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Complexity in the Evaluation of Contract Types Employed for the Construction of Highway Projects

Fani Antoniou^{a,*}, Georgios N. Aretoulis^b, Dimitrios Konstantinidis^c,
Glykeria P. Kalfakakou^b

^a*Egnatia Odos S.A. and Civil Engineering Department, Aristotle University of Thessaloniki, Thessaloniki, Greece*

^b*Civil Engineering Department, Aristotle University of Thessaloniki, Thessaloniki, Greece*

^c*Civil Infrastructure Engineering Department, Alexander Technological Educational Institute of Thessaloniki, Thessaloniki, Greece*

Abstract

The procurement of public works is by definition complex in that its success depends on many varied interrelated parties (client, designer, licensing authorities, contractors, construction supervisor, users). In addition, the construction process is always technologically complex as it is comprised of numerous tasks and objectives. The choice of the most appropriate contract type (CT) regarding the method of contractor compensation is one of the most essential and complex decisions. This choice is based on the decision maker's knowledge, experience and intuition. Following an extensive literature review to determine both the seven CT's employed in the construction industry and the nine selection criteria (SC) most commonly considered when choosing between CT's, a questionnaire survey was carried out among 79 highway construction professionals who were asked to rate each CT against each selection criterion. This study presents the frequencies of the CTs scores against each criterion but the main aim of the research is to decompose the complex selection patterns relating to the participants' choices. A correlation analysis carried out established associations among the respondents' profiles and their resulting ratings of each CT against each SC. The results indicate that the participants' origin, current position profile, years and type of professional experience and finally years of direct and indirect experience with each CT influence their perception of the appropriateness of each CT against each criterion and the respective scores awarded to each CT.

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* Corresponding author. Tel.: 0030-2310-470-326; fax:0030-2310-470-265.
E-mail address: fanton@egnatia.gr

1. Introduction

Vidal *et al.* (2011) argue that the definition of project complexity could be summarized in the following: “project complexity is the property of a project which makes it difficult to understand, foresee and keep under control its overall behavior, even when given reasonably complete information about the project system”. According to Baccarini (1996), “Project complexity can be defined as 'consisting of many varied interrelated parts' and can be operationalized in terms of differentiation and interdependency. This definition can be applied to any project dimension relevant to the project management process, such as organization, technology, environment, information, decision making and systems”. The application of complexity theory is to enable the systematic review of the inter-connections. Although the complexity of projects and their environment obviously influences important decisions, complexity as such is often taken intuitively or from previous experiences. In addition, complexity issues include but are not limited to the following:

- Project complexity influences the selection of project inputs
- Complexity is frequently used as a criterion in the selection of a project procurement system
- Complexity affects the achievement of project objectives of time, cost and quality.

The procurement of public works is by definition complex as, from project inception to project realization, it must go through a number of phases and its success depends on many varied interrelated parties. The major participants in the above procedure are the Owner or Client, the Design Consultant, Contractor and Construction Manager (CM). The number and type of contractual relationships between the major participants are crucial in terms of time, cost and quality achievement of the resulting project.

The construction process is considered a complex undertaking as it is comprised of numerous tasks and objectives, the most important of which is obtaining value for money, especially during times of recession. For this reason, the choice of the most appropriate CT regarding the method of contractor compensation is essential. In making this choice, decision makers use their own knowledge, experience and intuition according to specific selection criteria (SC) they have in mind.

This research focuses on the procurement authority participants' thought process and approach to the selection of the appropriate CT for highway construction projects. Each participant is considered a system which processes data and exports a justified opinion, in this case a proposal for a certain CT. The output of the system is the decision on the CT, which is based upon the assessment of certain SC. Each participant influences the others and shapes the final common decision on the best CT to be employed. Their personal assessment of the available CTs against the predefined SC is based on a number of factors, interconnections which are not apparent.

This paper considers all the above issues and focuses on the selection process of the appropriate CT against a predefined number of SC for the construction of public highway projects. The final aim of the current research initiative is to explore the way the profile of the engineer (experience: years, role, duties, type of projects) influence the decisions on the appropriate CT against a number of predefined SC.

2. Methodology

2.1. Determination of contract types and selection criteria

Since the late 1980's early 1990's the importance of choosing the most appropriate CT has been evident in the construction industry (Veld & Peeters 1989; Ward & Chapman, 1994). The literature review showed that for public works CTs and in particular regarding the method of compensation, there are numerous reports relating to: a) the evaluation of their performance in terms of the final cost, duration and/or quality of resulting project (Turner & Simister, 2001; Paul & Gutierrez 2005; Tang *et al.*, 2008;

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