for a designer \ contractor team to benefit from matching design and method for the best possible results.
d) Where the required expertise is not available in-house.

2.3.2 Construction Management (CM) Method

2.3.2.1 Approach

Construction management is a broad term covering a variety of project delivery scenarios in which a construction manager (CMr) becomes an integral part of the team, at early stages in the project, to oversee such elements as schedule, cost, and construction methodologies and procurement strategies.

Construction management (CM) method of project delivery is based on an owner's agreement with a qualified firm to provide leadership and perform management for a defined scope of services. A construction manager works throughout the various phases of a project and cooperates with the owner and a designer in furthering the interests of the owner [16]. Design and construction can usually overlap; they (design & construction) are purchased in phases through separate contracts.

The general Construction Management variations are *Construction Management-at-Fee* (CM at-Fee) and *Construction Management-at-Risk* (CM-at-Risk), and are discussed below.

Construction management-at-fee is a delivery method similar to the DBB, the traditional model, in which the owner \ client is responsible for the design, bidding and construction of the project. However, the construction management organization takes on the responsibility for administration and management, construction issues, day-to-day activities and assumes an advisory role or role of an agent to the client (see the figure below).

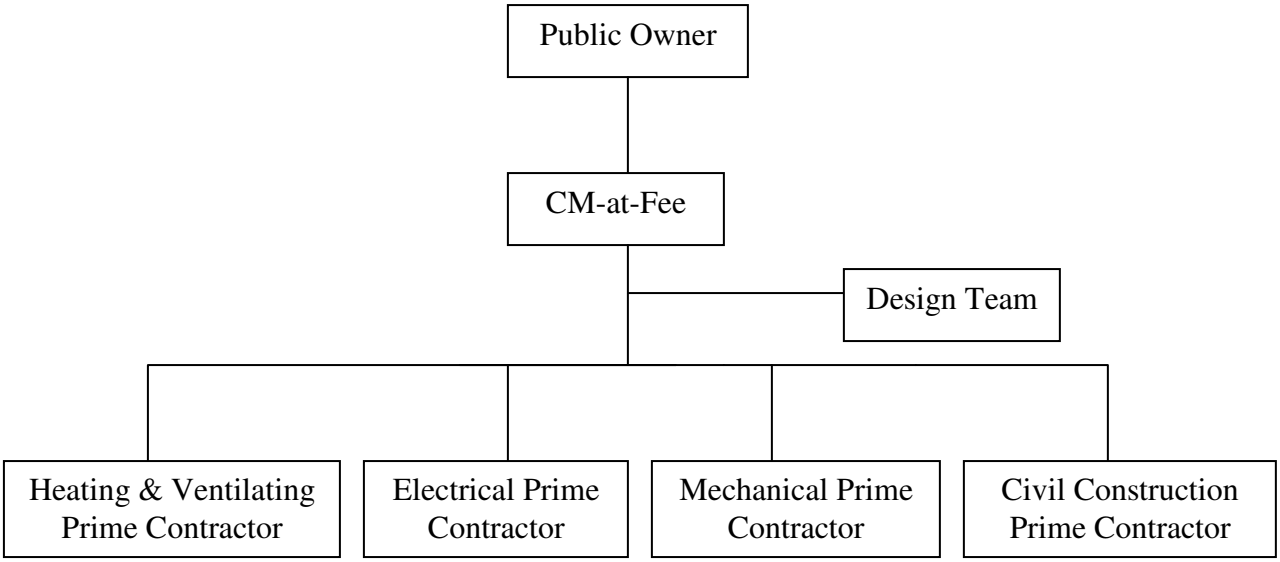


Figure 4. Construction Manager (CMr) as an Agent-CM-at-Fee [19, 28]

In this method, the construction manager is added to the team with powers of the owner. CM-as agent provides early consulting and may assemble and coordinate the consultants and the contractors. This method exempts the construction manager from taking any risks for the construction costs, allows the owner to step back from the project. The agent assumes financial authority for the project.

The consultants are selected, through the CMr, to design the project and prepare the construction documents. A general contractor is selected through a negotiated or bidding process and the cost of the work is established.

In this delivery system, the construction firm assumes the role of agent to the owner in a contractual relationship very similar to that of the architect and\or the engineer. The construction manager has limited risk because construction contracts are between the owner and individual contractors.

This delivery system is often referred to as "*CM for a fee*", "*Pure CM*" or by the American Institute of Architect as "*CM where the Construction Manager* is not a

Constructor [25]. With this delivery system, the owner assumes the risk for subcontractor's performance, financial stability, fluctuations in materials cost, etc.

In CM-at-fee method, the construction manager is responsible for project and site management, but is not involved in actual construction work. The construction manager monitors cost, time, quality and safety, but does not take responsibility for them. The construction manager is paid a fixed or time based for services provided (*ibid.).*

In CM-at-risk, the construction manager, apart from providing constructability inputs at the design stage, is also responsible for construction means and methods and delivery of the completed work, including quality and performance of the asset [32]. All procurement in the project is done by the construction manager, and the contracts are between the construction manager and the subcontractors. But, still, the client retains the final decision in project delivery (see figure below).

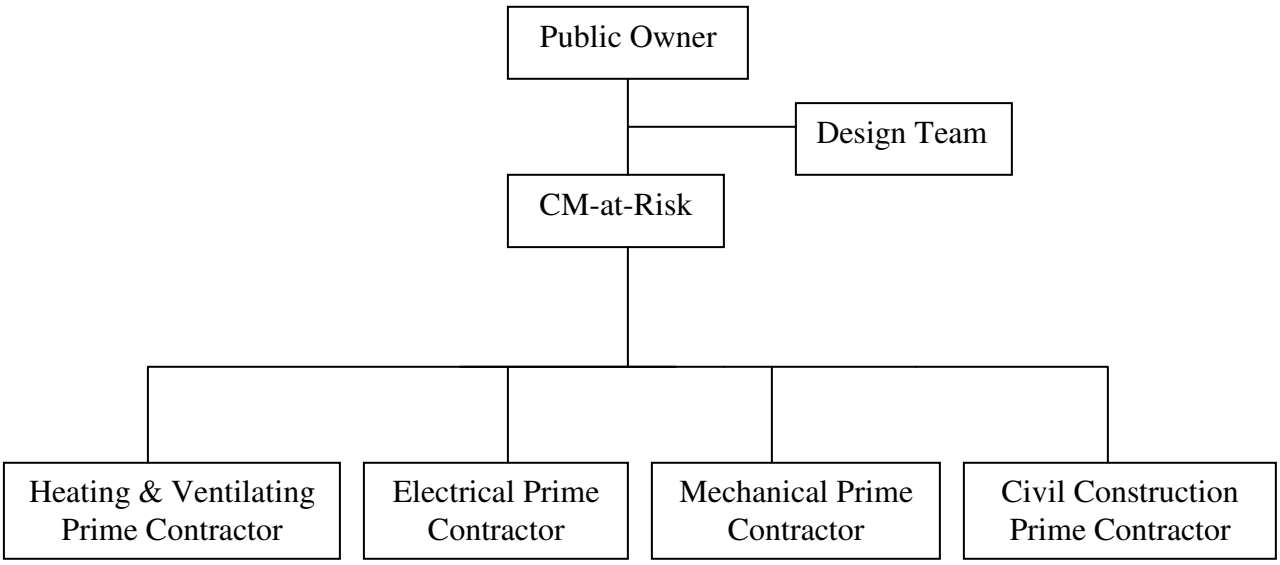


Figure 5. Construction Manager as a Constructor (CM-at-Risk) [28]

In this method, the public owner contracts with the designer and the construction manager-at-risk, and then the latter contracts with the prime contractors and subcontractors. This has been indicated in the figure above.

As with the design-bid-build, there are four phases of project delivery [3, 6, 30]:

a) Selection of a designer;
b) Design, and selection of a construction manager, and;
c) Construction of the project.

First the public owner develops the *project program* and then requests proposals from prospective designers. As with other methods, the public owner awards the contract on the basis of qualifications.

The designer then develops design documents. During this process the public owner requests proposals from prospective construction managers. The construction manager is selected on the basis of qualifications.

Once the construction manager is selected, the contract has two phases of execution. In the pre-construction phase the construction manager works with the public owner and the designers until the design documents are 80% complete. The construction manager may begin construction, even though the design documents are not complete. Contracts are awarded to the lowest, most responsible bidder, and construction takes place.

Construction management-at-risk approach involves a construction manager who takes on the risk of building the project. The construction manager oversees project management and construction technology issues, in which a construction manager typically has particular background and expertise.

Such management services may include advice on the time and cost consequences of design and construction decisions, scheduling, cost control, coordination of construction contracts negotiations and awards, timely purchasing of critical materials and long-lead items, and coordination of construction activities. The construction manager-at-risk contracts with trade contractors who perform the construction. These entities are

contractually bound only to the construction manager-at-risk. It should be noted that there is no contractual relationship between the *designer* and the *construction manager-at-risk.*

The following defining (unique) characteristics identify the construction management-at-risk method [25]:

a) Three prime players – owner, designer, construction manager at risk.
b) Two separate contracts – owner to designer, owner to the construction manager-at-risk.

And, typical characteristics of the construction manager-at-risk approach includes the following:

a) Overlapping phases – design and build (fast-tracking).
b) Hiring of the CM during the design phase.
c) Pre-construction services, such as constructability reviews, bid-climate development and bid management, are offered by the construction manager-at-risk.
d) Specific contractual arrangement determines the role of the players.
e) Clear quality standards produced by the contract prescription specifications.

2.3.2.2 Relationships

The CM-at-Fee organization has no contractual obligation to the design and construction entities. Again, the owner is responsible for operations and maintenance of the project as well as the financing aspects.
The owner contracts with the construction manager, who then directly engages the services of a prime consultant and a construction contractor, on behalf of the owner.

In the Construction Management-at-risk delivery method also, the CMr is hired prior to completion of the design to act as project coordinator and general contractor, assuming

all the liability and responsibility of a general contractor. The owner selects the consultants to design the project and to prepare the construction documents.

