

A Review on Performance Comparison of Construction Project Delivery System

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ABSTRACT

Projects can be delivered through several accepted project delivery systems, some of which have evolved over the last few decades. Success or failure of any project is greatly influenced by the performance of cost, time and quality aspects of a project. As these systems have evolved, construction researchers have attempted to better understand the benefits of these systems. Design-Bid-Build (DBB), Design-Build (DB), CM-at-Risk (CMAR) are the three principal project delivery systems in the construction Industry excluding their hybrids, operational and financing modes. To improve the performance of DBB, DB and CMAR project delivery systems, an Agency Construction Management (Agency CM) is added to each of them. The Design-Bid-Build (DBB) system is the most frequently used delivery method for construction projects. The study included literature review, designing a questionnaire, collecting data from 4 projects of Amaravati city.

Keywords: Design-Bid-Build, Design-Build, CM-at-Risk, Agency Construction Management.

1. INTRODUCTION

The global construction industry is expected to reach an estimated value of \$10.5 trillion by 2023. The major drivers of the construction industry are government spending, increasing population, high per capita income, and GDP growth. The future of the global construction industry looks good with opportunities in residential, non-residential, and infrastructure (Research and Markets, 2018). Increasing urbanization, easy credit availability, and rising consumer spending will also possibly boost the construction industry. Strong economic growth in developing nations, such as China, India, and the Middle East countries, is expected to further drive this industry.

Globally, Construction projects are suffering from cost overruns, time overruns and poor quality. The construction industry describes a successful building project as one that is completed on time, within budget constraints, and meets a certain quality standard.

Projects can be delivered through several accepted project delivery systems, some of which have evolved over the last few decades. Success or failure of any project is greatly influenced by the performance of cost, time and quality aspects of a project. As these systems have evolved, construction researchers have attempted to better understand the benefits of these systems. Research has varied from project specific cases, through opinion surveys, to empirical studies..

A. Agency Construction Management

Design-Bid-Build (DBB), Design-Build (DB), CM-at-Risk (CMAR) are the three principal project delivery systems in the construction Industry excluding their hybrids, operational and financing modes. Each of them has some disadvantages. These disadvantages affect the three major performance components of the project namely Cost, Time and Quality. It is reported that across the Construction Industry, including Architects, Engineers, Contractors and Owners, there appears to be a lack of consistency of opinion regarding the advantages and disadvantages of each method.

Agency Construction Management utilizes management techniques during the planning, design, construction and post construction phases of a project for the purpose of controlling the project cost, project schedule and project quality.

2. STATE OF DEVELOPMENT

Abdul Khader Jeelani Shaik, et. al. (2015)

A project delivery system is a comprehensive process of assigning the contractual responsibilities for designing and constructing a project. Design-Bid-Build (D-B-B), Design-Build (D-B), and Construction Management at risk (CM-at-Risk) are the three principal project delivery systems. Agency CM is as a construction management system, and is a way to manage the process of construction. Agency-CM doesn't take any performance risk in guaranteeing project cost, project schedule and project quality. Generally Agency CM is remunerated on monthly fee, lump sum fee or by the percentage of the project cost that has conflict of interest with the final

project schedule and final project cost. Considerable amount of fee is paid to the Agency CM in order to improve the efficiency of the project. This necessitates a comprehensive investigation in to the performance of projects delivered with Agency CM and projects delivered without Agency CM. Agency-CM can be used with any type of Project Delivery system. This study is intended to evaluate the project performance metrics such as Project Cost, Project Schedule and Project Quality in Projects where CM –at - Risk Project Delivery System was used with Agency CM and Projects and where CM-at-Risk Project Delivery System was used without Agency CM. The study included literature review, designing a questionnaire, collecting data from 200 CM-at-Risk projects of which 100 projects where Agency CM was used and 100 projects where Agency CM was not used. Analysis of data pertaining to project performance metrics was done by using Statistical Product and Service Solutions (SPSS) statistical software. An understanding of this study may help an owner/client better select the most suitable Project Delivery System between the CM-at-Risk Project Delivery System with Agency CM and CM-at-Risk Project Delivery system without Agency CM.

