

CRITERIA AND LIST OF QUESTIONS FOR SELECTING THE PROJECT DELIVERY METHOD

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Abstract

There are many different delivery models available in the construction industry. Owners are therefore faced with the difficult choice of selecting the most appropriate delivery method for their project. An analysis of the literature shows that several criteria are often used to select project delivery models. These criteria include project size, complexity, cost, schedule and others.

However, there is often no evaluation or question in the literature regarding the selection of a project delivery model, and it is difficult to make a decision based on just one criterion. Therefore, the criteria are used as a basis for developing the questions. They are derived and formulated in such a way that they can be answered with 'yes' or 'no'. In addition, KO questions are developed which lead to a systematic reduction of the project implementation models. In order to make a final choice, decision theory has to be taken into account and the model that best fits the YES, NO and KO questions is selected.

This paper presents a short catalogue of questions that the client can answer in a structured way. This will assist the client in selecting the project delivery model. The different decision models are presented and an evaluation or weighting of the questions is carried out to enable the project delivery method to be selected.

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1. Introduction

Clients, project managers, planners and consultants are often faced with the challenge of choosing the right delivery method. A large number of different criteria are listed in the literature and some questions are also formulated. The questions serve to create a better awareness of the project. Criteria or questions alone cannot help those involved in a project to choose the delivery method. To achieve this, an appropriate selection process must be developed. The selection process should be designed in such a way that, at the end, the client has several options as to which delivery method he considers most suitable for his project. To achieve this, the basic definitions will be briefly outlined below. The decision theory is briefly described and the selected decision methodology is presented. The criteria found in the literature and the pre-formulated questions are then shown. Subsequently, a decision sequence is presented that is intended to help the client answer the questions and arrive at a delivery model.

2. Definition of Delivery Methods

In literature, there is no clear definition for the delivery method. There are a lot of other paraphrases for delivery methods, for example: Project Delivery System, Construction Contracting Method and Procurement Method. In the following description only “Delivery Method” will be used [1]. A project delivery method will be defined in this paper as: “A Project Delivery Method (PDM) is a system used for organizing and financing design, construction, operations, and maintenance services for a structure or facility by entering into legal agreements with one or more entities or parties” [1, 2].

Choosing a project delivery method is one of the fundamental decisions owners (the owner will later be referred to as the user in this paper) make at an early stage for their project [3]. At an early stage the owner has to think about which delivery method is best suitable for their project. The main challenge is that there are many different kinds of delivery methods, contracts and procurement methods. So, the owner needs to involve a project manager or consultant for support and finding the delivery method.

By choosing the delivery method the owner has to think about three important elements. First of all, which kind of delivery method is best suited for the project. Secondly, which kind of contract best matches the delivery method and finally, which type of procurement method is most suitable for the delivery system and contract. Fig. 1 shows the main questions for the owner.

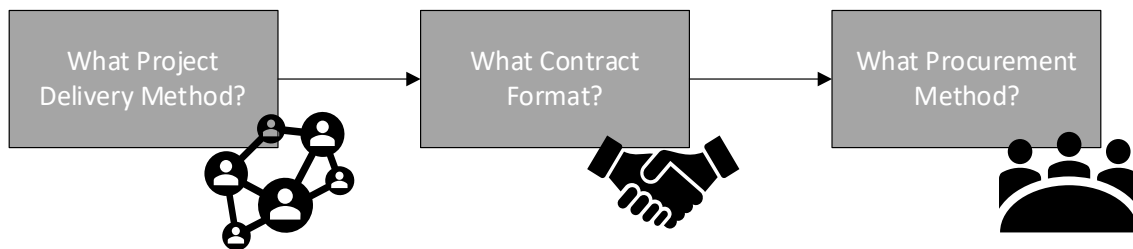


Fig. 1 Choosing the delivery method [1]

3. Criteria and Questions for delivery methods

In order to find the criteria and questions for the delivery methods, a literature analysis was carried out. In the analysis, the search string was structured as follows:

- (delivery) AND (method OR system OR model) AND (questions OR criteria)

Due to the large number of results, only an excerpt of the results is shown and structured here. The complete results will be published at a later date.

3.1. Criteria for choosing the delivery method

Of the 21 papers examined, there were 179 criteria for the selection of a delivery method [1, 4–23]. Not all of the criteria are presented here. However, the criteria can be divided into the following categories:

- Project
- Owner experience
- Cost
- Schedule
- Team Selection Considerations
- Design
- Procurement
- Contracting

- General

The results for the questions on the choice of delivery model are also shown below (see section 3.2) according to this scheme. Criteria such as “risk” and “quality” were also overriding criteria. However, these were not considered further in the questionnaire. The reasons for this can be found in section 3.3.

3.2. Questions for choosing the delivery method

It was evident that of the 21 papers examined, only 6 papers contained questions on the selection of the delivery model. The following Table 1 to Table 9 present 9 criteria containing questions on the selection of the delivery method.

