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# STREAMLINING CONSTRUCTION PROJECTS: CRITERIA FOR DELIVERY METHOD SELECTION

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**ABSTRACT:** One of the earliest and most essential decisions that need to be made in a construction project is the owner's selection of delivery method system to be used. This selection dictates how the contract language allocates risk, aligns different stakeholders and determines the timing, involvement and collaboration. This paper synthesizes existing industry knowledge and practices that concern selection of project delivery systems (PDSs) and puts forward a unified scoring rubric that project stakeholders can use to help determine the optimal delivery system for their unique project characteristics. The decision support tool offers the user a series of driving statements with predictive scores to help decision-makers narrow down the PDS options to the most appropriate choice for their particular project. This study aims to produce a document that can enhance and augment the PDS decision-making process of industry members who choose to apply it. It is not intended that this manual should completely supplant any existing project delivery system selection tools that may be present.

## 1. INTRODUCTION

Annually, the Associated General Contractors of America (AGC) issues an economic forecast for the construction industry. In 2024, as with countless prior years, labor availability was noted as one of the foremost challenges impacting the construction industry, as an aging workforce, slower population growth, and fewer new entrants to the trades combine to create a challenging labor environment. Additionally of note is a shift in types of construction available – commercial (warehouse, retail, farm) and office construction were both down over 10% year-over-year. By contrast, data center construction is up 69%, building upon the ever-increasing demand for processing power that is inherent to the AI revolution (Simonson, 2024).

These prevailing market conditions will result in an increase in both more complex construction (data centers as compared to warehouses, for example) and a continued focus on efficiency and project outcomes to combat labor productivity issues. Accordingly, it is unsurprising that construction, as an industry, has become increasingly aware of and interested in both the nuances of project delivery systems (PDS) and their relationship to project performance. The literature abounds with studies that compare, evaluate, rank, or score PDS relative to each other, often within the context of a type of construction (e.g. healthcare, institutional, etc.) or some other means of delineating a subset of data. However, the result of this vigorous research interest has perhaps been an oversaturation of information, resulting in decision paralysis for practitioners, and lower adoption of newer and more collaborative delivery systems (Bilbo et al, 2014). A gap in the literature exists – namely, there are few tools to help project teams evaluate the delivery systems available to them and select the most appropriate one for the goals they seek to achieve.

Different PDS are more appropriate for different types of work. For example, work that is technically complex, involves a large number of stakeholders or contractors, and/or is unfamiliar to the contractor in some way (new type of work, new geographic area, etc.) may be better suited to the more 'collaborative' delivery models, such as Integrated Project Delivery (IPD) or Construction Manager At-Risk/As-Agent (CMAR/CMAA) (Welker, 2024). By contrast, these delivery systems may be overkill for a low-risk, straightforward project that is familiar to the parties (e.g. construction of a new elementary school), for which Design-Bid-Build (DBB) may be appropriate. (Labib, 2019). Design-Build (DB, also interchangeably referred to as Engineer-Procure-Construct or EPC) is common in industrial work where design constraints are known at the beginning of the project. The figure below presents a summary of the four PDS considered in this research effort and various indicators of applicability.

