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PUBLISHER

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VERSION

VoR (Version of Record)

PUBLISHER STATEMENT

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Ng, Kung-Wing, and Andrew D.F. Price. 2019. "Optimizing the Performance of Sub-contractors in Building Construction Projects in Hong Kong". figshare. <https://hdl.handle.net/2134/19892>.

# OPTIMISING THE PERFORMANCE OF SUB-CONTRACTORS IN BUILDING CONSTRUCTION PROJECTS IN HONG KONG

Andy K.W. Ng<sup>1</sup> and Andrew D. F. Price<sup>2</sup>

<sup>1</sup>*Division of Building Science and Technology, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong.*

<sup>2</sup>*Department of Civil and Building Engineering, Loughborough University, Loughborough LE11 3TU, UK*

The performance of sub-contractors directly affects the outcomes of most construction projects. However, sub-contractors are sometimes unable to perform in their full capacity due to unfavourable project environment and poor quality of management by the main contractor. In-depth interviews to the management and front line staff, of the main contractor and the sub-contractors have been conducted to identify the major factors governing the performance of the sub-contractors in the building construction projects in Hong Kong.

Keywords: performance, sub-contractors, success factors.

## INTRODUCTION

In Hong Kong, it is common practice for main contractors to sub-let most of the construction works to domestic sub-contractors. The sub-contractors frequently further sub-let the work to sub-sub-contractors. This sub-letting process may sometimes go down several levels and can be characterized as a multi-levels sub-contracting system.

This approach has been in operation for a long period of time in Hong Kong because it is perceived: as an effective use of specialist knowledge; to lower the cost; and be flexible enough to cope with the changing demand of workload. However, the approach has some problems, such as greater demand in co-ordination work and high mobility of the worker causing poor workmanship.

The performance of the sub-contractor is one of the most important factors governing project performance, as they physically carry out the work not the main contractor. Frisby (1990) defined the management of the sub-contractors as one of the key functions of the main contractor. Currently, most of the industrial practitioners agree that the potential of sub-contractors has not yet been fully utilised and there is a need to establish how to optimise their performance.

## AIMS AND SCOPE OF STUDY

The aim of this study is to identify the main factors affecting the performance of a sub-contractor and subsequently the outcomes of a sub-contract in building construction projects from the different point of views of the key participants in a sub-

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<sup>1</sup> E-mail: bsandyng@cityu.edu.hk

<sup>2</sup> E-mail: a.d.f.price@lboro.ac.uk

contract. The key participants include the management and front-line staff of both the main contractor and the sub-contractors. The findings will be used to formulate the guidelines for the main contractor to lead the sub-contractors to their best performance. This study only covers the domestic sub-contracts as the main contractor normally manages the nominated sub-contractors in a different way due according to the contractual arrangements being used on a project.

## **CRITICAL SUCCESS FACTORS**

This section summarises the ways to measure project performances before proceeding to investigate the factors affecting the performance. Time, cost and quality are the three fundamental measuring criteria traditionally used to quantify project performance. Rapid development in terms of the complexity and size of construction projects is contributing to the level of public concern regarding the performance of such construction projects. Consequently, new project objectives are being introduced, for example, Ofori (1992) defined the environmental issues as the fourth dimension to construction project performance, and the issue of sustainable construction from a standpoint of economic, social and environmental performance has recently become critical. The performance of the contractors on the safety issues is also another project objective to be considered. In fact, more and more project objectives are being set for different projects according to their individual requirements.

Project objectives and their level of importance vary from projects to projects, and from project participant to project participant. Sanvdo, Grobler, Parfitt, Guvenis and Coyle (1992) defined the success for a given project as the degree to which project goals and expectations are met.

A dynamic temporarily multi-organisation system is created during a project development process that is continuously confronted with disparities between two levels of objectives: the temporary objectives of the project; and long-term objectives of the participating task organisation (Mohsini and Davidson, 1992).

There is an endless list of factors affecting to the outcomes of all projects. Certain factors have more impact than the others. Rockart (1982) used 'critical success factors' to describe these factors and are defined as those factors predicting success on projects.

Several approaches have been to identify the critical success factors of a project. Chan and Kumaraswamy (1995 and 1998) conducted questionnaires surveys to establish the main factors affecting construction durations in Hong Kong. They classified the factors into eight factors categories:

- project-related;
- client-related;
- design team-related;
- contractor-related;
- material-related;
- labour-related;
- plant/equipment-related; and
- external factors.

