Causes Leading to Poor Site Coordination in Building Projects

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IT IS A COMMON PRACTICE FOR THE MAIN CONTRACTORS OF HONG KONG BUILDING PROJECTS TO SUBLET MOST OF THE WORKS TO SUBCONTRACTORS. However, most of the subcontractors complain that they are unable to perform to their full capacity due to poor coordination of temporary works and access road to work places etc. Eighteen common site coordination problems and sixteen essential causes to the problems were identified from literature and advices from experienced industrial practitioners. The causes were grouped into three categories: *staffing related causes; technical related causes; and management system related causes*. The contribution, frequency of occurrence and aggregated importance of the causes on the quality of main contractors' coordination during the construction stage were ranked through a questionnaire survey. *Unclear job duties* was found to be the most important cause. The results of the survey established that the most important causes were mainly associated with management systems, especially communications, rather than staffing or technical related factors.

Keywords
subcontracting, site coordination problems, performance

INTRODUCTION

The construction industry is one of the main pillars of Hong Kong's economy. It employed eight per cent of approximately three million working population of Hong Kong according to government statistics. Over the years, Hong Kong construction industry has earned a reputation for the rapid construction of quality high-rise first class buildings.

Due to fluctuation of workload, there is a high level of subcontracting in the projects. According to government statistics, labour-only subcontractors and fee subcontractors contributed 24 per cent and 42 per cent of the gross value of construction work performed in 2008 respectively. As a result, the role of main contractors have gradually transformed from a constructor to a manager of subcontractors of the project.

Usually, main contractors would split the project into work packages by trade and sublet them to the first layer trade subcontractors. The first layer trade subcontractors further split their work packages into smaller packages and sublet them to the another layer of subcontractors. The subletting process may sometimes go down several more layers and can be characterised as multilayered subcontracting. This system has been functioning well for a long period of time in Hong Kong as a strategy to deal with long-term environmental uncertainties and to buffer the technical core of main contractors against short-term contingencies (Sozen, 1999).

There are increasing complaints from subcontractors that they are unable to efficiently and effectively perform their site work due to site coordination problems caused by main contractors with the rapid development of the construction industry in the recent years. A questionnaire survey with 197 valid replies was conducted by author in 1999 to collect the views from the industrial practitioners on the amount of productivity that had been wasted due to poor site coordination by the main contractors in their current projects. The survey results show that an average of 35.10 per cent productivity wasted was stated by the respondents.

AIM

The aim of this paper is to rank the essential causes leading to poor site coordination by main contractors. The degree of contribution, frequency of occurrence and aggregated importance of these causes on local building projects were analysed and recommendations were developed for improving site coordination by the main contractors. This study only covered building projects as Hong Kong based civil engineering main contractors do not sublet as much of their works to subcontractors, mainly due to less labour being required.

Literature review

There are only a few publications that analyse the performance of subcontractors in the building projects, consequently, the literature review mainly covered similar studies at the main contract level in order to extract the relevant information for the study.

Herbsman and Ellis (1990) developed a statistical model that illustrated the quantitative relationships between the influence factors and the productivity. The critical productivity influence factors can be divided into two groups: Technological factors and Administrative factors. Technological factors include design data, material properties, and location factors. Administrative factors include construction method and procedures, equipment factors, labour, and social factors. Lim and Price (1995) cited the seven factors identified as affecting overall construction productivity in Singapore: Buildability; Structure of the industry; Training; Mechanization and automations; Foreign labour; Standardizations; and Building controls. Zakeri et al (1996) analysed the constraints to site work on Iranian construction projects. The common problems identified were rank through questionnaire survey method. Results indicate that the five highest-ranking problems are: Material shortage; Weather and site conditions; Equipment breakdown; Drawing deficiencies/changes orders; Lack of proper tools and equipment. Kadir et al (2005) studied the production factors critically influencing the site work for Malaysian residential projects. The results indicate that the top most important, frequent and severe factors that are adversely construction labour productivity at a projects level were material shortage at site and non-payment to suppliers causing the stoppage of material delivery. Cottrell (2006) established a regression model to relate the factors affecting site productivity to the process improvement initiatives executed both before and during construction stage. The model demonstrates the strong relationship of project performance to a variety of process improvement initiatives including design completeness, the definition of a project vision statement, testing oversight, and project manager experience and dedication.