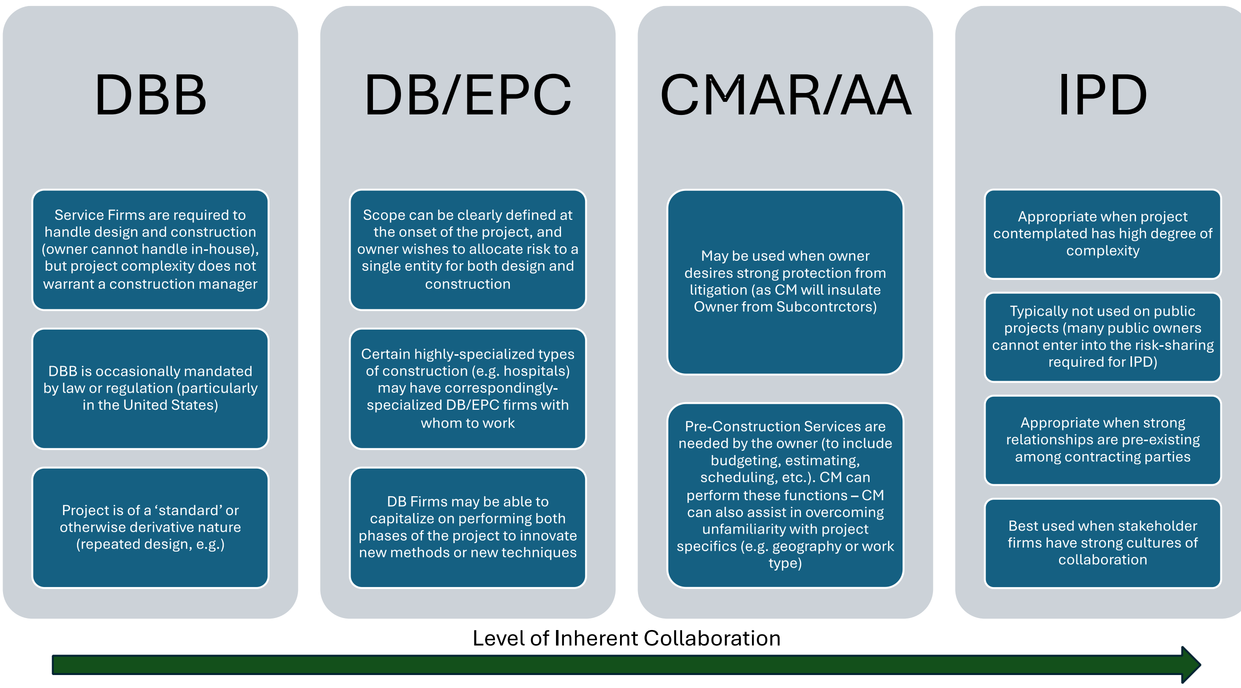


Figure 1: Indicators of Applicability of Common Project Delivery Systems

Despite the indicators of applicability for IPD aligning in the direction of the constantly evolving construction industry, the adoption of this system is surprisingly low (AIA, 2012). This is puzzling given the wealth of available research highlighting the importance of PDS selection as it correlates to project performance (Ibrahim et al. 2021). The construction industry faces growing demand, yet there has been pervasively low productivity and low margins. Given that PDS selection has been correlated to significantly influence project outcomes, it is imperative that project stakeholders carefully evaluate the available project delivery options before embarking on new projects, taking the adequate time and action necessary to carefully consider the delivery system best suited to the specific project requirements. This paper outlines the efforts of the research team to address this problem statement.

In 2019, a research team comprised of academic and industry professionals perceived that there was a need to reexamine the project delivery methods being used in the industrial sector to achieve several objectives: 1) to understand how PDSs were being used; 2) update commonplace terminology that had become outdated; and 3) determine quantitatively the benefits and limitations of the PDSs then in use. The purpose of this paper is to augment the existing body of knowledge that concerns PDSs and to synthesize the findings of the research team into a unified decision-making tool that project stakeholders can simply and readily use. This paper spells out the particulars of the decision-making process within a project to help owners arrive expediently at the optimal delivery system and to present to all project parties (i.e., owners, contractors, subcontractors, and project management consultants) a means of understanding the objectives of every other party, to better facilitate collaboration and the integration of the project unit.

