

Research Article

# Effective Project Delivery Method for Public Construction: Case in the Oromia Region, West Wallaga Zone

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## Abstract

This thesis is to identify and evaluate effective delivery methods and assess their applicability to the local situations in the Oromia region of the West Wallaga Zone. The significance of the research is that 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 facilitate the development of the infrastructure sectors. The objective of this research is to identify effective project delivery methods for public works construction in the Oromia Region West Wallaga Zone. The data collection process used in the research had the option of two basic methods: primary data collection and secondary data collection. Accordingly, four project delivery methods based on their relevance to the local situation have been evaluated; their merits, demerits, and requirements have been identified. These methods are: the design-bid-build, construction managers (at risk and at fee), the design-build, and the design-build-operate-transfer methods. Based on these findings of the study, the design-bid-Build method has been the most widely used effective project delivery method in the Oromia Region West Wallaga Zone. Performance-based project delivery methods are thought to offer a way to develop the sector and to benefit all stakeholders. In order to benefit all parties involved in the building sector, this will serve as a beneficial addition to the current techniques.

## Keywords

Construction Industry, Delivery Method, Design-Bid-Build, Design-Build, Construction Management, Design-Build-Operate-Transfer

## 1. Introduction

The most important factors in determining a building project's success are its delivery methods. Public construction, sometimes called public-works construction, refers to those construction works that 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 [1]. According to Pakkala, "project delivery methods" and 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 [2]. A number of standard strategies can be used to accomplish the delivery of building and/or civil engineering construction projects. These are the ones that constitute a substantial proportion of civil engineering construction projects. The most common are the design-bid-build, the design-build, the construction management, and the de-

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sign-build-operate-transfer methods.

In some public agencies, the works designed by one consultancy firm need to be reviewed by at least one other consultancy firm to check for design errors and 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 the Ethiopian construction sector have been observed reaching up to 20–30% of the project cost [3]. There are cases in which improper selection of the project delivery method can be cited as one of the main causes of contract disruption and then claims. This study focuses on views from the construction industry about various factors affecting effective delivery methods for public-works construction, analyzes these factors, and recommends appropriate measures that can be taken to improve effective delivery methods for public-works construction in Oromia Region West Wallaga Zone.

## 2. Literature Review

Based on the four criteria used to evaluate the selection of project delivery methods and to identify from the present research works: these are:- cost certainty, time certainty, ensuring quality, and reducing the administrative burden on the public owner. The selection of these criteria was based on the literature survey and test interviews conducted 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.

The design-build system was used in the olden days, for instance, during the construction of the pyramids [4]. But the method is still considered to be one of the most innovative in the construction industry. In a study conducted at Pennsylvania State University, USA, sponsored by the Construction Industry Institute, the design-build delivery system was identified as offering, on average, the best project performance [5].

An empirical research study by Sanvido and Konchar aimed to compare the various distribution mechanisms that are commonly utilized in the US. 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 [6]. The Turnkey System is a unique instance of the design-build delivery approach. 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 [7].

The Design-Bid-Build Method system was developed during the Industrial Revolution period, which resulted in the creation of specialized professional movements of architects, contractors, and engineers. For many years, project delivery systems have consistently used this method. In this model, an owner or client procures the services of a design consultant to develop the scope of the project and complete design documents, which are then considered legal documents for selecting a contractor who builds according to the specifications developed by the design team. In a study conducted at Pennsylvania State University, USA, sponsored by the Construction Industry Institute, the design-build delivery system was identified as offering, on average, the best project performance [5]. 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 [8].