As efforts have been rarely been made to obtain craft worker' input to examine the factors affecting the construction productivity, Dai et al (2007) measured the impact of 83 factors productivity factors, which had been identified through 18 focus group sessions with craft workers and their immediate supervisors on jobsites. The factors were categorized into eleven groups: Supervisor direction; Communication; Safety; tools and consumables; Materials; Engineering drawing management; Labour; Foreman; Superintendent; Project management; and Construction equipment. Kakulsawatudom and Emsley (2001) conducted a questionnaire survey to collect views from craftsmen working on five construction projects on the factors affecting construction productivity. Eight factors that have the most effect on construction productivity are concluded: Lack of material and Lack of tools and equipment; Incomplete drawings; Overcrowding; Poor site conditions; Tools/equipment breakdown; Incomplete supervisor; and Rework.

There are studies focused on reviewing the degree of impact of the important factors to the productivity. Moselhi, Assem and Ei-Rayes (2005) investigated the impact of change orders on construction productivity and introduced a new neural network model for quantifying the impact. The change orders factors that affect labour productivity include intensity of the orders, timing in relation to projection, work type, type of impact, project phase, and on-site management. The impact of subcon-

tracting on site productivity was evaluated through a questionnaire survey on general contractors in Taiwan (Hsieh, 1998). The survey findings demonstrate that contractual and behavioral linkages between firms call not only for the realization of an attractive gain from productivity improvement but also for an agreeable benefit-sharing mechanism between firms. Financial incentives are very effective to improve site productivity. A questionnaire survey was conducted by Fagbenle, Adeyemi and Adesanya (2004) to determine the impact of non-financial incentives on bricklayers' productivity in Nigeria. Fifteen common non-financial incentive schemes were selected for the survey. The analysis of the survey concluded that non-financial incentive schemes could motivate bricklayers and increase the productivity in bricklaying work for 6 to 26%.

The common site problems and the essential causes to these problems were shortlisted by studying the publications for the factors affecting the productivity at the site work level and the observation of common practices and advices from the experienced industrial practitioners.

Common Site Coordination Problems

Eighteen common site coordination problems were identified as shown in Table 1 and they were categorised into the following eight groups according to their nature.

Causes of Site Coordination Problems

Sixteen essential causes leading to the common site coordination problems identified were summarized in Table 2 and were grouped into three categories.

Group:	**Construction information**
Problems:	a. information not detail enough
	b. unclear or contradictory information
Group:	**Working programme**
Problems:	a. working programme not detail enough
	b. working sequence not practical
	c. short notice for commencing site work
	d. late change of working programme
Group:	**Preparation for work place**
Problems:	a. work place environment not yet prepared such as general site cleaning, fresh air supply, lighting
	b. inadequate or insufficient site reference points
	c. inadequate or insufficient temporary work support such as scaffolding, water & power supply
Group:	**Interfacing work to be completed by other subcontractors**
Problems:	a. work not yet completed
	b. work not accurately completed
Group:	**Access to work place**
Problems:	a. access road not yet ready
	b. access routing not convenient
Group:	**Plant support**
Problems:	a. late to provide plant support
	b. type of plant provided not appropriate
Group:	**Material support**
Problems:	a. insufficient amount
	b. type of material provided not appropriate
Group:	**Response to site problem**
Problems:	a. late response to site problems
	b. solution recommended not practical

Table 1. **Common Site Coordination Problems**

Technical Related Causes

Robbins (2005) defined the term technology as to how an organisation transferred its inputs into outputs. As the role of main contractors has already transformed from a constructor to a manager of subcontractors of the local building project, they should have adequate technical capacity to provide necessary assistance to subcontractors to perform efficiently and effectively.

