

# **Operation and Maintenance Budgeting for Commercial Buildings in Hong Kong**

## **Abstract**

The significance of whole-life cost for building operation and maintenance (O&M) is well known. The causes for ill-budgeted O&M resources, however, are often uncertain. Aimed at exploring in-depth the problems with budgeting O&M works for commercial buildings in Hong Kong, a study analysed collectively relevant literature and information obtained from a series of interviews with practitioners who played the roles of building owner, management company and O&M contractor. It was found that the practice of historical-based budgeting predominates among a variety of budgeting bases, and budgets are largely constrained by preceding budget and pre-determined budget ceiling. Budgetary costs are significant, which can be economised through bundling small contracts into larger procurement packages. The importance of satisfying O&M needs is highly recognised but the motivations of practitioners toward preparation of proper budgets are inadequate. Corresponding to the range of problems identified, a framework of improvement measures has been outlined, which requires further development to help achieve proper budgeting for sustainable operation and maintenance of buildings.

**Keywords:** Budgeting, facilities management, maintenance, cost.

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## **Introduction**

Buildings with state-of-the-art design and construction, if not operated and maintained properly, will not be able to perform as intended. The significance of whole-life operation and maintenance (O&M) costs such as those for utilities consumption, hiring management staff and upkeep of facilities is well recognised (Evans *et al.*, 1998) even though a consensus on occupancy cost ratios is yet to be reached (Hughes, 2004; Ive, 2006). In any case, adequate budget is prerequisite to proper delivery of O&M works, which are crucial to the performance and sustainability of buildings.

Commercial buildings comprising hotels, office and retail premises represent a major portion of the buildings in Hong Kong (Rating and Valuation Department, 2008). To strive for cost-effectiveness, owners of these buildings have increasingly outsourced O&M works for facilities like air-conditioning systems, electrical installations in one or a mix of partial, selective and bundled outsourcing manners (Lai *et al.*, 2004). An in-house team typically carries out minor works like visual inspection and data logging. O&M contractors, appointed directly by the owner or outsourced through a management company (Figure 1), undertake works that entail intensive yet fluctuating resources or those that must be done by registered parties (Lai and Yik, 2004).

‘Insert Figure 1 here’

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Ostensibly, little problem would arise if the resources budgeted by the owner, management company and contractor are in descending order. But if the budget of any of these stakeholders is less than the needed level, problems like substandard work quality, delays and backlogs are likely to occur. Premature deterioration of facilities, high utility bills, end users' dissatisfaction and reduced building income are among the common consequences.

In order to have a proper O&M budget, estimation of the required resources has to be properly prepared, checked and approved by the designated authority. However, building maintenance resources are often ill-budgeted ([Horner \*et al.\*, 1997](#)). What are the major reasons which give rise to this problem and how it may be avoided are of common interest to the stakeholders. To answer these questions, it is necessary to unveil the real practice of O&M budgeting. This was also the impetus to carry out the exploratory study reported here.

In the first stage of the study, prior relevant studies and budgeting models published in the open literature were reviewed. In the second stage, a questionnaire was designed and used for collecting data from O&M practitioners. The findings from these two stages were analysed, based on which the major problems with budgeting were examined.

## **Literature Review**

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Many postal surveys had attempted to investigate the budgeting practices in various sectors. For instance, the survey of [Umapathy \(1987\)](#) covered a range of industries including banks, hospitals, and companies of finance, life insurance, etc.; some other surveys focussed on federal facilities ([Federal Facilities Council, 1996](#)) and hotels ([Jones, 1998](#)). There were also studies on budgeting about buildings. They include the study of [Lam \*et al.\* \(2001\)](#), which was on budgeting for construction works but not O&M works. Whereas some surveyed building operating costs were analysed in [Macsporrán and Tucker \(1996\)](#), the practices that practitioners used in budgeting O&M works and any problems they encountered were not investigated.

On the other hand, in-depth information about O&M budgets for commercial buildings, e.g. contract sums, manpower resources deployed in budget preparation, etc. are sensitive and often confidential. The difficulty of pursuing this kind of research can be seen, for example, in the study of [Merchant \(1981\)](#) where the respondents were advised of their company's permission before asking them to participate in the study.

Literature on budgeting principles and methods for businesses are widely available, but they are not for specific use in the building O&M regime. [Table 1](#) summarises the characteristics of the budgeting bases given in [Scott \(1970\)](#), [British Institute of Management \(1972\)](#) and [Rachlin \(1999\)](#).

‘Insert [Table 1](#) here’

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

As regards budgeting models, [Barco \(1994\)](#) discussed the use of incremental model, zero-based model and models based upon project backlogs. [Ottoman \*et al.\* \(1999\)](#) reviewed eighteen models that may be used for budgeting facility maintenance and repair work. But these models are for budgeting repair and maintenance of large-scale infrastructure or civil works. In the context of maintenance of built assets, the review of [Bahr \*et al.\*, \(2008\)](#) found that budgeting approaches including data-oriented, history-based, value-based, analytical calculation and condition-based are unsatisfactory for estimating maintenance costs.

With the growth of the facilities management sector in the building industry, there has been an increasing volume of handbooks (e.g. [Lewis, 1999](#); [Cotts and Rondeau, 2004](#)) which include O&M practitioners as their target readers. The recommended practices, nevertheless, may not be universally applicable because different localities would have different legal requirements on financial compliance and the ways in which O&M works are organised may be different. A local guide on financial management of buildings has been published ([Independent Commission Against Corruption \*et al.\*, 2003](#)), but its main purpose is to foster an anti-corruption culture rather than providing detailed guidance for budgeting O&M works.