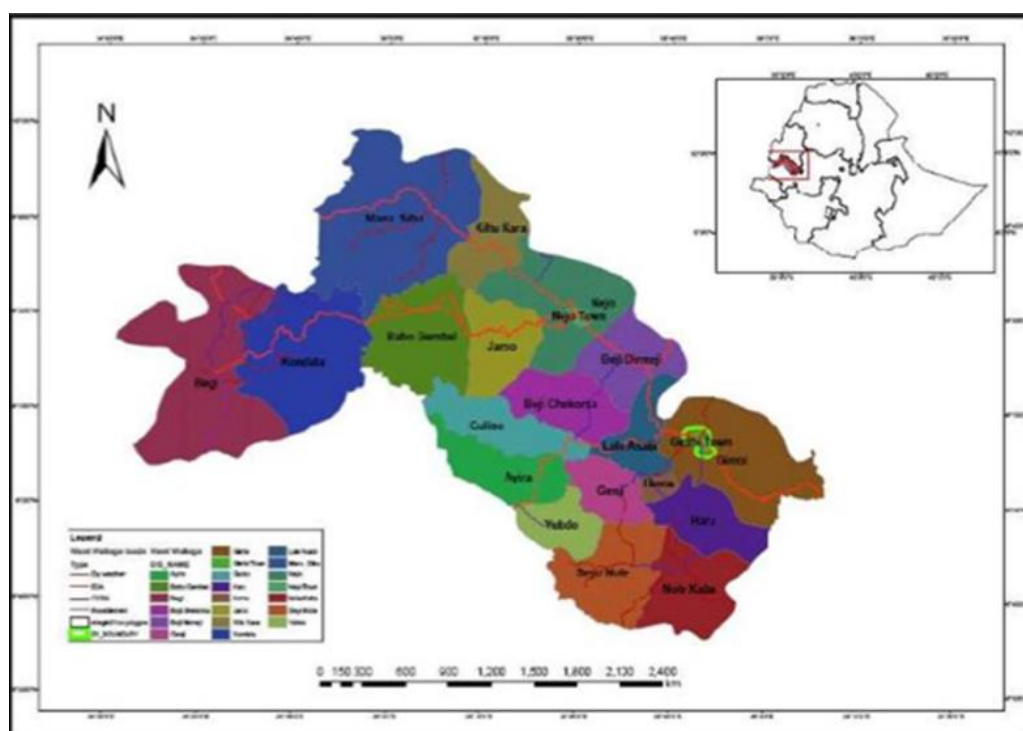
The construction management system is a broad term covering a variety of project delivery scenarios in which a construction manager becomes an integral part of the team at early stages to supervise aspects of the project like budget, timetable, procurement, and construction techniques. The construction management 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 to further the interests of the owner [8]. Design and construction can usually overlap; they are purchased in phases through separate contracts. 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 the delivery of the completed work, including the quality and performance of the asset [9].

**Design-Build-Operate-Transfer Method:** A private company is responsible for the design, construction, operation, maintenance, and financing of the project for a specified concession period. Up to the conclusion of the concession period, the contractor bears all financial risk. During this concession period, the company collects revenues from operating the project to recover its investment and earn a profit. Ownership of the project is passed to the client or owner at the conclusion of the concession period.

## 3. Research Design

### 3.1. Description of the Study Area

The study conducted in the West Wallaga Zone is located between Latitude: 9° 00' 0.00" N and Longitude: 35° 14' 60.00" E, at a distance of 441km from Addis Ababa, the capital of Ethiopia.



**Figure 1.** Map of the West Wallaga Zone.

### 3.2. Data Collection and Analysis of the Data

This study employed primary and secondary data. Both data were obtained from public agencies and private sectors. The primary data were collected through questionnaires and interviews with the main infrastructure construction sector actors in the selected study area. The interviews were supposed to have extensive experience with project delivery of alternative forms in order to be able to assess the acquaintance with and performance level in each case. The surveys were enhanced and validated with explanations derived from a review of the literature. The data was analyzed using both quantitative and qualitative approaches. To illustrate the scope of the answer, certain figures have also been employed, such as the proportion of respondents. The idea of measuring project success serves as the foundation for the study of the entire thesis work. According to Baccarini, project success consists of two separate components, namely project management success and project product success [10]. 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 project's end products. Thus, following Baccarini, in simplistic terms, project success can be summarized as: project success = project management success + project product success.

Generally, the thesis is 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. The 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.

## 4. Results

#### 4.1. Back Ground of Respondents

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. Information was gathered from reputable professionals, contractors, consultants, and public owners (public agencies). The respondents comprised 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 1** The numbers were decided on the basis of the time available for conducting the research work, the available funds for the study (project), and the reliability of the re-

spondents so that the overall research work would indicate reality. **Table 1** presents the samples and their distributions, including the response rate.

**Table 1.** 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                |

Among the 23 questionnaires distributed to public owners, contractors, and consultants, 45 were properly filled out and returned with a 96% return rate. Based on the response rate, 3 (100%) for a public owner, 7 (85%) for a contractor, and 12 (100%) for the consultants were collected. When we see the total percentage of the questionnaires returned separately, 3 (100%), 7 (85%), and 12 (100%) questionnaires were returned by the contractor, consultant, and client, respectively.

