A COMMON PROCESS FOR SELECTING A CONSTRUCTION-PROJECT DELIVERY SYSTEM

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Abstract

Project delivery systems define functions and scope of work of each concerned party for completing a project. Different project delivery systems yield different performance to a project. In other words, selecting an appropriate project delivery system affects the success of the project in terms of cost, time and quality. Accordingly, there are some researchers studied and explored various factors for project delivery system selection; whilst others developed models for project delivery system selection, and still others studied and suggested processes for selecting a project delivery system. However, these processes are different showing a lack of a common process for the selection. Thus, the research was aimed to develop such a common selection process. The research method used a qualitative approach to gather data from key informants using in-depth interview by a semi-structure questionnaire. After that, a conceptual process was modified corresponding to the observed data. Until no new information was received, the interview stopped. Then, a common process was established and validated. The result reveals that a common process for selecting a construction-project delivery system comprises 2 stages: (1) preliminary construction-project delivery system selection and (2) final construction-project delivery system selection. This result is beneficial for developing a model for the selection of a construction-project delivery system.

Keywords: Project delivery system; Selection; Process

1. INTRODUCTION

The definitions of project delivery systems are numerous, examples of which are the process by which the project phases are accomplished and the contractual relationships among the parties involved in each phase showing the roles and responsibilities of the parties involved in a project (Kuprenas, 2002); an execution framework in terms of sequencing of design, procurement, and construction (Oyetunji and Aderson, 2006); and the management functions of the owner in project execution that reflect the roles, responsibilities, risk allocation of project participants and payment for services by the owner (Chen et al. 2010).

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According to Carmichael (2000); Masterman (1992); and Sinthawanarong (2007), at present there exist many project delivery systems and the typical ones as well as their respective advantages and disadvantages are as follows:

- *Design-bid-build*: It is the most popular project delivery system and is referred to as the "traditional" system. This system has three key players: owner, designer and contractor. The advantages of this system are the checks and balances exercised by the designer and the contractor, e.g., in any changes made to the drawing of the design; and the simple nature of the system. Some of its disadvantages however are lengthy project duration, limited coordination between the designer and the contractor, and opportunistic behavior of either party to change the drawing details despite the checks and balances mechanism.
- *Accelerated tradition*: This project delivery system is much similar to the design-bid-build system except that in the accelerated tradition system construction work begins as design has been partially completed. The advantage of this system is that construction work can be completed faster, leading to shortened project duration, whereas its main disadvantage is the limitation of the drawing detail revision due to the beginning of construction before the completion of design.
- *Two-stage tendering*: With this system, the owner employs a contractor to provide construction information during the design phase, thus providing the designer with information on the construction processes and construction techniques. The construction and the design are thus consistent. The advantage of this system is a shorter project duration due to close coordination between the designer and the contractor, thereby leading to less conflict. The disadvantage is that the contractor who supplies construction details for the design may be inexperienced.
- *Continuity contractor*: This system uses the contractor employed in the current project to continue completing sequential similar projects. The advantage of this system is the shortened tendering process and thus cost and time is greatly saved. The disadvantages of this system are that the owner must have at least two similar projects and the contractor must be able to work continuously with the same owner.
- *Design-build*: Under this system, the owner hires a contractor to be responsible for design, construction and material procurement. The advantages of this system are the shortened completion time of the project and fewer conflicts as the designer and the contractor are from the same organization, thus allowing ease of coordination. The disadvantages are that quality control is difficult as the checks and balances mechanism would be absent and that the owner would be allowed revisions only before the project commences.
- *Package deals*: The owner hires a contractor and uses the contractor's standard drawings and construction methods. The advantages of this system are that it requires less effort from the owner as he/she is able to choose from the existing drawings and that the cost of design is greatly reduced as the standardized drawings and methods are used. The

disadvantages are that some construction specifications may not be what the owner desires and his requests for design modification are unlikely to be met.