### **Personal Interviews and the Samples**

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

For obtaining sensitive budgetary information and genuine opinions from O&M practitioners while maintaining confidentiality, a questionnaire was used in a series of semi-structured personal interviews with the practitioners. Based on the literature review, the questionnaire was designed with both quantitative and qualitative questions. Quantitative data collected make it possible to carry out numerical analysis of contract costs, resources deployed for budgeting and perception ratings of the interviewees; qualitative information helps reveal their practices and views ([Bryman & Bell, 2003](#)).

The questionnaire consists of four parts. The first part asked about job nature and work experience of the interviewees and characteristics of the buildings they looked after. The second part requested the interviewees, by referring to a representative O&M contract, to indicate its contract sum; the number of staff and their amount of time devoted to prepare, check and approve its budget; and the budgeting bases or models used. The third part solicited their perceptions about the importance of various purposes of budgeting and factors that would affect budgeting. The final part, intended to guide the interviewees to liberally express their opinions, contain a number of open-ended questions on: the process of budgeting; any policy or key information based on which budgets are prepared; any problems with budgeting and the improvements needed.

The interviewees were invited among the reputable practitioners in the field and those who are Executive Members of the Building Services Operation and Maintenance Executives Society, which is the leading learned society for O&M

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

professionals in Hong Kong. Before the interviews, the questionnaire was sent to the interviewees to pre-inform them about its content such that the needed data can be retrieved beforehand.

After repeated attempts of invitation, 25 among the 30 invited agreed to be interviewed. They include 8 owner representatives, 12 property management practitioners and 5 contractors. Although this amount of samples is limited, they were the only practitioners who were kind enough to willingly share their precious yet sensitive information over an 18-month data collection period. Each interview took about 1.5 hours, during which an interim break was allowed in order not to fatigue the interviewee.

Possessing on average 18 years of work experience, all the interviewees were at senior positions. The O&M works they handled were spread over 245 commercial buildings; those covered in this study range from small (2,135 m<sup>2</sup>) to mega (1,000,000 m<sup>2</sup>) buildings, including the new (1.0 year) and old (31.0 years) ones ([Table 2](#)). As two of the interviewees refused to provide sensitive cost data, the average contract sum, calculated based on the remaining 23 sampled contracts, is about HK\$1.15 million. Their aggregate sum exceeds HK\$26.6 million and the range of contract period is between 1 and 3 years.

‘Insert [Table 2](#) here’

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Collection of the quantitative data was straightforward. But for ensuring validity and objectivity of the qualitative responses, the interviewees were asked to provide, as far as possible, evidence of sample cases or documents as support. A response contradictory to those collected from the preceding interviewees was allowed. In such case, however, elaboration was sought to see if it was just a result of some atypical factors and, if so, such a response was not taken as representative of general practices.

### **Budgeting Bases and Budgetary Costs**

From the answers to the second part of the questionnaire, the use of historical-based budgeting prevailed (92%). Adoption of activity-based budgeting recorded a distant second (44%). Both expense/revenue-based and zero-based budgeting methods were only used in 8% of the sampled contracts. The remaining three budgeting bases, viz. “bracket”, “charge-back” and “flexible”, were not practised by any of the interviewees. The main reasons for this include: i) O&M work is a support service for which setting a profit target is uncommon; ii) accountability for profit or loss of such service is not often defined; and iii) the common preoccupation that O&M work is routine and would seldom vary in amount.

According to the interviewees, while most budgets were prepared based on historical data, the process for their preparation basically comprises three stages: preparation, checking and approval. The average salaries of four levels of practitioners participating in these stages, calculated based on the samples, are



Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

summarised in [Table 3](#). The salary of practitioners working at strategic level of the property management companies is much higher than that of the owner or contractor group, and the salaries of the remaining ranks of contractor staff are all comparatively low.

‘Insert [Table 3](#) here’

For measuring the amount of manpower used for budgeting purpose, a manpower deployment indicator (*MDI*) was developed. It is defined as the devoted manpower resources normalised by the amount of contract sum, i.e. the amount of man-hours used for budgeting unit sum (in million dollars) of contract work, as represented by [Equation \(1\)](#). Using this equation, the values of *MDI* pertaining to different levels of practitioners were calculated, as plotted in [Figure 2](#).

$$MDI_{pq} = \frac{N_{pq} T_{pq}}{C_O} \times 10^6 \quad (1)$$

$$C_B = \sum_{p=1}^3 \sum_{q=1}^4 N_{pq} T_{pq} \left( \frac{S_q}{Hm_q} \right) \quad (2)$$

$$\tilde{C}_B = \frac{C_B}{C_O} \quad (3)$$

where

$C_B$  = budgetary cost, HK\$

$\tilde{C}_B$  = proportion of budgetary cost, %

$C_O$  = contract sum of O&M work, HK\$

$Hm_q$  = average monthly working hours of the  $q^{th}$  rank staff

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, Construction Management and Economics, Vol. 28 (April), pp. 415-427.

$MDI_{pq}$  = manpower deployment indicator of the  $q^{th}$  rank staff participated in the  $p^{th}$  stage of budgeting

$N_{pq}$  = number of the  $q^{th}$  rank staff participated in the  $p^{th}$  stage of budgeting

$p$  = stage of budgeting (1: prepare; 2: check; 3: approve)

$q$  = rank of staff (1: strategic; 2: managerial; 3: supervisory; 4: operational)

$S_q$  = average monthly salary of the  $q^{th}$  rank staff, HK\$

$T_{pq}$  = time of the  $q^{th}$  rank staff participated in the  $p^{th}$  stage of budgeting, hours

‘Insert [Figure 2](#) here’

There are two extremes of resources deployment for budget preparation. Practitioners at managerial and supervisory levels were highly involved ( $MDI > 40.0$ ). Those at strategic and operational levels, on the other hand, participated little in budget preparation, with their  $MDI$  being around 4.0, or 10% of the preceding two groups. These observations reflect that budget preparation is mainly handled by practitioners at the middle levels.

