ESTIMATION OF PROJECT OVERHEADS: A CONTRACTOR'S PERSPECTIVE

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Project overheads are the general cost of administering a project including provision of general plant, site staff and site-based services. An accurate estimation of the project overheads not only helps to improve the chance of success in bidding, but also serves as a profit centre for the contractor. However, a lot of contractors often overlook the importance of project overheads estimation due to its apparently low percentage contribution to the contract sum. The aims of this study are to explore the estimation method of project overheads practiced by the large contractors in Hong Kong, to identify project overhead items that are likely to be over- or under-estimated. The research is based on a survey followed by interviews within 49 large contractors in Hong Kong. The data collected confirmed that detailed estimation based on professional judgement was the most common method used by the estimators for estimating project overheads. The results indicated a strong misalignment between the perceived importance of project overheads estimation and the level of resources allocated to project overheads estimation by the contractors. Project overhead items like site management salaries, protection to works, and site cleaning were identified by the contractors as being significant in terms of inaccurate estimation. A framework of 23 project overhead items was generated to provide a basis for further study of project overheads estimation.

Keywords: estimating, project overheads, risk management.

INTRODUCTION

Project overheads are defined as the general cost or indirect cost of the project for providing general plant and site-based services like insurance, site accommodation, etc. In Hong Kong they are generally included in the tender document as a separate section in the Bills of Quantities as Preliminaries. Since there is a general impression that the project overheads account for a relatively small percentage (around 15% and not more than 30%) of the contract sum (Assaf *et al.* 1999, Hegazy and Moselhi 1995), the estimation of project overheads is often overlooked by practitioners.

Definition of Project Overheads

According to the CIOB Code of Estimating Practice (1997), project overheads mean, "the site cost of administering a project and providing general plant, site staff, facilities and site-based services and other items not included in all-in-rates. Also commonly known as : preliminaries, general cost items or general expenses". Although there is no explicit definition of project overheads (or preliminaries) in the

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U.K. SMM7 (1988), the items listed out in the preliminaries / general conditions (Section A) can be summarised into two main categories : the specific requirements of the employer and the facilities which must be provided by the contractor. In the U.S. and Canada, the Construction Specifications Institute (CSI) has developed a master list, called the MasterFormat, which is commonly used for cost accounting and documentation in the construction industry (Dell'Isola 2002). The General Requirements (Division 1) in the MasterFormat is very similar to the U.K. SMM7 Section A. It covers the general conditions of contract and job overheads. Similar to the U.K. SMM7, the Preliminaries section in the HKSMM (1979) covers the project particulars, conditions of contract and general matters (site-based services and facilities provided by the contractor). Hence, there is a common interpretation of project overheads (or job overheads or preliminaries) among the U.K., the America and H.K.; which embraces all the expenses incurred to the contractor in order to provide the necessary site administration and site facilities.

Importance of project overheads estimation

The importance of project overheads estimation has already been stated by a number of theorists. Tah *et al.* (1994) claimed that estimation of direct cost was very similar among different bids, and the main variations among the competitors' bids were basically the mark-ups and indirect costs (project overheads). They further suggested that in order to improve the accuracy of tender prices, efforts should be directed at improving the methods of estimating the indirect costs. Solomon (1993) also claimed that the main area in a tender where the contractor could seek to gain a competitive edge was the adjustment of preliminaries, i.e. the project overheads. Taylor (1994) put forward the scenario that if the contractors subl*et al.*l or most of the works to subcontractors, equal or offsetting quotations would be obtained for these. Hence, accurate pricing of project overheads was essential to the success of bidding.

Estimation of project overheads in theory

The CIOB Code of Estimating Practice (1997) provides a detailed guide to the preparation of estimates for the project overhead items. In principle the Code states that every project overhead item is made up of either time-related costs e.g. rental charges, salary, and/or fixed costs e.g. installation, dismantling costs. If each of these cost centres is properly identified, estimation can be done in the same way as the estimation of the unit rates for measured works. Popular textbooks such as Brook (1998), Geddes (1996) and Kwakye (1994) cover the estimation of project overheads using the CIOB Code of Estimating Practice (1997) as a basis. Unlike the CIOB Code of Estimating Practice, Brook (1998) and Geddes (1996) follow the Common Arrangement of Works Sections advocated in the U.K. SMM7 although the basic principles of estimating suggested are the same as the Code. There are also a number of American textbooks which recommend similar method to estimate the job overheads (the term used in the America). A good example is Bartholomew (2000) which breaks down the project overheads into : salaries, time-related overhead expenses (e.g. power, water), non-time related overhead expenses (e.g. site office), insurances and taxes, and general plant in-and-out. Detailed examples on the estimation method are provided by Bartholomew (2000) and the principle of estimation is also the same as the CIOB Code. Other authors like Peurifoy & Oberlender (2002) also recommend similar method to build up the estimates of job overheads. In Hong Kong, only the HKSMM (1979) provides the general guideline on the measurement of preliminaries items during the pre-contract stage, but nothing on