- *Turnkey*: The owner engages a contractor to be responsible for design, construction, material procurement, financing, installation and testing of equipment, and perhaps the recruitment and training of employees for operation after project completion. The advantage of this system is that all responsibilities are delegated to the contractor, so the owner can use the project immediately after the delivery. The disadvantages are that the balance of power and participation between the owner and the contractor is reduced, that the quality control is difficult, and that the decision-making power of the owner about the project is limited.
- *Development and construction*: The project is delivered with an owner team responsible for development and design concepts and forms of construction. The contractor is hired only for the design details and construction. The advantages of this system are that the project meets owner's need and cost of concept design is reduced. The disadvantage nevertheless is that the owner has to have his own staff members for coordination with the contractor to solve problems and potential conflicts between the owner team and the contractor because of work overlaps.
- *Management contracting* or *project management*: Under this system, the owner employs a project manager to manage the designer and the contractor. The advantages of this system are that the owner receives consultancy right from the design stage; and that as the project manager has control authority over the contractor there is a guaranteed maximum price for the project. The disadvantages are that the quality control is difficult if the project manager is part of the construction team and that the owner has incurred additional costs by hiring the project manager.
- *Construction management*: Under this project delivery system, the owner engages a construction manager to be responsible for only construction. The advantage of this system is that the project can be divided into subprojects, allowing for better quality control of the construction by the construction manager. The disadvantages are that there is no guaranteed maximum price and that the owner must manage an increasing number of contractors undertaking the subprojects.
- *Build-Operate-Transfer*: The owner hires a contractor to be responsible for financing, design, and construction. The contractor can earn benefits from the project during concession. At the end of the concession, the project is transferred (i.e., returned) to the owner. The advantages of this system are that all responsibilities belong to the contractor and that the owner reduces the risk and cost of project implementation. The disadvantages are that there might not be remaining benefits for the owner after the end of concession, that quality control is difficult, and that owner’s decision-making power on the project is limited.

The relationships between parties in the aforementioned project delivery systems are shown in Figure 1. The selection of one project delivery system over another influences the

project success. Kumaraswamy and Dissanayaka (2001) found the correlation between project delivery systems and cost and time over-runs. Al Khalil (2002) recommended that the project delivery system selection be an essential decision for the owner. Mahdi and Alreshaid (2005) suggested that careful selection of the project delivery system results in cost savings and harmony in project delivery process. The project delivery system is one of the important factors for the project success (Chen et al. 2010). Thus, some researchers studied and explored various factors for project delivery system selection. For example, Skitmore and Marsden (1988) and Cheung et al. (2001) studied and explored various factors and techniques to choose a suitable project delivery system. Other researchers developed models for project delivery system selection. For instance, Alhazami and McCaffer (2000) developed the Project Procurement System Selection Model (PPSSM). Kumaraswamy and Dissanaya (2001) developed a decision support system for construction project procurement. Moon et al. (2011) developed a selection model for choosing a housing project delivery system. Still other researchers studied and suggested processes for selecting a project delivery system, examples of whom are:

Luu et al. (2003) proposed a process for selecting a project delivery system as follows:

- Identifying linguistic classifications of project delivery system selection
- Recalling similarity of current situation and successfulness of past projects
- Comparing the project delivery system with other existing project delivery systems
- Selecting the most suitable project delivery system.

Luu et al. (2005) suggested a process for selecting a project delivery system as follows:

- Identifying project delivery system selection criteria
- Examining the benefits and weaknesses of each project delivery
- Selecting the most suitable project delivery system.

Love et al. (2012) suggested a process for selecting a project delivery system. The process is divided into 6 steps as follows:

- Identifying project objectives and constraints
- Identifying project delivery selection criteria
- Weighting of criteria for selecting project delivery system
- Developing project delivery system appropriateness chart
- Conducting project delivery system review session
- Selecting the preferred project delivery system and making recommendation.

Review of the above literature indicates that most researchers suggested part of a process for selecting a project delivery system rather than in its entirety. In addition, the processes are fragmented, reflecting a lack of a common process for selecting a construction-project delivery system. As such, the purpose of this research is to develop such a common process spanning the beginning step to the final step for selection of a project delivery system. A qualitative method was utilized whereby in-depth interview was conducted with key

informants or players of the construction industry in Thailand during 1 April - 31 May 2013.