When the budget is checked before seeking formal approval, the participation of the middle levels dropped significantly ( $MDI$  lies between 7.0 and 17.0). The involvement of operational staff was even less ( $MDI = 0.2$ ). But at the later stages, the strategic level spent more man-hours on checking and approving the budgets; whereas the manpower deployment of all three lower levels of practitioners at the approval stage was minimal. In particular, there was no participation of operational staff ( $MDI = 0.0$ ) during budget approval.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Totalling the resources of various levels of staff who participated in preparation, checking and approval of budgets ([Equation \(2\)](#)), the cost incurred for budgeting,  $C_B$ , can be calculated. Among the 23 samples which provided useful information about contract sum, four were unable to supply detailed data of man-hours devoted to budgeting. Based on the remaining 19 useful samples, the calculated results are shown in [Figure 3](#) where budgetary cost is plotted against contract sum. There is no apparent observation except that within the sampled range of contracts, the maximum budgetary cost, while being less than HK\$70,000, is comparable to the monthly salary of practitioners at strategic level ([Table 3](#)).

‘Insert [Figure 3](#) here’

The budgetary costs were further examined by plotting their proportions ( $\tilde{C}_B$ ), which were calculated using [Equation \(3\)](#), against contract sums ([Figure 4](#)). For small contracts, significantly high proportion of budgetary cost, up to 40%, was incurred. Similar to the findings of [Lai and Yik \(2007a\)](#) on contract monitoring cost, the proportion declines with increasing contract sum, indicating the existence of economies of scale. The downward trend is unaffected by the different number of samples of the stakeholder groups, and the proportion of budgetary cost, on average, reduces from 8.6% (property management), through 3.1% (owner) to 0.2% (contractor).

‘Insert [Figure 4](#) here’

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

## Budgeting Purposes and Factors Affecting Budgeting

Before examining whether the practitioners had encountered problems with O&M budgeting or how problematic they were, the importance of various purposes of budgeting (adapted from [Jones \(1998\)](#)) they perceived was solicited based on a cardinal scale: 1 (no); 2 (low); 3 (fair); 4 (high); and 5 (extreme). [Table 4](#) displays the average importance ratings ( $R$ ) and the associated ranks corresponding to the overall response, and those grouped with respect to different stakeholder groups.

‘Insert [Table 4](#) here’

For testing the relative agreement of the perceived importance ratings among the three groups of practitioners, the Kendall coefficient of concordance ( $W$ ), which may lie between “0” (no community of preference) and “1” (perfect agreement), was calculated using [Equation \(4\)](#). The sum of the squares of the deviations ( $D$ ) of the row rank sums ( $K_i$ ) from their mean value  $m(n+1)/2$  pertaining to the  $n$  attributes rated by the three groups (i.e.  $m = 3$ ) was determined by [Equation \(5\)](#), where  $u_j$  is the number of consecutive members of the  $j^{th}$  tied rank ([Kendall & Gibbons 1990](#)).

$$W = \frac{12D}{m^2(n^3 - n) - m \sum_j (u_j^3 - u_j)} \quad (4)$$

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

$$D = \sum_{i=1}^n \left[ K_i - \frac{m(n+1)}{2} \right]^2 \quad (5)$$

The Kendall coefficient calculated based on the three groups of responses is 0.469. This moderate value indicates that there exists no significantly perfect agreement among their responses. Nevertheless, ‘to satisfy O&M needs’ was generally regarded as the most important purpose. The second most important purpose the respondents perceived was to satisfy company policy and procedure. Intriguingly, it was rated as the most and the least important by the property management group and the contractor group respectively. Possible reasons for this observation include two extreme situations: there was no properly documented budgeting policy and procedure for them to follow or; there was such documentation but the inadequate time allowed forced them not to follow it when preparing budgets.

The purposes of budgeting rated as intermediately important include: to aid control expenditure; to aid long-term planning; to aid short-term planning; and to coordinate with other departments’ budgets. Similar observations were noted when inspecting their ranks across the stakeholder groups. ‘To motivate the O&M team’ was rated the lowest. This suggests a weak link between proper use of budgeted resources and the way in which the performance of the practitioners is assessed.

From the reviewed literature, a number of factors that may affect preparation of budgets were identified. They can be classified into four types namely

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

“historical”- preceding budget, preceding expenditure; “endogenous” – pre-determined budget ceiling, budget prepared in-house; “exogenous” – quotation from contractors, benchmark information; and “economic” which includes (Census and Statistics Department, 2009): i) consumer price index – measures the changes over time in the price level of consumer goods and services; ii) wage index - measures the changes in prices of labour; and iii) gross domestic product (GDP) deflator - as a broad measure of overall inflation in the economy. Table 5 summarises the overall average perceived importance ratings (and ranks) of these factors and the results pertaining to the three groups of interviewees. Based on the three groups of results and using Equations (4) and (5), the calculated Kendall coefficient is 0.894. This indicates the existence of a strongly positive agreement among their perceived importance rankings.

‘Insert Table 5 here’

The practitioners generally considered the historical factor ‘preceding budget’ and the endogenous factor ‘pre-determined budget ceiling’ as the most influential to budget preparation. The contractor group, on the other hand, regarded the budget they prepared in-house as the most important, followed by the actual expenditure for the same work in the preceding period. External information, which include resources quoted by contractors of the owner / property management companies or by subcontractors of the contractors, and cost information that can be used for benchmarking purpose, were perceived by the three groups as of comparably moderate importance.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Variation in economic factors would lead to fluctuations in prices, and thus should be considered in budget preparation. The responses, nonetheless, show that consumer price index, wage index and GDP inflator were given low importance ratings (1.75 to 3.33) across the board. The rather short period of O&M contracts ([Table 2](#)), is probably a reason for the little consideration being given to these factors.