the estimation method for contractors is explained. Nevertheless, under the widespread use of the U.K. practices in H.K., the CIOB Code of Estimating Practice (1997) can be adopted as a good reference.

Estimation of project overheads in practice

Despite the advancement in IT in recent years, IT application in construction estimation by the contractors is still limited. Sophisticated estimation models using ANN (Boussabaine & Elhag 1999, Moselhi and Siqueira 1998, Hegazy and Ayed 1998), fuzzy modelling (Mason and Kahn 1997), and simulation models (Sha'ath and Singh 1993) are proposed by a lot of authors as being effective tools for cost estimation, but few are practiced in reality (Elhag and Boussabaine 1998). Most of the contractors only apply computerization to the extent of cost data management and spreadsheet programme (Peurifoy and Oberlender 2002). The estimation method for project overheads is even more primitive due to the lack of serious concern. A survey of general estimating practice in the USA (Hegazy and Moselhi 1995) revealed 83% of responding contractors estimated project overheads in a detailed manner; 14% of them estimated project overheads as a percentage of the direct cost while the remaining 3% did not estimate them at all. A survey of large foreign contractors in Saudi Arabia (sample size is 61) (Assaf *et al.* 1999), revealed only 71% of the sample estimated the project overheads with reference to the contract requirements laid out in the tender document. The rest of the contractors just applied a percentage against the direct costs of measured works for the project overheads allowance. In interviews conducted with the U.K. contractors by Skitmore and Wilcock (1994), pricing of the project overheads by them was based on their perceived expectations of the Architect, not the specifications laid down in the contract. Other interviews (Tah *et al.* 1994) showed contractors either priced the indirect costs as a percentage of the measured works or as a lump sum allowance. The earlier work all indicates that estimation of project overheads is quite dependent on both the individual estimator's decision and contractor's practice. Some textbooks also state similar practice among the contractors. Steward *et al.* (1995, p. 373) mention that estimating the project indirect cost is a time-consuming and inexact task, and hence contractors often apply a percentage of direct costs as an estimate of indirect cost. Peurifoy and Oberlender (2002, p.14) also criticise that some contractors will multiply the direct cost by a certain percentage to get the overhead cost. However, such a quick method may not be sufficiently accurate for most estimates.

Estimating the project overheads as a percentage of contract value is shown to be a current practice. As stated in the CIOB Code of Estimating Practice (1997, p. 146), this method of applying a fixed percentage to the total value for project overheads allowance is particularly common in case of small-scaled, repetitive works. However, this may result in under-estimation as many Preliminary items bear no linear relationship to the value of works. Lastly, no formal studies of the estimation of project overheads have been conducted in Hong Kong.

OBJECTIVES

Although there are limited studies of project overheads estimation, there is neither specific literature nor research in this subject for Hong Kong. The overall aim of this paper therefore is to investigate the estimating practices for project overheads in Hong Kong with the specific objectives of:

To identify the methods of estimating project overheads within large contractors

To measure the extent of these practices

To identify a framework of significant project overhead items

METHODOLOGY

The research was based on literature review with primary data being collected through questionnaire survey and interview.

Sample Selection
The Works Bureau of the Hong Kong Special Administrative Region Government maintains a list of Approved Contractors and Suppliers for carrying out the public works. The Approved Contractors are classified into 3 groups : A, B and C. Among them, only Group C Contractors are allowed to tender for public works of unlimited value. There are altogether 119 contractors in Group C as at April 2002. They represent the large and well-established contractors in Hong Kong. For the purpose of this study and to generate comparable results with past studies, only the Group C contractors of the Approved List were sampled. Questionnaires were sent to the senior estimators of the companies by fax. Forty-nine responses were received from the sample, representing 41.1% response rate which is considered reasonable and acceptable. Following the survey, individual interviews were conducted with 22 senior estimators from the participant companies who were willing join the study. The interviews were used to explore in greater detail the methodology of project overheads estimation used by the respondents, and to develop the list of significant project overhead items.

