

Review of Subcontracting Practice in Construction Industry

Lew Yoke-Lian, S. Hassim, R. Muniandy, and Law Teik-Hua

Abstract—Great numbers of traders from different specialisation makes construction industry is a complicated and unique industry. To overcome the demand on special expertise, advanced equipment, and huge investment cost, letting out work to subcontractors has been a norm in construction industry. Nevertheless, large presence of subcontracting poses challenges to contractors, client and their project management teams to manage such a large, diverse and fragmented group of subcontractors. Success of a construction project is essentially depending on the ability of general contractor to select the appropriate subcontractor during bidding process, and the sufficient management of subcontractor during construction. This paper served as a summary of literature review done on types of subcontractor, problems generated by subcontractor, and current proposed methods to enhance the subcontracting practice.

Index Terms—Subcontractors, construction.

I. INTRODUCTION

A construction project is awarded to a general contractor or prime contractor or principal contractor or main contractor, which resorts their work out to specialize outside firm to carry out specific project activities. General contractors are responsible for managing the project such as contract administration with clients, project financing, material and equipment procuring, and monitoring the project progress [1]. According to Albino & Garavelli [2], the general contractor's performance are strongly dependant on subcontractors. This statement is reinforced by Mbachu [3] which stated that the ability of the general contractor and consultant to deliver the project within time, quality and cost depends largely on performance of subcontractors.

When the scope of work and logical dependencies between subcontractors works are not fully understand by general contractor and owners, it became a critical problem to the success of complex and fast-paced projects. Cost litigation and dissatisfied customers due to the conflict between general contractor, subcontractors and other project participants would then followed [4]

Construction mismanagement might start with a single subcontractor, and cascade through the work force chain to affect the schedule and leading to damages to multiple parties [5]. Therefore, issues in subcontractor should not be

overlooked in defeating the challenge of achieving planned budget, cost and schedule.

Subcontractor is a common term used in construction. Due to the uniqueness of each construction project, the work force is transient, multiple craft are involved, each project are planned and worked in short time frames, and variety of materials and equipments required, one single construction project is often sublet to many subcontractors [6-13]. Subcontractors can contribute more than 50% [2], and can be as much as 90% of total project value to a construction process[6].

Subcontractors are specialist in the execution of a specific job, they act as a agents of the production system of the contractor company in supplying materials, manpower, equipment, tools or designs [6]. A subcontractor is a construction firm that contracts with a general contractor to perform some aspect of the general contractor's work. In most construction projects, a vital role is played by subcontractors who are hired to perform specific tasks on a project. In the usual case, the general contractor will perform the basic operations and subcontract the remainder to various specialty contractors. Subcontracting is used much more extensively on housing and building construction projects than on engineering and industrial projects [14].

II. TYPES OF SUBCONTRACTORS

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Attempts have been made to differentiate subcontractors. In Hong Kong, Ng, Tang and Palaneeswaran [7] classified subcontractors to (i) equipment-intensive subcontractors (who are hired due to their specialized plant and equipments), and (ii) labor-intensive subcontractors (those who are hired as a result of their specialized labor resources.

Costantino, Pietroforte and Hamill [15] revealed that labour-only subcontractor beneficial the subcontractor by reducing the cost of mobilization and purchasing material. Furthermore, it also offers economic advantages to the general contractor by avoiding the mark-up of full subcontracting. Quality problems and claims may still occur in getting the supply of material for application of this labour-only subcontractor. Therefore, some general contractors prefer full subcontracting to shift risk and liability.

Partnering relationship between general contractor and subcontractors were proposed to create a win-win situation [6],[16]. According to Lee, Seo, Ryu and Kwon [16], this

Manuscript received May 17, 2012; revised June 15, 2012.

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long-term relationship must be established to avoid adversarial relationship between general contractor and subcontractor. Several types of relationships between general contractor and subcontractor are discussed, competitive relationships and strategic relationships were among them. Comparison model based on transaction cost for both general contractor and subcontractor are developed respectively for each relationship.

Further subcontracting by subcontractor, or called multilayer subcontracting/latent subcontractor, allow the subcontractor to be less vulnerable to fluctuation in business, have more flexibility in workforce coordination, and be able to reduce cost of management [8].

In Turkish, practice of subcontracting work by subcontractors to secondary subcontractor is widespread [19]. A study on 35 general contractors and 56 subcontractor organizations revealed that most of them are willing to sublet their work under overload of work or time pressure.

When "latent" subcontractor happened, the extent of subcontracting is even larger. "Latent" subcontracting or multilayer subcontracting is the further subcontracting down the stream by subcontractors with or without the knowledge or consent of the general contractor or client. This has been alleged to be one of the major causes of poor construction quality and construction site safety in Hong Kong [17],[8]. Ekström, Björnsson and Nass [18] argued that payment to the second tier subcontractor/suppliers can be part of the performance measurement when evaluating subcontractor.

III. PROBLEMS OF SUBCONTRACTING

However, subcontractor related problems are still quoted as one of the main risk of construction project globally [9, 17-23]. The same applies to Malaysia, problems with subcontractors have been identified as one of the important causes contributing to delays in Malaysian construction industry. Subcontractor was quoted as one of the common causes of construction delays in Malaysian construction industry [24-25].

Several studies conducted in Malaysia shown that subcontracting practice is creating problems to the construction industry. Sambasivan and Soon [25] claimed that there are many subcontractors working under the general contractors particularly for huge projects in Malaysia. But subcontractors are found to be among the top five reasons contributing to project delay. In another study done by Alaghbari, Kadir, and Salim [26], lack of subcontractor skills are found to be one of the contributors to contractor in causing delay in 78 construction projects studied in Malaysia. Other than causing delay, coordination problems with subcontractor were quoted as factors that affect the construction labour productivity of residential projects in Malaysia [27].