### **Problems and Recommended Improvements**

Only some apparent reasons have been suggested for the above perceptions. This section, consolidated by integrating the literature review, the findings of the foregoing analysis, the recommended best practices and the opinions of the interviewees, examines the major problems with O&M budgeting and their causes. Suggestions for the necessary improvements are also given.

#### *Budgeting for newly completed buildings*

According to the cost model of [Lai et al. \(2008\)](#), O&M costs for commercial buildings include those for maintaining an in-house team, hiring outsourced contractors, purchasing spare parts and materials, replacing faulty installations, and paying utility bills.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Concurring with the findings of [Lai and Yik \(2007b\)](#), the interviewees advised that because major maintenance works are largely outsourced, the cost for keeping spare parts and materials is not substantial, which is particularly true for newly completed buildings. New installations do not normally require complete replacements. Even defects may be found with some components, the installation contractors are obligated to rectify them during the defects liability period (DLP). The cost for employing in-house staff, however, is rather difficult to estimate because their number, competence and skills required depends largely on the coverage and performance of the contract services during the DLP.

Energy cost, which dominates among the utility costs, is again a major item whose prediction could hardly be accurate. Although simulation software have been widely available for use in predicting building energy consumption ([Lomas et al., 1997](#)), unforeseen initial occupancy rate often results in significant difference between predicted and actual energy costs. Same as the experience of [McMahon \(2005\)](#), the interviewees further pointed out that services systems are often without proper commissioning, which renders energy wastage and thus deviation between designed and actual energy consumptions commonplace.

Because the predicted costs are unreliable, the practitioners often make reference to the costs-in-use of buildings they ever managed or those they concurrently look after. While this is a common practice, they realized that these buildings are older than the new ones and they may differ in O&M cost factors like grade of building, O&M standard, quantity or capacity of installations ([Lai and Yik, 2006](#)).



Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

To enable preparation of reasonably accurate cost estimations, trustworthy benchmark information which the practitioners are keen to know, should be made available.

#### *Lack of proper policy and procedure*

For buildings which have been occupied for a considerable period of time, far too often there is no formal O&M policy or budgeting procedure that the practitioners can refer to, not to mention the required standard of O&M works. On the contrary, a clear procedure for processing payments is usually in place and regular audits on the payments by accounting professionals are common. This practice can help achieve a good control of O&M expenditure, but no matter how rigorous it is, allocation of O&M resources would not be proper if the budget was ill-prepared in the first place.

Although it is desirable that O&M practitioners prepare budgets based on a clear policy and procedure ([Royal Institution of Chartered Surveyors, 2000](#); [Armstrong and Saville, 2005](#)), this does not necessarily mean such a document is suitable for all buildings, as they may be different in scale, complexity, organizational set-up, and so on. Rather, an O&M policy and procedure which takes into account the characteristics and peculiar requirements of the building should be tailored for use.

#### *Lack of proper O&M information*

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Installation contracts typically specify the provision of record drawing, commissioning record and O&M manual before handover ([Hastings \*et al.\*, 2007](#)). However, these documentations are often partial, not only because the period allowed for commissioning is too short but also because accepting incomplete set of such information by the O&M team has been a long-standing practice.

Inheriting this improper upkeep of documentations, the practice of logging system performance data is also loose. Although regular surveys are essential to realising the conditions of facilities ([Nanayakkara, 2000](#)), their comprehensive implementation are typically too costly. And if condition monitoring devices or redundant equipments are not in place, systems shutdown is only possible in unoccupied periods. This is a hurdle to performing proper and thorough evaluations of their conditions.

To tackle these problems, an independent commissioning agent should be engaged to ensure the commissioning process is complete and satisfactory ([Chartered Institution of Building Services Engineers, 2003](#); [American Society of Heating, Refrigeration and Air-Conditioning Engineers Inc., 2005](#)). Relevant education and training should also be provided to enhance the knowledge of O&M personnel. This can help them remove the custom of accepting incomplete O&M information during handover, while promoting a culture of maintaining proper facilities performance records.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

*Lack of industry standard*

Building O&M has never been a preferred career, and formal academic programmes dedicated for producing building O&M professionals are yet to be available (Lai and Yik, 2007c). Without industry-wide standard guidelines, the procedures that practitioners adopted in preparing O&M budgets are mostly domestic, which vary between organisations. Even in the same organisation, it is not uncommon that the budgeting practice differs from one team to another.

Unlike budgeting for new construction works where model bills (Architectural Services Department, 2004; 2007) and standard measurement methods (Architectural Services Department, 2001; Hong Kong Institute of Surveyors, 2005) are widely used, similar counterparts applicable for O&M works have been in lack. There are two main reasons for this. First, many O&M works are dissimilar to construction works. For instance, servicing work like overhaul of equipment (e.g. pump) is only needed in existing buildings but not in new building projects. Second, O&M works are often of too little value to be specified, e.g. tightening a loosened electric switch. Including every work item of this kind in a model bill would make it too bulky and hence impracticable.

A standard set of unit rates of O&M materials and manpower is also essential to budget preparation. Whereas Spain (2006) is an example and local standards available for use in public works include Architectural Services Department (1997a; 1997b), there is no usable set of unit rates for O&M works in the private

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

sector ([Lai et al., 2006](#)). Even if only rough O&M budgets are needed, which should be feasible by making reference to some ballpark benchmark data (e.g. [International Facility Management Association \(2006\)](#)), more research work has to be done before similar kind of information becomes applicable in the local context ([Lai and Yik, 2006](#)). The lack of such benchmark information also explains why it was given a relatively low importance rating ([Table 5](#)).

#### *Over-reliance on historical budget*

To practitioners playing the role of building owner or management company, the amount of money approved for disbursing O&M expenses in the preceding period is of great importance ([Table 5](#)). No matter what level of budget is drafted, they always compare it with the previous budget. Their experiences tell that a budget larger than the preceding one could hardly get approved, unless it is justified by extensive substantiation which, in practice, is time-consuming and unaffordable to them.

