ECONOMIC, MANAGEMENT AND CONTRACTUAL CONSIDERATIONS IN OUTSOURCING OPERATION AND MAINTENANCE WORK FOR COMMERCIAL BUILDINGS

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Abstract

Operation and maintenance (O&M) work, which is influential to the performance of a building and its economic value, had received little attention. Outsourcing for O&M works from contractors who specialize in the works can be more economical than performing the works in-house and can lead to better performance. Since the economic downturn in the late 90's in Hong Kong, building owners have increasingly outsourced for O&M work but the purpose has been primarily to cut cost, with up-keeping building performance left as an afterthought. Guidelines available from the open literature on making outsourcing decisions are not tailored for building O&M work. The aim of this study is to help building owners make decisions on whether or not to outsource for O&M works by providing them with guidance on the critical considerations and good practices that should be taken to ensure value for money, and to avoid potential negative impacts on the performance of their buildings. The study focused on commercial buildings in Hong Kong.

The empirical data collected via a self-administered questionnaire survey in the first stage of the study has unveiled that disputes are frequently found with O&M contracts where contractual responsibilities are vaguely defined by using common contract terms such as "fair wear and tear" and "vandalism". In probing into the key management, contractual and economic issues of outsourced O&M works, the face-to-face interviews with the practitioners in the second stage have revealed that O&M works are generally undertaken by a mix of in-house and outsourced resources, with the latter undertaking those requiring intensive labour resources or compliance with statutory requirements. Managing contractors are often employed to mediate various trades of O&M work, but bundling O&M contracts across building boundary, which in principle should be more economical, is not practiced in private commercial buildings. While effective communication among the in-house and outsourced O&M teams is generally regarded as highly important, sharing of O&M productivity information among the stakeholders remains limited.

The small individual O&M contract sums entail minimal *ex ante* resources being input into contract formation. Lacking a standard form, O&M contracts are often loosely formed with irregular conditions. A clear understanding of the contract concepts applicable to O&M works is uncommon. Competitive tendering, which is not generically suitable for outsourcing O&M works, has however been a custom. Discrepancy in the perceived scope of work is a major cause of disputes. When the demarcation between the internal and outsourced work scopes is unclear, remunerating the contractor for the overlapped work scope accomplished by the in-house team gives rise to wasted costs. Incomplete contracts and *ex post* opportunistic behaviours of the contracting parties also bring in additional transaction costs. However, a complete contract is not necessarily the most efficient contract, as making a contract complete also adds transaction cost. Making available a standard form of contract will help but forming a contract must take account of individual circumstances.

O&M resources, which are commonly budgeted by modifying the preceding budget or relying on contractors' quotation, are unlikely to meet the genuine needs. The major factors that affect air-conditioning O&M expenditures are air-conditioned area and plant capacity whereas building age is, in general, not a significant factor. Increasing or reducing the extent of outsourcing is not promising for cost saving. The focus for cost minimisation should be to improve building energy performance as the O&M cost of air-conditioning systems is dominated by the energy cost. Suitable contract pricing structure and appropriate tender bidding method are important attributes to a successful contract. Notwithstanding that allowing adequate amount of contingency sum is uncommon, it is necessary in theory of incomplete contracting as well as in real-life contracts where unforeseen scenarios would happen.

In essence, prior to outsourcing the building management should investigate the cost-effectiveness and service quality of the existing O&M work; base on a 'zero-based' principle to properly prepare budgets; look for strategic energy saving measures rather than myopic cost cutting means; and identify the O&M work whose fluctuating workload does not justify in-house production. If it is decided to go for outsourcing, it is preferable to bundle O&M contracts for lean management; make adapted use of standard contract form to fit for the work; and incorporate the principles of re-measurement, risk-sharing and relational contracting to draft *Pareto* efficient contracts with proper scope of work and specification, optimum contract period and financial incentives, and adequate contingency sum and suitable pricing structure. Additionally, a suitable method should be used to select a financially-strong contractor with adequate past work experience and professional qualification, and good reputation and large workforce dedicated to the work. Adverse selection of contractor must be avoided and, the explicit contract terms and implicit work scope should be fully communicated to the contractor.

Of equal importance to considering the *ex ante* preparations, the building management should plan to make optimized use of customer satisfaction survey, O&M audit and performance review meeting to measure and monitor the *ex post* contract performance. Running a relational contract by maintaining a good contractual relationship with the contractor can help economize on transaction costs for resolving disputes. Changes in O&M service quality should be weighed against cost variations throughout the contract period. This is essential for considering whether the contract should be terminated, renewed, or in-sourced in future.

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Declaration

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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Statement 1

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by giving explicit references. A bibliography is attached in the thesis.

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Abbreviations

ACA	Association of Consultant Architects, UK
ANAO	Australian national Audit Office
ASD	Architectural Services Department, HKSAR
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers
BD	Buildings Department, HKSAR
BSI	British Standards Institution
BSRIA	Building Services Research and Information Association, UK
BSOMES	Building Services Operations and Maintenance Executives Society, HKSAR
CEPA	Closer Economic Partnership Arrangement
CIBSE	Chartered Institution of Building Services Engineers, UK
CIOB	Chartered Institution of Building, UK
CIRC	Construction Industry Review Committee, HKSAR
CIRIA	Construction Industry Research and Information Association, UK
CMMS	Computerized maintenance management system
EMM	Estate Management and Maintenance
EMSD	Electrical and Mechanical Services Department, HKSAR
ETWB	Environment, Transport and Works Bureau, HKSAR
EU	Efficiency Unit, HKSAR
GFA	Gross floor area
HAD	Home Affairs Department, HKSAR

HKAPMC	Hong Kong Association of Property Management Companies
HK-BEAM	Hong Kong Building Environmental Assessment Method
HKCA	Hong Kong Construction Association
HKG	Government of Hong Kong (Pre-1997)
HKHA	Hong Kong Housing Authority
HKIA	Hong Kong Institute of Architects
HKIAC	Hong Kong International Arbitration Centre
HKIE	Hong Kong Institution of Engineers
HKIFM	Hong Kong Institute of Facility Management
HKSAR	Hong Kong Special Administrative Region, China
HPLB	Housing, Planning and Lands Bureau, HKSAR
IAQMG	Indoor Air Quality Management Group, HKSAR
IC	Industry Commission, Melbourne, Australia
IEE	The Institute of Electrical Engineers, UK
IFMA	International Facility Management Association, US
IMechE	Institution of Mechanical Engineers, UK
MBO	Management-But-Out
OED	Oxford English Dictionary
OI	Outsourcing Institute, US
O&M	Operation and maintenance
PACE	Property Advisors to the Civil Estate, London, HMSO
PCICB	Provisional Construction Industry Co-ordination Board, HKSAR
PMRC	Plant Maintenance Resource Center, Australia

PRH	Public Rental Housing
PSC	Property Services Contract
PSI	Private Sector Involvement
RICS	Royal Institution of Chartered Surveyors, UK
RVD	Rating and Valuation Department, HKSAR
TUPE	Transfer of Undertakings (Protection of Employment) Regulations, UK
UKAC	Audit Commission, UK
VTC	Vocational Training Council, HKSAR
WTO	World Trade Organisation

Notations

A_C	Contractual attribute
A_E	Economic attribute
A_M	Management attribute
AEC	Annual air-conditioning electricity cost
C_i	In-house cost element
C_D	Transaction cost incurred for drafting contract document
C_E	Transaction cost incurred for enforcement of contract
C_M	Transaction cost incurred for measurement of contract
C_{MO}	Transaction cost incurred for monitoring of contract
C_N	Transaction cost incurred for tender negotiation
C_S	Transaction cost incurred for searching contract information
CP	Contract performance
CV	Contract value
CV_{max}	Maximum contract value
$\Delta C_{1.b\text{-}a}$	Change in in-house labour cost associated with outsourcing
$\Delta C_{2.b\text{-}a}$	Change in direct material cost associated with outsourcing
d	Discount rate
d_c	Difference in rank between pairs of items under investigation
D_{ad}	Duration of O&M audit in hour
D_{pm}	Duration of performance review meeting in hour
Dm_j	Number of working days per month of O&M staff at work level j

E_n	Monthly air-conditioning electricity cost over a period of 12 consecutive months
E_O	Extent of outsourcing
EC	Energy cost per month
$EOGFA$	Equivalent office gross floor area in square meter
ECI	Energy cost intensity (energy cost per unit floor area)
EUI	Energy use intensity (energy use per unit floor area)
F_{ad}	Frequency of O&M audit during the contract period
F_{cs}	Frequency of customer satisfaction survey during the contract period
F_{pm}	Frequency of performance review meeting during the contract period
F	Frequency of dispute
FTE_j	Full-time equivalent for O&M staff at work level j
$\overline{FTE}_j$	Average full-time equivalent for O&M staff at work level j
GFA	Gross floor area in square meter
GFA_O	Gross floor area of office portion in square meter
GFA_R	Gross floor area of retail portion in square meter
Hd_j	Number of working hours per day of O&M staff at work level j
I_a	Monthly air-conditioning fee
$I_{a.O}$	Monthly air-conditioning fee for office area
$I_{a.R}$	Monthly air-conditioning fee for retail area
I_m	Monthly management fee
$I_{m.O}$	Monthly management fee for office area
$I_{m.R}$	Monthly management fee for retail area

I_r	Monthly rent
I_O	Monthly total income from office portion
I_R	Monthly total income from retail portion
$\bar{I}$	Normalised monthly total rental
$\overline{I_r}$	Normalised monthly rent
$I(j)$	Impact of dispute due to implication j
IC	In-house staff cost per month
IC_a	In-house cost for executing the O&M work after outsourcing
IC'_a	In-house cost after outsourcing
IC_b	In-house cost before outsourcing
M_O	Monthly all-in management fee inclusive of air-conditioning fee for office area
M_R	Monthly all-in management fee inclusive of air-conditioning fee for retail area
$\overline{M}$	Normalised monthly management fee
MC	Material cost per month
N	Number of surveyed contracts, or number of cases for which relevant information was available (as specified)
N_j	Number of O&M staff at work level j
OC	Outsourced contract cost per month
P	Number of overhead cost elements after outsourcing
Q	Number of overhead cost elements before outsourcing
r	Pearson product-moment correlation coefficient
r_c	Perceived importance rating given by interviewee on contract c

$r(F_c)$	Average perceived importance rating of the contractual factor/outcome
$R(A_C)$	Average perceived importance rating of the contractual attribute
$R_C(A_C)$	Average importance rating of the contractual attribute perceived by the contractor group
$R_O(A_C)$	Average importance rating of the contractual attribute perceived by the owner group
$R_P(A_C)$	Average importance rating of the contractual attribute perceived by the property management group
$R(A_E)$	Average perceived importance rating of the economic attribute
$R_C(A_E)$	Average importance rating of the economic attribute perceived by the contractor group
$R_O(A_E)$	Average importance rating of the economic attribute perceived by the owner group
$R_P(A_E)$	Average importance rating of the economic attribute perceived by the property management group
$R(A_M)$	Average perceived importance rating of the management attribute
$R_C(A_M)$	Average importance rating of the management attribute perceived by the contractor group
$R_O(A_M)$	Average importance rating of the management attribute perceived by the owner group
$R_P(A_M)$	Average importance rating of the management attribute perceived by the property management group
RC	Replacement cost per month
S_j	Monthly salary of O&M staff at work level j
S_r	Spearman rank correlation coefficient
$S(j)$	Severity of dispute due to implication j
SF_e	Scaling factor applied to energy cost