Mohammed I Al Khalil et. al. (2002)

A model using the analytical hierarchy process (AHP) is developed to select the most appropriate project delivery method. Several factors considered to be relevant to the selection decision are used in the ranking of the project delivery methods. Project owners are keen to choose an appropriate project delivery method because it could be a key project success factor. The model developed in this paper is simple to use and allows the owner to consider all decision-relevant factors. It is based on an intuitively appealing methodology, AHP.

Fouad M. Al-Sinan, et. al. (1988)

There are many project delivery systems that owners from developing countries can use in executing their facilities' programs. The traditional engineer, procure and construct system (EPC); the design-build (turnkey) system, and the construction management (CM) system are the three project delivery systems studied in this research. The process of selecting the appropriate project delivery system that responds to the project's nature and the owner's requirements is a very important step that may significantly affect the success or failure of the project. A project delivery selection model (PDSM), and a project delivery decision model (PDDM) are developed that incorporate the owner's requirements, the developing country's characteristics, and the project's nature. These models are very easy to use, yet they provide meaningful results that the owner can use in making his selection of the most suitable project delivery system

Ibbs, William et. al. (2011)

A project delivery system (PDS) defines the process by which the finance, design, construction, operation and maintenance activities of a project are executed. It also establishes the roles and responsibilities of the parties involved in a project (Love et al., 1998; Miller et al., 2000). The use of an appropriate PDS can significantly increase the efficiency and the success rate of a construction project (Rwelamila and Meyer, 1999; Luu et al., 2003a; Oyetunji and Anderson, 2006). Because of its importance in past decades, many theoretical methods have been proposed to assist decision makers in evaluating and selecting a PDS in a logical and systematic manner. Because each method has certain strengths and limitations, decision makers need to choose the one that best meets their specific decision-making circumstances. To do this, they first need to know what methods are available. They also need a comprehensive understanding on how these methods work, how they vary from each other and their strengths and limitations. Developing such knowledge is nonetheless a difficult undertaking because the various proposed methods are scattered in individual papers. Despite that much effort has been devoted to developing individual PDS selection methods, very little, if any, has been made to review, compare and systematize them. This paper therefore aims to bridge this gap.

Shaik Abdul Khader Jeelani et. al. (2012)

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100 projects where Agency CM was not used. Analysis of data pertaining to project performance metrics was done by using SPSS statistical software. An understanding of this study may help an owner/client better select the most suitable Project Delivery System between the Design- Build (D-B) Project Delivery System with Agency CM and Design-Build Project Delivery system without Agency CM.

Edward Oladigbolu et. al. (2022)

Project delivery systems outline the responsibilities and tasks of the parties involved in a project. They also established a framework for how the phases of design, procurement, and construction would be carried out. The decision made when deciding on a project. The delivery system of a project affects every aspect of its execution, and it also has a big impact on how effectively the project is completed. Such analyses ought to be sufficiently complete to support decision-making. The generalized, unstructured, and too simplistic approaches that characterize subjective judgments have been proven to have a number of disadvantages compared to processes for organized, quantitative decision-making. Project managers are typically obliged to base their choice of project delivery techniques on subjective evaluations because there aren't any quantifiable criteria for project delivery systems that have been established and validated via research. The establishment of the essential quantitative values for use in a decision analysis process, which also provides a valid justification for the selection of project delivery methods for capital projects, would considerably increase the quality of the decision-making process. The research findings that are provided in this paper provide the field with the requisite quantitative values.

Davidson Rajan Philip et. al. (2018)

Maintenance management of structures is a big try for the owners and managers in many countries with aging civil infrastructure. It is not easy to change or perhaps heal, all structures because of the really extensive escalate and disposal of such infrastructure, and its associated costs. A building exists to serve the user's time obligation. The special intention of maintenance is, to overemphasize the mean life of a building, by delaying deterioration, decay and failure. Building maintenance management is a complex process that involves planning, directing, governing and organizing resources for the livelihood of the building's functional opera. This paper outlines the most important looks of maintenance management systems, reflect on the most competitive practices in Chennai and highlight the state of the art in this area. It is seen through case studies integrating structural strength monitoring in the maintenance management systems is promising in rationalizing decisions that are needful for the benefit owners embarrassed by the scarce resources.