2.3.2.3 Applications

Construction management method of project delivery is considered applicable in the following situations:

a) If flexibility with regard to schedule and changes is required.
b) If fiduciary relationship with the contractor before and during construction is required.
c) Competition for the work is to be ensured.
d) Early completion of the work is necessitated.

One comment on the application of the CM-at-Risk methods reads as follows [28]:

"We have used the CM-at-Risk with great success. We built our new Justice Center under this method, and we just awarded bids for several large water department projects under a CM-at-Risk contract. In both instances the bids came in under projection. The Justice Center Came in on time and on budget-unheard of in government construction projects-and we saved over half a million dollars on the water department bids. So the finance officer and I are big funs of this project delivery method".

Norma Mills, Attorney, Dare County, North Carolina

In the end, it needs to be noted that the Construction Management (CM) delivery method has also other newly emerged variations. For instance, there are personalities who advocate the concept that a single company may be responsible for the design, construction, and also for rendering construction management services.

In such a case the owner concludes only one contract with one firm called Program Management Firm only. This approach is sometimes called Full Delivery Method.

This approach is supposed to avoid or minimize the fragmentation between services and works and to enhance the concept of integrated approach. However, this part has not been dealt with in the present study as adequate reading materials have not been found.

2.3.3 Design-Build-Operate-Transfer (BOT) Method

In this project delivery method, a private company is responsible for the designs, construction, operation, maintenance, and financing of the project for a specified concession period [24]. The contractor assumes the risks of financing until the end of the concession period.

During this concession period, the company collects revenues from operating the project to recover its investment and to earn a profit. At the end of the concession period, ownership of the project is transferred to the client/owner.

2.4 Choice of Project Delivery Methods: Some Considerations

In the delivery of capital projects considerations should be given to some fundamental elements and the type of environment that exists when infrastructure projects are to be secured. An example for consideration is given below. These fundamental elements are needed for a healthy procurement of infrastructure projects, and are listed in the following manner.

Fundamental Elements for Public Infrastructure Procurement

i. Client-defined scope;
ii. Head-to-head competition among competitors;
iii. Fair treatment of actual competitors;

iv. Transparency-signaling fair treatment to potential competitors;
v. Safety confirmed – An independent engineering check on the efficacy of the design;
vi. Competitors open to technological changes;
vii. Sound financial analysis by the client and producers over the project life cycle;
viii. Client decision-making at the portfolio level with the assistance of scenarios;

Choice of project delivery methods can also be pictured in a different context, which displays the project delivery methods viewed by means of *two criteria.* This is based on whether the project delivery methods are *segmented* or *integrated*, and whether *direct* or *indirect* funding by the public owner is required.

If the goal is to seek an integrated process in delivering a proposed project, then the client would consider the design-build-operate-transfer, referred to as BOT, the design-bid, referred to as DB, and the construction management-at-risk, referred to as CM-at-Risk methods of project delivery.

If the goal is to seek traditional or segmented delivery methods, then the client would consider the following delivery methods.

- Design-Bid-Build (DBB)
- Construction Management (CM) at fee.

If the goal is to seek external financing due to limited government allocations, then the client would consider the design-build-operate-transfer, commonly known as BOT method.

And if the intention is to seek direct project funding, the owner may consider the following options:

- Design-Bid-Build (DBB)
- D-B (Design-Build)
- Construction Management (CM) at fee and at risk.

The following two tables represents project delivery methods viewed based on approach (integrated or segmented)-table 1, and source of funding (direct or indirect)-table 2.

Table 1. Choice of project delivery methods based on approach and funding source [24]

Segmented Approach	Integrated Approach
a) Design-Bid-Build b) Construction Management (CM-at-Risk)	a) Design-Build (DB) b) Construction Management (CM-at-Risk c) Design-Build-Operate-Transfer (BOT)

Table 2. Project Delivery Methods based on Source of Finance [24]

Direct Funding	Indirect Funding
a) DBB b) DB c) CM	a) BOT

It is worth mentioning that the above division is based on the normal procedure or the usual practice. In cases where a contractor is financially sound and also willing to do so, those listed under the direct funding can be executed by indirect financing from the contractor.

2.5 Comparison of the Different Project Delivery Methods

Table 3 (below) lists some of the advantages and disadvantages of each delivery system. This list should not be considered as an exhaustive one, but merely a summary and a highlight

Table 3. Advantages and Disadvantages of Different Project Delivery Methods

Delivery Method	Advantages	Disadvantages
DBB	• Long history of acceptance • Owner flexibility • Open competition • Distinct roles • Ensures work for contractors of all size • Low tender cost • Allows the lowest contract price • Client control over project delivery method • Pre-qualification encourages better performance • Provides complete documentation allowing bill of quantity before construction • Industry capability available	• Self-serving adversarial relations • Usually cost overruns • Lack of innovation • Low bid - incentive for change orders • Owner responsibility for errors and omissions • Linear process (takes too much time) • Design suffers from lack of input from contractors • Does not encourage technological improvement or integration of systems • Lack of cost certainty • Multiple change orders • Does not promote privatization
DB	• Best-value selection • Better buildability through contractor contribution • Risk transfer	• Limited experiences with DB • Less work possibility for small and medium sized contractors • Limited competition in large projects

	• Innovation encouraged • Develops industry via cooperation • Better relationships • Encourages integration of systems • Shorten delivery process • Few change orders • Lowered administrative burden to owner	• Client experience may be lost or diminished • Reduced flexibility • High tendering cost due to designing requirements • Lack of aesthetic consideration • Inadequate contractor quality control and assurance
CM-at-Fee	• Managing and administering all phases of a project. • Treats Planning, Construction and Design, as an Integral Task. • Cost and Schedule Control • Constructability input at design stage	• No contractual relationships with trade contractors • No contractual responsibility for outcomes of a project • Client retains the risks • Additional cost for the Construction Manager
CM-at-Risk	• Good for clients with insufficient staff • Owner flexibility • Responsible for cost and time overruns • Holds and manages trade contractors • Constructability design review • Legal position as a General Contractor • Provides a GMP*	• Lack of capable construction managers • Demanding work organization • Lack of cost certainty for each work packages • Lack of contractors who can provide both construction management and construction services • The GMP may be high

	• Works closely as a teaming effort and encouraging trust and partnering • Phased construction (fast tracking) possible	• Fragmentation, as compared to DB& BOT • No exactly defined work packages (bill quantities)
BOT	• Completes projects when internal funding is not possible • Integrates the process of design, construct ion, operation, and maintenance. • Projects completed faster • Ownership transferred to the contractor	• Cost more in the long run • Longer tendering process • Costly tendering • Future political change may disrupt prior agreement • No capable local contractors • Contractors not interested in all works

GMP: Guaranteed Maximum Price

: is the amount stipulated in a construction contract as the maximum sum payable by the public owner to the Construction Manager-at-Risk for the works specified.

3. RESEARCH METHODOLGY

3.1 Research Design

The strategy followed in this research was, first, to formulate the research design. Then data and information sources were determined based on the formulated research design. On the basis of the data and information sources the research instruments were decided. Then the required data were collected and analyzed. Finally, available documentary sources were reviewed for cross-checking the validity and conformity of the information obtained through the overall research work.

A descriptive and exploratory survey design was used in this study. It was attempted to collect data from the relevant population (public agencies, consulting firms, contractors, and experts) to determine the status of the construction industry based on one variable. The variable in this study is the type of project delivery method used in the study area.

This survey-based research design has been selected as it is useful in demonstrating the prevalence of the problem through out the population [5, 10, 20]. Once the distribution of the problem has been determined it may be possible to get hints on how to prevent the problem. It also helps identify differences among groups and changes over time.

3.1.1 Data and Information Sources

The samples were drawn from public agencies in Oromia, Contractors, Consulting Offices, and relevant Professionals. The relevant public agencies (or public owners) in Oromia for the current study consisted of three sectors: namely Oromia Water Resources Bureau (OWRB), Oromia Rural Roads Authority (ORRA), and Oromia Works and Urban Development Bureau (OWUD). Purposive sampling was used to select these sectors as development of these sectors is directly linked to the development of the welfare of the general society. Moreover, these sectors utilize the lion's share of the annual regional budget. The respondents in the study were both men and women, who are

experts or occupying managerial positions in their offices. Both the relevant experts and the chief officers were purposely selected.

3.1.2 Research Instruments

Three research instruments were used for the collection of relevant information. One of the instruments was to solicit the relevant data through questionnaires. Tailored interviews were also used to seek information from those in higher echelons in their respective offices, as a second instrument. The third instrument employed was document analysis. This document analysis was used to gather information with regard to the different construction project delivery methods, their drawbacks and strengths. These instruments were also piloted on public offices, contractors, consultants and relevant experts.

3.1.3 Data Collection and Analysis

This study employed primary and secondary data. Both data were obtained from the already mentioned public agencies, private sectors, and individuals

The primary data were collected through questionnaires and interviews of main infrastructure sector (i.e. road, building, and water works) actors in the selected study area. The interviews were supposed to have extensive experience on project delivery of alternative forms in order to be able to assess the acquaintance with and performance level in each case. The information gathered through both interviews and questionnaires was supplemented and verified by explanations based on literature review.

A number of publications, newsletters and working papers from the above regional offices were also used as secondary data sources.

The study area was selected based on the preliminary study on the existing problems, that are, problems related to time and cost overruns and owners dissatisfaction with the

quality of the completed construction projects, and knowledge of the area (i.e. the region), which somehow helped me get easy access to available information.

The data was analyzed using both quantitative and qualitative approaches. Some statistics like the percentage of respondents has also been used to show the extent of the response.

The analysis of the overall thesis work is based on the concept of measurement of project success. According to Baccarini, project success consists of two separate components, namely *project management success* and *project product success* [4]. He distinguishes between them as follows:

Project management success focuses on the project management process and in particular on the successful accomplishment of the project with regards to cost, time, and quality, whereas, *project product success* focuses on the effect of the projects end-products.