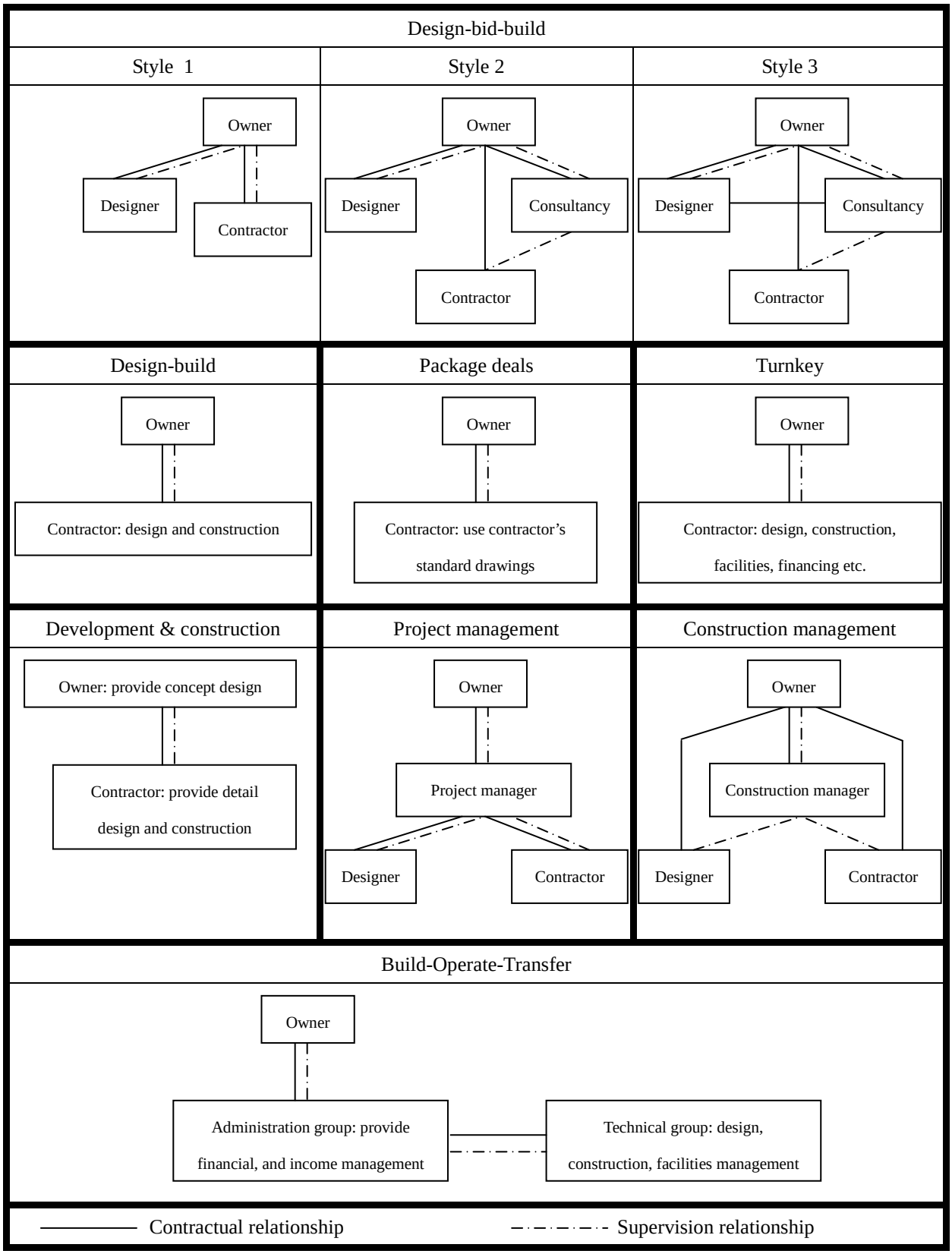

Figure 1: Relationships between parties in various project delivery systems.

2. METHODOLOGY

A qualitative research methodology was applied to exploring a process by which selection of a construction-project delivery system is undertaken. As such, in-depth interview was adopted to glean information as this data collection method allowed the respondents to freely express their opinions and share experiences with regard to the project delivery systems. The research methodology of this work is as follows:

- Review of literature on processes related to selection of a construction-project delivery system;
- Development of a conceptual framework for a hypothesized process for selecting a construction-project delivery system;
- Development of the first draft of the semi-structured questionnaire for use in the interview to ensure that all important aspects would be investigated;
- Pre-test of the draft questionnaire with three highly experienced practitioners of construction-project delivery systems in Thailand to confirm validity of the hypothesized process;
- Selection of respondents with experience in processes for selecting construction-project delivery systems, examples of whom are managing directors, project managers of construction companies, consultancy firms and owner companies. Nevertheless, the number of participating interviewees would not be initially fixed.
- Recording of the interview conversation on a voice recorder and noting down key information on the questionnaire.
- The interview data were validated by the investigation of data completion and all data harmony.
- Analysis of the interview data by *component analysis* and *analytic induction*. The component analysis was used to investigate the entire steps of the hypothesized process while the analytic induction was to test the relationships between all steps and to develop description of all steps. The hypothesized process was modified to be corresponding to interviewees' answers. Afterward, a process for selecting a construction-project delivery system together with its description was established.
- Validation of the obtained process against other key informants.