## 2. METHODS

To begin the research process, the research team aligned a group of industry experts for two years. During the research effort, the team identified and mutually agreed upon five principal responsibilities as the core structure of every PDS: 1) Project Management; 2) Engineering; 3) Procurement; 4) Construction Management; and 5) Construction. Every project assigns these responsibilities to different parties, and the specific combination of these assignments can help an owner decide which PDS to utilize. During its research, the research team identified 11 distinct matrices of responsibility, but it also determined that these matrices did not constitute 11 distinct delivery systems. Rather, the team classified each subsystem as belonging to one of four "major" PDSs: 1) Integrated Project Delivery (IPD); 2) Construction Manager at Risk or Construction Manager as Agent (CMR or CMA); 3) Design-Build/Engineer-Procure-Construct (DB/EPC) – called just "DB" or "EPC" many occasions; and 4) Design-Bid-Build (DBB). It should be noted that subsystem choice was not found to have an impact on project success within the same PDS – therefore, this paper will discuss results at the PDS level.

To achieve the research objective, both qualitative and quantitative project data were needed. The research team was able to avail itself of a continuous effort within the UW-Madison Construction Engineering Program to collect current-state project data from the construction industry via qualitative and quantitative surveys. The UW–Madison team developed this survey through a continuous effort to collect vital project performance data that reflect the current state of the construction industry. For brevity, the entire survey is not reproduced here, but should readers wish, elements can be made available from the corresponding author.

The survey questions were then tailored to the needs of this research effort through a combination of review of existing literature, the experience of the research team's academics (which included numerous efforts concerning project delivery), and a collaborative discussion among the research team's industry and academic members. From this data, the research team was able to identify the most widely used project delivery systems and what components were necessary for their execution within industrial projects. Using this information, the research team developed the qualitative scoring rubric and driving statements applicable to each system type. As such, these findings derive from and augment existing literature while simultaneously capturing the current state of practice in the industry at large. This paper characterizes the qualitative elements of this study in more detail – brief allusions may be made to the quantitative analysis, but the focus is on how and why certain PDS are selected.

## 3. RESULT

Following this discussion and data collection, the research team developed the assessment rubric to increase understanding of the relative merits of the project delivery systems (PDSs) that this research effort examined. The rubric focuses on the project and owner factors that impact project delivery, structured around a series of driving statements, such as, "All parties prefer to carry mutual protection from litigation." The project factors addressed include project size, cost, schedule, risk allocation, complexity, and design. An example of a driving statement corresponding to the project schedule factor found within Figure 1 is as follows: "This project will require the procurement of specialty components with protracted lead times." The owner factors addressed include owner experience, staffing requirements, control, involvement, choice of project partners, and relationships. An example of a driving statement corresponding to the This rubric is designed to assist owners in selecting the most suitable PDS for their project, recommending the option with the highest final score based on the project's unique characteristics and stakeholder preferences.

This process is designed to enhance and augment the PDS decision-making process for project stakeholders who choose to apply it, providing a tool to help owners efficiently identify the optimal delivery system for the unique needs of a given project. This paper serves as a means for all project parties—owners, contractors, subcontractors, and project management consultants—to understand each other's objectives, fostering collaboration and facilitating the integration of the project unit.

To use the rubric, assemble a small group of individuals with knowledge of the project. Not every participant needs to come from executive leadership – feel free to include estimators, project managers, and even labor supervisors (foremen), if available. As a group, discuss whether each driving statement applies to the project in question. If not, eliminate that statement. This approach will ensure that the final list of statements is tailored to the specifics of the project. Next, the users will score the PDSs they are considering by using the tailored list of statements and the scoring criteria presented within the methods portion of this paper.

The scoring system uses a three-point scale:

- 3 – Most Appropriate. This PDS has the highest degree of success in achieving the goal of the driving statement.
- 2 – Somewhat Appropriate. This PDS will permit some objectives of the driving statement to be achieved but may not do so as intuitively or as completely as a PDS that scores "3."
- 1 – Least Appropriate. Using this PDS may make it difficult to realize the objective of the driving statement. Consider other choices.
- X – Does Not Apply. This PDS, due to either its contracting mechanism or other internal factors, does not permit the driving statement to be achieved, and may not be construed to do so. This PDS should not be chosen for that application.