Thus, following Baccarini, in simplistic terms project success can be summarized as:

Project Success = Project Management Success + Project Product Success

In this thesis work, this concept is employed in setting criteria to appraise alternative project delivery methods. Besides, those selection criteria set by Baccarini, reduction of administrative burden to the public owner is used as an additional criterion.

Hence, the present thesis work employs the following selection criteria:

a) Project time certainty
b) Certainty of project cost
c) Ensuring a quality project, and
d) Reduction of administrative burden to the public owner

Apparently, these criteria were selected based on literature survey and test interviews made in the early phases of the research. The criteria are ranked based on the priorities set by the client organizations in the study area. Then the alternative chosen is the one that ranks highest with reference to experiences and studies conducted in the developed world (USA, UK, and Finland). These experiences and information have been gathered through reviewing different literatures.

Generally, the thesis comprised of the following stages (stages 1 to 10):

1) Preliminary activities were aimed at identifying the main project delivery method, infrastructure sectors of interest, and study area;
2) Identification of the principal sources of information, outlining the main headings of the problem, and formulation of the problems;
3) Development of the research methodology, both research strategy and data collection;
4) Design of appropriate research instruments (interviews, questionnaires, etc.);
5) Global and country or state-specific literature reviews (if any), including, government guidance, available case studies, academic publications, etc;
6) Summarizing data gathered through interviews, questionnaires and literature reviews;
7) Analysis of current project delivery performance based on all materials gathered. Applicability of the project delivery methods in different circumstances was also assessed;
8) Means of improvement available for different project delivery methods were also identified and studied;
9) Critical review of the research and its findings, as well as related recommendations;
10) Report on the completed research work, consisting of data gathering, analysis, associated recommendations, etc.

3.2 Limitations of the Research Methodology

This thesis work attempts to assess the current project delivery method(s), and to examine alternative approaches that could improve the overall productivity of the construction industry in Ethiopia's Oromia region. Every attempt has been made to seek information from relevant stakeholders, and to review different standard literatures.

However, the thesis work is limited by several factors. Due to shortage of time and budget allocated for the research work, it has not been possible to visit actual sites of the projects used for the study. Had this been conducted it would have been possible to include the pictures of the projects to support the overall thesis work.

It is also worth mentioning that in the absence of the problems cited above, it could be possible to assess many sample projects so that the entire analysis of the study would be more informative, exhaustive, and reliable. Hence, some of the findings of the study are based on fourteen sample projects.

The other important limitation is that due to their tight schedules, it has not been easy to conduct interviews and to have questionnaires filled by most of the managing directors of consulting firms and that of construction contractors.

4. PRESENT SITUATIONS, PROBLEMS AND MODIFICATIONS IN DELIVERY METHODS IN OROMIA: A CONTRXTUAL ANLYSIS

4.1 General Overview

In Oromia region, it has been noted that in some of the public infrastructure sectors both the design and construction undertakings are managed in-house (i.e., by force account). And at times these issues are handled by partnering between the public agencies at zonal (province) and *aanaa* (sub-province) levels. These are common especially in small-scale construction projects.

The other option available is that design and tendering will be the responsibility of those at the bureau level (upon request by those below) and the construction of the project will be the joint responsibility of those at the zonal and *aanaa* levels.

Outsourcing of construction projects is also commonly undertaken in the region especially for the implementation of large-scale infrastructure development projects. It is to be noted, in this regard, that several state-owned enterprises have emerged, which can provide design and\or construction services. Construction of any kind in the region, however, is not awarded to them directly and they are, hence, forced to compete for all projects in an open, competitive environment.

And, sometimes, they will have to compete with the private sectors. Full and open competition is expected and everything must be competed in an open market in accordance with the rules and legal requirements of the traditional method of project delivery [26, 27].

Globally, the construction industry is searching for the most effective project delivery method to maximize project performances [19]. There is the traditional project delivery

strategy, the DBB method, on one hand and the alternative (innovative) project delivery methods on the other hand, as dealt with in the preceding sections. It is true that there is tremendous global advance in the construction sector. The actual situation in Ethiopia in general and that in Oromia in particular has, however, shown little shift from the traditional approach. There are several issues and so-called problems associated with the traditional approach, as indicated by those people interviewed. These problems need to be addressed in order to meet public owners' needs (see section 4.2.1).

It is to be underlined that some of these issues have either not been noted or no attempt has been made to treat them by concerned professionals in the study area. There should have been intent to develop this industry so that it can be more productive and become a modern profession and a worthy industry in the future. One of the goals of this study, thus, is to help develop the industry and create opportunities for innovation and advancement.

The main purpose of this chapter is, thus, to contextually analyze three public infrastructures development sectors in Oromia. These three sectors include: *water resources development sector, rural roads development sector and building infrastructure sector.* The selection of these sectors depended on two reasons: (1) these sectors are directly linked with the day-to-day life of the community and, hence, need advancement, and (2) large percentage of the public fund is appropriated (apportioned) for these three sectors, and, hence, needs efficient utilization. The contextual analysis is given below.

4.2 Oromia Water Resources Bureau (OWRB)

4.2.1 The Existing Project Delivery Method

OWRB has been shouldering the responsibility of water sector development in the region since its establishment. This bureau has been contracting out both design and construction of water works projects.

It has been observed that water development projects in Oromia are typically designed first; competitive bids are obtained, and then constructed by a general contractor and its subcontractors that are contractually separate from the design process.

The theory behind this approach is that facilities will be constructed at the lowest cost, primarily by encouraging open competition among contractors that bid lump sums or unit rate to construct a fully designed project.

So, it can be said that the water projects delivery method in Oromia which has been in use is the traditionally focused DBB method. The tendering aspect typically uses a weighted average for floating design contracts (70-75% for technical requirements and 25-30% for financial proposal). That means public agencies rely on designers to provide complete designs, reasonable cost and schedule estimates and an independent objective inspection of the project during construction.

Water development offices at the zonal and\or *aanaa* level have been engaged with small-scale water development projects, such as hand-dug wells and spring development projects that could serve relatively small part of the general community. For large and relatively sophisticated projects, for instance, for Asalla and Badalle Water Supply Projects (for more information see table 1), capable consultants were invited to take care of the design together with a complete contract documents. It used to be the practice that the same design firm takes care of the construction supervision. The requirement followed to award construction contracts is to choose the least responsive bidder (or the lowest responsive bidder, as the SBD puts it), among the prospective contractors.

4.2.2 Existing Problems

It has been mentioned that water projects delivery method in the Oromia region is the traditional DBB. All of the innovative methods have not been known. There are also respondents who think that they apply the traditional method because it is the customarily used method for pubic projects. Some also mention that they use it because the DBB method is the only legally approved method.

The problems associated with the traditional approach of delivering projects as pointed out by concerned regional offices are:

i. Scope of the project is changed very often due to lack of timely sufficient fund with the public agencies;
ii. No real competition during contractors selection since contract awards are based on price;
iii. Procurement procedures are slow and bureaucratic;
iv. Excessive time overruns;
v. Actual cost are usually over the estimated costs
vi. Quality is compromised;
vii. In the case of disputes, legal procedures are slow and archaic

One can infer from the above list that all the problems mentioned are directly or otherwise related to the *management* aspect of construction projects.

It has been confirmed that there is direct relationship between the delivery method used and the problems of time and cost overruns in each particular project. Studies show that a project team experienced with the building process will address these risks during project development [14]. The risks are approached differently, depending on whether the team is in the pre-construction or construction phase of the project.

Some sample projects are presented, as given in Table 4, to assess the status of water projects contract accomplishment in the region. The table has been used to show the associated time and cost overruns, as per the sample projects.

Sample data have been collected to show the significance of these problems. The percentage of time and cost overruns are presented in Table 5.

Table 4. Sample water works projects (source: OWRB)

No	Project name	Initial cost (EB)	Final cost (EB)	Initial time	Final time
1	Asalla Water Supply	62, 000,000.00	65,000,000.00	2.00 years	3.30 years
2	Badalle Water Supply	40,000,000.00	39,019,500.00	2.00 years	3.00 years
3	Gore Water Supply	7,265,901.00	11,823,825.00	1.71 years	4.40 years
4	Hidhibu-Abote Water S	6,459,050.00	6,840,013.00	1.20 years	2.10 years
5	Matahara Water Supply	10,355,521.00	10,899,139.00	1.97 years	3.22 years

Initial cost: the cost initially estimated at the time of bid award (Contract Amount).
Final cost: cost actually incurred at the time of project completion (Actual Project Cost).
Initial time: estimated project duration at the time of bid award (Contract Duration).
Final time: time elapsed at the time of project completion (Actual Project Duration).
EB: Ethiopian Birr.

Table 5. Percentage of *Cost* and *Time* overruns in each project.

No.	Project name (WS)	Cost difference (EB)	%	Time difference (yrs)	%
1	Asalla Water Supply	3,000,000.00	4.84	1.30	65
2	Badalle Water Sup.	-980,500.00*	-2.45	1.00	50
3	Gore Water Supply	4,557,924.00	62.73	2.69	157
4	Hidhibu-Abote WS	380,963.00	5.90	0.90	75
5	Matahara Water Sup.	543,618.00	5.25	1.25	63
	Mean	-	**5.33**	-	**82**

* The actual project cost is below the initially estimated cost.

From the above tables it can be seen that, on average, there is about 5.33% cost increment beyond the initially estimated cost and about 82% time overrun. There are also cases in

which the cost actually incurred is slightly below the originally estimated cost, but the time overrun is 50% (project 2).

4.2.3 Modifications in the Existing Delivery Method

Considering the problems associated with the traditional method of delivering public projects, now-a-days, this approach is slightly modified. Hence, once the design of such projects have been completed by the first consultancy firm another and independent consultancy firm comes-in to take care of the *design review* and *construction supervision.*

The logic behind this approach is that the new consultancy firm will identify the design deficiencies of the former firm so that problems are identified and corrected before the start of construction. It is, however, important to note that it is after such lengthy procedures that the construction of the project commences.