SF_i	Scaling factor applied to building income
TC	Total O&M cost for air-conditioning system per month, or transaction cost for contract (as specified)
TC_1	*ex ante* transaction cost
TC_{1R}	*ex ante* transaction cost of a relational contract
TC_{1T}	*ex ante* transaction cost of a transactional contract
TC_2	*ex post* transaction cost
TC_{2R}	*ex post* transaction cost of a relational contract
TC_{2T}	*ex post* transaction cost of a transactional contract
TC_{ad}	Transaction cost incurred for O&M audit
TC_{cs}	Transaction cost incurred for customer satisfaction survey
Tcs_j	Transaction cost incurred for conducting customer satisfaction survey by staff at rank j
TC_{pm}	Transaction cost incurred for performance review meeting
W	Kendall coefficient of concordance

Equations

Pearson product-moment correlation coefficient (*r*):

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}}$$

where:

n is the number of paired observations

X is the X variable under investigation

Y is the Y variable under investigation

Spearman rank correlation coefficient (S_r):

$$S_r = 1 - \frac{6\sum_{c=1}^{N} d_c^2}{N^3 - N}$$

where:

c is the contract number

d_c is the difference in rank between pairs of items under investigation

N is the number of surveyed contracts, or number of cases for which relevant information was available (as specified)

Kendall coefficient of concordance (*W*):

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

$$S = \sum_{i=1}^{n} \left[R_i - \frac{m(n+1)}{2} \right]^2$$

where:

S is sum of the squares of the deviations of the row rank sums from their mean value

m is the number of groups of practitioners (observers)

n is the number of attributes under investigation

u_j is the number of consecutive members of the j^{th} tied rank

R_i is the row rank sums

Definition of Terminology

Operation	Combination of all technical and administrative actions intended to enable an item to perform a required function, recognizing necessary adaptation to changes in external conditions.
Maintenance	Combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function.
Outsourcing	Engagement of an outside service provider to perform the functions internal to an organization.
Gross floor area of a *building*	Area contained within the external walls of the building measured at each floor level) including any floor below the level of the ground), together with the area of each balcony in the building, which shall be calculated from the overall dimensions of the balcony (including the thickness of the sides thereof), and the thickness of the external walls of the building.
Gross floor area of a *unit*	Comprising the Saleable Area of that unit plus a proportionate share of all common areas within the building. It shall be measured in a similar manner as for the Gross Floor Area of the building as defined above.
Private commercial premises	Retail premises and other premises designed or adapted for commercial use, with the exception of purpose-built offices. Carparking space is excluded. Commercial premises built by the Housing Authority and Housing Society are also excluded.
Private office premises	Premises situated in buildings designed for commercial/business purposes. Non-domestic floors in composite buildings are excluded.
Rental and price indices	Derived from the same data that are used to compile average rents and prices. The indices measure value changes by reference to the factor of rent or price divided by rateable value of the subject properties rather than by reference to the rent or price per square meter of floor area.

Chapter 1

INTRODUCTION

1.1 Introduction

Operation and maintenance (O&M) work for buildings can be undertaken in-house or by means of outsourcing, or a mix of the two. For the work to be carried out internally, building owners would need to directly employ and organize individuals via employment contracts. In the absence of outsourced contracts, there may be less contractual problems but whether the in-house 'production' of the O&M services is economical would be unknown without investigation. This is not only crucial to the short-term finance of the building, but also the cost effectiveness of the O&M work and hence the strategic building value in the long run.

If the work is procured from outside service providers, the building owner would need to deal with less in-house staff issues but problems are often encountered in managing the outsourced O&M contract works. Common problems include ambiguity in the demarcation of the scope of the contract work, varied interpretation of the obligations, such as "damages due to vandalism" and "malfunction due to fair wear and tear" etc., and in-cooperation between the in-house team and the contractors. Investigating the causes of and finding solutions for these problems should be of great value to the industry.

Outsourcing for O&M work through competitive tendering can be a good means for optimizing the O&M expenditures of a building, as the building owners can select to award the contract to the lowest tenderer who can undertake the work to the stipulated O&M requirements. In order to secure further contracts or extension of contacts upon expiry of the current one, the contractor will incline to perform to the satisfaction of the building owner while minimizing costs. It has become common that O&M contractors are demanded by building end users to achieve continuous improvements in total quality.

Competent contractors specializing in O&M work should be more knowledgeable and have stronger manpower resources compared to an in-house O&M team. The contractors' expertise will also grow with time and number of contracts undertaken, i.e. the information cost for specialist contractors to acquire knowledge about good O&M practices is lower than that of an in-house team. In some cases, O&M contracts may include requirements on energy efficiency performance, e.g. incorporating performance contracting as a part of the contract, for better overall results.

Procurement of O&M work involves the contracting parties entering into a contract. The success of the contract hinges on a complete set of equitable and enforceable contractual terms and conditions, which should be able to clearly define the obligations and liabilities between the employer and the contractor. Although the benefit of reducing in-house manpower resources as a result of outsourcing can be instant and significant, the formation, monitoring and enforcement of the outsourced contract will incur transaction costs. All in all, the total costs and benefits, both pecuniary and non-pecuniary, should be thoroughly scrutinized before an outsourcing decision is made. In practice, however, it is common that the outsourcing process precedes the decision to outsource (Fan, 2000) and many organizations are even unaware that outsourcing has been in place in their companies for years (Johnson, 1997).

While the trend of outsourcing has been rising in recent years and relevant studies in a wide variety of industries and business sectors have been booming, there appears little in-depth study focusing on outsourcing for O&M work in commercial buildings. This study targets to probe into this under-explored, if not unexplored, research area.

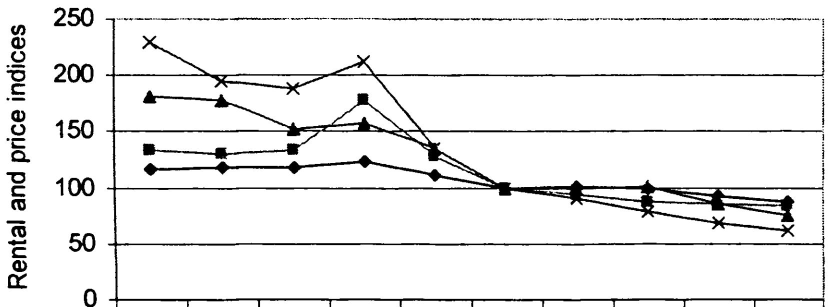
1.2 Commercial Buildings in Hong Kong

Being the 11th largest trading economy, the 6th largest foreign exchange market and the 12th largest banking centre in the world, and Asia's 2nd biggest stock market (HKSAR, 2005), sustainable economic development in Hong Kong hinges on having quality commercial buildings in which business operations take place. Different grades of commercial buildings are equipped with different types and levels of building facilities to suit different user demands (Table 1.1).

Table 1.1 Classification of commercial buildings in Hong Kong (Source: RVD, 2004)

Grade	Essential features and provisions
A	Modern with high quality finishes; flexible layout; large floor plates; spacious, well decorated lobbies and circulation areas; effective central air-conditioning; good lift services zoned for passengers and goods deliveries; professional management; parking facilities normally available
B	Ordinary design with good quality finishes; flexible layout; average-sized floor plates; adequate lobbies; central or free-standing air-conditioning; adequate lift services, good management; parking facilities not essential
C	Plain with basic finishes; less flexible layout; small floor plates; basic lobbies; generally without central air-conditioning; barely adequate or inadequate lift services; minimal to average management; no parking facilities.

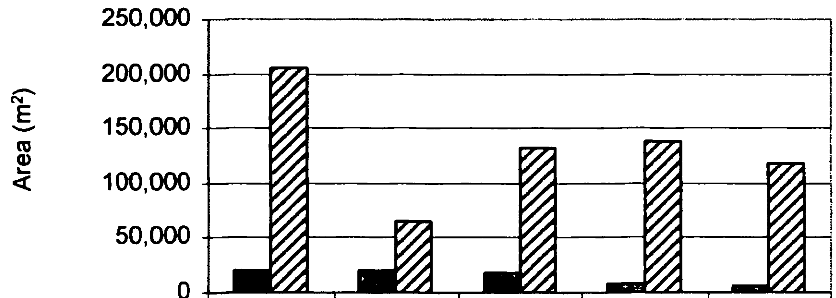
The Asian financial turmoil in the late 90's has rendered the commercial property market in Hong Kong a lengthy slump. Derived from the statistical data of RVD (2004), Figure 1.1 shows the drastic drop of the rental and price indices (100 in Year 1999) of office and retail premises since 1997. Despite the persistent decline in the rent and price of commercial properties, the amount of newly completed stock has far outweighed the demolished buildings (Figures 1.2 and 1.3). The office vacancy rate has been significant and the anticipated negative demand of office space in Hong Kong ranked first among the major Asia Pacific cities (JLL, 2004a; 2004b). These factors have prompted building owners to cut costs for non-core activities, among which O&M work is prominent for its substantial amount of expenditure.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Retail - rent	116.5	117.8	117.8	123.5	111.2	100	101.3	99.4	92.9	86.5
Retail - price	133.5	129.7	134	177.3	128.3	100	93.6	86.8	85	84.2
Office - rent	181.8	178.6	152.3	156.8	135.9	100	98.5	101	85.4	74.6
Office - price	230.3	194.6	188.4	213.1	134.5	100	89.9	78.7	68.4	62.1

Year

Figure 1.1 Rental and price indices (100 in Year 1999) of commercial premises



	1999	2000	2001	2002	2003
Demolition (Commercial)	19900	21100	18100	7700	6400
Completion (Commercial)	205400	64300	131500	138000	117900

Year

Figure 1.2 Private commercial buildings – demolition and completions

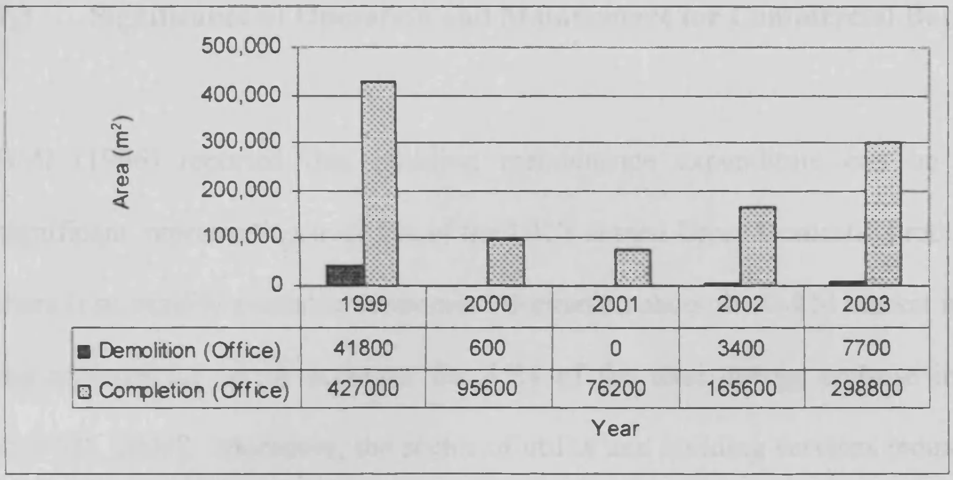


Figure 1.3 Private office buildings – demolition and completions

On the other hand, both the commercial and office building stocks have continued to increase (Figure 1.4). The demand for commercial buildings in Hong Kong is expected to rise given the China's entry into the World Trade Organisation (WTO) and the implementation of the Closer Economic Partnership Arrangement (CEPA) in 2004 (HKSAR, 2005). The workload of building O&M would increase and there would be more market opportunities in the field.