At the end of the session, the PDS that scored the highest will be the one that the company should consider first. If the selected PDS does not meet project criteria, the group should suggest the PDS with the second-highest score.

Below is an example of a completed PDS rubric with scoring values based on a sample project analyzed by the research team. The values are arbitrary. This figure was provided to demonstrate how project participants may utilize the scoring system to aid in PDS selection.

| Driving Statement | DBB | CM | DB/EPC | IPD |
|---|---|---|---|---|
| This is a 'small' project for our company (default: <$100M) | 3 | 3 | 2 | 2 |
| This is a 'medium' project for our company (default $100M < X < $500M) | 2 | 3 | 3 | 3 |
| This is a 'large' project for our company (default: >$500M) | 1 | 3 | 3 | 3 |
| The budget needs to be established as early as possible | 3 | 2 | 3 | 3 |
| The owner's cash flow is constrained | 3 | 2 | 2 | 1 |
| Cost Growth is a major concern | 1 | 2 | 3 | 3 |
| Preventing Schedule Growth is a major concern | 1 | 2 | 2 | 3 |
| This project will require the procurement of specialty components with protracted lead times | 2 | 3 | 3 | 3 |
| The owner wishes to minimize total delivery time (design and construction) | 1 | 2 | 3 | 2 |
| This project has tight milestones or critical deadlines | 1 | 3 | 3 | 3 |
| The owner wishes to transfer design/construction risk | 2 | 2 | 3 | 1 |

| | | | | |
|---|---|---|---|---|
| All parties prefer to carry mutual protection from litigation | 1 | 2 | 3 | 3 |
| The owner is willing to have a mechanism to share cost and reward risk | 2 | 3 | 1 | 3 |
| The owner wishes to minimize the risk of errors and omissions in plans and specs | 1 | 2 | 3 | 3 |
| The owner wants to reduce the size and frequency of change orders | 1 | 2 | 3 | 3 |
| The project is complex or nonstandard in nature | 1 | 3 | 3 | 3 |
| The project is repeatable, standardized, or non-complex | 3 | 3 | 2 | 2 |
| The project scope necessitates coordination of multiple trades, especially or additionally with complex work sequencing | 1 | 3 | 3 | 3 |
| The project design is 20% complete | X | 2 | 3 | 3 |
| Project design is 60% complete | 1 | 3 | 1 | X |
| The owner wants to benefit from value engineering/constructability analysis | 1 | 3 | 3 | 3 |
| The owner wishes to permit innovation during both design and con | 1 | 2 | 3 | 3 |
| The owner wants to minimize design-related claims | 1 | 2 | 3 | X |
| The owner is experienced with technology, scope, location, etc | 3 | 1 | 1 | 2 |
| The owner is willing and has the ability and experience to administer multiple contracts for design and construction | 3 | 2 | 1 | 1 |
| The owner has sufficient staff with the appropriate management skills and experience | 3 | 1 | 1 | 3 |
| The owner prefers to have designers, contractors, and key participants involved early and contractually bound | 1 | 2 | 1 | 3 |
| The owner prefers a minimal number of parties to be accountable for the project performance | 2 | 2 | 3 | 1 |
| The owner has a minimal number of employee resources to dedicate to this project | 1 | 3 | 3 | 1 |
| The owner is willing to share decision power with key project participants | 1 | 2 | 2 | 3 |
| The owner prefers to have a high degree of control or influence over the project | 3 | 1 | 1 | 2 |
| The owner wants to get involved in the design process | 2 | 2 | 1 | 3 |
| The owner is unfamiliar with project specifics or does not wish to be involved in day-to-day operations | 2 | 3 | 3 | 1 |
| Schedule growth and control is a key concern | 1 | 2 | 1 | 3 |
| The owner wishes to benefit from a competitive bid process | 3 | 2 | 1 | 1 |
| Laws or regulations dictate which PDS(s) are permitted | 3 | 2 | 2 | X |
| There are strong preexisting relationships between contracting parties | 1 | 2 | 3 | 3 |
| The owner desires a direct relationship with the designer | 3 | 2 | 1 | 3 |
| All parties are willing and able to commit to transparency | 1 | 2 | 2 | 3 |
| The owner values more expedient and successful project communication (as measured by RFI/Change Order processing time) | 1 | 2 | 3 | 3 |