4.3 Oromia Rural Roads Authority (ORRA)

4.3.1 Existing Project Delivery Method

As its name implies, this state-owned authority is concerned with the development of road infrastructures in Oromia. Roads design contracts are awarded to capable consultants first and then construction contracts are awarded separately to a contractually independent general contractor – the DBB method. Construction supervisions were used to be the role of the design team some years back.

4.3.2 Existing Problems

The main problem associated with the former approach, as mentioned by the contract administration division head in the authority, was that the design team used to disregard some details of the design works considering that it would revise, correct and include them

during supervision of the actual construction works. This revision of design works entitles the contractor to additional funds, while it is an additional cost to the client organization.

The problems are summarized as follows:

a) Cost and time overruns;
b) Lack of innovation;
c) Lack of latest design requirements,
d) Absence of latest construction technologies,
e) Lack of integration,
f) Final design fails to reflect the interests of the owner

These problems, too, are *project management* problems. Some sample road projects are given as follows in Table 6 in support of the existing management problems. The data in the Table are meant to support the time and cost overruns mentioned earlier.

Table 6. Selected sample rural roads projects (source: ORRA, Contract Administration Division)

No.	Project name (Road project)	Initial cost (EB)	Contract amt (EB)	Final cost (EB)	Initial time (Days)	Final time (Days)
1	Shakiso-Soda	34 million	36 million	37.2 million	885	1657
2	Ejere-Gundo-Maskal	42 million	28 million	30 million	920	1600
3	Asgori-Batu	18 million	17 million	25 million	810	720
4	Ayana-Hinde-Kello	16 million	17 million	17.8 million	885	1200
5	Jama Bridge	18 million	14.2 million	12 million	720	980

The additional costs (or budget overruns) incurred and the time extensions are presented in the following table (Table 7).

Table 7. Cost and time overruns in selected sample road projects

No.	Cost difference (ETB)	Cost overrun (%)	Time difference (days)	Time overrun (%)
1	1.2 million	3.33	772	87.23
2	2.0 million	7.14	680	74.00
3	8.0 million	47.10	-90*	-11.11
4	0.8 million	4.7	315	35.6
5	-2.2 million	-15.5**	260	36.11
	Mean	**16**	**-**	**58**

* The project was completed in lesser time than the time initially estimated.

** The actual cost incurred was lesser than that initially estimated.

From Table 7, it can be seen that the average cost overrun amounts to 16 % of the initial cost and the average time extension was 58% of the initial project time.

4.3.3 Modifications in the Existing Delivery Method

The current practice is to assign design services to a design consultant and construction supervision role to a new and an independent construction consultancy firm. It needs to be noted that the second approach itself has an inherent problem associated with it. Real practices in the field testify that when actual design and construction supervision are managed by separate and independent firms, the supervisory team may identify several design deficiencies (or design errors) in which case the design team has to be re-approached for consultation.

The design team most of the time are to become very reluctant to be cooperative when re-approached for consultation, though there are some design firms that are easily approachable and are cooperative.

It is worth noting that the general contract that is being used by the authority is the standard form of agreement that includes the general descriptive criteria, conditions, schedules,

standard specifications, quality criteria, warranty considerations, and other miscellaneous criteria.

Hence, the bidding process for the award of design contract is based on the criteria assigned by the management staff of the authority, i.e., 70% for technical requirements and 30% for financial requirements.

These selection criteria are in conformity with the standard practice of design-bid-award, for instance, that followed by the World Bank, which sets a maximum of 90% and minimum of 70% for technical requirements, and a maximum of 30% and a minimum of 10% for price quoted by a consultant [15]. From these ranges given by the Bank, one can conclude that the average standard criterion is 80% for technical evaluation and 20% for financial capability.

Once the design of the road project is complete with the satisfaction of the authority, the next step is to go for the bidding process for the actual construction. The usual practice is that the authority awards construction contracts to the construction firm that offered the least responsible price (i.e., the lowest responsive bidder).

4.4 Oromia Works and Urban Development Bureau (OWUDB)

4.4.1 The Existing Project Delivery Method

The development of this sector is the responsibility of the Oromia Works and Urban Development Bureau (OWUDB). Under this bureau, Oromia construction and design authority (OCDA) was established to be directly concerned with building projects.

The usual trend has been, for relatively big building projects, a competitive bid is announced to attract eligible design consultants that complete design of the works. Once this is accomplished, the Oromia construction and design authority (OCDA) was assuming the responsibility of design revision (or at times minor design comments) before the works are

awarded to construction contractors, contractually independent from the design firm - the DBB method.

It can be said that the former OCDA was both designing building works and supervising their construction in the region. It was also rendering professional consultancy services on works designed and constructed by other design consultants.

The OCDA used to have two teams, namely, the Design Team and the Contract Administration and Construction Supervision Team. Both teams still exist in the new branch, with different responsibilities, of course.

There were also occasions when the mentioned authority designed the works, for small building projects, and construction became the responsibility of an independent general contractor.

The major building projects in the region are construction of educational centers (i.e., schools), public health posts, agricultural development training centers, agricultural research centers, and etc. The designs of these projects were carried out either by a consultant or the OCDA itself.

Once the design team of OCDA executed the design or the design review aspect of the project, as the case may be, the contract administration and construction supervision team used to handle the bidding process and the actual construction inspection. This was the usual practice in the region. Some selected building projects are presented for demonstration as in the following table.

4.4.2 Existing Problems

The existing problems are similar with the ones listed above, and the pressing ones are summarized as follows:

a) Excessive time overrun
b) Excessive budget overrun
c) Adversarial relations between the design and construction team
d) Low quality products
e) Too much change orders

Selected sample building projects are present to support the existing project management problems (time and cost overruns) as in the following table.

Table 8. Some selected sample building projects (Source: OWUDB-Construction Design Branch)

No.	Project name	Initial cost (EB)	Final cost (EB)	Initial time (days)	Final time (days)
1	Mattu Teachers' Training Institute	12,368,826.00	15,910,380.00	420	1365
2	Ambo Vocation. Training and & Technical Center	11,416,060.62	12,240,919.50	986	1241
3	Oromia PSC* Expansion	2,172,434.15	1,199,153.14	284	525
4	Feche Secondary School	7,768,561.00	7,981,665.00	550	660

* Public Service College

Table 9. Cost and time overruns (selected building projects)

No.	Project name	Cost overrun (EB)	%	Time overrun (days)	%
1	Mattu TTI	3,541,554.00	29	945	225
2	Ambo TTC	824,859.00	7	255	26
3	Oromia Public Service College	973281.01	**	241	85
4	Fiche Secondary School	213,104.00	3	110	20
	Mean	**-**	**13**	**-**	**89**

** Final cost is less than the estimated cost (see table 5)

The above Table signifies that the budget and time overruns range from 3 to 29% of the initial costs (average 13%) and from 20 to 225% (mean 89%) of the initially estimated time respectively. One can imagine how appalling it is to see a time extension of 225% of the original time. The cost overrun itself is high though not as high as the time extension.

The above tables indicate that public-works construction projects have not been running as per the durations and the budgets estimated before the commencement of the actual construction in Oromia. Consideration given to the time and cost analysis of the above fourteen projects indicates that the, overall, time extension ranges from 35.6 to 225 % of the initial time schedule. The corresponding cost increment ranges from 3 to 63% (mean 62.73%) of the initial costs.

4.4.3 Modifications in the Existing Delivery Method

Currently there seems change of responsibility in the OWUDB. There is branch for Construction of Works, formerly known as the Oromia Construction and Design Authority (OCDA). The current and major responsibility of the branch is to act as a *regulatory body* for building works.

It appears that this branch for construction of works is not directly engaged in designing building projects. It only regulates and issues standards, and inspects the construction of building projects.

It is apparent that, once, the public construction projects delivery in Oromia region have been analyzed contextually, and the existing problems identified, attempts have been made to address the causes of the problems.

Thus, the primary causes of these problems have been addressed. Accordingly, different stakeholders were interview and \ or asked to respond to questionnaires. Results were obtained from these interviews, questionnaires and discussions. The next chapter deals with these results.

5. RESULTS AND DISCUSSIONS

5.1 General Overview

The study sets out to determine the existing project delivery methods in Oromia. It attempts to identify the problems of the current practices and mechanisms the agencies developed to cope up with these problems. The present study also determines the priority that the respondents give for the variables set out in the literature review (cost, time, administrative burden to the owner, and quality) to select a project delivery method.

The research project, finally, suggests the possible strategies that can be used to enhance the productivity of the construction industry in the study area based on the survey results.

Data was collected from Public Owners (Public Agencies), Contractors, Consultants, and reputed Professionals. The respondents comprised of a total of 65 professionals: 8 from public owners, 17 from contractors, 20 from consulting offices, and another 20 from reputed professionals as given in Table 10.

The numbers were decided on the basis of the time available for conducting the research work, available fund for the study (project), and the reliability of the respondents so that the overall research work would indicate the reality.

The eight respondents assumed to represent the public owners were from the three public agencies selected for this research work in the study area (two from Oromia water works, three from Oromia rural roads, and three from Oromia building infrastructures).

More respondents were not required from the public agencies as routine works are executed in each office so that increasing the number would not change the essence of the response. The results of both the interviews and questionnaires are presented and analyzed in the subsequent sections.

5.2 Study Population

The study population was drawn from three public agencies in the study area (Oromia), contractors, consulting offices, and professionals. As much as possible attempts have been made so that the samples drawn from the population are representatives. The following table presents the samples and their distributions, including the response rate.