An alternative way to get such “extra” work funded is to defer and package them to become some improvement work, better known as capital work in their custom. This kind of work can then be financed by the sinking (reserve) fund drawn from the collected management fee over a certain period ([Loo, 1991](#)). Obviously, the price for this improper practice is the inability to timely meet the real O&M needs.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

It is suggested that historical costs are useful benchmark information with which reference can be made when estimating cost for routine works with little change over time. For capital works of specific nature, e.g. lift modernization, chiller replacement, etc., preparing their budgets on “activity” and “zero” bases ([Table 1](#)) is recommended.

#### *Exogenous information and uncertainties*

Besides budgeting the portion of in-house work by internal staff, it is common to ask the serving contractors to provide quotations for the works that they have been undertaking. Unless the quoted amounts differ significantly from the extant contract sums or where there is great pressure to cut costs, they are normally taken as the budget for that part of work.

For new items of O&M work, the owner or property management representatives typically call quotations from a few contractors including the serving contractor. Any exceedingly high or low estimates would be discarded; the mean of the majority quotes would be regarded as reasonable. But because the estimates are often made swiftly based on some preliminary specification, the apparently reasonable quotes may in fact deviate from the needed budget. This also reflects why, as [Table 5](#) shows, ‘quotation from contractors’ was only regarded as moderately important.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Recurrent O&M expenditures are disbursed from management fee collected from building tenants ([Hong Kong Institute of Real Estate, 2005](#)). Forecast of the receivable management fee and the control of its use, nevertheless, are in the hands of the leasing manager. Being a party external to the O&M team, such a controller often predetermines a ceiling for the O&M budget. According to the interviewees, they have long accustomed to this top-down approach.

Ever-changing user demands would result in the need to modify tenant premises and the associated facilities, e.g. combining two adjacent premises. Whereas a market downturn often leads to high tenant removal, the demand for modification work would be low so long as the vacated premises remain vacant. When the market recovers, the vacant premises would need to be modified to cater for new tenants. This demand and the corresponding O&M resources are difficult to estimate. In addition, unprecedented events such as the SARS outbreak ([Department of Health, 2003](#)) necessitate extra budget for additional O&M works. But this kind of variable could not be predicted in advance.

The use of lump sum contracts without contingency allowance, same as that revealed by [Lai et al. \(2006\)](#), is predominant. Without adequate work breakdowns, descriptions for the work scope may contain ambiguities but they are the main information based on which the tenderers prepare their cost estimates. In consequence, overestimated bids would not get awarded. Tenders which are underestimated, on the contrary, are often selected. The inadequate

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

allowance of resources frequently leads to disputes over unbudgeted or underestimated works.

Reserve fund, a standard item in building management budget, is vital to cater for urgent needs stemming from contingent scenarios. Since such needs are unpredictable, it is difficult to set a fixed level for the fund. An appropriate level can be determined by a proper risk analysis of the circumstances, but it can be maintained only when the owners accept that it is beneficial rather than trivial to do so.

#### *Fear of underestimation*

Practitioners accountable for budgeting work tend to prepare padded budgets, fearing that seeking additional funding during the budget period would be difficult, if not impossible. This phenomenon is common to both the owner and property management groups. If surplus is anticipated when approaching the end of a budget period, they will try to exhaust it, even through ordering works which are unnecessary. Servicing work such as cleaning of façade lighting is a typical example, as it is hard to verify its necessity (i.e. whether the lighting was dirty enough to justify cleaning) after work completion. The amount of money so expended is actually wasted.

When there are underestimated works, practitioners representing the owner or the property management company often require the O&M contractor to absorb them

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

in order to prevent over-budget. This, however, would not be successful unless the contract is strongly relational (Lai *et al.*, 2006) or when the contractor is promised to get compensation in future contracts. In case of budget overrun, so long as it is not substantial and the justifications are reasonable, it is usually covered by budget surplus of other departments (e.g. leasing department) or by using in advance the funding of the next budget period. In any case, the responsible parties are seldom penalized.

For practitioners working as O&M contractor, they are much more cautious in budget preparation. If the budget is properly prepared and surplus is available eventually, a performance bonus would usually be rewarded to the relevant staff. In another extreme, if the resources are significantly underestimated, the responsible staff may get demoted, or even fired. These mechanisms, though being rare in the owner or property management organisations, can introduce motivations for proper budgeting. Money saved from not doing the unnecessary work, apart from funding the bonus, can become part of the reserve fund or support works with genuine need.

#### *Small scale and intangible service*

An O&M contract is different from a construction contract by its relatively small scale, which makes preparation of detailed budget unjustifiable. A plausible way to solve this problem is to bundle small contracts into larger package for procurement. Although this can make the budgetary cost economised (Figure 4),



Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

there are factors which run counter to the efficiency of bundling contracts. For works that involve multiple specialist contractors, the cost for coordination and performance management can be significant. For contracts which cover multiple buildings with different O&M standards, the effort for demarcating their differences and the need for the contractor to customise their deliverables to suit different standards will also impair the efficiency.

Some O&M services are intangible in nature, e.g. inspection of operational status of equipment, whose execution could not be verified after its completion. Budgeting for this kind of works is inaccurate because, as pointed out earlier, there is no standard set of unit rates for O&M manpower and materials. To overcome this difficulty while looking for quality services, it is preferable to use performance-based contracts where appropriate performance targets (e.g. key performance indicators like frequency, timeliness, etc.) are clearly defined, with due incorporation of incentive or penalty clauses into the contracts.