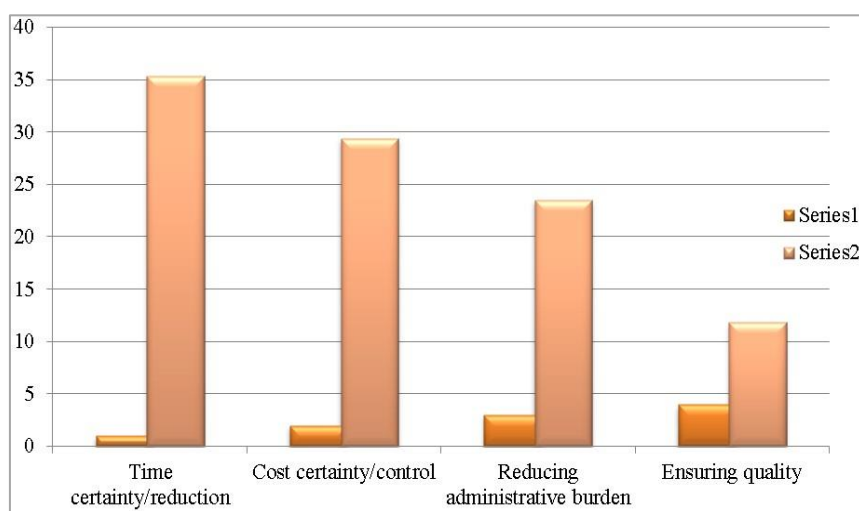
## 4.2. Survey Results

The study has attempted to find out that opinions vary greatly depending 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: (1) criteria (variables) for the selection of delivery methods; (2) practical knowledge with regard to the various project delivery methods; (3) ensuring project quality; (4) administrative

burden on the public owner; and (5) opinions on the applicability of the innovative methods to the local situation.

### 4.2.1. Criteria for Selection of Delivery Method

As per this study, for the 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 the second pressing criteria (29.4%) for selecting among the delivery methods. Respondents were also asked to express their opinion concerning the need to reduce the administrative burden on 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 methods, and the figures below show these results by graph.



**Figure 2.** Ranking of construction variables.

The first priority given to reducing 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 project costs [11]. However, from the cost and time overrun results, it can be seen that the time overrun is extremely high as compared to the cost overrun. In addition, from this study, it can be inferred that this project time reduction preference reflects the interest of the parties, which has not been met usually in the local construction industry. From the interviews conducted for this study it seems that the current practice of tremendous Project time overruns in the local construction sector are 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. Some of these problems are: (1) lack of working capital; (2) overstretching or over-extension (having several contracts at a time); (3) trying to use the advance payment granted for one contract for another and unrelated activity; etc.

The first priority given to reducing 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 project costs [11]. From the interviews conducted for this study, it seems that the current practice of tremendous project time overruns 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. 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 project time, cost, quality, and reduction of burden to the client (owner).

#### 4.2.2. 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. 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 will not be any design review during or after construction has started.

The DB is also effective in controlling costs, though not as effective as the DBB. Hence, 28.6% of the respondents indicated that the DB is effective in meeting project costs. The

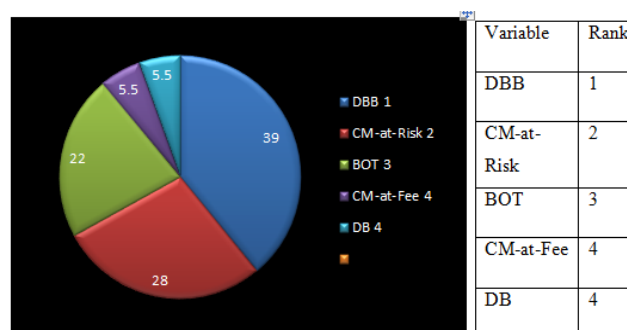
third effective method for controlling the costs of a project, according to the respondents, is the BOT method (14.3%). No respondent has responded that the CM methods ensure cost certainty.

**Table 2.** Variable rank of the delivery methods.

| Variable       | Percentage | Rank |
|----------------|------------|------|
| DBB. Method    | 38.60%     | 1    |
| BOT method     | 24.30%     | 2    |
| CM-at-fee Risk | 15.40%     | 4    |
| DB             | 21.70%     | 3    |
| total          | 100.00%    |      |

#### 4.2.3. Ensuring Project Quality

The majority of the respondents (39%) showed that the DBB method is effective in maintaining a quality construction project. The reason is, as noted, that 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 aesthetic). This is because, as the respondents mentioned, highly experienced construction management professionals are involved who can provide 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 or she willingly tends to execute the project within the specified standard of 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.