Table 10. Distribution of interviews and questionnaires and percentage of respondents

Respondent Category	No. of Interviewees	Questionnaires Distributed	Questionnaires Collected	Response Rate (%)
Public owners	5	3	3	100
Contractors	10	10	7	85
Consultants	8	12	12	100
Professionals	-	20	20	100
Total	23	45	42	96

Professionals include those reputed experts engaged in the construction industry. Both questionnaires and interviews were used in the distribution of the survey. Interviews were intentionally directed to higher officials who seem reluctant to spend time filling the questionnaires, and some contractors who seem busy with other businesses.

The contractors included in both instruments (interviews and questionnaires) were all either Category 1 or 2, and were either General Contractors (GC) or Building Contractors (BC).

5.3 Survey Results

This section presents the results of the overall thesis work. The study has attempted to find out that opinions vary greatly on the relative merits and risks of each method. Based on the results of both questionnaires and interviews distributed to the respondents, the following areas of interest for discussion have been identified. These include:

a) Criteria (variables) for selection of delivery methods;
b) Practical knowledge with regard to the various project delivery methods;
c) Anticipated causes of the problems,
d) Willingness to shift from the traditional approach to the innovative ones (general attitude of the respondents), and;
e) The innovative method/s that can be adapted to the local situation as discussed in the next section;

5.3.1 Criteria for Selection of Delivery Method

As per these study, for majority of the informants (35.3%) the first critical criterion they consider to select among the project delivery methods is to maintain or, if possible, to reduce the *project duration.*

The need for cost certainty is considered as the second pressing criteria (29.4%) for selecting among the delivery methods.

Respondents were also asked to express their opinion concerning the need for reduction of administrative burden to the owner when choosing among the delivery methods. Accordingly, it was reported by 23.5% of the respondents that they consider *reduction of administrative burden to the owner* as their first priority in selecting from the methods available.

Project quality is given the fourth highest priority (11.8%) in selecting delivery method. Table 11 depicts ranking of these criteria of the public owners.

Table 11. Ranking of construction variables (Source: Author's Computation from Survey Data)

Variable	Rank	Percentage
Time certainty/reduction	1	35.3
Cost certainty/control	2	29.4
Reducing administrative burden	3	23.5
Ensuring quality	4	11.8
Total	-	100%

The first priority given to reduction of project time, however, does not seem to be in conformity with previous studies that indicated the local construction industry seemed to give tremendous consideration to the project costs [2]. However, from the cost and time overrun illustrated above (tables 6, 8 and 10) it can be seen that it is the time overrun that is extremely high as compared to the cost overrun. And, hence, from this study, it can be inferred that this project time reduction preference reflects the interest of the parties which has not been met almost always in the local construction industry.

From the interviews conducted for this study it seems that the current practice of tremendous project time overrun in the local construction sector is no longer tolerated. This is because public owners have come to understand that most of the time extensions requested by contractors are due to their own problems (of the contractors). Some of these problems are:

i. Lack of working capital,
ii. Over-stretching or over-extension (having several contracts at a time),
iii. Trying to use the advance payment granted for one contract for another and unrelated activity, etc.

After considering the criteria they set for the choice of the project delivery method(s), respondents views were also requested as to which method(s) they think meet(s) project time, cost, quality, and reduction of burden to the client (owner). And these are presented in the section 5.3.5.

5.3.2 Practical Knowledge of the different delivery methods

Almost all of the respondents (87%) from the public owners responded that they have never used any of the innovative methods to deliver at least one construction project so far. Hence, it has been noted that these offices have been using the traditional, DBB, method. These respondents were either contract administration division heads or senior experts in their respective offices.

Only one respondent has responded that both *construction management at fee (CM-at- Fee) and Construction Management-at-risk (CM-at-Risk)* methods are, occasionally, used in his organization. Here, it needs to be noted that the actual delivery method, as later on explained to me during interview, was neither the CM-at-Fee nor CM-at-Risk method of project delivery.

What the respondent called CM-at- Fee method was the following approach:

The bureau, in which the respondent was working, first contracts with the design team. Then it contracts with a new and an independent *construction supervision consultancy firm* entirely for the supervision of the construction. The approach is sequential in that the design must be completed before the construction supervision consultancy contract is concluded. In the construction management-at-fee method, however, the construction manager-at-fee is employed even before the owner concludes contracts with the designer. Moreover, the construction manager-at-fee (CMr-at-Fee) is the agent of the owner. The intent here is that the CM-at-Fee provides constructability aspects of the project to the designer at the design stage so that there would not be any design review during or after construction has started. For more clarity readers are referred to Table 12.

Table 12. Differences and Similarities between the CM-at-Fee and Construction Supervision Consultancy.

CM-at-Fee	Construction Supervision Consultancy
▪ Provides constructability, value-engineering, etc, inputs for the design team	▪ Not even hired at the design stage
▪ Construction supervision	▪ Construction supervision
▪ Does not assume any liability for construction supervision, for design and also for finance	▪ Assumes full liability for construction supervision, but not for finance.
▪ Design team is hired (required)	▪ Design team is hired (required)

Again, what the respondent called the *construction management-at*-risk method was:
First, the office (bureau) contracts with the design team. After the design is completed, the owner, then, concludes contract with an independent *design review* and *construction supervision consultancy firm* (DR and CSC) to identify design errors and to supervise the actual construction work (this is the current practice).

It has been noted that this consultancy firm is entirely independent of the first team. The responsibility of this consultancy firm also includes bid document preparation and selection of the *lowest responsive bidder* among the prospective general contractors. The basic differences between the design review & construction supervision consultancy (CSC) and the CM-at-Risk are also presented in Table 13.

Table 13. Similarities and differences between the normal CM-at-Risk and DR and CSC

CM-at-Risk	DR and CSC
▪ Provides constructability, value-engineering, etc inputs at the design stage	▪ Not even hired at the design stage ▪ Revises the design (after the design has been completed by the design team)
▪ Can later become a contractor or responsible for construction risks by subcontractor(s)	▪ Construction supervision only
▪ Assumes liability for either the design or construction supervision, as well as for finance*	▪ Assumes full liability for both design review and construction supervision, but not for finance.
▪ Design team is required	▪ Design team is required

* Responsibility for finance includes liability in case of project cost overrun.

This strategy developed by the above organization should be encouraged as it is one step forward. It should, however, be improved to become the standard innovative project delivery method.

Overall, about 78% of the respondents indicated that they have never employed any of the innovative project delivery methods and, hence, have no practical know-how.

5.3.3 Anticipated Causes of the Problems

a) With respect to the DBB method

The respondents also mentioned problems like absence of timely project completion, cost overruns and poor quality of the finished products as the main problems. The administrative burden to the owner here is more than that due to other methods. Lengthy procedure as it requires separate procurement of both design and construction.

Some of the causes of these problems are:

a) Lack of both honesty and goodwill with the local contractors;
b) High adversarial relationship between the designer and the contractor;

c) Lack of professional competence and liability with the local consultancy firms;
d) Lack of financial capability with the local contractors;
e) Lack of managerial capacity;
f) High tendency to seek change orders;
g) High intention to underbid construction projects;
h) Lack of professional indemnity with local consulting offices;

That lack of professional competence was particularly referred to as the management aspect of public constructions.

b) With respect to the DB method

Lack of knowledge transfer, as one entity is responsible both for design and construction. The contractor may conceal design and\or construction defects i.e., no chance for crosschecking the quality of the works.

With the local situation: lack of experience in such broader services delivered by a single entity, lack of technically, financially, and managerially capable local contractor(s), there is a popular tendency with the local contractors to underbid construction contracts. Once this [underbid] has been granted, experience indicates that there is a chance for sacrificing project quality.

5.3.4 Willingness to Shift from the Traditional to the Innovative Method(s)

Asked if they intend to shift from the traditional method of project delivery to the innovative ones, all of the respondents preferred to hold *mixed feeling*. One of them mentioned that government procurement guidelines do not encourage the use of these innovative methods. However, standard public works procurement guideline (lately issued in January 2006) allows the conclusion of any lawful project procurement (project delivery) contract at one's disposal, including the innovative methods [27]. Others respondents quote lack of capable

local contractors in the country, and absence of local standard conditions of contract for the use of the innovative methods.

5.3.5 Respondents' View with Regard to Priority Setting and Method Selection

Here, these questions were directed mainly to those respondents, who have theoretical or practical exposure, if any, so that reliable information can be obtained (most of those respondents were people working in international companies or academics).

5.3.5.1 Meeting Project Schedules (Time Certainty)

In this regard, the questionnaire of this study attempted to ask the delivery method that effectively *meets project schedules.* Accordingly, 39% of the respondents responded that the BOT method is effective, because the contractor assumes all project responsibilities, from design stage up to the concession period for project transfer, it intentionally reduces the time schedules required to process the activities.

And, moreover, he/she can process and execute most of the activities concurrently to complete the project in a short period of time so that enough revenues can be collected from project operation during that specified concession period.

The second highest score (28%) was given to the DBB method that, according to them, this method meets the estimated project duration. The third highest score was to the DB method (17%). The fourth was given to the CM-at-Risk method (11%). And their final choice was the CM-at-Fee method (5%).

Table 14. Respondents' perception on the method that meets project schedules

Delivery method	Rank	Percentage
BOT	1	39
DBB	2	28
DB	3	17
CM-at-Risk	4	11
CM-at-Fee	5	5
Total	-	**100%**

5.3.5.2 Controlling Project Costs (Cost Certainty)

It was observed that 57.1% of the respondents indicated the DBB delivery method is preferable *to meet project costs.* According to these respondents, the public owner benefits from separating the designers from the contractor(s). This separation creates a system of *checks and balances,* unlike the case with other methods. It can be seen from above tables that the cost overruns, as compared to the time overruns, were not significant.

This could be one of the reasons that majority of the informants have selected the DBB method. This confirms what is documented in literatures, i.e., as the DBB method necessitates open competition among competitors, the cost is usually low.

Table 15. Respondents' perception on the method that meets project costs

Variable	Rank	Percentage
DBB	1	57.1
DB	2	28.6
BOT	3	14.3
CM-at-Risk	-	0
CM-at-Fee	-	0
Total		**100%**

The DB is also effective to control cost, though not as effective as the DBB. Hence, 28.6% of the respondents indicated that the DB is effective to meet project costs. The third effective method in controlling costs of a project, according to the respondents, is the BOT method (14.3). No respondent has responded that the CM methods ensure cost certainty.