Dissanayaka and Kumaraswamy (1999) evaluated the factors affecting the time and cost performance on Hong Kong building projects and grouped them into procurement and non-procurement related factors. They define the scope of procurement as the

framework within which construction is brought about, acquired or obtained. Tam and Harris (1996) determined the factors that would influence the performance of the main contractor from the client's perspective. The model produced in the research measured the three dimensions of a project: the inherent characteristic of the project; the contractor's internal attributes; and the external influence of the project team. Mohsini and Davidson (1992) analysed the impact of the inter-organizational conflicts among the task-organizations upon the project performance. The conflicts include domain consensus, availability and access to information and interdependence of tasks.

## **RESEARCH METHODOLOGY**

A list of factors that could affect the performance of a sub-contractor was prepared based on the various studies on the determinants of the outcome of the main contract. Most of the factors normally considered from a main contract level were not included as their impact at the sub-contract level was considered a bit remote. Adopting the model developed by Tam and Harris (1996), the factors are classified into three main categories:

- inherent project characteristics;
- ability of the key participants; and
- the influences of the participants to the sub-contracts.

The inherent project characteristics include the nature and complexity of the sub-contract work, the relationships among the key participants. These factors figure out the basic constraints of the project. The ability of the key participants refers to the knowledge, experience and company support their companies. These factors can reflect their potential in achieving their assigned tasks under the sub-contract. There is no guarantee to the success of a project even though the project has favourable inherent project characteristics and is handled by competent project participants. The appropriateness of the influences made by the participants can enhance or even spoil the performance of the sub-contractor.

Three construction managers and three foremen were interviewed using a well-structured in-depth interview method as means of data collection. They were asked to express their point of views from the management and front-line staff respectively. In order to obtain the views from different side, three project officers of the sub-contractors were also interviewed. All the interviewees were from different firms and had more than eight years working experience in the industry. During the interviews, the interviewees were reminded to refer only to the three basic project objectives, i.e. time, cost and quality, in making their options so as to maintain the consistence of the assumptions. Interviewees assigned a score from 1 (very unimportant) to 10 (most important) to each of the factors influencing the performance of the sub-contractors and give a short explanation for their options. They were permitted to also suggest other factors that not yet included in the preliminary list presented in Table 1

## **FINDINGS**

Table 2 shows the ten most important factors to the performance of the sub-contractors in descending order according to the mean of score assigned by the interviewees and the following section summarises their views.

Table 1: List of factors discussed during the interviews

<b>Inherent sub-contract project characteristics</b>
Complexity of the works
Use of new technology
Restrictions due to environmental factors
Unrealistic contract duration
Quality of the design document
Buildability of the design
Relationships among the participants
Payment methods
Incentive scheme
Perceived profitability
Risk sharing between the main contractor and sub-contractors
Involvement of the sub-contractor in the design work
Clarification of the involvement
Communication system
<b>Ability of the key participants of the sub-contracts</b>
Technical ability
Financial ability
Managerial ability
Response to change
<b>Influences of the key participants to the sub-contracts during construction stage</b>
Plant support
Material support
Staff support
Levels of co-ordination
Payment
Construction information
Design changes
Schedule changes
Disputes settlement
Claims
Response by the participants

Table 2: Important performance factors

Priority of Factors	Construction Management	Foreman	Domestic sub-contractors
1	Perceived profitability of the sub-contracts	Perceived profitability of the sub-contracts	Payment to the sub-contractors
2	Payment to the sub-contractors	Payment to the sub-contractors	Perceived profitability of the sub-contracts
3	Approval process	Buildability of the design	Level of co-ordination
4	Relationship among participants	Level of co-ordination	Claims for extra works
5	Level of co-ordination	Claims for extra works	Relationship among the participants
6	Understanding on the sub-contract works	Staff support of the sub-contractors	Treated fairly
7	Design changes	Approval process	Plant support by the main contractor
8	Unrealistic subcontract duration	Incentive scheme	Design change
9	Staff support of the sub-contractors	Formal feedback channel	Schedule change
10	Response by design team	Acceptance of new ideas	Incentive scheme

## COMMON VIEWS OF THE INTERVIEWEES

The perceived profitability of the sub-contract is considered as the most important factor from the point of view of the main contractor. They believed that good profit margin could motivate the sub-contractor to perform well. However, it is necessary to point out that sub-contractors are normally medium to small size firms. In according to the local trade practice, sub-contractors have to pay their sub-sub-contractors, direct labours and material suppliers twice each month. So sound cash flow is essential to their survival, which is controlled by the punctuality and the degree of underestimation of the payment to them. The interviewees do not concern too much about the impact of the nature and complexity of the project to the performance of the sub-contractors. They all agree that even though all buildings are unique in terms of design except the standard public housing block, there is not too much difference in the nature of the sub-contract works.