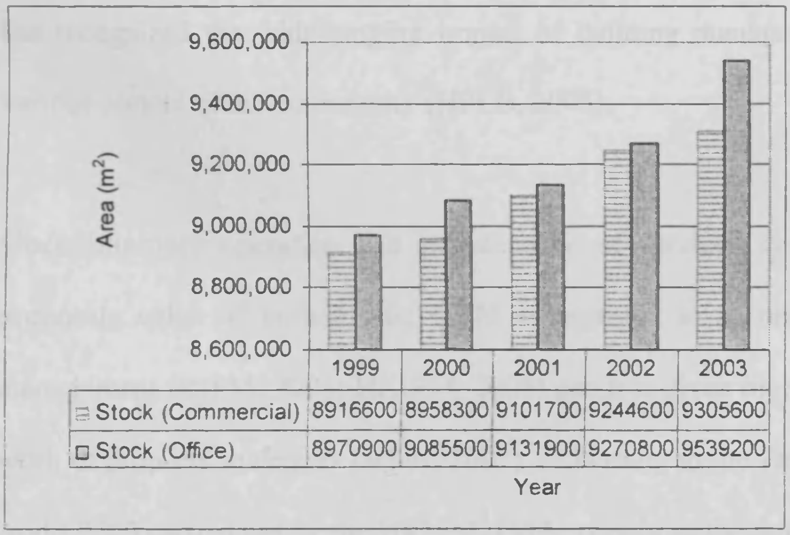


Figure 1.4 Private commercial and office building stocks

1.3 Significance of Operation and Maintenance for Commercial Buildings

BMI (1996) reported that building maintenance expenditure can be economically significant, representing over 5% of the UK's annual Gross Domestic Product. Although there is no readily available economic information about the O&M market in Hong Kong, the commercial sector accounts for 35% of the total energy end-use in Hong Kong (EMSD, 2004). Moreover, the sector of utility and building services industries is one of the biggest employers second only to the Hong Kong Government (Tse, 2002).

Building O&M work is classified as a kind of support services. Yet, it is essential for ensuring satisfactory business operations in commercial buildings (Howard, 2000), in addition to being a core business of the providers who supply the work. Many buildings with sophisticated engineering services have been built in Hong Kong in the past couple of decades during the peak period of economic development. Their proper upkeeping during the recent economic decline has been challenging and recently, the government has recognized the wide-ranging impact of building management and maintenance on various sectors of the community (HPLB, 2005).

Since improper operation and maintenance of services systems can undermine the economic value of built assets, O&M is regarded as a core competency of facilities management (BIFM, 2005; HKIFM, 2005) and it is given high priority in the day-to-day work of property managers (Jones, 2002). According to the Facility Management Market Audit 2003 carried out by the HKIFM, O&M remain as the dominant service provided by the surveyed property owners and the service providers (BSP, 2004). In addition, the establishment of the Building Services Operation and Maintenance Executives Society (BSOMES) in 2000 also signifies the growing recognition of the importance of building O&M work in Hong Kong (BSOMES, 2005).

The economic recession has given rise to sluggish property transactions and hence reduction of new building completions. Consequently, a considerable amount of construction practitioners has switched to the job market which deals with the existing building stock. As reported in VTC (2004), there were 57,218 technical employees working in the Property Management and Maintenance sector, increasing from 54.3% in 2001 to 65.7% in 2003 of the total real estate services workforce. On the one hand, the O&M sector has become a shelter for practitioners who were forced to withdraw from the increasingly saturated new building construction industry. On the other hand, competitions for O&M jobs have become more fierce.

1.4 Research Background

Before realizing the burst of the "economic bubble" in 1997, the economic prosperity in Hong Kong had been sustained for a long period. The continued rise in property values had encouraged building developers to concentrate on erecting new buildings. Property investors were used to look for profits from transacting properties. Building designers and constructors had enjoyed good remunerations in parallel with the increasing number of new building construction projects. On the other side, building owners had paid little attention to the importance of O&M investment. The building O&M market had never been a battlefield where the contractors would compete for their core business. Building users had become accustomed to adapting to the traditional quality and levels of O&M services.

In addition, tertiary education programmes dedicated to nurture potential O&M practitioners has remained unavailable. O&M practitioners have relied on intermittent on-the-job training to enrich their knowledge and skills. O&M work for buildings has long been regarded as a less preferred career. O&M research studies have not been popular. Since trustworthy literatures which can aid practitioners to handle O&M matters have been limited, they have followed the customary practices in discharging their duties. Alternatively, some practitioners may imitate decisions made by other organizations which show superior performance. However, without making clear the circumstantial factors that should be considered, making such decisions for tackling O&M issues may risk arriving at inappropriate solutions.

Recently in Hong Kong, there have been a number of large public and private organizations which have outsourced for O&M work for their buildings. Meanwhile, there were cases where the Hong Kong Housing Authority in-sourced the O&M work that had been outsourced (e.g. HKET, 2005)[1], showing that outsourcing may not be always beneficial because the quality of the outsourced service may deviate from that required by the outsourcer. Despite there is a paucity of publications about in-sourcing of

[1] Although relevant announcement in the private sector was not proclaimed in the public domain, the author acquired from an O&M practitioner that in-sourcing had taken place in his company. For reason of confidentiality, the name of such major telecommunication company in Hong Kong could not be disclosed.

building O&M work, the counterpart in other sectors such as telecommunication and library services sectors is rather common (e.g. Turner, 1996; Dobb, 1998).

In contrast with in-sourcing, there have been overwhelming reports on O&M outsourcing incidents in recent years. However, whether outsourcing for building O&M work has brought along genuine benefits and more fundamentally, whether the outsourcing decision has been given rational considerations appears to be unknown. These are the major motives which triggered the conduction of this research study.

1.5 Research Aim, Objectives and Scope

The aim of this study is to establish a framework to guide building management to make decisions of outsourcing O&M work for commercial buildings. The framework embraces a series of crucial considerations that should be taken by the management, to ensure value for money and to avoid impairment of building performance, and thus asset value. The study investigated the critical economic, management and contractual issues and their impacts associated with outsourcing, through the accomplishment of the following objectives:

1. To investigate the current management practices in in-house and outsourced operation and maintenance (O&M) work in commercial buildings.

2. To investigate various problematic conditions in outsourced O&M contracts taking into account relevant statutory requirements and trade practice.

3. To evaluate the performance of outsourced O&M contracts from monetary and quality service viewpoints.

4. To make clear the impacts of management, contractual and economic considerations to the success of outsourcing O&M work.

5. To develop a framework to guide building management to make outsourcing decision.

The main body of this research study includes the findings from an extensive literature review, a questionnaire survey and a series of in-depth personal interviews with O&M practitioners who take the roles of owner, building management or contractor for some private commercial buildings in Hong Kong. In the context of this study, commercial buildings cover single-usage buildings and composite buildings consisting of either one or a combination of office, retail, hotel and car parking areas. Extreme care has been taken to safeguard the anonymity of the interviewees and to keep the collected data confidential, on top of analyzing the data in an unbiased manner.

1.6 Outline of the Thesis

This thesis comprises 10 chapters, and appendices which show the relevant supportive information. This first chapter has introduced the impetus for undertaking the study and described the research background including some principle benefits of outsourcing building O&M work, and the enlarging commercial building stock which requires more proper and productive O&M work; followed by specifying the aim, objectives and scope of the study.

Based on the searched literatures, Chapter 2 identifies the varying definitions and classifications of "Operation and Maintenance" and "Outsourcing" being used in different industries. It also reviews the growth of outsourcing for O&M work in the global and local regimes. After finding from a variety of literatures where a number of drivers, advantages and disadvantages associated with outsourcing are suggested, their application to building O&M work is presented in Chapter 3. Additionally, some of the methods proposed for making outsourcing decision are reviewed.

Grounded on economic theories, Chapter 4 infers some key hypothetical issues in the context of outsourcing for O&M work in commercial buildings in Hong Kong to form the research framework. In Chapter 5, the rationales and considerations for the selected research process and methodology are elaborated. The major difficulties encountered during data collection are also explained. Chapter 6 analyzes and presents the results of the questionnaire survey in Stage I which was intended to test the existence of problems with outsourced O&M contracts.

Drawn from a series of in-depth face-to-face interviews with a group of O&M practitioners which probed into the three main facets of considerations for outsourcing, namely management, contractual and economics, Chapter 7 appraises the common practices of managing outsourced O&M contracts and discusses the use of some key management tools for ensuring the performance of the procured work. Chapter 8 examines the common contractual problems and analyzes the contractual issues which are critical to transaction costs and contract performance. Focusing on the trade of air-conditioning whose expenditure dominates the other O&M work, Chapter 9 analyzes the relation between its costs, building rental incomes and the extent of outsourcing, in addition to introducing a simplified approach for gauging the change in costs associated with outsourcing for building O&M work.

Chapter 10 concludes the study by making recommendations on what the critical issues are; how and when they should be considered; and who should consider them in outsourcing O&M work for commercial buildings. Finally, some relevant future studies are also suggested at the end.

Chapter 2

O&M OUTSOURCING: DEFINITION, CLASSIFICATION AND ITS GROWTH

2.1 Introduction

O&M work for buildings is a traditional trade which has been practiced since there were buildings. However, the lack of formal education tailored to train engineers or managers for the field has led to non-standardized information and hence discrepancies in the knowledge they acquired. Even for the basic classification of the types of O&M work, different literatures have defined them in different ways and their different meanings in different industries have given rise to confusion. Additionally, "outsourcing" has become a buzzword in the modern business environment. Its variable definitions have been a topic for discussion. It appears that a consensus of the interpretation of their meanings has remained outstanding. Apart from reviewing the commonly used definitions and classifications in a number of industries, the first part of this chapter will specify the meaning of the key terms used in the context of this research study.

Outsourcing is not a new activity. It has emerged as a fashionable business strategy over the years and became a powerful management process in a wide range of industry sectors such as Information Technology, Library Services, Pharmaceutical, Logistics, Catering, Fleet Management, Manufacturing etc. Different industries would have different forms of outsourcing as a result of their differences in business nature and operation. As reviewed in Kakabadse & Kakabadse (2000), the paradigm of the outsourcing trend in a broad range of outsourcing activities has started to shift. Particularly in the facilities management sector which embraces building O&M work as a key discipline, outsourcing has shown a rapid growth (Johnson, 1997; Lankford & Parsa, 1999; OI, 2004). The second part of this chapter will present a review focusing on the global as well as the local growing trend of outsourcing for building O&M work.

2.2 Definitions of Operation and Maintenance

The Glossary of Terms Used in Terotechnology of the British Standard (BSI, 1993) defines "***operation***" as:

> "The combination of all technical and administrative actions intended to enable an item to perform a required function, recognizing necessary adaptation to changes in external conditions[1]"

BSI (1993) also defines "***maintenance***" as:

[1] Here, external conditions mean, for example, service demand and environmental conditions.

"The combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function."

In the field of industrial engineering where heavy-duty electrical and mechanical plants are involved, maintenance and operations are often performed by two different groups, leading to the common problems of conflict between the groups when maintenance is outsourced (Dunn, 2002). In some government sectors where energy efficiency is of great concern, for example, Sullivan et al. (2002) defines ***"Operations and Maintenance"*** as:

"the decisions and actions regarding the control and upkeep of property and equipment. These are inclusive, but not limited to, the following: actions focused on scheduling, procedures, and work/systems control and optimization; and performance of routine, preventive, predictive, scheduled and unscheduled actions aimed at preventing equipment failure or decline with the goal of increasing efficiency, reliability, and safety."

It can be seen that there are different definitions of the terms "operation" and "maintenance" in different industries and sectors. With particular reference to buildings, Armstrong (1990) states that operation and maintenance of building plants are two separate tasks which may often be made the responsibility of one person or a group. This has also been a common way in which O&M work is arranged for commercial buildings in Hong Kong.

2.3 Classification of Maintenance Work

Smith and Tate (1998) classify building services maintenance work into two main groups, namely "planned" and "unplanned"; under which the subdivisions include condition-based, time-based, breakdown, run-to-failure and emergency maintenance. While in particular for hospitality engineering systems, Lee (2002) suggests five strategic bases (i.e. time, performance, breakdown, renovation and integration) for ten types of maintenance including routine, time-based preventive, condition-based preventive, corrective, reactive, emergency, modification, design-out, total productive and reliability-centered maintenance.