5.3.5.3 Ensuring Project Quality

Majority of the respondents (39%) showed that the DBB method is effective to maintain a quality construction project. The reason is, as noted was, this method creates *checks* and *balances* between the design team and the contractor(s) so that the defects of one party are not concealed.

A significant number of respondents (28%) replied that the CM-at-risk method is also effective in ensuring a quality project (both functional and esthetic). This is because, as the respondents mentioned, highly experienced construction management professionals are involved who can give constructability, material quality, value engineering, and cost control inputs both at the design and actual construction stages. Moreover, they quoted that as the Construction Manager at Risk assumes most of the project risks, he\she willingly tends to execute the project within the specified standard care.

The respondents thought that the BOT method ensures a quality project better than the DB and CM-at-fee methods, as given in the following table.

Table 16. Respondents' perception on the method that ensures project quality

Variable	Rank	Percentage
DBB	1	39

CM-at-Risk	2	28
BOT	3	22
CM-at-Fee	4	5.5
DB	4	5.5
Total		**100%**

5.3.5.4 Administrative burden the public owner

Overwhelmingly, 69.2% of the respondents indicated administrative burden to the public owner is dramatically reduced if the BOT delivery method is used. The CM-at-Risk is also selected to reduce the administrative burden to the owner. The other better choice, as per the informants, is the DB method. The respondents thought that the final choice in this respect to be the DBB and the CM-Fee method. The following table presents the percentage scores.

Table 17. Respondents' perception on the method that reduces administrative burden of the owner

Variable	Rank	Percentage
BOT	1	69.2
CM-at-Risk	2	15.4
DB	3	15.4
CM-at-Fee	4	0
DBB	4	0
Total		**100%**

5.3.6 Respondents' Opinions on the Applicability of the Innovative Methods to the Local Situation

The respondents thought that the DB, CM-at-Risk, the CM-at-Fee, and the BOT methods can be applied, effectively, to the local situation. They appreciate the extent these methods have

been successful in the developed world. Accordingly, 29.4% of the respondents indicated the DB method can be applied, again 29.4% replied the CM-at-Fee can be applied. 23.5% of the respondents indicated the CM-at-Risk is applicable to the local situation. Lastly, 17.7% of the respondents recommended the adoption of the BOT method to the local situation, s given in Table 18.

Table 18. Respondents' perception on the method that can be applied to the local situation

Delivery method	Rank	Percentage
CM-at- Fee	1	29.4
DB	1	29.4
CM-at- Risk	3	23.5
BOT	4	17.7
Total	**-**	**100%**

They, however, asserted some of the accompanying inconveniences. Listed below are some of the problems the respondents mentioned considering the application of the methods to the local situation.

a. Lack of experience in such broader services provided by a single entity, in Oromia State or Ethiopia.
b. Lack of project procurement guidelines, including local formal Standard Conditions of Contract, which can be applied.
c. Lack of capable local contractors to effectively apply these methods. This incapability includes: technical, managerial, administrative, ethical, etc. It was noted in an interview with one of my respondents that the local contractors are not bold enough even to claim that their rights to the contract are respected. The [words] of the supervising consultant are taken for granted.
d. Local design consultants lack experience in the latest construction technologies.
e. Financial incapacity of the local contractors, especially to apply the BOT method.
f. The slowest legal proceedings in the country.
g. Construction management consultancy firms are just emerging.

h. Lack of professional ethics

5.3.7 Respondents' Comment on the Overall Local Construction Industry

Most of the local contractors interviewed for this research project responded that it is not within their capacity to choose the project delivery methods. It is the role of the client to decide the method, and they are compelled to abide by this in order to win the contract.

Accordingly, the usual method they employ is the traditional approach. Asked if they intend to shift the existing paradigm, the majority responded that they have no intention. One of the respondents responded that his construction firm, as a short term plan, has no any intention of shifting to any of the innovative methods. However, if the situation is changed and is compelling, the innovative methods can be applied, as to that informant.

One of the contractors critically recommends the adoption of the DB method of delivery as it requires lesser time and lesser overhead costs, though he believes that all methods ensure a quality project if the whole processes of design and construction are well managed.

Majority of the contractors complain the traditional approach is not timesaving and is a costly method, and more likely to pose adversarial relationships between the concerned parties. And some even call it a dispute-prone method!
Some who are well versed in the construction world even comment on one of the innovative methods as such: DB, as practically become evident in the developed world, is a better approach, but has the associated and undeniable problem of absence of knowledge in-breeding, as the same contractor is assuming the responsibility for both the design and construction. And they also raise issues like concealment of design defects. It is important to pay attention as this is a serious issue unless our local contractors develop a sense of responsibility for what they do.

Generally, the existing consultancy firms in the country do not seem satisfied with the existing situation of the local construction industry. They boldly uncover the very fact that

the current malpractices are professionally appalling. Besides, it has been mentioned very often that the industry is still traditionally approached. It was said all stakeholders are to assume, with no doubt, the lion's share of responsibility for the problem, including even the *regulatory bodies*. The major problem, as per the informants, is loose or sometimes totally lack of appropriate response from the regulatory bodies to rectify the prevailing problems.

It was also mentioned that local consultants lack adequate construction management concept. Absence of detailed pre-contract planning is also presented as one of the reasons for disruption of construction contracts. Besides, consulting firms sometimes tend to strictly reflect the interests of the owners whenever they change ideas very often.

The other problem is contractors and/or consultants' *prequalification* not strictly attended to. Almost all of the consulting firms I approached share the stated problems.
Other problems stated by the respondents are the local contractors are not capable enough to implement projects using the DB and\or turnkey methods. They argue that no local contractor is financially sound, technically and managerially capable, and ethically reliable.

All of the professionals reflect similar view that the Ethiopian construction industry is lacking innovative project delivery methods, and latest construction technologies. They unanimously argue that something has to be done to improve the situation. One of my respondents, a water development expert in Oromia Water Resources Bureau, points out the method in which local private firms rendering wider services needs to be encouraged. He states that this method (DBB) undermines the growth of private firms providing broader services, thereby hinders the development of the national economy.

The majority of the experts state that as long as Construction Company's goodwill in Ethiopia has remained unimproved, the innovative methods seem difficult to be applied.

Experts underline that contractors and consultants should prove themselves credible in meeting the owner's fullest demands.

According to these respondents the Construction Manager-at-Fee is free, and, hence, may commit a professional misconduct. And these respondents recommend that the Construction Management-at-Risk for the local situation, if the contractors flourish to the level required that they can ensure credibility.

Considering the BOT method, it is the view of the majority that this is the most difficult method for local situation in the foreseeable future as it requires the most efficient managerial capability and the soundest financial position of contractors, as compared to others, which the local construction industry is currently gravely lacking.

5.4 Analysis of Some Key Information Obtained

In this section the key information obtained through interviews and questionnaires are thoroughly discussed and argued or supported. These arguments or back-ups are based on the information available in literatures, which themselves are based on experiences in the developed world (USA, Finland, UK).

5.4.1 Respondents' Perception that the DBB Method Meets Project Schedules and Costs Better than Most of the Innovative Methods

The traditional mode (DBB method) has distinct advantages and disadvantages (see table 3, pp 32). In choosing this method, the owners must make tradeoffs. One major advantage is the fact that the owner knows the cost when construction begins. Nevertheless, studies indicate that this method is short of the collaboration between the design team and the construction team that could improve the design and lower the overall price [13, 14, 21, 30].

Furthermore, experiences in the developed countries show that the method lacks the potential cost savings for absence of fast tracking. It is also argued even that certainty of cost is only as good as the quality of the documents. If there are a large number of change orders to cover

works not specified or detailed properly to increase the scope, the cost may be even higher. Collection of different literatures also indicate that for projects with political, technical, or schedule constraints, the DBB method must be examined more closely [14].

It is also stressed that it is difficult to reduce the time required to do both design and construction using the DBB method, because the process is sequential and linear; there is no opportunity to overlap tasks to reduce the overall time. Thus, the notion of the respondents that the DBB method reduces the project schedule and cost better than the innovative methods should be considered cautiously.

5.4.2 Respondents' Perception of Mixed Feeling on the Adoption of Innovative Methods

It has been mentioned in section 5.3.3 that all of the respondents hold some kind of hesitation (mixed feelings) on the adoption of the innovative methods. The excuses the respondents cited for their mixed feelings were:

i. Lack of capable local contractors, and
ii. Lack of local law allowing the use of these innovative methods.

One major reason for choosing the innovative methods is to benefit from the good communication that can be created between the design team and the construction team. Many of the construction companies in the developed world specialize in particular areas and have developed a smooth flow between the design and construction [14, 25]. The collaboration between these specialized disciplines allows the project to be fast tracked, cutting down on overall schedule for the project.

It is evident that most of the local contractors lack financial and/or managerial capabilities, and sometimes technical competence. Almost all of the local construction contractors have no experience on design of works. Local consulting firms also lack latest design and construction technology skills. But, if *partnering* is created between these two, it allows

easier incorporation of changes due to scope or unforeseen conditions since their coordination occurs within the same contractual entity.

Partnering, here, is referred to as a long-term commitment between two or more organizations for the purpose of achieving specific project objectives by maximizing the effectiveness of each of the participant's resources. The principal benefits to be gained by such a merger are the pooling of assets, equipment, facilities, financial resources, and individual talents into a common course of action.

Hence, for the sake of the reasons mentioned, the respondents' perception that the local construction industry lacks capable local contractors for adoption of innovative project delivery methods could not be firm ground for not introducing or applying the innovative methods.