The questionnaire
In order to understand estimating practice of the large contractors in Hong Kong, the questionnaire was designed to collect the following information :

The method of estimating project overheads used by the company. Here, contractors were asked about the general method they used to estimate the project overheads. Based on the past studies (as mentioned earlier), typical methods included estimation in detail with reference to the contract conditions, estimation as a percentage of the total value and estimation as a lump sum.

The method used to determine the allowance for individual project overhead items if the project overheads were estimated in detail. Since past studies as described earlier revealed that estimators normally prepared the estimates based on their professional judgement, estimators who prepared the estimates of project overheads in detail were asked how their estimates were made, the use of experience or sophisticated estimation models were the two extreme practices. A third option was the build up of specific costs for each item as advocated by the CIOB Code of Estimating Practice. They could also enter the specific method adopted by the companies if they did not use one of these methods.

The source of cost data used in determining the project overheads. In this question, estimators were asked to identify the source of their cost data. Generally, cost data could be based upon:

- Cost indices / schedule of rates published by the H.K.Government or large PQS firms like Davis Langdon and Seah, and Levett & Bailey.

- In-house cost databases

- Quotations from subcontractors or suppliers for items that would be sublet or procured e.g. plant rental charges, scaffolding

Feedback or review of estimation accuracy for the project overheads items. Respondents using in-house cost data were asked to state whether there was a feedback / review system on the estimating accuracy of the project overheads in their company. This was to see whether reliability of the in-house data was continuously reviewed by the companies.

The interviews

The interviews were structured with open-ended questions to cover three main areas, as explained in Table 1:

Table 1:Summary of the content of structured interviews

Area of questions	**Expected outcomes from the questions**
Estimation method used by the company	Identify : Major component in estimating, Staff involved in estimating project overheads, Time spent in estimating, Perceived risk transferability of estimates, General accuracy of project overheads estimation
Project overhead items likely to be under- or over-estimated	Identify at most 3 items likely to be under- or over-estimated by each interviewee
List of project overheads to be included for pricing/ study	Identify the project overhead items that should be priced / studied

RESULTS AND FINDINGS

Method of estimating project overheads

46 respondents (94%) of the sample responded that the project overheads were estimated in detail with reference to the contract conditions. The other 3 contractors (around 6%) estimated the project overheads as a percentage of the total value of measured works. This illustrated that a very high proportion of estimators spent their time and effort in preparing estimates for the project overheads. It is quite different from studies in the western countries where a much larger percentage (29% in Assaf, SA *et al.* 1999) of estimators will estimate the project overheads by a percentage of the measured works or even a lump sum addition to the bid.

Method to determine the allowance for individual project overhead items

From the 43 respondents who estimated the project overheads in detail, a majority (65%) of them used their experience and professional judgement to arrive at the individual item allowance. Around 35% estimated the item amount based on cost data. None used sophisticated estimation models. The results matched well with the practice in western countries. Estimators' judgement was the dominating method in estimating functions.

Source of cost data

The 16 estimators used cost data either referred to the company in-house database (19%) or to the quotations from sub-contractors or suppliers (31%) or referred to both (50%). No estimators used the schedule of rates published by the HK government or PQS firms. This suggested that estimates based on cost data contained a good mix of solid knowledge and latest cost figures to provide a realistic bid.

Availability of feedback or review of estimation accuracy
For those companies (16 no.) that estimated project overhead items as per the CIOB Code, 90% of them had proper feedback / review mechanism in place to review their estimation accuracy. This reflected good awareness of the estimation accuracy among the contractors.

Most important component of estimating
Among the various parts of the tender document : project overheads, measured work, profit margin and attendance, majority of the interviewees thought that setting profit margin was the most important (around 64%) because this was the prime interest of the company shareholders. Around 27% said that pricing measured work was the most important. Most of them who chose measured work as being the most important claimed that this was the "main body" of the tender document, and contributed the largest amount to the tender sum. Only 9% of them thought that estimating project overheads was the most important. These minority thought that project overheads was often the last resort that the contractors could squeeze for savings.