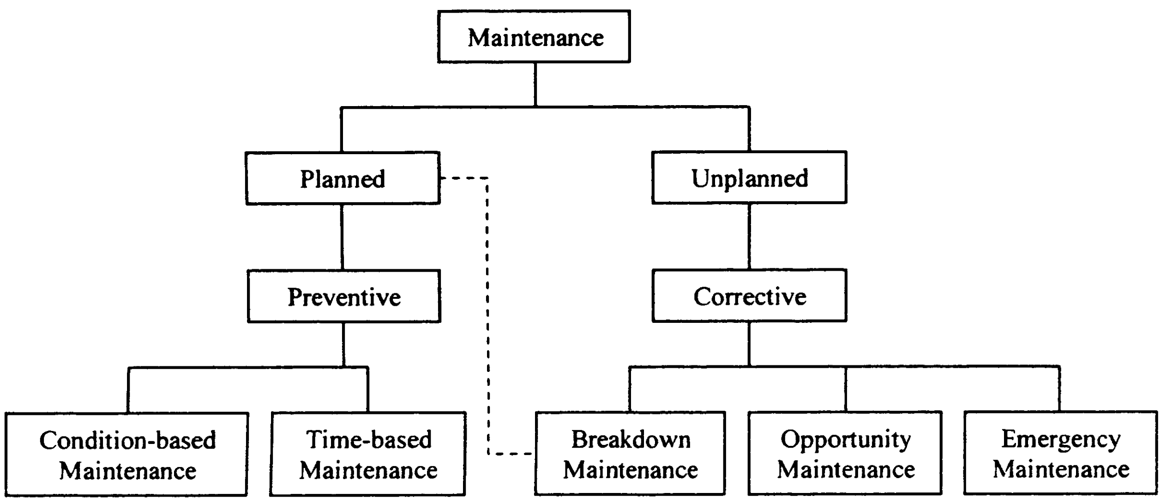


Figure 2.1 Classification of maintenance work for commercial buildings

In a facilities management context, rather than a *'soft'* service which is more 'people-based' (e.g. reception, help desks etc.), maintenance for buildings is regarded as a *'hard'* support service (Reuvid, 2002). It diversely encompasses small-scale minor repairs; regular inspections, testing and examinations; medium-scale overhauls and refurbishments; and large-scale system reinforcements and modernizations of installations etc.

Table 2.1 Definition of types of maintenance work

Maintenance types	Definition
Condition-based	The maintenance carried out according to the need indicated by condition monitoring.
Time-based	Also known as preventive maintenance: the maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item.
Breakdown	The maintenance carried out upon an item failure or malfunction.
Opportunity	The maintenance of an item that is deferred or advanced in time when an unplanned opportunity becomes available.
Emergency	The maintenance that it is necessary to put in hand immediately to avoid serious consequences.

Figure 2.1 mimics the classifications by considering whether the maintenance activities are planned or unplanned and, preventive or corrective. By making reference to BSI (1993), Table 2.1 summarizes the meaning of the various maintenance techniques with which practitioners are often confused. In particular for breakdown maintenance, it is noteworthy that it is not possible to exclude all failures but remedial action(s) for dealing with breakdowns can be planned beforehand (Smith & Tate, 1998).

2.4 In Search of a Definition of Outsourcing

Compared with the terms 'operation' and 'maintenance', the meaning and interpretation of 'outsourcing' vary more significantly in the literature. For instance, the former Director of Research and Member Programs at the Outsourcing Institute, Michael Corbett, quotes within seconds. eleven other words and phrases carrying the meaning of outsourcing (Johnson, 1997).

Originated from the automotive engineering design industry, 'outsourcing' became a new word around the late 70's. The following highlights the milestones in the usage of 'outsourcing' in chronological order (OED, 2005):

1979 *Jrnl. R. Soc. Arts* CXXVII. 141/1. We are so short of professional engineers in the motor industry that we are having to outsource design work to Germany.

1983 *Fortune* 7 Mar. 110/2. To a large extent the products out-sourced are low-technology items such as window cranks, seat fabrics, and plastic knobs.

1986 *Times* 9 Jan. 29/2. It is now fashionable to outsource everything that is not of strategic consequence to the organisation.

1988 *Industry Week* 21 Nov. TM28/2. Outsourced designs and products must be integrated with each other and with in-house designs as the final product moves toward completion.

OED (2005) defines 'outsourcing' as:

> "the action 'to obtain (goods, etc., esp. component parts) by contract from a source outside an organization or area; to contract (work) out".

Apart from this classic definition, 'outsourcing' has many synonyms and appears in many guises (Jeffers, 1996; Incognito, 2001). According to the literature findings in Embleton & Wright (1998), there are some simpler definitions which do not address certain issues and make no differentiation between 'contracting out' and 'outsourcing'; and there are also more detailed definitions of 'outsourcing' as listed below.

Simpler definitions:

- "... having an outside vendor provide a service that you usually perform in-house"
- "The transfer of routine and repetitive tasks to an outside source"
- "... paying other firms to perform all or part of the work"

More detailed definitions:

- "… finding new suppliers and new ways to secure the delivery of raw materials, goods, components and services, by utilizing the knowledge, experience and creativity of new suppliers not used previously"

- "the practice of handing over the planning, management and operation of certain functions to an independent third party"

- "… outsourcing is not a synonym for contracting out. Contracting out refers to work assigned to an outside supplier on a job-by-job basis … Outsourcing … entails a long-term relationship between supplier and beneficiary, with a high degree of risk-sharing"

'Outsourcing' is often used interchangeably with the term 'facilities management' (Arnold, 1995; Heywood, 2001); it is commonly regarded as synonym of 'contracting-out' (e.g. Barrett & Owen, 1993). Yet, Alexander (1992; 2003) emphasizes that 'facilities management' and 'contracting-out' are not synonymous, because one should not contract out the former which is an organization's core business. Barrett (2000) uses 'outsourcing' to denote a particular type of 'contracting-out' where a function which had been performed in-house is transferred together with its workforce and management responsibility to the service provider. Besides, Katsanis (2003) argues that although the difference between 'outsourcing' and 'subcontracting' is subtle and their characteristics overlap, the scope of outsourcing extends beyond providing services to remedy for the lack of resources and know-how.

Outsourcing is a dynamic concept which has been interpreted in various ways (Frost, 1996; 1997). It also generates a family of sub-categories, which vary dependant on the perspectives in which they are defined. For examples, Hussey & Jenster (2003) suggest classifying outsourcing according to the complexity of the service, namely traditional, peripheral activities, critical activities, and strategic and problem-solving activities; while Heywood (2001) gives a more comprehensive classification, which is adapted and summarized as follows:

1. *Full or total outsourcing.* The staff and, possibly, assets relating to the whole of a major business area, will be transferred to the service provider for the period of the contract.

2. *Part or selective outsourcing.* A significant part of the function will be retained in-house.

3. *Co-sourcing.* It was originally devised to describe a version of partnership outsourcing; recently used to describe outsourcing arrangements involving multiple providers.

4. *Transitional outsourcing.* It occurs when an organization transfers control of its legacy systems/platforms to a third party in the belief that its own internal staff have the abilities necessary for the development of new systems.

5. *Transformational outsourcing.* An organization brings in a service provider to completely re-engineer the work of the function, probably developing new systems and building up a reliable skill base for the client to take over. At the end of the project the client regains full control and responsibility.

6. *Joint venture outsourcing.* It involves setting up a new company to exploit a perceived business opportunity. The client's staff and assets will then be transferred to this joint venture company, rather than to the service provider.

Although some of the above are more commonly used in IT or finance sectors, the contractual relationship with which the contract runs can be applied to outsourcing for building O&M work. Nonetheless, one should be clear about their differentiations before adoption.

In industrial maintenance management, Campbell (1995) mentions that outsourcing focuses on two strategic ways of developing a competitive advantage. They are: concentrating the organization's resources and investments on what it does best – called core competences; and outsourcing all other activities for which the company has neither a strategic need nor a special capability.

In the context of facilities management which covers the O&M function, outsourcing has been a dynamic force for nearly two decades and has been recognized as the most powerful management strategy since the Industrial Revolution (Incognito, 2001). According to Langston & Lauge-Kristensen (2002), outsourcing was originally defined as hiring an outside firm to supply services that were performed in-house to a wider scope, as a way for companies to reduce their expenses, focus on their core business and strategic direction, and increase capital and surplus. In housing studies, contracting out or outsourcing of services are alternative terms for disengagement activities (Lau, 2001).

A generic definition of outsourcing given by Lankford & Parsa (1999) is: "the procurement of products or services from sources that are external to the organization". It is distinct from the differentiation made by the International Facility Management Association, IFMA (1999): "*out-tasking* is the hiring individual, specialized vendors to provide one or more facility management functions while *out-sourcing* means hiring of full-service, single vendor to provide many services bundled together". In connection with the differentiated definitions made by IFMA, Kleeman (1994) observes that out-tasking was more widespread than outsourcing in the U.S.

Regardless of the overheated and endless debates over the non-unified definitions, Embleton & Wright (1998) opine that, in essence, the various definitions of outsourcing refer to the concept of looking for expertise to handle certain business functions outside the existing firm. The Efficiency Unit of the Hong Kong Government also regards outsourcing as the same as contracting out (EU, 2003). As far as this research study is concerned, outsourcing refers essentially to:

> *"the engagement of an outside service provider to perform the O&M functions internal to an organization."*

2.5 The Growth of Outsourcing in the Global Context

The trend of outsourcing real estate operations commenced to spread globally in the early 60's (Angel, 2003) but it was not a popular fashion until the last decade. In the U.K., a signpost started with the renowned precedent where Rank Xerox Ltd. outsourced the facilities management functions including the O&M work to CBX Ltd. in 1994 for five years. Satisfactory annual cost savings ranging from 5% to 62% were attained (Houston & Youngs, 1996). The outsourcing trend sustained and has continued to increase (Mosher, 1999; McMorrow, 2003). In recent years, for examples, Consignia handed over the management and maintenance of its buildings to Balfour Beatty (TE, 2002); Sheffield City Council asked Kier London (Company) and Morrison & Co. to give final offers for a 5-year (extendable to 10 years) partnering deal to provide building services work including repair, maintenance and improvement amounting between £50 million and £60 million a year (Warner, 2002); Ericsson (a major telecommunication products manufacturer), Unipath (a major clinical products manufacturer) and the Autoglass head office outsourced their air conditioning maintenance service to Eaton-Williams Service (TEWM, 2003a; b; c).

BSRIA (2001) expected that the trend of contract maintenance for building engineering services would rise from 49% in 1995 to 66% (equivalent to £2.07 billion) by 2003. Another BSRIA's survey reveals that the growth in the U.K. facilities management outsourcing market (embracing maintenance work) will continue at 10% a year from 2001 to 2006, while the German and French counterparts will grow by a more sedate 6% a year (CJ, 2002).

In the North America, the rising trend of outsourcing is reflected by a survey[2] finding: in 1999, 22 percent of the respondents indicated that they had brought back services previously outsourced, compared with 26 percent in 1993 (IFMA, 1999). Incognito (2001) also mentions that outsourcing has been utilized, to some degree, by nearly all of the Fortune 500 companies and has become an alternative to the Fortune 1000 for costly resources and needed cash infusions. Further to the steadily increasing trend of outsourcing in the U.S. since 1999 (Eileen, 2003), a survey in 2004 reveals that practitioners regard outsourcing as the most important issue which affects how facilities are operated in the coming ten years (IFMA, 2005).