Respondents also mention construction law in Ethiopia/Oromia region prohibits methods other than the DBB method. It is worth noting that the selection or use of specific project delivery methods may be mandated for some owners. For instance, public agencies are often required by law to use the traditional method in the USA [14, 21, 28]. However, the local situation appears to be a bit relaxed in this regards. Hence, the Standard Public Works Procurement Guideline for Competitive Bidding, issued in January 2006, allows the application of the innovative methods. In this regard, it recommends the adoption of the FIDIC Conditions of Contract [31].

Hence, it appears that this notion, too, does not seem reasonable. It is the opinion of the researcher that these two ideas might have been raised due to lack of a thorough understanding of the local construction industry and local legal system too.

5.4.3 Lack of Real Competition Among Bidders (Contractors or Consultants)

It has been mentioned by majority of the respondents that a sort of professional misconduct is being practiced during bidding processes (i. e., lack of professional ethics in both sides).

After all, the necessity to advertise for bidders is to accept bids from all who are inclined to compete, and to award contract to the lowest responsible bidder (not the lowest bidder). The employment of an unqualified contractor usually leads to difficulties during contract operations. Also, slow progress, unsatisfactory quality of the work, and excessive cost may result.

Studies show that over 60% of the cost of delays and unsatisfactory progress in the USA are due to poor management and inadequate equipment [13]. Another study, in the same country, shows that 75% of the cost of the losses sustained by defaulted contractors is due to inadequate financial responsiveness, overextension, and incompetence.

To avoid or reduce these difficulties, proper selection of bidders is recommended. This can be achieved via pre-qualification of bidders. The purpose of pre-qualification is to determine before a contractor and/or a consultant is allowed to bid whether he/she is responsible and competent to satisfactorily complete a given construction contract. This needs to be adhered to for successful accomplishment of construction contracts.

Moreover, the Ethiopian Civil Code has provision which states that in case of non-performance of contract, the owner is entitled to different remedies as follows [7]:

1) He/she may require the enforcement of the contract;
2) He/she may require the cancellation of the contract;
3) He/she may, in certain cases, cancel the contract him/herself;

The Code in addition states that the owner is entitled to require that the damage caused to him by non-performance be made good.

This legal provision needs to be advocated to all parties concerned. In this regards, trainings, workshops, professional magazines, and other relevant means would be helpful. And in case of default the law needs to be enforced.

5.5 The Ethiopian Experience on the Innovative Project Delivery Methods

This section attempts to briefly discuss the awareness level of the Ethiopian construction industry on the innovative project delivery methods. The Ethiopian context has been briefly dealt with to check whether there is an experience on the innovative methods in the local construction industry. In depth analysis of the Ethiopian context is beyond the scope of the current thesis work.

It is convincing that public owner's primary goal in choosing a delivery method should be to ensure that the method will meet the project objectives and at the same time allow the project to be delivered on time and within budget. The choice should also consider the required project quality, safety, and owner's involvement during both design and construction periods.

The practice in Ethiopia, however, does not seem that these aspects are considered. Contractor's capacity to discharge the contract responsibility should also be one of the criteria in adopting methods for project delivery.

Majority of the construction projects are delivered using the traditional design-bid-build (sometimes called design-bid-award) method. Discussions and interviews with selected experts and officials disclosed that most of the public owners in the country even do not seem to know whether other options are at their disposal. Some public offices are unjustifiably reluctant to apply any method other than the one they are very well familiar with.

Moreover, there are also experiences on the innovative delivery methods that justify that the shift has not been prohibited in Ethiopia. For example, the Ethiopian Roads Authority (ERA) has attempted the *design-build* method for some fourteen (14) rural roads projects some 12 to 13 years back as demonstrated in the next section. The Ethiopian Electric Power Corporation (EEPCO) is also employing the design-build method.

The Amhara National Regional State has also employed the DB method to deliver one road project successfully (Alemketema-Sekota road Project). As per this informant three local contractors jointly took part in the project. These include: African Engineers, BERTA Construction Pvt. Ltd, and SUR Construction Pvt. Ltd.

The Oromia National Regional State is currently using Design Review and Construction Supervision Consultancy approach. This, itself, is a shift from the traditional DBB method.

A document review and some other relevant studies indicate that there were some problems in applying the DB method, especially, in the case of ERA. These are also briefly demonstrated in the accompanying sub-sections of the thesis.
So, from these and other similar evidences one can conclude that it is not the regulation that has been the impediment to the application of the innovative methods. Rather, it has been the local capacity (capacity in all its facets) that has been the hindrance. Some of the selected sample projects are presented below.

5.5.1 Experience of ERA on Design-Build Projects

ERA awarded fourteen design-build road projects contract to local contractors. These were rural road projects intended to connect different rural towns in different parts of the country. A document review was conducted and discussions were held with concerned experts in the authority to identify the associated difficulties in bringing the intended success of the projects. Thus, these projects together with the project costs and other relevant information are presented in Table 19 below.

Table 19. ERA Rural Roads Projects (Source: ERA, Head Office)

No.	Name of Project	Contract Amount (EB)	Work done up to the end of the contract period (%)	Remark
1	Gog-Akobo	45,547,030.00	32.50	Contract terminated
2	Walmara-Guba	30,300,205.20	53.56	Contract terminated
3	Sawula-Usno	32,931,274.00	76.50	On verge of termination
4	Diri-Masha	68,263,545.00	63.45	Substantially complete
5	Fissehagenet-Konso	79,488,545.00	83.42	Maintenance left
6	Delbo-Bilate	10,606,800.00	80.22	Completed
7	Alemketema-Akista	48,951,661.00	33.87	Contract terminated
8	Akista-Tenta	31,847,451.44	50.32	Completed
9	Dawunt-Lalibela	70,926,413.00	78.97	Completed
10	Lalibela-Sokota	97,922,236.00	36.14	Completed
11	Fik-Imi	69,341,713.00	84.80	Completed
12	Serdo-Afrar Haik	64,592,648.30	81.55	Completed
13	Gode-Hararghe	78,366,000.00	27.47	Completed
14	Assaitta-Dicootta	15,409,374.00	68.00	Partially termination
	Total	**744,496,895.94**	-	-

It was noted that the projects stated "completed" in the table are those projects whose contract agreement was accomplished with the contractor in some financial difficulties. It was also revealed that there have been court cases between the ERA and some of the contractors for the last 12 years. No court decisions have been made to date and the issues are still pending, as one of the respondents in ERA explained it. From this, one can imagine how protracted the Ethiopian legal proceeding is.

Some contractors and even owners indicate that it is because of the slow legal system of the country that they do not bring one another in front of a court, in case of a default.

Generally, it has been observed that people engaged in the local construction industry prefer not to go to court before they have exhaustively exploited other options.
It can be seen, from the above Table (Table 19), that the minimum work the respective contractor accomplished up to the end of the contract period was 27.47% and the maximum was 84.80% of the contract amount. Furthermore, from the table, it can be seen that no project has been completed on time.

After proving the accomplishment of similar projects by international contractors, it is now believed that if we can really improve the situation which both the contractors and the owner were in at that time we can really make a difference in the local construction industry.

Accomplishment of 84.80% of the works up to the end of the contract period may be taken as a signal for success in the local construction industry, which is rarely employing the DB method with the local contractors.

It is also interesting to note that seven of the projects have been completed though with *certain time overrun* and *financial difficulties*-as reported. This is an indication that if impediments had not been there the projects would have been accomplished on time and on budget.

Some of the impediments were:

a) Lack of the required experience and expertise with the local contractors;
b) Client itself was not having the required experience for the DB delivery method;
c) Lack of well-established pre-contract planning;
d) Local contractors lacked proficient design staff-the case with most of the local contractors still;
e) It seems that local contractors showed a tendency to 'underbid' the works;
f) Over-extension of contractors;
g) No clear guidelines for procurement of goods and services;
h) Financial incapability of local contractors, and;
i) Inadequate equipment;

The above listed problems can be regarded as *Project Management problems.* And, failures due to these problems can be considered as *Project Management Failures.*

So, it can be argued that most of the problems in ERA projects can be regarded as *Project Management Failures,* and not as *Project Product Failures,* as these are directly associated with the managerial aspect of construction projects.

Although outcomes of project management success and project product success seem inseparably linked, the usual relationship between them is weak. This is because, for example, being over time and/or budget, projects can be deemed as project management failures, but the resulting product can be a success-the above seven completed projects can serve as good examples (Table 19).

For the future, this tendency of underbidding by the local contractors should be avoided and they (the local contractors) should observe, in advance, the real work which they will be executing. And, also, local contractors should build the capacity to exercise their rights to the contracts. They should claim when it should be claimed. It needs to be noted that international contractors are benefiting from such strategies.

Also, different literatures indicate that, to bring success, it is wiser to award contracts to multiple prime contractors rather than awarding the whole work to one general contractor, though this aggravates the problems due to fragmentation (separation) of responsibilities among the parties concerned.

Moreover, experience in the developed world indicates that these innovative methods are highly rewarding to all parties concerned in terms of timesaving, cost saving, and maintaining the stipulated quality of the projects. So, it is highly advisable that employing the innovative project delivery methods should resume than totally stopped-the position taken by ERA. This time, however, caution needs to be taken not to pre-qualify a design-builder (contractor selection) which does not fulfill the stipulated requirements set for selection.

5.5.2 Other Infrastructure Sectors

This section tries to discuss the experience the local construction industry is accumulating on the innovative project delivery methods. Thus, the experiences of different sectors that have tried at least one construction projects using the innovative methods are presented.

a) The Experience of Ethiopian Electric Power Corporation (EEPCO)

The EEPCO has the experience on Design-Build Projects with the international contractors. The corporation often awards contracts to international contractors to handle both design and construction of projects. The electromechanical installation projects are always with the DB method. It is noted that the corporation encountered no significant problem in this regard. This is evidence that if the local contractors can build their capacities, there seem to exist opportunities for success.

b) Ethiopian Water Works Construction Authority (EWWCA)

The former Ethiopian Water Works Construction Authority (EWWCA), now renamed as Water Works Construction Enterprise (WWCE), has also tried the construction of one road project (Hargalle road project) using the design-build project delivery method.