Staffing for estimating
All of the 22 interviewees claimed that both junior and senior estimators were involved in estimating. All of them agreed that junior estimators were involved in preparing estimates for the measured work, because almost all of the measured works would be sublet. Juniors were mainly involved in sending out the tender invitations, preparing tender analysis for the quotations received, and billing the measured items. Around 23% of them would ask their juniors to consolidate cost data for pricing project overheads. For the project overheads estimating and profit setting, all of the interviewees said that the former was done by the seniors whereas the latter was done by the directors of the company. This indicated that companies intuitively believed estimation of project overheads demanded a higher level of professional knowledge. This also matched with the earlier findings from this survey that estimation of project overheads relied heavily on the professional judgement of the estimators.

Risk transferability
This was to identify the perceived level of risk transferability of different estimates : project overheads, measured work, profit margin and attendance in case of errors or inaccuracies during estimation. Around 82% of the interviewees agreed that the risk of wrong estimation in project overheads was the most difficult to transfer. Contrasted with project overheads, no interviewees chose measured work because it would be sublet to sub-contractors, and most of the inaccuracies in estimation were transferable. A small percentage (18%) of interviewees said that the error in profit setting could not be transferred elsewhere.

General accuracy of project overheads estimation
Around 45% of the interviewees commented that over- or under-estimation of project overheads was common in their estimates. On top of that, 32% of the interviewees felt that the inaccuracies in project overheads estimation were acceptable because there were a lot of uncertainties in the project which were difficult to forecast. Only 23% of interviewees felt that the project overheads estimate was accurate.

Project overhead items most likely to be over- or under-estimated
There were diversified views on which project overhead items that were most likely to be over- or under-estimated. The interviewees were invited to quote at most 3 project

overhead items which they thought were more likely to be inaccurately estimated. The findings were summarised in Table 2:

Table 2:Views on the project overhead items likely to be inaccurately estimated

Items	**Site management salaries and expenses**	**Protection to works**	**Cleaning & removal of rubbish**	**Site offices, temporary stores Contract conditions**	**Testing**	**Others *****
No. of responses	16	14	13	7	7	6
No. of responses / Total no. of items*	25.4%	22.2%	20.6%	11.1%	11.1%	9.5%
No. of responses / No. of interviewees**	72.7%	63.6%	59.1%	31.8%	31.8%	27.3%

Note : *N= 63, **n=22, *** "Others" covers miscellaneous items including drawings prepared by contractors, insurance, noise and dust control.

As shown in the above table, majority of the interviewees said that site management salaries and expenses were likely to be inaccurately estimated. The other two items : protection to works and general cleaning were also said to have a higher likelihood of inaccurate estimation.

List of significant project overhead items

Around 86% of the interviewees agreed that the Preliminaries section of the Hong Kong Standard Method of Measurement of Building Works (1979) was a useful basis from which to build the framework of project overhead items. For simplicity, details of the preliminaries items of the HKSMM (1979) will not be discussed here. There are altogether 36 items, but some of them were suggested to be streamlined or combined by the interviewees. The final framework of 23 items that reflected a majority view (more than 50% at least) from the interviewees was detailed in Table 3.

Table 3:List of project overheads items that should be included for pricing / study

Item	**Significant Project overheads items to be included for pricing / study**		
1	Definitions of various contractual parties	13	Protection of finished works
2	Description of works	14	Protection of adjacent / existing works
3	Nature of site and site inspection	15	Safety precautions
4	Site possession and completion	16	Facilities to be provided by Main Contractor : plants, scaffolding
5	Site management, watchman and attendance to NSCs	17	Site offices, stores, latrines
6	Principles of measurement of the Bills of Quantities	18	Setting out
7	Drawings to be prepared by the Main Contractor	19	Samples, mock ups
8	Contract conditions and amendments	20	Testing
9	Methods of measuring and valuing variations	21	Power and water supply
10	Fees and Levies	22	Temporary works e.g. hoardings, temporary roads, signboard
11	Restrictions to noise and dust nuisance	23	Cleaning and removal of rubbish
12	Insurances		

Table 4:Consolidated comments from the interviewees on the generation of the list of project overheads for pricing / study