Benchmarking studies across countries show that the pattern of outsourcing facilities-related services continues to differ. Bröchner et al. (2001)'s study reports that the U.K. tendency to outsource is stronger than in the Swedish cases. For property-related management outsourcing in Europe and North America, there was a gradual trend away

[2] Approximately 4,000 North American members, including 271 members in Canada, were randomly selected to receive a six-page survey by post. 539 participants returned the questionnaires, representing a 15 percent response rate.

from outsourcing during the period between 1993 and 1994, an increase in popularity from 1997 to 1999 and, the leveling off of the increasing trend in 2002 (Bon & Luck, 1999; 2001; Bon et al., 2003).

2.6 The Growth of Outsourcing in Hong Kong

While the growth of outsourcing for O&M work has commenced early in the overseas countries, it has remained in its infancy in Asia and the underdeveloped business in Greater China can be ascribed to the following reasons (SCMP, 1997):

1. *Cultural challenges.* Giving responsibility for running parts of your business to an outsider was not necessarily something that would come easy to Hong Kong's close-knit family-dominated businesses. Some might regard inviting outsiders in as an admission of failure.

2. *Perception.* It is a general perception that outsourcing inevitably leads to downsizing and cutting the workforce. Companies used to operating on the principle of offering lifetime employment may see outsourcing as a slash-and-burn proposition.

3. *Short-term perspective.* The desire in Asia to see instant financial gratification for new initiatives is common, whilst outsourcing in many cases is a long-term added-value proposition.

In Hong Kong, the growth in the trend of outsourcing for building O&M work has become obvious after the economy started to decline in the late 90's. Many leading private corporations and government departments have increasingly farmed out their building management and ancillary services to a single service provider (SCMP, 1999). For examples, Cathay Pacific notified 70 building maintenance workers out of the 350 redundant employees about the termination of their employments as a result of outsourcing the maintenance function to an outsider (HKS, 1997). The Hong Kong Housing Authority (HKAPMC, 2000), HSBC - a major bank (HK IMAIL, 2002a) and PCCW - a major utility company (HK IMAIL, 2002b), outsourced for building services maintenance work which was previously done in-house. More recently, Hutchison Telecommunications International Ltd transferred 480 of the 750 redundant workers to its outsourcing partners (SCMP, 2004) regardless of various positive signs suggesting the commencement of economic recovery.

Echoing with Langston & Lauge-Kristensen (2002), a senior engineer of the public networks marketing for Northern Telecom (Nortel) claimed that for bigger companies, there is a trend to outsource non-core business operations to other companies (SCMP, 1998). An illustrative example is that the client organization "The HONGKONG Telecom", a major telephone company in Hong Kong, concentrates on expanding its core business by winning a contract outsourced by Cathay Pacific Airways for operating a global Call Centre (HKS, 1998); while outsourcing its own building O&M functions to outsiders (HK IMAIL, 2002b).

The Hong Kong Government has succeeded in achieving efficiency and productivity gains through outsourcing many public services to the private business operators (EU, 2003). The Hong Kong Housing Authority (HKHA) confirmed the direction of greater private sector involvement (PSI) in the provision of estate management and maintenance (EMM) services to their public rental properties (HKAPMC, 2000). The EMM function of the first batch of public rental housing (PRH) estates was outsourced to property services companies in October 2000 (HKHA, 2003a). In April and September 2002, the EMM function of some 59,100 public rental housing flats under Batch 5 Property Services Contracts (PSC) and Batch B Management-Buy-Out (MBO) contracts were outsourced. The trend is expected to grow as outsourcing the EMM function for the PRH estates via the private sector participation remains clear as one of the initiatives in the 2003/04 Corporate Plan of the HKHA (HKHA, 2003b). Meanwhile, another flagship is that the Hong Kong Government announced in early 2002 that the Architectural Services Department would outsource up to 100% of the range of its maintenance activities by 2008/09 (ETWB, 2003).

The increase in the market opportunities can be reflected by the fact that many of the well-known real-estate companies, like Vigers, Jones Lang Wootton and Colliers Jardine had set up their facilities management division (SCMP, 1999) and the number of Corporate Members and Associate Members of the Hong Kong Association of Property Management Companies (HKAPMC) has respectively grown from 69 and 6 in 2000 to 77 and 11 in 2004 (HKAPMC, 2000; 2004). Nonetheless, as pointed out by the director and general manager of a major real estate management company, facility management which encompasses maintaining and managing buildings is still embryonic – fewer than 10 of the HKAPMC's 80 members are involved in facility management; and there is vast potential for growth in the field (SCMP, 2003).

2.7 Chapter Summary

The definitions and classifications of the key terms used for this study including "Operation and Maintenance" and "Outsourcing" vary among different sectors and business natures. This chapter has specified their essential meaning for the purpose of the study. Furthermore, the emergence and the growing trend of outsourcing in the global context and that found in Hong Kong have been reviewed. The increasing trend of outsourcing for O&M work in commercial buildings has attracted more companies to enter into the market.

Chapter 3

DECISION MAKING FOR OUTSOURCING

3.1 Introduction

Very often a phenomenon emerges before a decision is made with rational consideration of the underlying drivers, potential advantages and disadvantages. It appears that outsourcing for building O&M work is no exception. As discussed in the previous chapter, since the late 90's more building owners have started to resource externally for O&M work. But, whether their decisions to outsource were appropriate are yet to be verified.

Searching the open literatures reveals that the industrial maintenance and facilities management sectors generate most studies and publications which, to some extent, are relevant to building O&M work. The plants and equipment in an industrial maintenance context are similar to those in buildings, and facilities management covers a wide range of services which include O&M work as the topmost primary function (IFMA, 2005). Based on this literature, this chapter reviews the common driving reasons, pros and cons, and some suggested decision making methods for outsourcing. Notwithstanding that many of these suggestions and recommendation are not pinpointing to O&M work for buildings, they can serve as useful references which help generate ideas for constructing the research framework and subsequent discussion of the findings.

3.2 Drivers for Outsourcing

The driving forces for outsourcing vary according to the type of business function and the circumstance which the organisation is facing. In the industrial maintenance management world, Idhammar (2003) points out that many organisations outsource for reasons of politics, ingrained union practices, and lack of skilled craftsmen and resources to cope with increase in workload. According to a survey on maintenance outsourcing (PMRC, 2001), the most common reasons for using contractors were to increase labour productivity, reduce maintenance costs and focus in-house personnel on 'core' activities.

There have been a number of propositions for the strategic reasons for outsourcing (e.g. Bragg, 1998; Heywood, 2001; Langston & Lauge-Kristensen, 2002; Heikkilä & Cordon, 2002; Angel, 2003). While most of them are generic rather than for specific context, the relevant drivers are consolidated and applied to outsourcing for building O&M work as follows:

1. *Freeing resources for strategic business focus.* This permits an organisation to redirect its resources from non-core activities (e.g. O&M work) to activities having greater return.

2. *Access to world-class capabilities.* Specialist service providers can bring world-class, often worldwide, resources to meet the needs of the outsourcing organisation.

3. *Acceleration of re-engineering benefits.* The outsourcing organisation can immediately realize the anticipated benefits of re-engineering by having an outside organisation that is already re-engineered to world-class standards to take over the activity.

4. *Shared risks and contingent liabilities.* The service provider will share with the outsourcing organisation the risks (e.g. financial loss) and contingent liabilities (e.g. claims from third parties) of undertaking the outsourced work. Additionally, the service provider will be able to spread the risks across multiple clients.

5. *Market forces outside the outsourcing organisation.* Increased workload in the O&M industry may cause service providers to attract more practitioners who used to be hired in-house. Such shift in labour resources will drive up the cost for the providers in employing O&M practitioners. It would become more economical to procure the service rather than to make it in-house.

6. *Convert fixed costs to variable costs.* By procuring contract services on a

variable basis, the outsourcing organisation would be able to deploy its resources more flexibly. For instance, non-critical O&M work can be deferred until the organisation is at a better financial position.

In practice, however, a really strategic perspective is rarely taken in making an outsourcing decision whilst a short-term perspective aiming for immediate cost reductions often prevails (McIvor, 2000). Occasionally, organisationally immature companies may be motivated by imitative behaviour to outsource their work as what has been done by their peers in the industry (Jenster & Pedersen, 2000).

3.3 Advantages of Outsourcing

Every coin has two faces. There are advantages but also disadvantages associated with outsourcing. After researching into these two faces, Owen (1994) concluded that they vary not only between organisations but also dependent upon the type of facilities management services being considered. In connection with Owen's (1994) findings, Barrett (2000) further highlighted the most important ones among the nineteen categories of pros and twenty-seven categories of cons associated with outsourcing. Nevertheless, they were not focussing on building O&M work.

As mentioned earlier, the most relevant literature on the pros and cons of outsourcing were found in the contexts of industrial maintenance management (Sullivan, 1993; Edmond, 1994; Campbell, 1995; Bragg, 1998; BBP, 2001; Dunn, 2002) and facilities management (Corbett, 1998; Pearson, 2002a; Angel, 2003; Katsanis, 2003; Usher, 2004). Their main ideas applicable to building O&M work are consolidated as follows:

1. *Economies of scales.* The cost of production can be reduced by buying service from specialist contractors. By serving multiple-clients, the contractors can share the capital cost for O&M tools and equipment, maximize the utilization of labour resources and economize on the cost of materials through bulk-purchase. In addition, other overhead costs such as insurance coverage for labour and equipment can also be optimized by virtue of their larger scale maintained by the contractors.

2. *Cash infusion.* Facilities and equipment which are dedicated to the outsourced O&M activities can be sold to the service provider in return for cash to the outsourcing organisation (e.g. mobile elevated platform for accessing work at height).

3. *Intensive labour and specialized equipment.* Service providers who serve multiple buildings would have maintained larger amount of manpower and higher level of specialized equipment, which can be deployed to meet fluctuating O&M workloads of the outsourcing organisation.

4. *Specialist knowledge and skills.* Specialist O&M service providers would have obtained levels of expertise and skills beyond those of the in-house team.

In order to remain competitive, the providers would need to continually invest in human resource training and development. The experience gained from serving multiple sites would also enhance the providers' knowledge and skills and thus the outsourcing organisation would enjoy a better specialist service.

5. *Quality and efficient service.* Through implementing tried and tested O&M processes, specialist contractors can provide better service both in terms of time and quality. Internal staff of the outsourcing organisation exposed to such service would have the opportunity to improve their customary practices by learning the best practices. In the long run, this knowledge transfer will improve the quality and efficiency of the portion of work undertaken by the in-house team.

6. *Access to back-up service.* As specialist service providers are plugged in to a network of equipment manufacturers, they would have better access to the manufacturers' support services and hence can get answers to any 'knotty' O&M problems quickly.

7. *Flexible service.* O&M service providers tend to be more resilient in handling workload. They can provide flexible service to allow the outsourcing organisation to change the scope, scale, location and quality of the work to account for changing business needs or user demands.

8. *Acceleration of process re-engineering.* Unlike the in-house team, outside service providers do not require extended time to implement a new concept. The taking over of an internal function by the contractor would enable the outsourcing organisation to immediately re-engineer the original O&M process that is less than satisfactory. In addition, internal human resource troubles (e.g. late turn up, sick leaves) would be transferred to the contractor and hence would help re-engineer the existing process.

9. *Incentives and motivations.* The contractors would have more incentives to deliver quality service to the outsourcing organisation as they would perform to standards and meet targets in order to share savings (if the contract allows) as well as to secure further contracts. When the contractor can expand its business through winning more contracts, more opportunity for promotion is also a significant motivation for its team members to deliver a better service.

