Quality Performance of Multi-layered Subcontracting Practices in Malaysian Construction Industry

Yoke-Lian Lew1*, Sok-Yeng Lai1, Tien-Choon Toh1, Ooi-Kuan Tan1, Yong-Yan-Yan Felicia1 and Li-Ping Yow1

1 Department of Surveying, Lee Kong Chian Faculty of Engineering & Science, University Tunku Abdul Rahman, Sungai Long Campus, Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor, Malaysia
*Corresponding author: lewyl@utar.edu.my

Abstract. Multilayer subcontracting system is widely used within construction industry for better efficiency of subcontractors’ operation due to their unique skills. However, the practice raises poor quality products in construction practice and contributes to poor project performance. Therefore, this study was conducted with the objectives to investigate the practice of multilayer subcontracting in Malaysian construction industry, to identify the problems arisen from multilayer subcontracting and to identify the methods for improvement of quality performance by multilayer subcontracting. A questionnaire survey was conducted. Based on the results, implementation of multilayer subcontracting system contributes largely to the poor performance across all major aspects including ineffectively time and cost management, quality works deficiency and poor communication and coordination performance. With various layers, the long communication channel causes various problems such as less control on bottom layers subcontractors, communication errors with the consequent of extra cost and time incurred due to abortive and remedial works are being taken. Recommendations for improving the practice are suggested to enhance prequalification of subcontractors, restrain the use of “supply-and-fix” subcontracting arrangement, and formulate an appropriate subcontractor evaluation system. The findings of this study provided a baseline in examining the multilayer subcontracting practices among main contractors and subcontractors and exploring the areas where the improvements can be made for obtaining the benefits of using this practice.

1. Introduction

Builder who is the most basic stakeholder which is also known as the general contractor or main contractor whose responsibility is to carry out construction works or offer the specialize works to other company that carry out specific project activities. Main contractor manages project process in term of material arrangement, equipment management, cost monitoring, labour engagement, contract administration and others project progress [1]. The main contractor is responsible to get the design, material collection and building construction done within allocated time with limited budget. However, contractors’ performance are influenced the performance of subcontractors. It was found that successful partnering between subcontractors and general contractors’ results an improvement of quality performance in projects. Good teamwork and cooperation between main contractors and subcontractors or within subcontractors themselves is particularly essential in improving the quality performance of projects and can be achieved by having a good communication between team players.
[2]. Communication is inevitably important in construction work as wrong or dispute information delivery, such as specification of materials, standard of workmanship requirement, resulted from poor communication would indirectly impact on the progression and eventually the quality performance of the project [3]. Therefore, the importance of managing the various layer subcontractor performances should be stressed on towards successful construction project.

2. Literature Review
Subcontractors are construction organisations that have contractual relationship with a general or main contractor to perform some aspect of the general contractor’s work [4]. Occasionally, multilayer subcontracting practices is formed when the subcontractor employs another company, which is known as latent subcontractor, to carry out specific project activities [5].

Construction industry of Malaysia relies heavily on large amount of subcontractors and thus the multilayer subcontracting practice is often being taken into consideration when selecting procurement system for a project [6-7]. Ng, Luu and Chu [8] commented that subcontracting is a conventional practice in the construction industry to trade on the skills of trade specialists and to meet with the fluctuating construction demand. This mechanism allows contractors to possess market competitive by providing specialist construction services as well as to be able to transfer volatile workloads to subcontractors only if the subcontracting practice is managed properly [9]. The specific skills of subcontractors engaged in the specialist subcontract work would give a great advantages as the work can be delivered economically and efficiently [5]. Yau [10] also emphasised that high degree of flexibility in subcontract works offers the main contractors with the provision of cost-saving. Proper subcontracting is then form an effective partnership could impose shared risk between parties in agreement [11]. As the roles and responsibility of all parties are clearly established under the term and condition of contract, contractors will expose lesser risk when unexpected risk appeared [12].

A successful construction project can be achieved by constantly giving a constant quality services and good quality performance in the project. As a matter of fact, the quality performance of construction industry in Malaysia still lags behind other industries [3]. Multi-layered subcontracting practices has now become the latest trend in the construction industry of Malaysia [7], however, internal issues of multilayer subcontracting practice lead to the poor quality performance of construction work and thus cause delays in projects. In addition, poor labour workmanship occurs as the recruitment of workers by lower tier subcontractors is not fully conducted under the supervision of top tier subcontractors [13].

There is a consensus that problems arise from multilayer subcontracting practise are affecting the rate of success of quality performance in construction project. Thus, this study is initiated to reveal the practice of multilayer subcontracting in Malaysia. Towards the end of this study, the prevention and potential reduction of the risk of using multilayer subcontractors would be identified as a reference to various project stakeholders in local construction industry.