Figure 2: Completed Project Delivery System Assessment Rubric Sample

## 4. DISCUSSION

Project cases analyzed included 41 projects within the downstream chemical manufacturing sector and 55 institutional projects with similar scope and complexity. Data collection focused on projects completed within the last 15 years, for recency and accuracy. The research objective was to understand why a firm might move to a new PDS and realize better results on its projects for the trouble. As the researchers began to compile and score the driving statements within the selection rubric, particular use cases for different PDS began to emerge. DBB, for example, is an increasingly poor choice as project size increases, while smaller projects do not offer enough complexity of scope to benefit from the higher degree of collaboration found in DB/EPC or IPD. That said, DBB does offer higher degrees of cost certainty, making it more applicable when the cash flow of the project is constrained up-front. Note, though, that while DBB's use of lump-sum payments can generally provide initial cost certainty, it has been found to be exceptionally poor at controlling cost growth. IPD is particularly ill-suited to constrained cash flow projects, as it has higher upfront costs for planning and coordination.

In terms of schedule, DBB projects have been found to experience the highest amount of schedule growth of any PDS – upwards of 40%. Thus, in any situation where schedule performance is critical, or where timelines are accelerated, this PDS should be avoided. More collaborative PDS also demonstrated higher applicability where specialty procurement has the potential to endanger schedule with long lead times.

Risk management strategies also helped to define PDS selection, as did project complexity. Risk is generally best allocated and managed under an IPD arrangement, unless the owner wishes to allocate all risk externally, in which case DB/EPC is a stronger choice. DBB requires that the owner assume at least partial risk. Thus, as risk increases, the more collaborative PDS are stronger choices. Complexity follows much the same pattern, in that more complex projects were found to be more appropriate for collaborative delivery styles, but low complexity work saw diminishing returns and could be better off with DBB.

The owner, naturally, has a significant impact on how a project will be delivered. The degree of involvement desired can steer a project toward IPD (for the very involved owner) or toward CM (for an owner who wishes to be more hands off). Additionally, the more leverage an owner can realize from preexisting relationships, the better success they will find with collaborative delivery.

Certain factors, like design percentage complete, 'lock out' a PDS – it is not possible to deliver under DBB while design is at 20% complete, nor would one enter into an IPD agreement at 100% design complete. Similarly, regulatory factors can eliminate DB, IPD, and in some cases CMAR/AA - note that in many US states, the only method permitted on public projects is DBB.

It is important to note, however, that these factors and their scores are derived from averages and an analysis of the industry as a whole, as well as the experience of the research team's academic and industry members. Over time, as the tool becomes more familiar, the user can and should feel free to re-weight the PDSs relative to each other for each driving statement. For example, consider the driving statement, "The owner wishes to benefit from competition and the existence of a large pool of qualified contractors." If the user has an established relationship with a DB/EPC firm that takes full advantage of subcontracting, then the user could re-weight the DB/EPC score for that statement to a "3" to capture that particular situation better.

While the research team rigorously discussed and analyzed this tool, the PDS assessment rubric should not be perceived as "etched in stone." The research team strongly encourages that, after an organization becomes familiar with this method of assessment, it should develop its own driving statement(s) and consider local factors, company factors, and any particularities that only the owner will be aware of.

Finally, the rubric as presented here considers all things to be equal for a contractor outside of the factors within it. This is not necessarily true for contractors in general – corporate culture at firms that primarily execute low-bid DBB work will be different than that of firms which are set up for IPD work, which will differ from those set up for CM work. These cultural factors are important to consider, as they too can impact the selection of PDS and the success that a company is able to achieve on a project. Moreover, the owner of the project has their own culture that should be considered – if the owner's attitudes toward collaboration and problem solving do not align with the selected contractor, project success may suffer.