3.4 Disadvantages of Outsourcing

On the reverse side of the above advantages, the main risks and demerits concerning outsourcing in the industrial maintenance management regime (Sullivan, 1993; Campbell, 1995; Bragg 1998; BBP, 2001; Dunn, 2002) and the facilities management areas (Pearson, 2002a; Angel, 2003; Katsanis, 2003; Usher, 2004) are multi-fold. When applied to outsourcing for building O&M work, the key concerns include the following:

1. *Loss of critical skills and equipment.* As a result of outsourcing certain O&M work, outsourcing organisations may have removed some key personnel[1] and essential equipment. In case the organisations later find the contractors unable or unwilling to perform to expectations, they would have lost the critical skills and equipment to perform the necessary O&M activities. This becomes a barrier for them to revert to in-house production upon contract termination. Meanwhile, the contractor, after building up expertise with the outsourcing organisation's support, may attempt to provide their skills to competitors. In addition, the communication among skilled people in different departments of the organisations may be undermined because the traditional lines of communication would be redrawn after outsourcing. The potential for cross-skilling would thus be reduced, with a potential loss of flexibility.

2. *Costly contract formation.* The well thought out of upfront specifications for the deliverables is paramount but is usually uneasy and therefore costly, especially for O&M work which is required to satisfy the changing needs of the occupants and any unforeseen scenarios. When a quality service is required, the contractors would pass on the significant cost for keeping qualified service personnel to the owner, leading to costly contracts.

3. *Loss of control.* The outsourcing organisation would not have much close control over the O&M work that has been outsourced and would become

[1] Despite no such legal requirement has been in force in Hong Kong, the Transfer of Undertakings (Protection of Employment) Regulations of the UK preserves employees' terms and conditions when a business or undertaking, or part of one, is transferred to a new employer (Heywood, 2001).

dependent on the contractor. The lack of direct influence and control over the resources used for executing the work often leads to loss of quality control. Such underperformance of the contractor would impair the O&M service delivery.

4. *Process disruption and culture shock.* There is much to be learnt by the contract personnel in familiarizing with the existing O&M conditions before their service provision becomes productive. Except for new buildings, bringing in outside contractors would create culture shock to the existing in-house workforce. The original O&M process would also need to incorporate the work processes undertaken by the contractors.

5. *Less ready service.* An off-site service provider is likely to respond to breakdowns and emergency incidents less promptly than the in-house O&M staff residing on-site. Contractors which serve multiple sites would also be less likely to provide timely service to the clients with lower priority.

6. *Up-keeping and quality of spare parts.* Unless required by relevant contract conditions, the contractor may be unwilling to stock spare parts for specialized types of equipment as they may not be applicable for other customers. Contractors are inclined to use the cheapest parts in repairs if the contract is on a fixed-fee basis and no specific requirements have been stipulated in the contract.

7. *No sense of ownership.* The contractor will go with the contract expiry and therefore would unlikely have a sense of 'ownership' of the O&M work. Comparatively lower service quality would result because the contractor who works to the standard set by the client would not have the same degree of ownership and loyalty as that of the in-house employees. The contractor would also tend to do what is required in the contract, without taking initiative in making constructive recommendations.

8. *Increased security problem.* Granting access for the contractor to the building would also necessitate more security control measures. In particular, the outsourcing organisation would struggle when some restricted areas require the execution of O&M work by the contractor.

9. *Costly contract management.* The outsourcing organisation would need to spend a significant effort to choose the right contractor. Since self-interested contractors would strive for profit by shirking their responsibilities, the effort required to monitor and measure the contractor's performance can be costly. Any disputes over the contract would also give rise to costly resolutions and consequences.

10. *Legal liabilities.* Because of the complex web of subcontracting and back-to-back contractual liabilities, the service provider's accountability for the

outsourced work would be dissipated. On the other hand, there is a risk of the outsourcing organisation being held liable in law for the actions of the contractor when they are done in the organisation's name. In other words, the organization may be able to outsource the work, but not the liabilities.

11. *Problems with contract termination and renewal.* The outsourcing organisation may have lost sight of the policy issues relevant to the area of O&M work that had been outsourced, simply because it is no longer directly managed. The process of managing termination and replacement would give rise to more difficulties than if the work had not been outsourced in the first place.

In addition to the above pros and cons, there are other elements which may influence one to decide whether to make or buy a service (Owen, 1994). Before going to the ensuing chapters which would further investigate these factors and their considerations, the following section reviews some of the methods suggested in the literature for making outsourcing decisions.

3.5 Methods for Making Outsourcing Decision

Bringing in an outsider to provide an existing function performed in-house requires a carefully-designed process. When making an outsourcing decision, different factors may need to be considered with different weights according to different situations. Searching through the literature has not been able to reveal a proven decision making framework in particular for outsourcing O&M work for commercial buildings, although Barrett (2000) suggested some practical steps in general for decision making in the facilities management context.

Table 3.1 Six steps to outsourcing (Campbell, 1995)

1. Is outsourcing a viable alternative to self-provision? • Self-provision by data collection • Current outsourcing data collection • Management interviews • Open session with management • Preliminary assessment • Final report	4. Evaluate outsourcing alternatives by function • Map organisation by function • Review functions and alternatives • Determine interim steps to functional • Outsourcing • Preliminary route map • Final recommendations
2. Are the objectives achievable through outsourcing? • Impact on current stated strategy • Cost objectives • Organisational objectives • Transition(right-sizing) objectives • Economic development objectives • Reis, control, access rights objectives • Preliminary assessment • Final report	5. Request for proposal to outsourcing suppliers • Determine legal issues • Determine vendor profile • Document requirements • Document performance measurements • Prepare and issue request for information • Evaluate request for information • Prepare and issue request for proposal • Evaluate request for proposal
3. Is the organisation ready to use outsourcing? • Chart functional organisation • Examine need for consolidation of functions • Assess people vs. functional management style • Assess management compensation (re: outsourcing) • Preliminary assessment • Final report	6. Vendor selection and agreement negotiation • select vendor • negotiate deal: a. start b. manage vendor c. normal termination • transition quality assurance (plan and review) • perform periodic reviews

There are some proposed and recommended processes for making outsourcing decision in other sectors. For instance, Campbell (1995) suggested a 6-step systematic approach in the industrial maintenance context (Table 3.1). The framework, however, is generic rather than specific for use in making outsourcing decision for building O&M work.

Interpreting the questions and making judgment on the considerations for each of the steps may vary among different sectors, leading to different outcome decision.

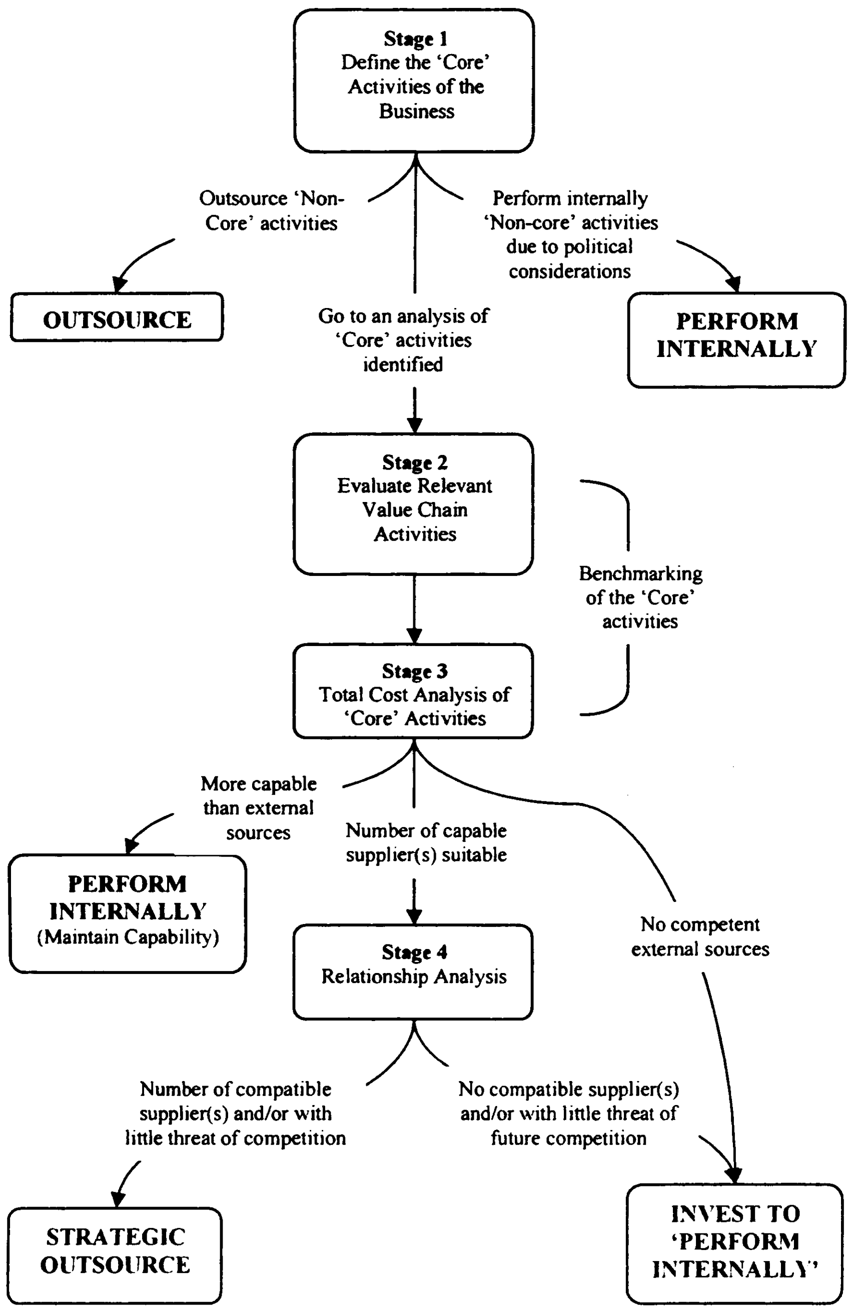


Figure 3.1 A practical framework for evaluating the outsourcing decision (McIvor, 2000)

Besides, through conducting 12 structured interviews in a variety of industries including electronics, telecommunications, mechanical engineering, aerospace, chemicals and medical packaging etc., McIvor (2000) developed a four-stage framework of the outsourcing decision-making process. Similar to Campbell's (1995) work, it is not tailored for the building O&M outsourcing context. Moreover, it does not elaborate the critical considerations that should be taken in making the decision in each step.

For libraries services, by modifying Macrum's (1998) matrix Ball (2003) proposed a weighted decision matrix. It considers nine cultural, economic and functional factors (with assigned weight factors) for consideration when deciding whether to outsource for the services (Table 3.2). Ball (2003) believed that the matrix is a useful tool for aiding decision-makers to assess the suitability of outsourcing a particular library service instead of being a substitute for professional or political judgment.

Table 3.2 A weighted decision matrix for outsourcing library services (Ball, 2003)

Weight Factor		No			Yes
		1	2	3	4
3	High capital cost				
3	Market/suppliers exist				
3	High recurrent cost				
2	Complies with corporate strategy-ies				
2	Poor or declining performance				
2	Easy to specify service				
1	Peripheral to service identity				
1	Corporate policy				
1	Difficult to deliver service				
				Total	

The decision matrix, however, is not suitable for use in considering outsourcing for building O&M work because the factors included in the matrix assessment do not make particular reference to the characteristics of O&M work. Furthermore, the weighting factors assigned to the items being considered appear to be arbitrary. In order to formulate a useful decision tool, it is crucial that appropriate weights are assigned to the attributes according to the needs and circumstances in front of the outsourcing organisation (Atkin & Brooks, 2000).

In addition to the above methods, the study of Chandra (1999) attempted to investigate how a firm should make strategic decision on what service activity to outsource. More recently, Hassanain & Al-Saadi (2005) presented a generic framework model for outsourcing asset management services in municipalities. However, all these decision methods and frameworks were intended to help make an outsourcing decision for some services but not specifically for building O&M work.