	Consolidated comments from interviewees	**% of interviewees proposed**
1.	Combined items 13 (Foreman), 22 (Watching) and 30 (Attendance) of the HKSMM2 for their similarity in nature	91%
2.	Combined items 5 (Form of Contract), 6 (Particulars to be inserted in Appendix of Conditions) and 20 (Conditions of payment) of the HKSMM2	77%
3.	Combined items 9 (Notices and fees) and 11 (Industrial training levy) of HKSMM2 since they were of similar nature and accounted a fixed percentage of the contract value	86%
4.	Combined items 17 (Injury to persons and damage to property), 18 (Insurances, etc.) and 21 (Surety or bond) of HKSMM2 for their similarity in nature	100%
5.	Combined items 28 (Water) and 29 (Lighting and power) of HKSMM2	77%
6.	Combined items 31 (Hoardings, etc.) and 33 (Temporary roads) of HKSMM2	68%
7.	Excluded item 7 of HKSMM2 (Working hours, rates of wages, etc.) since normal working hours were applied in large projects, except for some fitting out works (which is outside the scope of this study)	45%
8.	Excluded item 15 of HKSMM2 (Sub-letting) because this was already a general practice in HK and any cost incurred could be covered by site management and attendance	14%
9.	Excluded item 16 of HKSMM2 (Artists or tradesmen not sub-contractors) for attendance to artists would be allowed in the site management item	68%
10.	Excluded item 19 of HKSMM2 (Provisional and prime cost sums) for no direct cost implication to main contractor	32%
11.	Excluded item 24 of HKSMM2 (Treasure trove, coins, etc.) for no direct cost incurred to main contractor	23%
12.	Excluded item 32 of HKSMM2 (Works by public authorities) since attendance to the workers of the public authorities would be allowed in the site management item	68%
13.	Excluded item 34 of HKSMM2 (Drying the building) since it was not significant in H.K.	23%
14.	Excluded item 36 of HKSMM2 (Defects after completion) since rectification of defects would be covered by subcontractors on a ‘back to back’ basis, and the main contractor’s attendance during Defects Liability Period would be allowed in site management item	36%
15.	Included “Principles of measurement of the Bills of Quantities” as it was a common item in Preliminaries Section of the Bills of quantities in H.K.	59%
16.	Included “Drawings to be prepared by the Main Contractor” as this item incurred cost to the contractor and it was a common obligation of the contractor	82%
17.	Included “Restrictions to Dust and Noise Nuisance” as this item incurred cost to the contractor and it was a common obligation of the contractor	95%

Special comments from the interviewees regarding the inclusion/exclusion of the project overhead items for pricing / study were listed out in Table 4 below. In general, the comments helped to streamline the list of project overheads and to reflect the likely cost commitment of the contractor more realistically.

CONCLUSIONS

From the survey of forty-nine large contractors in Hong Kong, it was found that almost all of them would estimate the project overheads in detail. However, most of the estimators still relied on their experience to work out the estimates without much use of artificial intelligence. A good reference to cost data seemed not to be a common practice, and only accounted for around 33% of the total sample. Results from the

interviews identified misalignment between the perceived importance of the project overheads estimation and the level of resources allocated to project overheads estimation by the contractors. Only 9% of interviewees felt that project overheads was the most important component in estimation, but all of them allowed senior estimators only to carry out the estimation task. Besides, 82% of interviewees agreed that the risk of estimation errors in project overheads was the most difficult to transferred. However, majority of them (around 77%) commented that inaccuracies did exist in project overheads estimation, particularly for items like site management salaries, protection to works, site cleaning and site offices. The results evidenced the inadequate concern and importance of project overheads estimation, and more studies in this area should be done. Besides the overall review of project overheads estimation, the interviews also generated a total of 23 project overhead items (out of 36 items in the HKSMM2) for future study in project overheads estimation.

RECOMMENDATIONS

There has been little research into the estimation of project overheads, particularly in the South East Asia. From the results of this study, it was confirmed that estimation of project overheads was overlooked by most contractors. Besides, it was clearly identified that inaccuracies existed in the estimates of project overheads and further studies to improve the estimation accuracy should be done. Since the list of significant project overhead items were identified in this study, it was suggested that further study in estimation of project overheads could be conducted based on the framework highlighted here. Furthermore, with the development in information technology and artificial intelligence, further investigation to improve the efficiency and reliability of project overheads estimation was recommended.

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