Management System Related Causes

The responsibilities and duties of each member of the project team should be well defined to ensure the activities can proceed without any problems. During the project development process, a dynamic temporarily multi-organisation system is often created that is continuously confronted with disparities between two levels of objectives: the temporary objectives of the construction project; and long-term objectives of the participating organisations and operational phase of the project (Mohsini and Davidson, 1992). Main contractors need to establish dynamic management systems that facilitate the coordination of activities and control the actions of their members.

Staffing Related Causes

There is no guarantee to the success of a project even though main contractors can establish a well organised management system to meet the nature of the project. Contractor have to assign adequate staff with necessary technical knowledge and experience to operate the management system.

RESEARCH METHODOLOGY

A questionnaire survey based on the common site coordination problems identified was developed and distributed to industrial practitioners. Thirty-six valid replies were received. Respondents were requested to rate each identified causes in terms of: the degree of contribution to the identified common

		C	F	C x F
Category	**Technical**			
Causes	a. insufficient technical support from head office	5.03	6.61	33.25
	b. poor temporary work design	4.93	6.06	29.88
	c. insufficient site office space	4.44	4.53	20.11
	d. poor site layout	3.91	3.17	12.39
	e. poor project programme or phasing of work	3.17	5.14	16.29
Category	**Management system**			
Causes	a. unclear job duties	7.08	7.11	50.41
	b. unclear communication path	7.03	6.44	45.27
	c. insufficient authority for frontline staff	6.97	5.19	36.17
	d. unclear accountability system	6.86	6.67	45.76
	e. too much paper work	4.83	6.56	31.68
Category	**Staffing**			
Causes	a. staff too inexperienced to coordinate the technical administration work	6.94	6.86	47.61
	b. frequent change of personnel	6.68	3.72	24.85
	c. staff too inexperienced to coordinate the site work	6.19	5.76	35.65
	d. insufficient directly employed worker to carry out the temporary work	5.81	6.53	37.94
	e. insufficient staff to coordinate the site work	5.50	5.26	28.93
	f. insufficient staff to coordinate the technical administration work	5.23	5.17	27.04

Key C: Degree of Contribution; **F:** Frequency of Occurrence **C x F:** Aggregated Importance Score

Table 2. **Causes of Site Coordination Problems**

site coordination problems from 1 (very unimportant) to 9 (very important), with a 0.5 interval; and the frequency of occurrence of the cause in Hong Kong building projects from 1 (never happen) to 9 (happen every time), with a 0.5 interval. In this 9-points scoring scale, 5.0 represented a cause that fairly contributed to the common site coordination problems and occurred fairly frequently in the building projects. Table 2 presents the mean of the scores rated by the respondents.

DATA ANALYSIS

Degree of Contribution

Column C of Table 2 summarises the mean scores assigned by the respondents for the degree of contribution of the causes to the common site coordination problems.

Eleven out of the 16 causes selected for the questionnaire survey were considered as having significant (i.e. mean scores are above five) contribution on main contractors' site coordination problems. The top three significant causes relate to management systems.

Unclear job duties was found to be the largest contributing cause, probably because scope of work of each building project is different, however, works cannot be proceeded smoothly if the duties of key staff are not well defined.

The mean score for *unclear communication path* is only slightly below the most crucial cause. One frequent complaint from frontline staff in Hong Kong building projects is that they have too much responsibility but not enough authority to get the job done. This can be critical in Hong Kong building projects where project durations are often relatively short due to high land price. The authority delegated to frontline staff must therefore align with stated job responsibilities, so that timely decisions can be made.

The role of the main contractor's project coordinator has become critical for the success of local multidisciplinary construction projects (Jha, 2005). The project coordinator has to handle technical matters as well as management issues and thus needs to be a 'generalist' rather than 'specialist' (Powl and Skitmore, 2005). Due to rapid developments of construction projects in terms complexity and size, information has become so voluminous and complex that it cannot be passed in totality from one individual to the next (Chapman, 1999). Frequent changes of personnel could thus induce unnecessary uncertainties to the project if the appropriate systems are not in place.