#### *Cost-led procurement*

Competitive tendering prevails among the methods for forming O&M contracts. Rather than the “value” of contract service, the focus of tender assessment is usually on the “cost” quoted. During economic downturns, it is common that contractors submit unreasonably low bids without really estimating the required resources for the work. Annual inspection of fire services system serves as an example. While it is a statutory work and the penalty on its non-compliance is

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

heavy (Lai and Yik, 2004), some contractors even ask if site visit for appraising the system condition is necessary before tender submission and if not, their tender price will be lower. In fact, the contractors simply quote a price for issuing a statutory certificate for the work without performing the actual inspection. The travelling and time costs saved from skipping the visit enable a low bid. They are tempted to do so because, even if problems arise, it is often difficult to trace the source of responsibility for this intangible service. In an extreme case, a contractor inspected the fire services system of a 40-storey office building with just a nominal contract sum of one dollar. Underlying this unreasonable bid is his speculation of getting compensated from profits of some upcoming addition and alteration (A&A) works for the building.

None of the contractors, the management company or owner representatives expressed that predatory pricing (McGEE, 1958) had ever taken place, not even during the past economic booms. While there was no such anti-trust behaviour of the contractors, the unrealistic contract prices, if referenced, is a low-cost signaling that will direct the competitors to believe that their price was not low enough. Cutthroat competitions (Telser, 1966) so caused would create a vicious circle where both O&M budget and quality of contract service continue to drop, defeating the purpose of competitive tendering. Rather than defining some minimum tender price levels, which is undesirable in a free market, a key to alleviating this problem is tightening the enforcement of relevant regulations while raising the contractors' awareness about the consequence of non-compliance. For non-statutory works, if the owners opt to take advantage by

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

accepting cutthroat bids, they should not complain about low service quality in case the contractors were not given the chance to obtain the profits they expected from the A&A works.

#### *Short tender period and fresh tenderers*

O&M contractors who are newly invited to bid for a particular contract would assess the facilities conditions during a pre-tender site visit. Such assessment, however, is rough both because of the limited time allowed and the minimal time that they can afford. Therefore, they often resort to ask the owner's representative for the maintenance history, such as the recurrent consumption of spare parts and any burdensome work which is invisible from the explicit contract scope. The extent and accuracy of such information depend greatly on the relationship between the owner representative and the tenderer. In contrast, the serving O&M contractor has been familiar with the plant performance and asset conditions, which are unknown to fresh tenderers. Although this situation of asymmetric information is different from that between an employer and an contractor ([Lai et al., 2006](#)), the serving contractor, because of his better knowledge about the site, can often submit a bid lower than that of the fresh tenderers.

For fresh tenderers who have enough jobs in hand and thus are not keen to win the contract, they will submit sky-high bids in order to avoid being selected. Those who submit a low bid without understanding the poor site conditions will

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

run into trouble of getting inadequate payment to cover the contract work. Meanwhile, the knowledge of the original contractor about the existing conditions will be lost. And although the employer may seemingly gain by paying less to the new contractor, more effort is normally needed to monitor his performance. A way to retain the possessed knowledge (value) is for the new contractor to employ the same team of staff who used to work for the original contractor. Notwithstanding that it did happen in some cases, this practice should not be encouraged if the staff are deprived as a result of the re-employment.

## **Conclusions**

Despite the difficulty of obtaining sensitive cost and information about budgeting O&M works for commercial buildings, the study, through a series of personal interviews with the experienced practitioners, has investigated in-depth the actual practices of budgeting and the major problems encountered in the Hong Kong context.

Among a variety of budgeting bases, the use of historical-based budgeting predominates. Budgets are essentially prepared and checked by practitioners at managerial and supervisory levels; those at strategic level mainly keep a close eye on their approval. Individual O&M contracts, while being small when compared to construction contracts, entail significantly high proportions of cost for their budgeting. Such budgetary costs can be economised through bundling discrete contracts into larger procurement packages.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

The importance of satisfying O&M needs through proper budgeting is highly recognised by the practitioners, but their motivations toward preparation of proper budgets are inadequate. The factors that greatly affect budgeting include 'preceding budget' and 'pre-determined budget ceiling'. Without addressing the genuine needs, budgets prepared under these influences are doomed to be improper.

Recommended best practices for budgeting are widely available, but the study has exposed a range of problems which are the major causes for improper budgeting. The suggested improvements, rather than being some instant solutions, are meant to outline a framework of measures that need to be further developed for tackling the problems. Although O&M budgeting has not been a common focus of construction industry reviews (e.g. [Egan, 1998](#); [Tang, 2001](#)), it is hard to imagine how buildings, even with quality construction, could be sustainable without proper budgets for their operation and maintenance.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

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Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

## Tables

Table 1            Characteristics of budgeting bases

Basis	Characteristics
Activity	<ul style="list-style-type: none"> <li>• Quantification of expected activities to reflect management forecast of workload and financial and non-financial requirements to meet agreed strategic goals</li> <li>• Three key elements must be present: type, quantity and cost of work to be done</li> </ul>
Bracket	<ul style="list-style-type: none"> <li>• Complements conventional budgeting techniques to overcome the inadequacy in dealing with difference in actual profit from target</li> <li>• By varying the same percentage of each element, the elements can then be ranked according to their impacts</li> </ul>
Charge-back	<ul style="list-style-type: none"> <li>• The facility department charges each operating division a rent for those services</li> <li>• Each operating division may use the in-house services or procure them from outsiders</li> </ul>
Expense/revenue	<ul style="list-style-type: none"> <li>• Budget determined based on some defined relationship between the particular expense under consideration and revenue, frequently in terms of a ratio or a percentage</li> </ul>
Flexible	<ul style="list-style-type: none"> <li>• Developed taking into account a relevant range over which a budgeted activity is expected to fluctuate</li> <li>• Usually includes a separation of fixed and variable costs over the relevant range</li> </ul>
Historical	<ul style="list-style-type: none"> <li>• Takes into account the previous period's budget and its actual result</li> <li>• Budget for the projected period is adjusted, depending on the previous period's result and on the expectations for the projected period</li> </ul>
Zero	<ul style="list-style-type: none"> <li>• Budget is prepared from the ground up, as though it were being prepared for the first time</li> <li>• Typically undertaken on a less regular basis, only for a subset of responsibility centres at any one time, because its preparation involves considerable time and resources</li> </ul>

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Table 2            Key information about the samples

	Total	Mean	Minimum	Maximum
Area of building (m <sup>2</sup> )	1 365 096	54 604	2,135	142 973
Building age (year)	-	15.0	1.0	31.0
Contract sum (HK\$)*	26,635,536	1,158,066	7,500	8,351,200
Contract period (year)	-	2.0	1.0	3.0

\*Based on 23 samples which provided the relevant cost.