3. Methodology
A questionnaire survey using five-point Likert scales was adopted for data collection. In order to overcome the low feedback from respondents, the combination of distribution methods were adopted. Survey through questionnaires provided a low cost method to collect large samples which are dependable and reliable. The targeted respondents of this study are main contractors and subcontractors as both parties are the main participants involved in delivering project quality. As multilayer subcontracting is commonly practiced in large scale construction projects, Kuala Lumpur and Selangor areas as the heart of Malaysian construction industry’s development, the respondents were selected from Kuala Lumpur and Selangor area. The targeted respondents were randomly selected from the list of registered contractors from Construction Industry Development Board of Malaysia (CIDB) [14]. Total of 123 sets of questionnaire were sent out through email and 20 sets of questionnaire were delivered by hand.

The questionnaire collected the profile and demographic details of the respondents. The respondents’ experience in multilayer subcontracting were collected. Then, the problems of implementing multilayer subcontracting and the ways to improve quality performance of multilayer
subcontracting were listed in questionnaire. The respondents were required to rate them with 5-point likert scale. After collected and recorded all the respondents response, weighted mean of each statement is calculated and shown the respondent’s favourableness toward the given point of view. Relative Importance Index (RII) of each statement were calculated for main contractors and subcontractors.

Statistical Package for Social Science (SPSS) was adopted in this study to perform data analysis. Cronbach’s Alpha Coefficient is used to ensure the internal consistency among each individual variable in the research. Cronbach’s Alpha Coefficient equal or more than 0.700 is considered acceptable [15].

Independent samples t-test is used to used to compare means from independent groups or unrelated groups [16]. In this study, grouping variable divides cases into two categories, which are main contractors and subcontractors, while the test variable describes each case on some quantitative dimension such as reasons and improvement of implementation multilayer subcontracting practices. The t test evaluates whether the mean value of the test variable for main contractors differs significantly from the mean value of the test variable for the subcontractors. Therefore, the five point scale ranged from 1 (strongly disagree) to 5 (strongly agree) were adopted and will be transformed to t value for analysis.

4. Results and Discussions
A total of 63 questionnaires were collected out of the 123 sets distributed. However, 3 sets out of the returned 63 sets questionnaire was eliminated as these questionnaires were either not fully completed or contain unreliable information. A total of 30 main contractors and 30 subcontractors had participated in this survey. The working experience of respondents ranged from 1 year to 40 years, where almost half of them (58%) was classified into group with 5 years or less working experience. 22% of them has been working for almost 6 to 15 years and the remaining 20% of respondents were among those who have the longest working experience, which is more than 15 years.

The respondents were asked to rate the frequency of multilayer subcontracting in their previous projects according to the categories of very frequent, rarely, sometimes, and never. The results are summarized in Table 1. 39 respondents have mentioned that multilayer subcontracting is being frequently used in current industry while remaining 19 and 2 respondents declared that the practice is sometimes and rarely be implemented respectively. None of respondents stated that they never involved in subcontracting practice.

| Table 1. Multilayer subcontracting practices in Malaysia |
|-----------------------------------------------|
| Frequency of Implementation | Main Contractors | Subcontractors |
| Very Frequent | 13 | 26 |
| Rarely | 2 | 0 |
| Sometimes | 15 | 4 |
| Never | 0 | 0 |

The respondents were then asked to rate their agreement on problems arisen by multilayer subcontracting and ways to improve quality performance of multilayer subcontracting using a 5-point Likert scale (5-Strongly Disagree, 4-Disagree, 3-Neutral, 2-Agree and 1:Strongly Agree). Cronbach’s Alpha analysis was carried out in order to measure the internal consistency or average correlation of items in a survey instrument in order to calculate the reliability of the Likert scale used [16]. It was found that all the scale used indicated good consistency with Cronbach’s alpha coefficient of 0.9336 and 0.8691 respectively.

The problems arisen in multilayer subcontracting practice are summarized in Table 2. The perceptions between main contractor and subcontractor were compared using t-test. The results of t-test were summarised in Table 3, 4 and 5.
Table 2. Problems arisen in multilayer subcontracting causing poor project quality performance.