3. RESULTS

Analysis of the main steps in the hypothesized process for selecting a construction-project delivery system is performed. Afterward, the hypothesized process has been altered marginally by 8 key informants. So, a process for selecting a construction-project delivery system was clearly delineated. To confirm this process, other 5 key informants were used to review this process. There is no further comment from them. A common process for selection of a construction-project delivery system is thus illustrated in Figure 2.

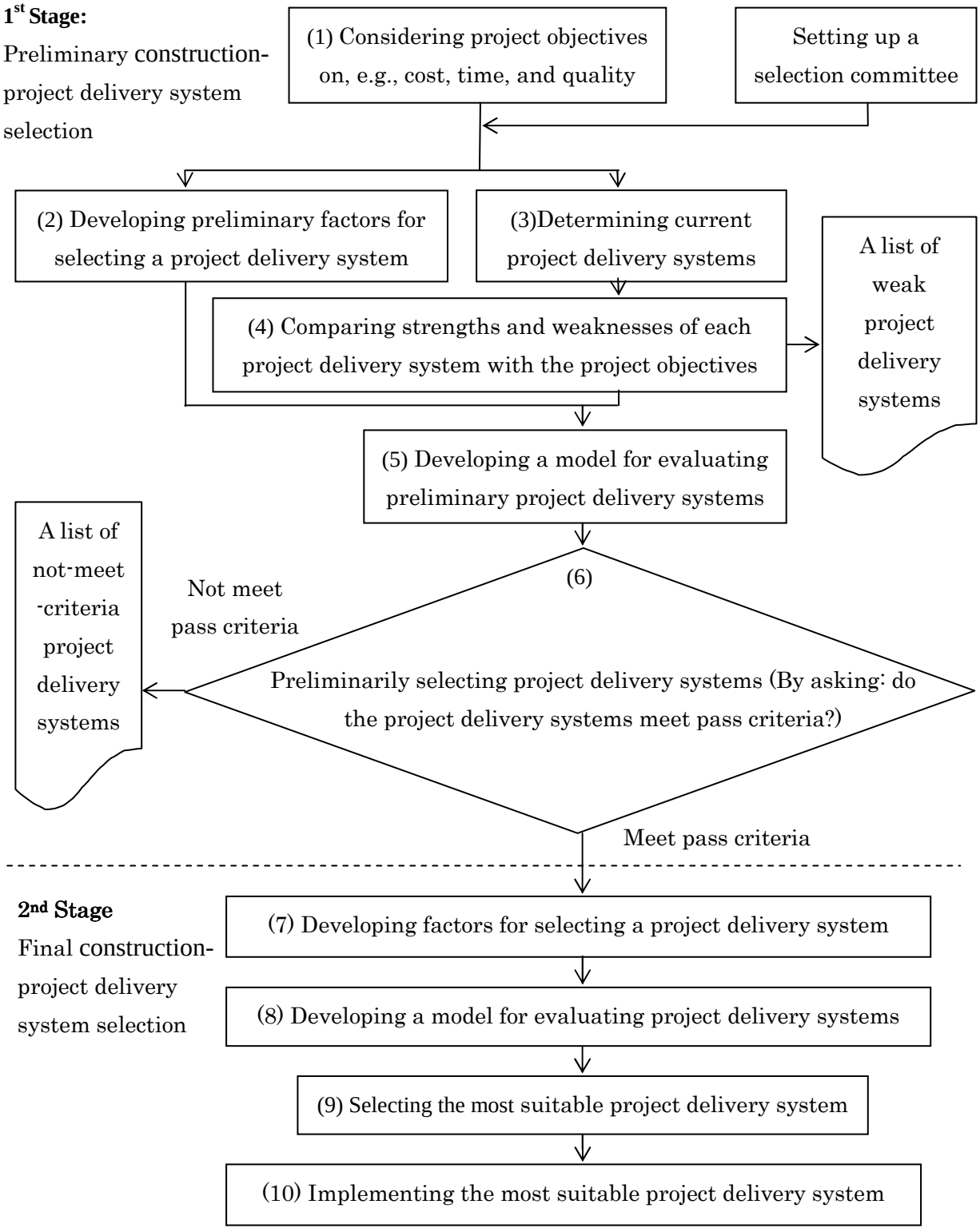

Figure 2: A common process for selecting a construction-project delivery system.