## 5. CONCLUSION

One of the earliest and most essential decisions made in any construction project is the owner's selection of which delivery method to use. Since the choice of project delivery system (PDS) will dictate the contract language and the signing timing, the owner must decide before collaborative partners can contribute. The research team aimed to address an observed need to examine the state of practice in the industrial sector in terms of project delivery systems (PDSs). The objective of this paper was to present to the industrial sector a comprehensive series of steps to aid the owner in the crucial selection of which PDS to use on a project. This study presented four major PDSs: 1) Integrated Project Delivery (IPD); 2) Construction Manager at Risk or Construction Manager as Agent (CMR/CMA); 3) Design-Build/Engineer-Procure-Construct (DB/EPC); and 4) Design-Bid-Build (DBB). This paper presents a PDS selection decision support tool structured around a series of driving statements and a method by which the owner can tailor these to reflect their unique project objectives. These statements are assigned various levels of appropriateness based on the empirical data collected by this research effort and the opinions of the team's industry members. The research team identified 11 subsystems within the four major systems. These subsystems are explained using a series of hierarchical diagrams and decision trees to help an owner understand which alternative is the most effective for the given situation. This paper also presents the research results completed by the team for those who wish to review them, though an understanding of the statistical and mathematical analysis performed is not necessary to use the decision tools presented in this paper.

The goal of this research is to emphasize that project delivery system (PDS) selection should not be dictated by habit or familiarity. The most suitable PDS for a project may differ from the one a firm traditionally uses or has the most experience with. The tool introduced in this paper serves as a valuable aid in the complex process of selecting a PDS. Recognizing that each project comes with its own unique characteristics and owner requirements, the rubric helps stakeholders carefully evaluate how the specific variables outlined in the driving statements align with their project needs.

This process is designed to enhance and refine decision-making for stakeholders who adopt it, providing a practical tool to guide owners toward identifying the optimal delivery system. While not intended to replace existing PDS selection tools, the manual offers a framework that encourages collaboration by helping all project parties—owners, contractors, subcontractors, and project management consultants—understand each other's objectives, fostering teamwork and project integration.

When combined with the quantitative analysis presented in this paper, which highlights that more collaborative delivery systems often yield better project outcomes across metrics like cost, schedule, quality, communication, and change management, this rubric becomes a valuable prompt. It encourages stakeholders to consider whether collaborative delivery methods align with their project's unique characteristics, ultimately leading to more informed and effective PDS selection.

The research team was surprised by the lack of adoption of IPD across the industrial sector. Given the size (in market share) and scope (in millions) of the industrial sector, the team urges its leaders to consider IPD as an option to improve performance on future projects. The team had initially hypothesized that IPD would be the second most popular delivery system, because all of its members were aware of the popularity of DB/EPC. Yet, this was not the case for the data set analyzed. If IPD becomes more widely accepted in the industrial sector, as the team hopes will happen, this research effort should be repeated or updated as more industrial-specific IPD data becomes available. Any additional update would further enhance the applicability of the recommendations presented herein.

The most important element of any industry snapshot report such as this one is timeliness. That is not to say that these results will become inaccurate or inapplicable over time, but rather to acknowledge that construction frequently innovates and changes. As such, to capture change and improve recommendations, the research team hopes that this effort can become a cornerstone of future project delivery system research. Expanding the data set or adding other sectors of the construction industry to this research would help the industry understand project delivery better. In addition, reflecting on completed PDS report after project completion can offer valuable input into whether the rubric aligned with initial expectations—

specifically, how accurately key outcomes such as cost, schedule, and performance were anticipated. It also allows for reflection on how well the initial completion of the PDS rubric aligned with the final project objectives. This continuous, iterative process can support the ongoing development of the owner's manual, allowing for expansion to better prepare project stakeholders to attempt their next project.

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