Although the documentation requirements of the ISO standards can be extremely onerous and bureaucratic (Love et al., 1998), quality certification to recognized standards such as the International Organisation for Standardization (ISO) 9000 has become common place in Hong Kong based construction companies. The survey results show that the increase paper work has not unduly affect the site coordination work with a mean score just slightly below five. The bottom three causes relate to technical related cause and their mean scores are all below five.

In this study, it was assumed that all the causes are of equal importance to their respective category of causes. The score for each category is the mean of the scores of the causes in the same category. Table 3 summarises the mean scores for degree of contribution according to the categories of causes of the site coordination problems. The result shows that management system related causes make the most significant contribution to main contractor's site coordination problems. The technical related causes were not so critical as its mean score was below five.

Rank	Category	Mean score
1	Management system	6.56
2	Staffing	5.22
3	Technical	4.29

Table 3. **Degree of Contribution**

Frequency of Occurrence

Column F of Table 2 shows the mean score assigned by the respondents for the frequency of occurrence of the essential causes in the local building projects.

Thirteen out of the 16 causes selected for the questionnaire survey were considered as frequently occurring causes leading to site coordination problems in building projects as their mean scores were above five.

Project organisation is a dynamic temporarily multi-organisation system that is created during a project development process. *Unclear job duties* was found to be the most frequent cause and its mean score is well above the other causes.

Performance of construction project manager was the single most critical factor affecting successful project outcomes (Hartman, 2000; Bandow, 2001). Unfortunately, local project managers tend to assign inexperienced staff to handle the technical administration work.

There is little difference in the mean scores of the third to the seventh most frequent causes. Three out of four least frequent causes are technical related causes.

Table 4 summarises the mean scores for frequency of occurrence according to the categories of causes of the site coordination problems. The mean scores for all three categories are above five.

Rank	Category	Mean score
1	Management system	6.39
2	Staffing	5.55
3	Technical	5.10

Table 4. **Frequency of Occurrence**

Aggregated Importance Score

Aggregated importance score (F x C) for the causes as shown in Table 2 is designed based on the model developed by Kadir *et al* (2005). It was taken as the combined score of frequency of occurrence (F) and the degree of contribution (C) to the site coordination problems.

As a nine-point scoring system was adopted for both the contribution and frequency variable for this study, causes with aggregated importance score above 25 were considered as the important cause of site coordination problems in Hong Kong building projects. Twelve out of 16 causes selected for the survey were considered as the important causes as their aggregated scores are above 25.

Unclear job duties was the most important cause and its score is well above the others. Three out of the four highest scores causes are management system related causes. The three causes with the lowest scores are technical related causes.

Table 5 summarises the mean aggregated importance scores according to the categories of causes of the site coordination problems. The mean scores for management system related causes and staffing related causes are above 25. Even though the mean frequency score for technical is above five, its mean aggregated importance score is still below 25 because this category of cause has low mean contribution score.

Rank	Category	Mean score
1	Management system	41.85
2	Staffing	33.64
3	Technical	22.37

Table 5. **Aggregated Importance Score**

CONCLUSION

Sixteen main contractor related causes that lead to ineffective and inefficient site coordination in Hong Kong building projects were identified from literature and advice from experienced industrial practitioners. These were classified into: *staffing related causes; technical related causes;* and *management system related causes*. The results of the questionnaire survey show that:

- eleven causes made a significant contribution to main contractors' site coordination problems;

- thirteen causes were identified as frequently occurring causes;
- twelve causes were considered as the important causes based on their aggregated importance scores being above 25;
- *unclear job duties* was found to be the most essential and the most frequent cause of site coordination problems; and
- the mean aggregated importance score of *management system related causes* was well above *technical related causes* and *staffing related causes*.

It is thus recommended that main contractors should focus their efforts in the management systems, especially communications, in order to develop more efficient and effective site coordination that should lead to improved subcontractor performance in the Hong Kong building projects.

From the client's point of view, time, cost and quality are the three most common fundamental criteria for a building project (Bennett, 1983; Stuckenbruck, 1990; Walker, 1990). Further study can be formulated to establish the relationships to relate the identified essential causes, critical site coordination problems and the three project outcomes for subcontracts.

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