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, Construction Management and Economics, Vol. 28 (April), pp. 415-427.

Table 3          Average monthly salaries (HK\$)

Staff rank	Examples of title	Overall	Owner	Property management	Contractor
Strategic	Director; Head of department	62,650	57,167	74,000	42,500
Managerial	Maintenance manager; Technical manager	38,409	42,000	39,583	32,000
Supervisory	Officer; Supervisor;	20,875	21,571	21,667	18,000
Operational	Fitter; Technician	11,739	12,500	12,083	10,000

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, Construction Management and Economics, Vol. 28 (April), pp. 415-427.

Table 4 Importance ratings and ranks of budgeting purposes

Purposes	Overall		Owner		Property management		Contractor	
	<i>R</i>	Rank	<i>R</i>	Rank	<i>R</i>	Rank	<i>R</i>	Rank
To satisfy O&M needs	4.04	1	4.00	1	4.08	3	4.00	1
To satisfy company policy and procedure	3.84	2	3.50	3.5	4.42	1	3.00	6
To motivate the O&M team	3.12	7	3.25	6	3.08	7	3.00	6
To aid control expenditure	3.76	3	3.38	5	4.00	4	3.80	2
To aid long-term planning	3.72	4	3.50	3.5	4.17	2	3.00	6
To aid short-term planning	3.60	5.5	3.75	2	3.50	6	3.60	3.5
To coordinate with other departments' budgets	3.60	5.5	3.13	7	3.92	5	3.60	3.5

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

Table 5 Importance ratings and ranks of factors on budgeting

Factors	Overall		Owner		Property management		Contractor	
	<i>R</i>	Rank	<i>R</i>	Rank	<i>R</i>	Rank	<i>R</i>	Rank
Pre-determined budget ceiling	3.88	2	4.13	1	3.83	2	3.60	3
Preceding budget	3.96	1	3.75	2.5	4.33	1	3.40	4.5
Preceding expenditure	3.76	3	3.75	2.5	3.75	3	3.80	2
Budget/quotation from contractors	3.33	5	3.43	5	3.25	6	3.40	4.5
Budget prepared in-house	3.68	4	3.50	4	3.67	4	4.00	1
Benchmark information	3.00	6.5	3.00	6	3.17	7	2.60	6.5
Consumer price index	3.00	6.5	2.75	7	3.33	5	2.60	6.5
Gross domestic product deflator	2.12	9	1.75	9	2.33	9	2.20	8.5
Wage index	2.56	8	2.63	8	2.67	8	2.20	8.5

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, Construction Management and Economics, Vol. 28 (April), pp. 415-427.

## Figures

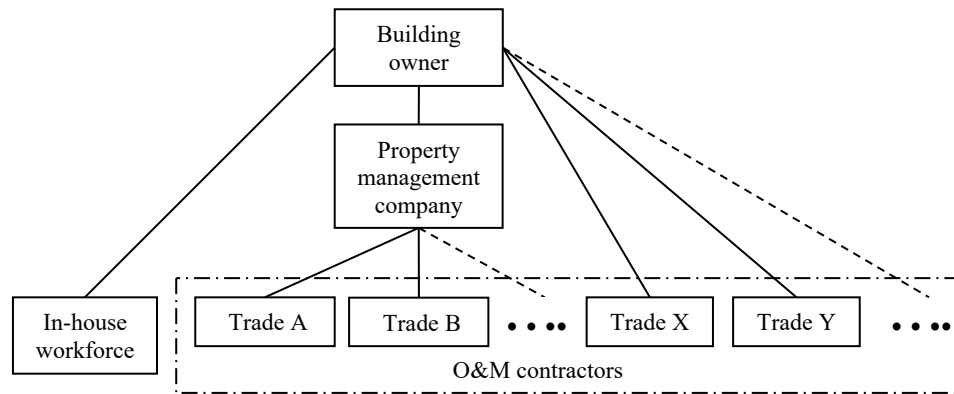


Figure 1 Typical arrangement of stakeholders of O&M contracts

Lai, J.H.K. (2010), Operation and maintenance budgeting for commercial buildings in Hong Kong, *Construction Management and Economics*, Vol. 28 (April), pp. 415-427.