| Factor                                                   | Main Contractor | Subcontractor | Overall |
|----------------------------------------------------------|-----------------|---------------|---------|
| Poor communication and coordination                      | RII  Rank       | RII  Rank     | RII  Rank |
| Lack of communication channel                            | 0.75  1         | 0.80  1       | 0.77  1   |
| Lack of team works(Lack of communication)                | 0.73  2         | 0.80  1       | 0.76  2   |
| Conflict among team members                              | 0.70  4         | 0.74  3       | 0.72  5   |
| Ineffective communication channel (difficult in sharing timely information) | 0.66  7         | 0.62  6       | 0.64  17  |
| Delay in communicating decision to bottom layers due to long chain | 0.67  6         | 0.63  5       | 0.65  16  |
| Increasing communication errors when increasing layer of subcontractors | 0.69  5         | 0.55  7       | 0.62  18  |
| Lack of main contractor’s mediation on dispute among subcontractors | 0.71  3         | 0.66  4       | 0.68  13  |
| Quality deficiency in subcontractor works                |                 |               |         |
| Poor communication such as late transferring information | 0.69  4         | 0.75  1       | 0.72  5   |
| Employing poor labour workmanship (low skilled foreign workers) | 0.77  1         | 0.75  1       | 0.76  2   |
| Employing inferior materials                             | 0.68  5         | 0.69  5       | 0.69  12  |
| Subcontractors irresponsible for quality with lower tendering price | 0.71  3         | 0.71  3       | 0.71  9   |
| Inability of subcontractor to practice works properly and technically | 0.74  2         | 0.71  3       | 0.72  5   |
| Ineffective time and cost management                     |                 |               |         |
| Long channel of communication                            | 0.71  1         | 0.71  4       | 0.71  9   |
| Lack of supervision                                       | 0.70  2         | 0.79  1       | 0.74  4   |
| Abortive/remedial works                                  | 0.70  2         | 0.72  3       | 0.71  9   |
| Unrealistic contract period                               | 0.67  5         | 0.65  6       | 0.66  15  |
| Low efficiency of workers                                | 0.70  2         | 0.75  2       | 0.72  5   |
| Dispute solving                                           | 0.67  5         | 0.68  5       | 0.68  13  |

Table 3. T-test result for poor communication and coordination.

| Scores                  | Mean  | SD    | t     | df   | p     | Decision |
|-------------------------|-------|-------|-------|------|-------|----------|
| Main Contractor (MC)    | 3.4952| 0.8659| 2.0017| 58.00| 0.7389| Reject   |
| Subcontractor (SC)      | 3.4286| 0.6627|       |      |       |          |

Table 3 shows that there are no significant difference between the perception of main contractor and subcontractor on “Poor Communication and Coordination” as problems detected in multilayer subcontracting at t (58) = 2.0017, p = 0.7238, since sig-t (0.7238) > α (0.05). The survey results in Table 2 suggested that ‘lack of communication channel’ is the most obvious problem suggested by main contractors and subcontractors as it received a value of 0.75 and 0.80 in RII respectively.
One of the reasons is because construction drawings and written instructions, such as Architectural Instruction or Engineering Instruction which providing the information to the actual workers, may fail to approach workers at bottom layer. All blue and white collar workers must work in unison otherwise it will cause an improper quality level being achieved on site [1]. As most of the time main contractors pass the information and coordinate work through personnel at middle layer of the multilayer subcontracting system to workers at bottom layer of system, there will be chances that the middle-layer personnel will misunderstand and misinterpret the info or incautiously not passing over the information, which eventually causing the workers to receive wrong information or even receive nothing [17].

Table 4. T-test result for quality deficiency in subcontractor works.

| Scores         | Mean  | SD    | t (two tail) | df   | p (two tail) | Decision |
|----------------|-------|-------|--------------|------|--------------|----------|
| Main Contractor (MC) | 3.5933 | 0.6898 | 2.0017       | 58.00| 0.9186       | Reject   |
| Subcontractor (SC)   | 3.6133 | 0.8136 |              |      |              |          |

Table 4 shown that there are no significant difference between perception of main contractor and subcontractor on “Quality Deficiency in Subcontractor Works” as problems arisen in multilayer subcontracting at t (58) = 2.0017, p = 0.9186, since sig-t (0.9186) > α (0.05). The survey results in Table 2 indicate that ‘employing poor labour workmanship’ is the most practical problem suggested by main contractors and subcontractors as it received a value of 0.77 and 0.75 in RII. In subcontractors’ opinion, poor communication is also one of the most important factors, which has a RII value of 0.75.

Since the construction industry of Malaysia relies on illegal foreign workers, who might produce work with relatively low quality when compared to local labours, thus inefficient productivity and low quality performance of work will be achieved [18]. Language barrier is the most significant factor that leads to miscommunication between management team and the foreign workers, and thus eventually would lead to poor performance of work [17].

Table 5. T-test result for ineffective time and cost management.

| Scores         | Mean  | SD    | t (two tail) | df   | p (two tail) | Decision |
|----------------|-------|-------|--------------|------|--------------|----------|
| Main Contractor (MC) | 3.4611 | 0.7826 | 2.0017       | 58.00| 0.5211       | Reject   |
| Subcontractor (SC)   | 3.5778 | 0.6061 |              |      |              |          |

Table 5 shows that there are also no significant difference between perception of main contractor and subcontractor on “Ineffective Time and Cost Management” as problems arisen in multilayer subcontracting at t (58) = 2.0017, p = 0.5211, since sig-t (0.5211) > α (0.05). The survey results in Table 2 present that ‘long channel of communication’ and ‘lack of supervision’ are the most important in main contractors and subcontractors opinion by receiving the value of RII with 0.71 and 0.75.