As seen in Figure 2, there are two major stages in this common process:

1st stage: Preliminary construction-project delivery system selection. In this stage, all existing project delivery systems are evaluated according to preliminary factors and their respective strengths/weaknesses. If any project delivery systems do not satisfy the minimum criteria, they will be discarded. Six main steps constitute this first stage:

(1) Considering project objectives on, e.g., cost, time and quality. Different projects have different objectives, which include minimizing cost, minimizing time or improving safety. These objectives affect the selection factors and their weights of relative importance. Thus, understanding these objectives is importance before the decision maker continue to the next step of this process. In addition, a selection committee is established for next steps.

(2) Developing preliminary factors for selecting a project delivery system. The preliminary factors under consideration should support the success of the project objectives, or at least support the screening of project delivery systems.

(3) Determining current project delivery systems. The existing project delivery systems are reviewed in order to generate alternatives for selection. The existing project delivery systems include design-bid-build, design-build, package deals, turnkey, development & construction, project management and construction management.

(4) Comparing strengths and weaknesses of each project delivery system with respect to the project objectives. For the sake of screening, strengths and weaknesses of each project delivery system are reviewed and then compared with the project objectives. The project delivery system having weaknesses that hinder the success of the project objectives will be quickly eliminated. For example, if an objective of the project is to shorten construction time, the design-bid-build system with its weakness for long project duration will be discarded from the process.

(5) Developing a model for evaluating preliminary project delivery systems. In this step, all preliminary factors are interrelated to form a model. Here, weights are assigned to all the factors and all factors for each project delivery system are measured. Then, the model will evaluate the values of all project delivery systems.

(6) Preliminarily selecting project delivery systems by questioning whether the project delivery systems satisfy the pass criteria. In this step, minimum passing scores, called “pass criteria”, are specified. Any project delivery systems with the scores greater than or equal to the pass criteria will continue to the 2nd stage; otherwise, they will be discarded.

2nd stage: Final construction-project delivery system selection. This is the stage where the most suitable project delivery system for a construction project is selected. Four main steps constitute this stage:

(7) Developing factors for selecting a project delivery system. Similarly, the factors developed should support the success of the project objectives. In practice, the factors are subdivided into lower factors, and then further subdivided into lower factors and so on. This

subdivision results in a hierarchy of factors more complex than that of step (2).

(8) Developing a model for evaluating project delivery systems. Similar to step (5), a model is developed to evaluate project delivery systems. However, the factors and model in this step should be of high sophistication with capability of, for example, putting together preferences of multiple decision-makers, covering elements of risk and uncertainty, and offering computer interaction that makes the model flexible to any changes in the situation.

(9) Selecting the most suitable project delivery system. The result of the previous step shows the ranking order of all project delivery systems under consideration. The first ranking order should be selected as the most suitable project delivery system.

(10) Implementing the most suitable project delivery system. The most suitable construction-project delivery system, once selected, should be implemented for the project. During the implementation, modification to the chosen system may be necessary.

4. CONCLUSION

Review of existing literature relevant to this research work reveals an absence of a common process for selecting a construction-project delivery system. Accordingly, such a process was the focus of this research. The result confirms the hypothesized process that consists of 2 stages: (1) preliminary construction-project delivery system selection and (2) final construction-project delivery system selection. These two stages together consist of 10 main steps: (1) considering project objectives on, e.g., cost, time and quality, (2) developing preliminary factors for selecting a project delivery system, (3) determining current project delivery systems, (4) comparing strengths and weaknesses of each project delivery system with the project objectives, (5) developing a model for evaluating preliminary project delivery systems, (6) preliminary selecting project delivery systems (by asking: do the project delivery systems meet pass criteria?), (7) developing factors for selecting a project delivery system, (8) developing a model for evaluating project delivery systems, (9) selecting the most suitable project delivery system, and (10) implementing the most suitable project delivery system. In addition, this process involves multiple factors and multiple decision markers. The results of this research render a beginning position for further development in construction-project delivery area. However, testing this process with more number of construction-project delivery system practitioners is required to standardize the process for the Thai construction industry, which is an ongoing research of the authors.

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