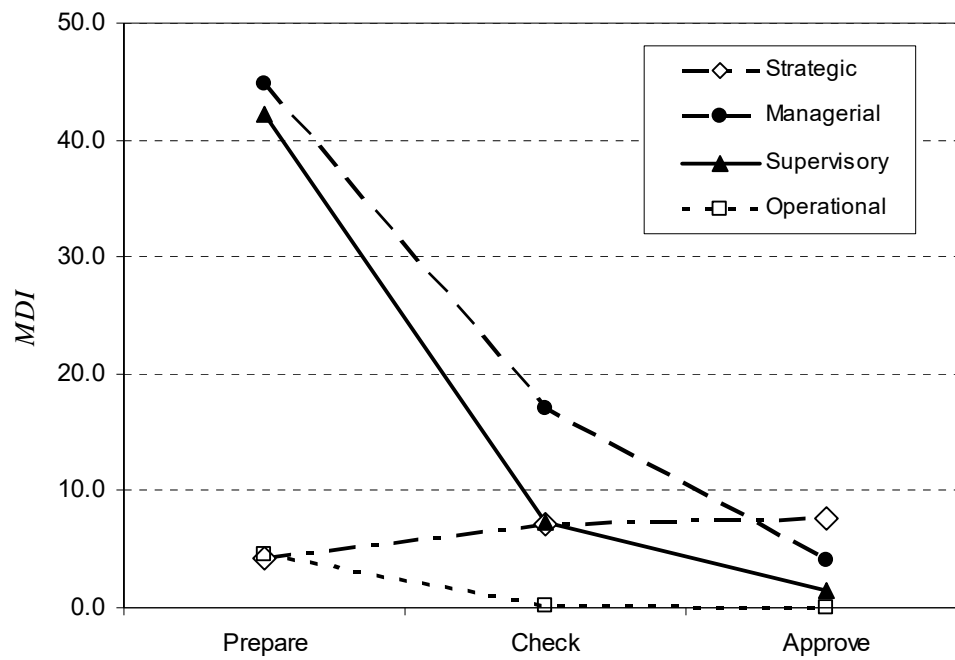


Figure 2 Manpower deployment at different stages of budgeting



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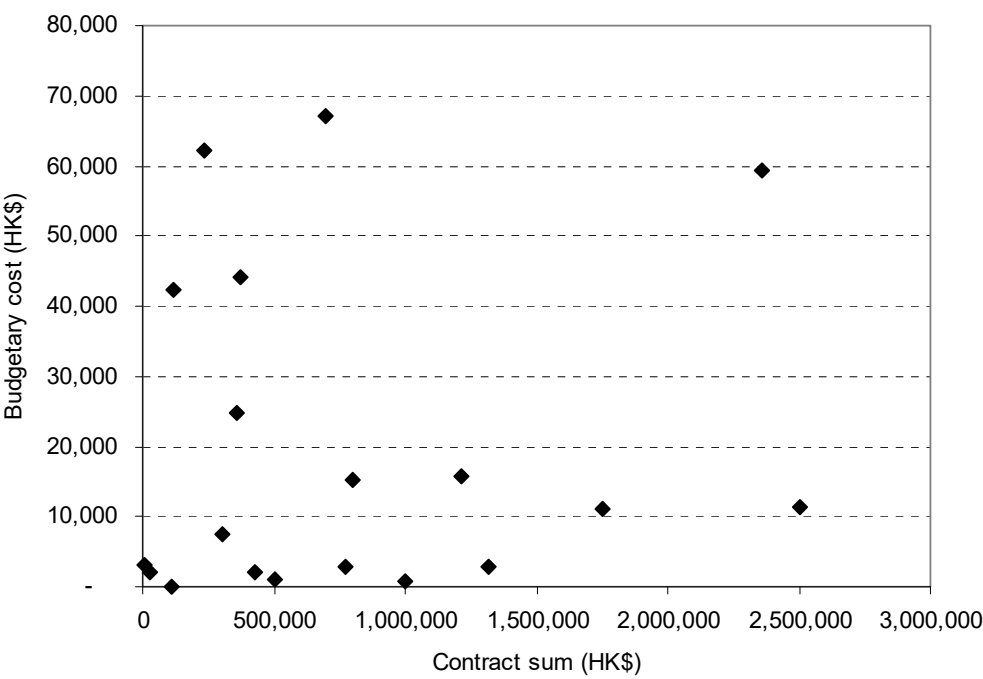


Figure 3      Budgetary cost against contract sum

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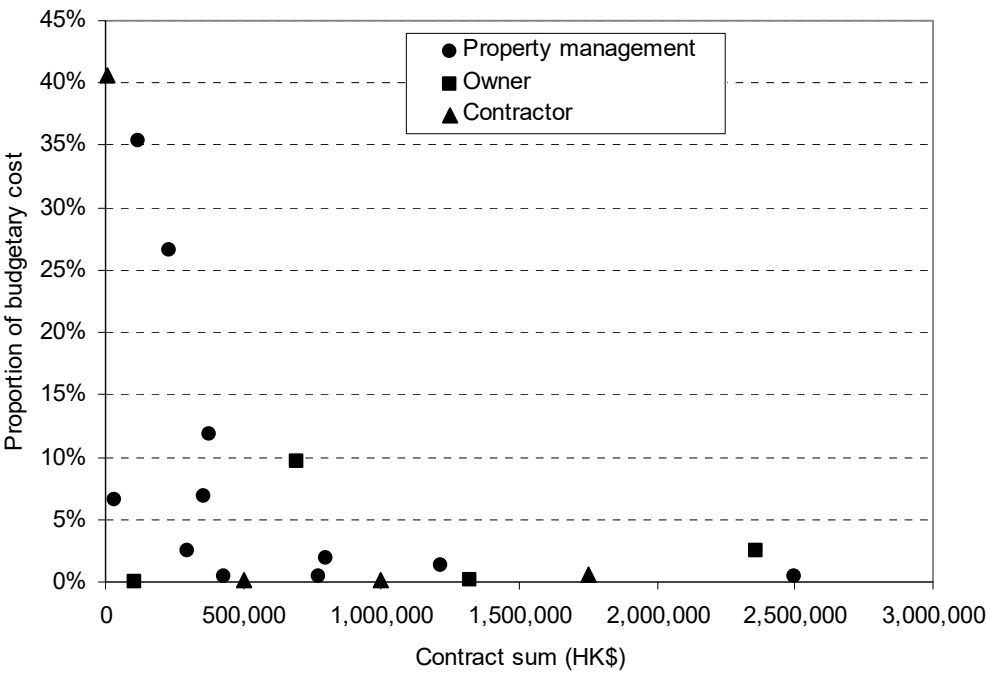


Figure 4 Proportion of budgetary cost against contract sum