Because WWCE does not have an experience on design of works it subcontracted it to a certain consulting office. Due to lack of good communication between the design team and the construction team (WWCE) and lack of constructability inputs at the design stage, the project was not accomplished as per schedule and budget. After this experience the enterprise does not seem to take design-build projects.

It has to be noted that each project delivery method has to be applied when all the requirements, based on the situation in which the construction is to be executed, are fulfilled.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Changes are taking place in the construction industry. New methods are available to manage projects, and new construction techniques are being used. To protect themselves from losses due to the use of inappropriate delivery methods, public owners should be aware of new laws and information.

In this research work, different *Project Delivery Methods* have been described. Their relevance to the situation in Oromia region of Ethiopia has been examined. The criteria set by construction stakeholders to select among the different delivery methods, in the study area, have been identified.

The existing problems and the anticipated causes of these problems have also been determined. Perception of different stakeholders with regards to the local construction industry has been sought. The validity of their views has been cross-checked with the information in relevant literatures. Hence, based on these findings of the study, the following conclusions are made:

a) The DBB method has been the widely used project delivery method in the Oromia region of Ethiopia;

b) While DBB is a well-known project delivery method that promotes competition and ensures transparency, there are significant problems with the process. The main challenge is the extensive need for client resources in managing the contract. And also, it does not allow cooperation between different participants of a project thereby hindering industry innovation;

c) Generally, there is a tendency (an attitude) to improve the existing delivery methods thereby improving the overall project performance. The Design Review and Construction Management Consultancy approach employed by one of the public agencies is an indication for such an attitude that a new and an alternative approach better than the DBB method is being sought;

d) The local construction industry does not, currently, seem ready that the BOT method can be applied to meet the owner's fullest demands. This being entirely due to lack of capable contractors (financial capability).

e) Based on the stipulated precedence order of project criteria set by the public bodies and other project stakeholders in the study area, the innovative methods need to be applied. Hence, among the innovative methods, DB, CM-at-Risk, and CM-at-Fee can possibly be applied to the context in Ethiopia's Oromia region.

6.2 Recommendations

Based on the findings of the study, it appears that the local construction industry lacks some of the critical requirements to apply the innovative project delivery methods. Hence, the following recommendations are put forward for improvement of the current practices.

a) Partnering

Partnering is applied outside the contract to align goals and objectives of parties and to facilitate communication, teamwork, and joint problem solving. This arrangement generally includes sharing of risks/rewards and open evaluation and constructive feedback on the partner's operations. This partnering could be consultant- contractor or contractor-contractor partnering, based on the problem at hand.

b) Standardization

The preparation of the request for proposal, tendering, and preparing contract documents is often mentioned as the biggest problem in DB method. However, project delivery may be facilitated through a more standardized approach to risk assessment and management. Standardization of processes increases the confidence of the private sector in the transparency of the delivery method(s).

c) Contractor/Consultant Selection

Short-listing of prospective contractors not only ensures that high quality contractors are selected, but also reduces the administrative burden of evaluating tenders and cost of tendering. It also reduces the risks of selecting non-responsive contractors and/or consultants.

d) The Legal Procedures

It has been observed that the legal proceedings in Oromia region or in Ethiopia as a whole show a tendency to be protracted. So, in this regard, steps need to be taken so as to improve the situation. In this regards legal personnel need to receive tailor-made trainings so that their horizon in the construction sector could be widened;

e) Restricted use of the Traditional DBB Method

The use of the DBB methods needs to be restricted to situations when the public owner wishes to be actively involved in the design and construction processes, and when it has sufficient time to permit design to be fully completed before construction bids are obtained.

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APPENDICES

APPENDIX-A

Questionnaires filled by Public Owners and Contractors

Company Name----------

Position ----------

1. Indicate the project delivery methods used by your organization to procure at least one construction projects.

Project delivery method	**Yes**	**No**	**Do not know**
Traditional			
Innovative			

2. If your organization has ever used the innovative methods, indicate them.

Innovative project delivery methods		**Yes**	**No**	**Do not know**
Design-Build (DB)				
Construction Management (CM)	Fee			
	Risk			
Design-Build-Operate-Transfer (BOT)				

3. How often has your organization used the traditional or the innovative methods?

Delivery method	**Always**	**Usually**	**Typically**	**Rarely**	**Not used**

Traditional					
Innovative					

4. If you have been always employing the traditional method so far, do you intend (i.e. plan) to shift to the innovative project delivery methods?

   a) Yes b) No c) Mixed feeling

5. If yes, what is\are the reason\s behind your decisions? Prioritize your reasons.

Reasons \ priority	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**I do not know**
To reduce project cost							
To reduce project time							
To ensure project quality							
To ensure project safety							
To reduce administrative burden to owner							
Others							

Others----------

6. How do you choose any of the method (traditional or innovative)?
   a) After considering the merits and demerits of each.
   b) Because it is the customarily used method.
   c) Others (indicate).

7. Which method do you think is particularly recommended in that it meets project schedules? Prioritize!

Method \ Priority		1st	2nd	3rd	4th	5th	I do not know
DBB							
DB							
CM	Fee						
	Risk						

BOT						

Why ----------

8. Which method do you think is specifically advisable to meet project costs? Prioritize!

Method \ Priority		1st	2nd	3rd	4th	5th	I do not know
DBB							
DB							
CM	Fee						
	Risk						
BOT							

Why----------

9. Which project delivery method ensures a quality project (both functional and aesthetic)? Prioritize!

Method \ Priority		1st	2nd	3rd	4th	5th	I do not know
DBB							
DB							
CM	Fee						
	Risk						
BOT							

Why----------

10. Which project delivery method is effective in reducing administrative burden to the public owner? Prioritize!

Method \ Priority	1st	2nd	3rd	4th	5th	I do not know
DBB						
DB						

CM	Fee						
	Risk						
BOT							

Why----------

11. Are there any legal provisions to adopt any one particular delivery method?
    a) Yes b) No c) Do not know

12. If yes, adoption of which method is legally provided?
    a) DBB b) DB c) CM-At-Fee e) CM-At-Risk f) BOT

13. Indicate the associated problems of adopting the different project delivery methods listed below in the Ethiopian context.

DBB----------

DB ----------

CM-At-Fee----------

CM-At-Risk----------

BOT----------

14. Which of the innovative project delivery methods can be adapted to the situation in Ethiopia and Why?

APPENDIX – B

Questionnaire filled by Consultants and relevant Professionals

Company Name----------

Position----------

1. Which of the following delivery methods have you ever used to procure, at least one, construction project?

Method		Yes	No	Do not know
DBB				
DB				
CM	Fee			
	Risk			
BOT				

2. Which variables do you use to rate the importance of project delivery method in the context of Ethiopia? Prioritize them.

Variable \ Priority	**1st**	**2nd**	**3rd**	**4th**	**5th**	**I do not know**
Project cost						
Project schedule						
Project quality						
Project safety						

Administrative burden to the owner						

If you think that there are also other rating variables, please indicate----------
---.

3. How important are the above variables to choose the best project delivery method?

Variable\Rate	Very Important	Rarely Important	Not important
Cost			
Time			
Quality			
Safety			
Administrative burden to owner			

4. Indicate the extent to which you recommend the following project delivery methods for public works projects in Ethiopia? Use 1 = Strongly, 2 = Moderately, 3 = Rarely, 4 = Do not recommend, 5 = Do not know the method.

Delivery method		1	2	3	4	5
DBB						
DB						
CM	Fee					
	Risk					
BOT						

Why?

DBB----------

DB ----------

CM at-fee----------

CM at-risk----------

BOT----------

5. Please indicate the relative merit of each delivery method in meeting *Project Costs* by prioritizing them.

Method		1st	2nd	3rd	4th	5th	Do not know
DBB							
DB							
CM	Fee						
	Risk						
BOT							

6. Prioritize each method with respect to the merit in meeting *Project Schedules.*

Method \ Priority		1st	2nd	3rd	4th	5th	Do not know
DBB							
DB							
CM	Fee						
	Risk						
BOT							

7. Indicate the relative advantage of each delivery method in meeting *Project Quality* by prioritizing.

Method \ Priority		1st	2nd	3rd	4th	5th	Do not know
DBB							
DB							
CM	Fee						
	Risk						
BOT							

8. Indicate the priority of each method in ensuring *Project Safety*.

Method \ Priority		1st	2nd	3rd	4th	5th	Do not know
DBB							
DB							
CM	Fee						
	Risk						
BOT							

9. Rate each delivery method with respect to *Owner's Involvement (administrative burden to owner).*

Method		Highly	Moderately	Less involved	Not involved	Do not know
DBB						
DB						
CM	Fee					
	Risk					
BOT						

10. Are there any legal provisions to adopt any one particular delivery method?
    a) Yes b) No c) Do not know

11. If yes, adoption of which method is legally provided?
    a) DBB b) DB c) CM-At-Fee e) CM-At-Risk f) BOT

12. Indicate the associated problems of adopting the different project delivery methods listed below in the Ethiopian context.

DBB----------

DB----------

CM-At-Fee----------

CM-At-Risk----------

BOT----------

13. Which of the innovative project delivery methods can be adoptable to the situation in Ethiopia and Why?

APPENDIX-C

List of Some of the Respondents (Name of Organizations Only)

Regional Offices (Public Owners)

Oromia Water Resource Bureau
Oromia Rural Roads Authority
Oromia Works and Urban Development Bureau

Federal Offices

Ministry of Works and Urban Development
Construction Sector Capacity Building
Ethiopian Roads Authority

Consulting Firms

MH-Engineering PLC
GATMeTS International PLC, Consulting Engineers, Planners, and Architects
Construction Design Share Company
Oromia Design and Construction Authority

Contractors

Oromia Water Works Construction Enterprise
SUR Construction PLC
Sunshine Construction PLC

MIDROC Construction Ethiopia PLC

BERTA Construction PLC

Ethiopian Water Works Construction Enterprise