3.6 Chapter Summary

Much of the literature in the areas of industrial maintenance and facilities management have submitted the drivers, merits and drawbacks associated with outsourcing for various services. After review and consolidation, this chapter has applied them to outsourcing for building O&M work. In addition, the chapter has presented a review of the relevant methods suggested for making outsourcing decisions, together with a discussion on their applicability to building O&M work.

Chapter 4

RESEARCH FRAMEWORK

4.1 Introduction

In theory, producing building O&M work in-house would save resources associated with managing outsourced contracts but would require effort for organizing and coordinating the direct staff. Outsourcing for building O&M work would take place where it is more economical to buy than to make the work. The recent development of the O&M market (see Chapter 2) has evidenced the increasing use of outsourcing. How this trend will develop can have profound impacts, not only on the practitioners, but also on the quality of buildings in Hong Kong.

This chapter lays down the theoretical framework for the research study and infers the key hypothetical issues. Firstly, the relevant theories are introduced, followed by an outline of the importance of O&M work for buildings and an explanation of the environmental reasons which have given rise to the rising trend of outsourcing. The factors that affect the costs for O&M and their influence to a building owner on making the decision of whether to go for outsourcing are also analyzed. Finally, the implications of the predicted trend are discussed.

4.2 The Theoretical Basis

The following analysis is based on the author's understanding about buildings and building services O&M in Hong Kong and some critical economic theories, including specifically:

1. The nature of the firm (Coase, 1937), which, in simple terms, is that firms exist because of the desire to minimise transaction costs, the costs for individuals to find out whom to trade their outputs with, negotiate price, form and execute contracts, etc. The transaction costs can be extremely high if everyone has to produce a specific product and obtain products from others through trading with one another. Joining a firm means that an individual accepts the direction of the firm on what to produce in exchange for the salary, leaving the onus of organising the factors of production and the trading of products to the management of the firm. In this way, the overall transaction cost will be drastically reduced.

2. The contractual nature of the firm (Cheung, 1983) points out that the difference between having firms to organise factors of production and sell the products and having individuals to organise themselves to produce and

trade are two choices of contractual arrangements. In the former, a firm makes contracts with suppliers for the required factors of production, which include contracting with individual employees for the human capital, and making sales contracts with customers of its products. An individual may choose to enter into an employment contract with a firm to allow the firm to have the right to make use of his human capital or to undertake production himself and make contracts with customers to sell his product. Which of the different contractual arrangements will be chosen depends on which leads to a lower total cost, including the transaction costs.

3. The law of contractual performance (Cheung, 2002) is about the relation between contracts and transaction costs. In essence, the law asserts that each party of a contract has the tendency to shirk liabilities; less on aspects that are directly measured and priced for in the contract and more on aspects that are not. For instance, employees paid based on attendance will tend to work sluggishly whilst those paid based on units of output will sacrifice quality for volume. This implies that measurement and monitoring are essential to ensuring adequate contractual performance, which may take various forms and will incur different transaction costs. The choice of contractual arrangement will be made based on the consideration of whether the chosen arrangement will yield the highest benefit taking into account the costs for measurement and monitoring.

The above theories are relevant to the present analysis as the choice that a building owner has to make between hiring an in-house O&M team to provide the services or to outsource for O&M services from a contractor are of similar nature. The associated transaction costs, especially the costs for measurement and monitoring of contractual performance, are a crucial factor to making such a choice. In the following, these theories are applied to analyse what factors will make outsourcing for O&M services a viable choice.

4.3 Operation and Maintenance for Buildings

A building will continue to be a valuable asset only if it is properly operated and maintained. It requires maintenance to upkeep its structural integrity, water tightness and aesthetic appearance both inside and outside. The services systems also require proper O&M to ensure indoor environmental conditions can be kept under proper control and people are well facilitated to move in and out to work, to get the goods and services they want or to enjoy the amenities inside the building. The economic rent of a building will diminish with the lowering of such qualities.

Proper O&M also helps minimise the cost for providing the services. The major cost elements include the cost for human resource, the energy cost, the costs for consumables and spare parts required in routine service and repair of equipment, and the charges for various utilities, e.g. municipal waste and waste water disposal. Substantial investments will also be needed periodically for major retrofits (e.g. refurbishment of external finishes and indoor redecorations) and replacement of worn-out plants and equipment.

Organisation and management of the O&M work for the building services systems in a modern building can be rather complicated, given the wide range of systems that are involved, which typically include those for air-conditioning, lighting, electricity and gas supply, fire detection and protection, water supply and drainage and vertical transportation, and various other installations such as building automation system, waste disposal systems, external wall access and cleaning facilities, etc. The majority of the O&M work is routine and can be scheduled to take place on a regular basis, but calls for O&M work may also arise from time to time, e.g. when a complaint is received from a tenant about interruption of power or water supply, insufficient cooling, water leakage or excessive noise in their premises.

There are also regulatory requirements for safeguarding the health, safety and well being of people inside buildings (including both the end-users and the workers) and the passers-by, which will call for specific O&M work to be done in the prescribed manner (Lai & Yik, 2004). For instance, the fire services systems and the lifts and escalators must be periodically inspected, tested or examined by registered contractors for the respective types of systems while installation and repair of electrical systems can only be carried out by registered electrical workers. Furthermore, some works, such as the overhaul and major repair of complex equipment (e.g. chillers), changes to sophisticated systems (e.g. the building automation system) and special measurements and tests (e.g. chemical analysis of water quality) have to be carried out by persons with specialist knowledge and skills, and for some works also with special equipment.

To ensure O&M work will be carried out when and where required to maintain adequate services to occupants, especially when problems requiring immediate attention arise (e.g. equipment or system breakdown), most building owners hire an in-house team to execute the work. This will help ensure a prompt response to urgent calls for remedial actions and allow close monitoring of the quality of the O&M work. However, it will not be economical to have an in-house team that can deal with every aspect of the O&M work; and those that require specialists or registered contractors to perform are typically outsourced. Traditionally, the extent of the outsourced O&M work, both in terms of the scale of the work and the expenditure, is small compared to those that are conducted by the in-house team.

4.4 Reason for Outsourcing

As reviewed in Chapter 2, the economic recession in the late 90's has triggered more building owners to cut O&M costs by means of outsourcing. The cost saving, which is realised mainly by largely downsizing the in-house O&M team, can be substantial because of either or both of the following:

1. The existing O&M personnel had enjoyed rapid salary increases when the property market was booming, but reduction in salary since the recession has been moderate and slow.

2. The much reduced number of new building projects forced contractors and workers for new installations to shift to O&M work for existing buildings. The increased competitions, including among practitioners for O&M jobs and among contractors for O&M contracts, caused sharp reductions in O&M contract prices.

Whilst the above situations boosted outsourcing for building O&M work in Hong Kong, will this trend continue, especially when the economic situation starts to revive? This is an important question to firms formed or expanded to meet the recent demand for contracted O&M services, and is equally important to practitioners in the field. Its emergence is expected to make a large impact to the ways in which O&M work is organised and conducted, and presents an unprecedented opportunity for substantial improvements to the knowledge and skills of practitioners in the field, which has long been regarded as routine and low level (technically). The keen competition for O&M jobs in existing buildings by practitioners who used to work on design or installation of systems in new buildings is a threat to existing O&M practitioners but is also a drive for them to improve their knowledge and skills, especially those that can help buildings save operating costs (e.g. raising operating energy efficiency and better management) (Yik et al., 2002).

4.5 The Determining Factor

Hiring an in-house O&M team and outsourcing for O&M services are two choices of contractual arrangements between which building owners may select either one, or a mix of the two, in organisation of the factors of production of O&M services for their buildings. In the former, a building owner assumes the role to organise and manage the O&M works by procuring the required factors of production of the O&M services (manpower and other resources) through contracts with the individuals and suppliers. In the latter, the building owner outsources for the services through one single contract with a contractor who assumes the role of organising and managing the factors for delivery of the O&M works. Which choice a building owner should make hinges on the more fundamental concern, i.e. which will lead to a lower overall cost.

In principle, contractors specialised in O&M work should be able to deliver the required services more economically due to their comparative advantage over in-house O&M teams in the following aspects:

1. The specialist O&M contractor should be able to organise and manage the O&M work more efficiently. For instance, deployment of labour force can be optimised; especially the cost for procurement of expert knowledge and skills can be shared among the buildings served. The building owners will also be freed from such tasks and concentrate on their own core businesses.

2. The overhead cost for the organisation and management of the O&M work will be lower by virtue of economies of scale.

3. Their specialist knowledge can help building owners run their plants more efficiently and thus save running cost.

4. They can source for equipment and spare parts more easily and promptly, which will help reduce downtime and enhance reliability of plants, and likewise in recruitment of appropriate manpower.

5. They are in a better position to bargain with suppliers of replacement equipment and spare parts, and are able to optimise the stock of spare equipment and parts, which will help reduce the associated costs.

However, the replacement of an in-house team by an outsourced contractor for the O&M work will incur the following *ex ante* and *ex post* costs:

1. The costs for preparing, inviting and vetting tenders and negotiation of contract terms for forming a contract between the building owner and the contractor, and for the associated professional services (technical and legal).

2. The costs for measuring and monitoring the performance of the contractor.

3. The costs for settling any disputes between the two contracting parties.

All the above are parts of the transaction costs associated with the choice of outsourcing for the O&M services, and they can be quite substantial. The costs for measurement and monitoring of the contractor's performance is for avoidance of any losses arising from non-performance of the contractor, which include the potential losses in rental revenue due to any degradation in the quality of O&M services. This means that there will be either type of costs; attempting to reduce one type of costs could lead to an increase in another.

Smooth execution of a contract may be jeopardized if a building owner intends to avert the risk of unpredictable costs, such as the costs for repairs and replacements resultant from wear and tear and vandalism, by shifting the risk to the contractor through the O&M contract. This can lead to ill-defined scope of work in the contract, which may lead to disputes and, in turn, to costly consequences, such as degraded services and the time and effort required for negotiations for settlement and when this fails, arbitration or even litigation.

4.6 Influential Factors to O&M Costs

The above discussion highlights that whether the overall cost to the building owner for the O&M work can be reduced is the key factor that would influence whether the work should be done in-house or outsourced. The cost for O&M work depends on many factors, which include (Figure 4.1):

1. The range, scale and complexity of services systems to be operated and maintained;

2. The quality of services to fulfil tenants' requirements;

3. The competence of the in-house team and the contractor, both in technical knowledge and skills and in organisation and management;

4. The budget that can be made available for O&M of services systems; and

5. The transaction costs associated with the contractual arrangements.

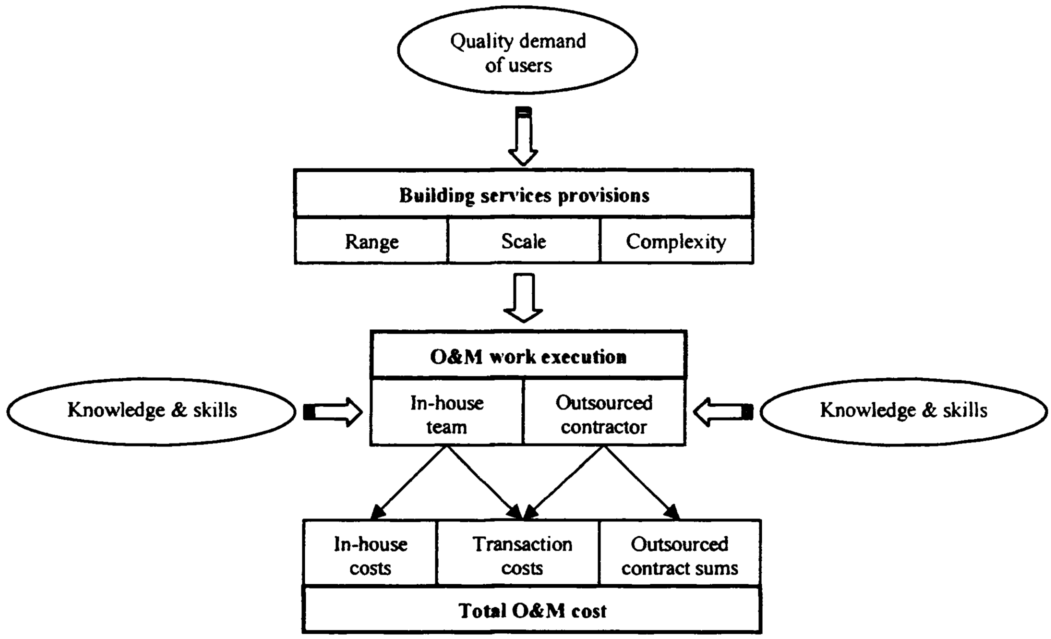


Figure 4.1 Influential factors to O&M costs

The first two in the above list determine the size of the O&M team and the knowledge and skills that they require, which together determine the expenditure on human resource. Although O&M personnel with better knowledge and skills would demand for higher salary, their more efficient operation and maintenance of the services systems will help lower the overall running cost of a building (Yik et al., 2002). However, the budget that can be set aside for O&M differs from one building to another. It depends on the class and location of the property, which determine the rental rate and management fee that the building owner can charge the tenants; the higher the revenue, the greater the budget that can be made available. Transaction costs always exist but can vary largely with the contractual arrangements chosen. For instance, measurement and monitoring of performance is needed both for hiring an in-house team and outsourcing for O&M services, but the means used and the associated costs are different.