Design change of project is frequently happened in construction industry. When thclient or main contractor decided to make changes in project design or work programme, it is then needed to issue a site instruction or Architectural Instruction. The information will need to go through all the layers before reaching the workers who actually do the works. Despite extra time is needed to be spent on long communication channel as communication is a two-way process in transferring information among construction workers [3], it is still necessary to go through the same long channel in order to obtain instructions or approval before responding to any problems occurred on site.

The ways to improve multilayer subcontracting practice are summarized in Table 6. The perceptions between main contractor and subcontractor were compared using t-test. The results of t-test were summarised in Table 7.
**Table 6.** Improvement of quality performance in multilayer subcontracting practices.

| Methods                                             | Main Contractor RII | Rank | Subcontractor RII | Rank | Overall RII | Rank |
|-----------------------------------------------------|---------------------|------|-------------------|------|-------------|------|
| Appropriate evaluation system                       | 0.75                | 1    | 0.75              | 3    | 0.75        | 2    |
| Lowest tendering price must be awarded should be considered | 0.63                | 10   | 0.61              | 11   | 0.62        | 11   |
| Enhancing registration and pre-qualification of subcontractor | 0.72                | 4    | 0.76              | 2    | 0.74        | 3    |
| Clients only allow best performing subcontractor to tender | 0.67                | 9    | 0.51              | 12   | 0.59        | 12   |
| Realistic construction period                        | 0.64                | 11   | 0.70              | 8    | 0.67        | 9    |
| Training of supervisor and foreman                  | 0.71                | 5    | 0.73              | 5    | 0.72        | 6    |
| Training of construction workers                     | 0.71                | 5    | 0.75              | 3    | 0.73        | 5    |
| Limited ‘supply and fix” subcontracting arrangement  | 0.59                | 12   | 0.66              | 10   | 0.63        | 10   |
| Develop formalized quality performance management system | 0.71                | 5    | 0.71              | 7    | 0.71        | 7    |
| Employed skill workers instead of unskilled workers  | 0.75                | 1    | 0.79              | 1    | 0.77        | 1    |
| Better partnering relationship                       | 0.70                | 8    | 0.69              | 9    | 0.70        | 8    |
| Better subcontractor management and arrangement system | 0.74                | 3    | 0.73              | 5    | 0.74        | 3    |

Table 7 shows that there are no significant difference between perception between main contractor and subcontractor on “Methods of Improvement of Quality Performance in Multilayer Subcontracting Practices” at $t (58) = 2.0017, p = 0.8092$, since $\text{sig}(0.8092) > \alpha (0.05)$. Based on Table 6, contractors’ considered employed skill workers instead of unskilled workers (RII = 0.77) are the most effective method of improvement. Instead of employing foreign workers who are performing low workmanship, employing skilled workers to ensure standard of workmanship is essential.

**Table 7.** T-test result for improvement of quality performance in multilayer subcontracting practices.

| Scores                  | Mean | SD  | $t$ (two tail) | df   | $p$ (two tail) | Decision |
|-------------------------|------|-----|----------------|------|----------------|----------|
| Main Contractor (MC)    | 3.4583 | 0.7290 | 2.0017          | 58.00 | 0.8092         | Reject   |
| Subcontractor (SC)      | 3.4972 | 0.4896 |                  |      |                |          |

By minimising poor workmanship of subcontractors, enhancing appropriate evaluation system (RII = 0.75) in selecting subcontract should be considered. The selected subcontractor must have adequate experience manpower, technical and financial capability in carrying out the project [19]. Appropriate evaluation system should be applied with several important criteria such as standard of workmanship, ability to adhere to programme progress and ability to maintain good contractual relation.

Incorrect selection of a contractor may potentially lead to a failure of construction practices [2]. Qualification of subcontractors plays important role in the quality performance of a project. Enhancing registration and pre-qualification of subcontractor (RII = 0.74) helps to succeed on the project depends on diverse inherent attributes ranging from project complexity, and technical expertise of subcontractors. From subcontractors’ perception, employing skill workers could be substituted by training construction workers to achieve the objective of ensuring standard of workmanship is up to standard requirement.
5. Conclusions
Poor construction performance has been shown in our country and improper multilayer subcontracting practice become one of the major reasons. A portrait of conducting of multilayer subcontracting practice in Malaysia has been presented in this study. It is proved that implementation of multilayer subcontracting practices is a common phenomenon in our construction industry. Without proper arrangement, the subcontracting practice led to several problems related to project performance.

The research results provided useful reference for multilayer subcontracting practice to construction industry and allowed contractors more understanding the effects of it thus improving the efficiency of this practice in construction industry.

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