Table 1 Criteria for project

Project	Source
Is there any potential for changes during construction?	[11]
Is there a possibility of change in design?	[5]
Is there an incentive fore early completion?	[5]
Is the project familiar in the industry?	[5]
Does the project offer unique or unusual features?	[7]

Table 2 Criteria for owner experience

Owner experience	Source
Has the owner used this delivery method before?	[11]
Is the owner knowledgeable about the construction industry?	[5]
Ability - What is the owner’s ability to participate in the project delivery process? What role or roles is the owner capable of filling?	[13]
Desire of Involvement - How much direct involvement does the owner want in the project delivery process?	[13]
Are specialty skills needed for design or construction?	[7]

Table 3 Criteria for cost

Cost	Source
Do you want to be strongly involved in the design phase?	[5]
Is there an incentive reducing project budget & duration?	[5]
Potential to obtain an early cost commitment?	[20]
To what ability can the delivery method reduce claims/cost for changes and delays?	[20]
To what extent does the method permit the owner to influence systems, materials and construction methods to minimize life cycle costs?	[20]

Table 4 Criteria for schedule

Schedule	Source
Is there a need to overlap phases of the project?	[11]
Are design and construction funded?	[11]
Is there an urgency to start the project?	[5]
Is the penalty for late completion high?	[5]

To what extent can the delivery method achieve accelerated delivery, or ensure delivery to a specific schedule? [20]

Table 5 Criteria for team selection considerations

Team Selection Considerations	Source
Laws - Do state or federal laws dictate methods of team member selection and procurement?	[13]
Availability and Experience - What is the availability and experience of the design and construction community for the specific project at hand?	[13]
Relationships - Does the owner have relationships with particular designers and/or contractors?	[13]
Team Building - What team members will provide the best opportunity to build a winning team?	[13]

Table 6 Criteria for design

Design	Source
How complex is the design review process for the owner?	[20]
To what degree does the owner and user have direct contract with the design consultant and are they able to directly influence the design?	[20]
To what extent does the delivery method inherently minimize changes?	[20]
To what extent must user requirements be defined prior to tender?	[20]

Table 7 Criteria for procurement

Procurement	Source
Is advanced procurement beneficial to the project?	[5]
Are permits acquired or predictable?	[7]
Is right-of-way acquired or predictable?	[7]
Have all inter/intra-governmental agreements been obtained?	[7]
Are utility agreements in place or predictable?	[7]

Table 8 Criteria for contracting

Contracting	Source
To what extent is the required design and construction experience and knowledge available for the method?	[20]
Ability to prequalify the prime contractor on publicly funded projects?	[20]
To what extent does the method employ a simple bid evaluation and selection system?	[20]
What level of construction quality can be achieved with the applicable delivery method?	[20]

Table 9 Criteria in general

General	Source
To what extent do owners have the experience and knowledge required to employ the method?	[20]
Is the geotechnical fieldwork complete?	[7]
What level of collaboration is desired?	[11]

3.3. Results from the criteria and the questions

Obviously there are a large number of different criteria are available for selection. Although the questions can be categorized according to the criteria, this type of question collection is too unstructured.

It should also be noted that although there are criteria such as “risk”, it is not very useful to introduce this as a question. With regard to the topic of quality, it can also be seen that there are hardly any questions in this category. This can be explained by the fact that the majority of quality or construction quality is actually defined by standards and other regulations. This should not be an overriding selection criterion. Below is only a short description of how to develop a decision system by the decision theory.

Concerning to the questions, it is also easier for the user to reformulate them so that they are closed and can only be answered with “yes” or “no”. The answers to the questions are then scored according to how many points they give for each delivery method.

To further support the client and make the selection easier, KO questions should also be implemented after the first questions to further limit the selection.

A utility analysis is carried out at last. The utility values are chosen subjectively, as the results based on empirical data vary greatly due to the client's experience, the legal conditions in the country, etc. To incorporate a more objective opinion, a quantitative risk analysis is also carried out for the costs and deadlines or individual risks in order to be able to carry out an evaluation from this. The evaluation between risk analysis and benefit analysis is carried out independently. This is followed by questions using an event tree, which is carried out in the KO model in order to further narrow down the selection.

4. Summary

This article shows the guiding questions for choosing af delivery methods. Futher criteria for selection are shown. Questions were also identified by means of a literature analysis. The analysis is not conclusive and must be further investigated in another publication. However, the methodology should be questioned. It should also be questioned how useful it is to use a list of questions from different sources without knowing their origin. It would be more expedient to examine the individual components of delivery methods and derive the decisive questions from them.

5. Outlook

A comprehensive analysis of all criteria and questions should then be carried out. A list of questions can be drawn up from this. However, the list of questions will never be exhaustive. It is actually easier to identify the advantages and disadvantages of the individual components (delivery method, contract and procurement method). This means that a well-founded statement or rather a selection can be made with a limited number of questions. Although a catalogue of questions is an aid, it is still difficult to make a decision. In addition, each question must be evaluated subjectively.