## VIEWS OF MAIN CONTRACTOR'S SITE MANAGEMENT

The main contractor's site management manage the project from the macro view taking into account of the balance among the different objectives of a project. Basically, they would put the progress of work as the top priority objective. Their views have been summarised below under the headings of: Approval process; Relationships; Level of co-ordination; Understanding of the sub-contract works; Design changes; Unrealistic sub-contract duration; Staff support of the sub-contractor; and Response by the design team.

**Approval process.** The approval of shop drawings, material samples and test reports is usually an on-going and complicate process. Delay due to the fault of any of the participants can interfere the planned sequence of work. Sub-contractors are very reluctant to allocate additional effort to re-sequence the work to minimize the delay or to accelerate the following activities to catch up with the programme. Sometimes sub-contractors may be willing to take the risk to proceed the work without completing the approval process if they have good relationship with the main contractor.

**Relationships:** Relationships can be one of the inherent project characteristics as some participants may have been working together in the previous projects. Co-operative culture within the project is cultivated through mutual trust. However, it can easily be spoiled by inappropriate actions such as unreasonable late payment to the sub-contractors. There are often some grey areas in the sub-contract document, which can be clarified and agreed in a mutual beneficial way under a harmonic working environment.

**Level of co-ordination:** The wages of the workers is calculated on a daily basis. Sub-sub-contractors are very much concerned the productivity of their workers. As the mobility of the workers from project to project is high, sub-sub-contractor would only keep their workers in the project if they can work with well organised site condition, updated and sufficient information, constant workload, sufficient material and attendance from the main contractor etc.

**Understand the sub-contract works:** The tender period for the local projects is normally very short. Both the main contractor and sub-contractors usually have insufficient time to digest the document before submitting the tender. And most of the sub-contractors also have a perception that the scope and nature of work would not vary too much from project to project. It may have the chance that they underestimate

the scope of their works. Main contractor should have the responsibility to explain the contract works to the sub-contractors at the early stage of the project.

**Design changes:** Both the main contractor and sub-contractors have found it difficult to plan their works if there are a lot of design changes during the construction stage. Although sub-contractors can claim for compensation for the abortive work caused by design changes, it normally takes a long time to agree the amount of reimbursement with the respective parties. Sub-contractors prefer to carry out their works without any disturbance and receive the payment on time in order to maintain a sound cash flow.

**Unrealistic sub-contract duration:** Most of the contract duration of local projects is very short. However, sub-contractors would still willing to take up a job even though an unrealistic contract duration is imposed because of keen competition in the industry. Under this situation, sub-contractors would always seek opportunities to claim for extension of time for their contracts. This would dilute their efforts in monitoring their works and subsequently deteriorate the friendship relationship with the other parties.

**Staff support of the sub-contractor:** Because of low profit margin or inability of the managerial staff, sub-contractors just sub-let the work to their sub-sub-contractors without providing any necessary guidance and supervision. As it is difficult to trace out a clear picture on the responsibility of the defective work under the multi-level sub-contracting system, the sub-sub-contractors would be no doubt to use the fastest method to complete their works with no concern to other parties. This of course would increase the demand of co-ordination work to the main contractor.

**Response by the design team:** Slow response of the design team to the requests such as outstanding construction information, attendance to the site test and operations etc. would cause a lot of unnecessary delay to the sub-contract works. Subsequently sub-contractors would be discouraged and slow down their progress of work.

## VIEWS OF MAIN CONTRACTOR'S FRONT LINE STAFF

The main contractor's front line staff is are those directly responsible for the site production work. They mainly concentrate on controlling the progress and the quality of the works. Most of them are not too sensitive to the cost implication in making any decisions because they have the perception that it is the responsibility of the management to control the profit of a project and also normally they do not have the relevant costing information in hand for making the judgement. So their scoring pattern on the critical success factors are a bit different with that of the site management. Their views have been summarised below under the headings of: Buildability; Level of co-ordination; Claims; Staff support of the sub-contractors; Approval process; Incentive and feedback channel; Acceptance of new ideas. |

**Buildability:** Due to tight programme, both the foremen and the sub-contractors have to carry out the work with little time to digest the construction information. Design with good buildability can reduce the learning time and thus improve the productivity and quality of work. Buildability (Adams: 1989) is the extent to which the design of a building facilities ease of construction, subject to the overall requirement for the completed building. The buildability of the design can be improved by providing a formal involvement of the front line staffs in finalising the detail of the work.

**Level of co-ordination:** This is the main responsibility of the site foreman. The more effort they contribute on the co-ordination work, the better would be the progress and the accuracy of work. This can avoid unnecessary double handling of work, conflicts among the sub-contractors etc. so as to maintain a stable working environment.