**Figure 3.** Method ensures the project quality.

#### 4.2.4. Administrative Burden the Public Owner

Overwhelmingly, 69.2% of the respondents indicated ad-



ministrative burden to the public. Owner is drastically decreased while using the BOT delivery method. The CM-at-Risk is also selected to reduce the administrative burden on the owner. The other better choice, as per the informants, is the DB method. The respondents thought that the final choice in this respect would be the DBB and the CM-Fee method. The following table presents the percentage scores.

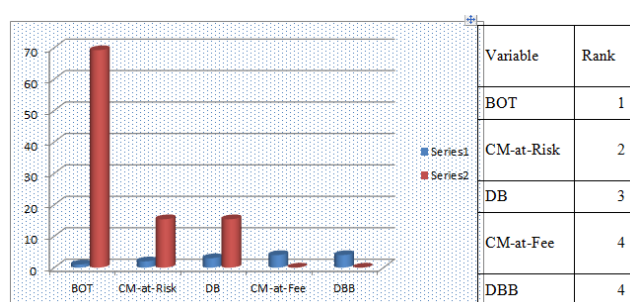


Figure 4. Method reduces the administrative burden.

The respondents thought that the DB, CM-at-Risk, CM-at-Fee, and BOT methods could be effectively applied to the local situation. They appreciate the extent to which these methods have been successful in the developed world. Accordingly, 29.4% of the respondents indicated the DB method can be applied, and again, 29.4% replied that the CM-at-Fee method 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 for the local situation, as showed in figure 5.

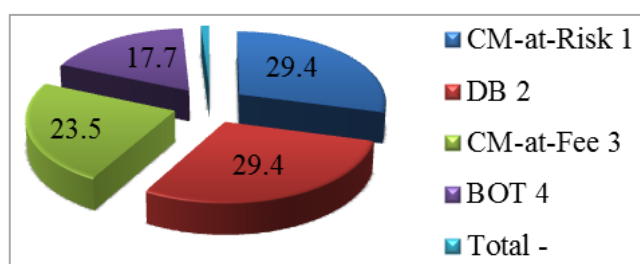


Figure 5. Delivery method local situation.

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: (1) Lack of experience in such broader services provided by a single entity, in Oromia State or Ethiopia. (2) Lack of project procurement guidelines, including local formal Standard Conditions of Contract, which can be applied (3) Lack of capable local contractors to effectively apply these methods. This capability 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 to claim that their rights to the contract are respected. The words of the supervising consultant are taken for granted. (4) Local design consultants lack experience with) financial incapacity of technologies. Contractors, especially to apply the BOT method. The latest construction technologies. (5) Financial incapacity of the local contractors, especially to apply the BOT consulting he slowest legal emerging Nags in the country. (6) Construction management consultancy firms are just emerging. (7) Lack of professional ethics. Generally, the key information obtained through interviews and questionnaires is thoroughly discussed, argued for, or supported for all of the above ranking of construction variables (source: author's computation from survey data). The cost certainty method is better than most of the innovative methods.

## 5. 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 appropriate delivery methods, public owners should be aware of new laws and information. In this research work, different effective project delivery methods have been described. Their relevance to the situation in Oromia Region, West Wallaga Zone 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. The perceptions of different stakeholders concerning the local construction industry have been sought. The validity of their views has been cross-checked with the information in the relevant literature. Hence, based on these findings of the study, the following conclusions are made: (1) The DBB method has been the most widely used effective project delivery method in the Oromia Region West Wallaga Zone of Ethiopia. (2) While DBB is a well-known, effective 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 to manage the contract. And also, it does not allow cooperation between different participants of a project there by hindering industry innovation. Generally, there is a tendency (an attitude) to improve the existing delivery methods there by improving the overall project performance. The Design Review and Construction Management Consultancy approach employed by one of the public agencies is an indication of such an attitude that a new and alternative approach superior to the DBB approach is being looked for. (3) 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). (4) 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. Therefore, DB, CM-at-Risk, and CM-at-Fee are three novel approaches that may be used in the Oromia Region of West Wallaga Zone, Ethiopia.

## Abbreviations

|     |   |
|-----|---|
| DBB | Design-Bid-Build                          |
| DB  | Design-Build                              |
| CM  | Construction Management                   |
| BOT | Design-Build-Operate-Transfer             |
| AIA | American Institute of Architects          |
| AGC | Associated General Contractors of America |

## Author Contributions

**Marema Keno:** Investigation

**Chera Merga:** Investigation

## Conflicts of Interest

The authors declare no conflicts of interest.

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