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References

- [1] DESIGN-BUILD INSTITUTE OF AMERICA, Ed., "Choosing a Project Delivery Method: A Design-Build Done Right Primer," 2015.
- [2] A. Engebø, O. Lædre, B. Young, P. F. Larssen, J. Lohne, and O. J. Klakegg, "COLLABORATIVE PROJECT DELIVERY METHODS: A SCOPING REVIEW," *JOURNAL OF CIVIL ENGINEERING AND MANAGEMENT*, vol. 26, no. 3, pp. 278–303, 2020, <https://doi.org/10.3846/jcem.2020.12186>.
- [3] J. B. Miller, M. J. Garvin, C. W. Ibbs, and S. E. Mahoney, "Toward a New Paradigm: Simultaneous Use of Multiple Project Delivery Methods," *J. Manage. Eng.*, vol. 16, no. 3, pp. 58–67, 2000, [https://doi.org/10.1061/\(ASCE\)0742-597X\(2000\)16:3\(58\)](https://doi.org/10.1061/(ASCE)0742-597X(2000)16:3(58)).
- [4] Association of California Construction Managers, Ed., "Project Delivery Handbook: A Guide to California School and Community College Facility Delivery," Sacramento, 2017.
- [5] W. Cho and M. Hajdu, "Framework of Project Delivery System Selection Tool Based on Cross Functional Relationship," in *Proceedings of the Creative Construction Conference 2019*, 2019, pp. 108–116, <https://doi.org/10.3311/CCC2019-017>.
- [6] Y. A. Elziny, M. A. Mohamadien, A. S. Essawy, H. M. Hassan, and I. H. Mahdi, "Developing Decision Support System to Optimize the Delivery System, Tendering Method and Type of Contract," *American Journal of Engineering Research (AJER)*, no. 9, 176-185, 2020, <https://doi.org/10.2174/18741495-v17-e230215-2022-51>.
- [7] G. E. Gibson and J. Walewski, "Project Delivery Methods and Contracting Approaches: Assessment and Design-Build Implementation Guidance," Austin, 2001.
- [8] C. Gordon, "Choosing Appropriate Construction Contracting Method," *Journal of Construction Engineering*, pp. 196–210, 1994.
- [9] S. W. Hasan, "University of Texas at Arlington Dissertation Template," Master Thesis, The University of Texas at Arlington, 2010.
- [10] A. Hosseini, O. Lædre, B. Andersen, O. Torp, N. Olsson, and J. Lohne, "Selection Criteria for Delivery Methods for Infrastructure Projects," *Procedia - Social and Behavioral Sciences*, vol. 226, pp. 260–268, 2016, <https://doi.org/10.1016/j.sbspro.2016.06.187>.
- [11] M. E. Kenig, "PROJECT DELIVERY SYSTEMS FOR CONSTRUCTION," Wilson, 2011.
- [12] T. Mearing, "Project Delivery Method Handbook," 2017.
- [13] D. Moore, "Selecting the Best Project Delivery System," Houston, 2000.
- [14] V. B. Nair, "Choosing the best project delivery method for contractor success," *PM World Journal*, VIII, Issue VIII, pp. 1–17, 2019.
- [15] NZ Transport Agency, Ed., "Procurement manual," Rep. w, 2009.
- [16] M. Saikat and N. M. d. Almeida, "Discussion of procurement methods in the construction industry," *InterConf+*, 32(151), pp. 678–695, 2023, <https://doi.org/10.51582/interconf.19-20.04.2023.073>.
- [17] The Construction Management Association of America, Ed., "AN OWNER'S GUIDE TO PROJECT DELIVERY METHODS," 2012.
- [18] A. Touran, *A guidebook for the evaluation of project delivery methods* (TCRP report 131). Washington D.C.: Transportation Research Board, 2009.
- [19] Unknown, Ed., "Delivery Model Analysis," Accessed: May 28, 2024. [Online]. Available: https://55construction.com/buildingqld_wp/wp-content/uploads/2019/08/13.-Delivery-Model-Analysis.pdf
- [20] K. TZANAKAKIS, "Project Delivery Methods for the Transport Infrastructure," unkown, 2019.
- [21] Z. Y. ZHAO and R. U. LIU, "SELECTING THE APPROPRIATE PROJECT DELIVERY MODES USING NON-STRUCTURAL FUZZY DECISION METHOD," *Advancement of Construction Management and Real Estate*, unkown, 2006.
- [22] S. C. Becker and P. Sander, "DEVELOPMENT OF A "PROJECT OBJECTIVE SYSTEM" (POS) TO ALIGN THE INTERESTS OF ALL THE STAKEHOLDERS AND FIND THE RIGHT DELIVERY MODEL," in *Proceedings: Creative Construction Conference 2023, CCC 2023, Kezthely, Lake Balaton, 20-23 July 2023*, M. J. Skibniewski and M. Hajdu, Eds., Budapest: Diamond Congress Ltd, 2023, pp. 252–257.
- [23] S. C. Becker and P. Sander, "Development of a Project Objective and Requirement System (PORS) for major infrastructure projects to align the interests of all the stakeholders," in *Expanding Underground - Knowledge and Passion to Make a Positive Impact on the World*, G. Anagnostou, A. Benardos, and V. P. Marinos, Eds., London: CRC Press, 2023, pp. 3369–3376.