**Claims:** Most of the foreman understands that the sub-contracts are basically of very low profit margins. Claims can provide additional profit to the sub-contractors. Foreman has to provide necessary assistance to the sub-contractors in recording the abortive and additional work, and inform the site management so that the sub-contractors can receive the payment as soon as possible.

**Staff support of the sub-contractors:** The representative of the sub-contractors normally has to take up several jobs at the same time. So it is quite common that sub-contractors just assign a very junior staff to take up the routine site matters and their project in-charge would directly contact the senior management of the main contractor for the contractual issues. In this case, the sub-contract work sometimes would be out of control as the junior staff lacks of ability and experience to lead the project.

**Approval process:** Incompletion of the approval process on the samples, shop drawings and test reports is one of the common excuses claimed by the sub-contractors for not commencing their work. A clear picture on the latest approval status can assist the foreman to monitor the sub-contractors' work.

**Incentive and feed back channel:** Appropriate incentive scheme can motivate people and this is particularly effective to the small and medium size firms like sub-contractors as they can easily forecast the additional profit in return from the extra efforts contributed to the project. Formal channel to feedback the comment on the performance of the sub-contractors to the management is also as important as to the incentive scheme.

**Acceptance of new ideas:** With the introduction of the new construction methods, materials and management concept, sub-contractors have to upgrade their technical knowledge. Sometimes it may take a long time to explain the new construction methods to the sub-contractors as they are always reluctant to change.

## **VIEWS OF THE DOMESTIC SUB-CONTRACTORS**

There is no doubt they would put cost as the top priority objective to be achieved in any project. Sometimes, long-term relationship can be scarified in return for immediate profit of a project. They are more flexible in running the project, but quite sensitive to any actions by the main contractor that may affect their profit and cash flow. Their views have been summarised below under the headings of: Level of co-ordination; Claims; Relationships; Treated fairly; Plant support; Design change and schedule change; Incentive scheme.

**Level of co-ordination:** Sub-contractors express that the main causes leading to the financial loss in a project are non-productive activities such as double handling of work, idling of workers due to poor co-ordination by the main contractor. They prefer the foreman to have around one week's advance planning to enable them to schedule the work force among different projects.

**Claims:** The strategy of the sub-contractors to a project would be affected by the altitude of the main contractor towards their claims for extra works. They would become conservative in taking any pro-active actions to optimise their performance if their claims have been unreasonable rejected

*Relationships:* No contract document is perfect and can define all details of the works clearly. Under a co-operative working relationship, sub-contractors would willing to carry out some extra works for no payment because they believe that main contractor would compensate them in another way later such better site storage areas and access route for delivering the materials.

*Treated fairly:* All sub-contractors in a project must be treated fairly in terms of plant and material supports, priority of using the access road etc. Conflicts among sub-contractors can cause never-ending problems to the project.

*Plant support:* Due to poor planning of work and lack of co-ordination, sub-contractors always complain the main contractor of not providing the necessary plants support to their work such as using the tower crane to deliver the heavy materials to the work place. This would cause the unnecessary wastage of manpower to the sub-contractors.

*Design change and schedule:* The sub-contractors claim that the amount of extra expenses to re-plan the work due to these two problems would not easily be justified and to form a formal claim for reimbursement of money.

*Incentive scheme:* Sub-contractors welcome any incentive scheme as they have a clear target to work for and it can provide additional profit to the project. However, they point out that the scheme must be well defined with achievable standards. On the other hand, the incentive scheme could also spoil the mutual trust spirit between the main contractor and the sub-contractors if it only demands the sub-contractors to contribute additional resource without equal amount of rewards.

## CONCLUSIONS

Unlike the main contractor, sub-contractors may not have long-term planning and commitment to the industry. Consequently, they tend to optimise their performance only if they have reasonable profit margin and can maintain a sound cash flow through out the project. Some inherent project characteristics such as reasonable project duration, good relationship among the participants and the qualified sub-contractors can also affects the outcomes of sub-contracts.

Appropriate actions have to be taken at each stage of the project to ensure the sub-contractors to proceed the work with full swing under a co-operative working environment including:

- explain in detail of the scope and nature of work, contract conditions to the sub-contractors before commencing the work;
- pro-active planning, detail co-ordination work and sufficient plant support to maintain constant workload to the sub-contractors;
- maintain an efficient shop drawing, material sample and test report approval system; and
- provide necessary assistance to the sub-contractors to prepare the claims for reimbursement for the extra work done.

Finally, appropriate incentive scheme and performance evaluation system are effective monitoring tools in the context of sub-contractor management. Based on the findings of this study, another survey will be conducted to investigate the relationship between the performance of the sub-contractors and the outcomes of the main contract.

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