S. Z. Syed Zuber et. al. (2018)

The selection of project delivery method is one of the factors that can influence the success of a construction project. Therefore, understanding each of the primary project delivery methods used in construction industry; Design-Bid-Build (DBB), Construction Manager at Risk (CM at Risk) and Design-Build (DB) are important before the decision-making. This paper is a theory based and the objectives are to develop a new definition of project delivery method by synthesizing the existing definitions and to describe the project delivery methods aforementioned. Their advantages, disadvantages and comparison in terms of delivery phase and performance are also presented. There is no project delivery method that appropriate to be used for any construction project therefore, the development of new ideal methods is important to achieve a successful construction project.

Qingping Zhong et. al. (2022)

Determining a project delivery method that matches the characteristics of a construction project is a critical step that affects the success or failure of a project. The Project Delivery Method (PDM) should be adapted to the activities and processes of project implementation. However, the traditional selection method does not come from the internal process of the project which may lead to the delivery method not being able to meet the actual project requirements. This research proposes a DSM-based PDM selection framework model that regroups activities and identifies appropriate PDMs by revealing the dependencies and intensities between activities. The research uses a case to demonstrate the feasibility of the framework. After considering specific project requirements and goals, the framework model can be used as a basis for choosing specific project delivery methods, or as a visualization tool to help owners schedule activities.

Ji-Wei Zhu et. al. (2020)

Choosing an appropriate project delivery system (PDS) directly affects the achievement of performance goals, and at the same time it is of great significance for sustainable construction project management (SCPM). This paper took the PDS of construction engineering as the research object, took the Design-Build (DB) and the Design-Bid-Build (DBB) as examples, and established the indicator system for determinants of the PDS decision. Based on Multi-Agent Systems (MAS), a decision-making simulation model of the PDS decision was constructed, and this paper analysed the influence of the project attribute characteristics, policy and market

environment, owner ability and preference, and contractor technology and capabilities of the PDS decision. While analyzing the circumstances under which the owners tend to choose DB or DBB, the following conclusions were reached: (1) the contractor technology and capabilities increase faster in DB than in DBB. (2) The PDS with policy and market environment preferences has an advantage in the PDS decision, and the owners are more willing to choose the PDS which was selected previously. (3) The competition mechanism in the construction market will eliminate contractors whose growth rate is too low to meet the needs of projects in the market. The research provides theoretical references for the scientific decision-making of construction enterprises.

Naser Saad Almutairi et. al. (2022)

The construction industry has grown during the last decades and has developed concurrent with technological and information development. The main objective of this paper is to investigate the different methods of project delivery systems and their relationship with the project organization represented by different project parties. The work also briefly describes tendering methods and the different contract types to identify how to create a contractual strategy for large construction projects. The construction industry is characterized by its multiplicity of parties involved in the implementation of mega projects. Each party has a key role in the success of the project during its implementation stages until the completion of the project. There may also be multiple countries involved in implementing them. Hence, they are based on multiple contracts with different parties, responsibilities, and obligations that emphasize the role of “contract engineer” or “contract administrator”. It is the responsibility of the contract administrator to manage multiple contracts for different parties and from different countries that have added international character to the construction contracts. The overall responsibility is to ensure that all parties fulfil their contractual obligations as stipulated in the terms of the contract. The contract can thus be considered a future plan for the implementation of the project. Therefore, the contract is a vision for the future, and projects do not pass without facing many risks surrounding them, i.e., whether there are external sources such as economic changes that affect prices, currency exchanges rates, or internal sources such as technical problems. The risk allocation must be balanced against the terms of the contract so that the project can conclude successfully.

3. CONCLUSION

- After reviewing all of the research articles on our issue, we discovered something that is not mentioned in any of them
- Construction Industry is in search of project delivery methods that would make the construction and maintenance of projects more efficient in cost, schedule and quality.
- The disadvantages of design-bid-build (DBB) projects include minimal input from constructors and development of adversarial relationships.
- This traditional approach, in some cases, may promote more adversarial relationships rather than cooperation or coordination among the contractor, the designer and the owner.
- A strong working relationship between the owner and the Agency-CM is paramount to success. Early involvement in the project develops trust and confidence between the Agency-CM and the owner's staff. A keen understanding of the critical internal and external issues related to the project is fundamental for success.

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