Despite interruption to work progress, role of subcontractor as partner of general contractor, material supplier and safety performance in construction project are also revealed. Subcontractors are identified as one of the risk associated with in partnering project in Malaysian construction industry [28-29]. The importance of subcontractors' past safety performance was revealed as a criterion for soliciting bids for new work by the general

contractors in Malaysia [30]. Further, subcontractors are found crucial in material supply chain of Malaysian construction industry due to their role as the mediator between suppliers and main contractor [31].

Subcontractor failure has been listed as one of the risk allocated to general contractor in construction contracts [32]. This is supported by El-Sayegh [22] which stated that subcontracting is risky and can lead to low quality, delayed completion and unsafe practice. Another risk created by subcontractor is the possibility of them to breach contract and dispute with the general contractor. Hence, subcontracting has been listed as one of the significant factors causing delay United Arab Emirates [19],[33] and Malaysia[24-25].

Payment issues, retainage withheld by general contractor, bidding issues, bonding issues, insurance issues, safety issues, partnering issues, and productivity issues are among the issues needs to be investigated in subcontracting practices [9].

The problems does not limits to the general contractors, subcontractors also be inflicted with unfairness. An exploratory study participated by 28 subcontractors revealed the fact that subcontractors are often required to assume all risks and obligations stipulated between the owner and general contractor, without given the opportunity to examine them [32]. Meanwhile, a study one in Scotland studied on the set-off, or more often called contra charge, shows that subcontractors has faced the problem to settle this obstacles with the main contractor fairly. Though some subcontractors are protected by the contract clauses, the subcontractors were found reluctant to use their contractual entitlements due to the fear of being denied opportunities to tender for the future jobs [33].

IV. PERTINENT STUDIES ON SUBCONTRACTING

A series of study has been done to enhance the subcontracting practice by focussing on either registration, selection, or monitoring it [34]. Most studies on subcontractor focused on either registration of subcontractor [34-35], selection of subcontractor [11,36-37], or monitoring/performance rating during construction stage [2-4,18,38-40].

Focus of researchers goes to either determining the constituents of subcontracting or developing new approaches/techniques to select and/or manage subcontractors. Subcontractor has become an issue on its own, separated from selection/management of general contractor by client/consultants due to its complexity. Numerous subcontractor selection and monitoring model has been proposed [2],[4],[34-36].

A. Selection of Subcontractor

Many selection methods of subcontractors have been proposed in the literature. Arslan, Kivrak, Birgonul and Dikmen [36] developed a web-based subcontractor evaluation system (WEBSES) to ease the selection of subcontractors. The criteria for evaluating were identified by estimators of construction firm in USA based on a database of approximately 4000 subcontractor firms.

Ng & Luu [35] developed a model for subcontractor registration decision through case-based reasoning approach.

12 experts were interviewed to provide essential steps needed for differentiating good and bad subcontractors. The model developed uses each attributes' calculated ratings for identification of matching cases and similarity score of each individual cases. The historical data of subcontractors can be retrieved and use for the current evaluation. Weighting of all attributes can be easily modified according to the users preference, thus the effectiveness of this model is still very much depends on the experience and knowledge of users.

Manoharan [41] proposed a subcontractor selection method using Analytic Hierarchy Process (AHP) based on 29 questionnaires collected from contractors involved in construction projects located at Putrajaya, Malaysia. It is an Expert System to assist the main contractors in making their decision by using pairwise comparison. The decision maker will need to make their own judgement on the relative importance of each element with respect to the elements at a higher level. Argument might occur when the judgement of different decision makers are diverse.

As an effort to reduce the incidents of delay, and other possible problems that might be originated from the problems of selecting the wrong sub-contractor, this study aims to expand the sample of study as suggested by Manoharan[41] in the effort of create an more reliable and applicable sub-contractor selection model.

B. Management of Subcontractor

Selecting the right subcontractor does not guarantee the success of a construction project. Coordination and monitoring of subcontracted work during the construction stage is essential. Ko Cheng and Wu [38] developed a Sub-contractors Performance Evaluation Model (SPEM) by employing Evolutionary Fuzzy Neural Inference Model (EFNIM). Subcontractors were evaluated by field superintendents according to the types of subcontract. Different evaluation factors were adopted for different subcontract to achieve fair evaluation.

Albino & Garavelli [2] proposed a rating system for management of subcontractor by using neural network. An application case related to the evaluation of potential subcontractors competing for a bid has been used to show the practical implementation of this neural network. In accessing the competitor subcontractors, the decision maker have to consider five main parameters, namely price reduction, time reduction, technical/qualitative characteristic of the bid, contractual reliability of the competitor, and management skills of the competitor. The network will propose a suitable subcontractor based on previous decisions made by the expert. Therefore, examples of previous decisions need the expert to be inserted into this neural network.

Dainty, Briscoe and Millett [42] focused on supply chain's management from the perspective of subcontractor. The role of subcontractors in UK construction industry is explored and followed by proposal of a framework for addressing current barriers to supply chain integration.

V. CONCLUSION

Subcontractor has become a great subject to all the practitioners in construction industry due to the common practice of subletting construction works into smaller

packages in construction industry. Effective subcontractor selection and monitoring which can minimize the problem would determine the success of construction companies.

Problems of subcontractors, if ignored, can cause an immense impact to the construction project, and can extend into the operation of the general contractor's organisation. Therefore, attention shall be given to the issues of subcontractor, which is the main participant in almost all the construction projects.

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