For a residential or small commercial building, it is usually equipped with just the basic range of services, such as electricity and gas supply, water supply and drainage, fire hydrants and hose reels, lifts, lighting, small scale ventilation systems, security systems and TV, telephone and computer data transmission networks. Small commercial buildings will also have sprinkler systems which is a regulatory requirement. Such buildings are seldom equipped with central air-conditioning systems. Rather, individual households and tenants will equip their apartments/ premises with split- or window-type air-conditioners and other domestic appliances for which the building management has no responsibility for ensuring their proper operation other than failures due to the connected landlord provisions.

The range of services systems in these types of buildings do not need to be manned from time to time except during the regular execution of statutory maintenance work. Operation of the plants and equipment (e.g. turning them on and off at different time in the day) requires little amount of work and can be taken care of by other workers, such as caretakers or security guards. Hence, the need for a dedicated team of O&M staff is low and the O&M work is primarily outsourced, typically from several proprietors or small engineering firms. For those that are managed by estate management agencies, a few technicians may be employed by the agency to look after several buildings under their management to attend to emergency calls. The quality of service demanded would be limited to reliable services with minimum down time, hygienic water supply and fulfilment of relevant regulatory requirements. This style of O&M work organisation and management would lead to a much lower overall cost than keeping an in-house O&M team.

For medium-sized commercial buildings, the range of services systems would include, in addition to those present in small buildings, various types of fire detection and protection systems, central air-conditioning systems, escalators and more sophisticated control systems (e.g. a building automation system). The amount of O&M work that needs to be performed and the relatively more demanding tenants' requirements justify the establishment of an in-house O&M team to undertake the normal and routine O&M work, whilst the specialised works and in some cases some labour intensive work (e.g. cleaning of air filters) will be outsourced.

Because the rental rate and management fee for premises in medium-sized buildings are significantly lower than large, prestige buildings, the O&M budget that can be made available limits the quality of O&M services that can be delivered. The organisational structure of the O&M team is usually rather simplistic; with the team headed by an experienced technician, assisted by a team of tradesmen and artisans. The team may be divided into two divisions, one responsible for the mechanical services and the other for various types of electrical services, which is the result of the different training that workers would require to perform the O&M work. Although the building owner of a medium-sized building may outsource for O&M work, the limited budget available may not permit the retention of an experienced staff to act on behalf of the owner to supervise and monitor the performance of the contractor.

In large building complexes, especially those that comprise a mix of building types (e.g. hotels, commercial offices, shopping malls, car parks and various types of places of public entertainment), there will be an even wider range of services systems, which will include hot water supply systems, waste handling systems, public address systems, etc. High quality services are a must in such complexes and the associated costs can be sustained by the higher income from rents and management fees.

The amount and complexity of the O&M work necessitate a bigger O&M team than that for a medium-sized building, and the team is typically headed by a professional engineer. There may be a few levels in the organisational structure, including the team head, a couple of engineers, a number of supervisors and several gangs of operatives. For big property owners with a large number of buildings in their portfolio, there will be an engineering director or a chief engineer who oversees the O&M operations, including approval of budgets, control of expenditures, making decisions on and managing major retrofit projects and evaluation of performance of the O&M teams in individual buildings.

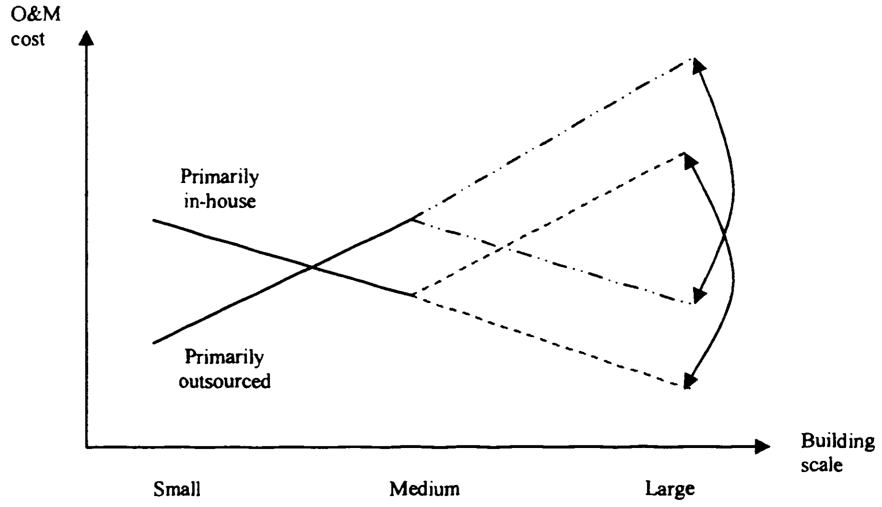


Figure 4.2 Cost of O&M work performed in-house or outsourced

Whether or not the O&M work for large building complexes would be outsourced is more difficult to predict (Figure 4.2), as there are more factors that can influence the overall cost. Given the size of the O&M team, the comparative advantage of an O&M contractor over an in-house team diminishes. On the other hand, the costs for managing the bigger team of O&M staff will increase. However, in the case of outsourcing for O&M services, building owners can afford the appointment of professional engineers to scrutinize contractors' performance, to avoid degradation in service quality, and thus will go for outsourcing if the overall cost can be lessened.

Despite the more variable influential factors, the emerging situations support the following cause-effect relations and prediction of future development:

1. The rental income used to outweigh the O&M cost. Hence, the desire for quality services tended to catalyze a bulky, well remunerated O&M team.

The O&M expenditure, however, would become a burden when the rental income largely dropped (as has happened in Hong Kong recently). When downward adjustments of staff's remunerations or downsizing cannot yield the required cost reduction, the management would look for other means to cut costs. As discussed above, this should be the major cause for the trend of outsourcing for O&M services.

2. After outsourcing, if the performance of the contractor is less than satisfactory, the building owner may decide to re-establish an in-house O&M team. However, if the contractor's performance is found to be good, the switch to outsourcing will become long term.

3. The market for contracted O&M services was relatively small in the past which was unfavourable to the emergence of professional O&M contractors. It, however, will take time for those in the market to upgrade their expertise to meet the expectations of owner of prestige buildings.

4. Therefore, in the near future, some buildings may continue to outsource for O&M services but others will continue with or switch back to hiring an in-house team. The market for outsourced O&M services is expected to grow steadily but it will not completely replace in-house O&M.

4.7 Implications to Building Owners and O&M Practitioners

To practicing O&M personnel, the trend of outsourcing will force them to switch from working for a building owner to working for an O&M contractor. Since there will be more buildings to look after, the workload will increase. However, the fierceness of competition among peers for jobs will also increase – the number of employees in the property management and maintenance sector has already increased by 43.2% between 2001 and 2003 (VTC, 2004) while the amount of building completions has continued to shrink (RVD, 2004). When taken positively, this will lead to betterment of knowledge and skills of practitioners in the field, but many would have to upgrade themselves to meet the demand.

To O&M contractors, the trend means greater business opportunities but there will also be greater competitions because more companies will enter the market; as evidenced by the respective increase in Corporate Members and Associate Members of the Hong Kong Association of Property Management Companies (see Chapter 2). Whether or not the market will continue to grow depends on whether their services can meet the expectation of building owners to keep them choose outsourcing for O&M services.

To building owners, the emergence of more O&M contractors will allow them to obtain the required services at lower costs. For building owners that are still retaining an in-house O&M team, market competition will drive the in-house team to upkeep service quality, as outsourcing is always an option available to them.

4.8 Chapter Summary

Based on the relevant theories of economics, this chapter has analyzed the incentives for outsourcing, the factors which should be considered in making an outsourcing decision and those that are influential to O&M costs. In addition, the implications of the rising trend of outsourcing on the stakeholders of the O&M industry have been predicted. The research framework so formed has guided the forthcoming data collection, and their analysis and synthesis for the study.

Chapter 5

RESEARCH PROCESS AND METHODOLOGY

5.1 Introduction

Without a rigorously designed research process and methodology, it is unlikely to obtain meaningful and useful results. In fact, there are numerous means for conducting a research study and their modifications and adaptations, as essential to suit different circumstances, may even be unlimited. Having reviewed the various research methods in literature, this chapter explains the considerations and rationale for the selected methodology and describes the research process for the study. In addition, the major difficulties that have been encountered in the course of data collection and hence the limitations of the data are also elaborated.

5.2 Problem Identification through Exploratory Observation

Prior to the commencement of the study, little about the considerations for O&M outsourcing was known and no information was available on how similar problems or research issues have been tackled. Exploratory observation was undertaken on-the-job to identify any problems existing in practice (Sekaran, 2003). Such observations, lasting over one year during which the author worked as a maintenance manager for a maintenance service provider involving in a number of outsourced O&M contracts, enabled better comprehension of the nature of the problem and the familiarity with the various issues associated with outsourcing. This prior experience greatly helped the development of a rigorous strategy and design for the research study.

5.3 Research Strategy

Since this research study on outsourcing for O&M work deals with an existing phenomenon in the building industry, a predominantly descriptive research approach supplemented by empirical data collected through surveys was adopted (Salkind, 1996). The result so obtained can generate a profile or help describe relevant aspects of the phenomenon from an individual, organizational or industry-oriented perspective (Sekaran, 2003).

To enable better investigation and hence understanding of different aspects of the phenomenon in question, a hybrid strategy intending to collect both quantitative and qualitative data was adopted (Bryman, 1988; Ritchie & Lewis, 2003). Quantitative data would allow numerical or statistical analysis of the findings whereas qualitative information would help reveal facts, practices and attitudes of O&M practitioners in the social reality (Bryman & Bell, 2003). By presenting data in an organized and meaningful form, it can help understand the characteristics of a group in a given situation; think systematically about aspects in a given situation; offer ideas for further probe and research; and make certain simple decisions (Sekaran, 2003).

Quantitative methods such as Pearson product-moment correlation, Spearman rank correlation and Kendall's test of concordance were used to analyse the quantitative data, e.g. frequency of disputes, contract sums etc. Information collected from the in-depth interviews such as achieved O&M service quality for the building, comments from the interviewees etc. were analysed qualitatively. Table 5.1 summarises the use of analysis methods for different sections of the study. Detailed procedures for applying the methods are explained in corresponding chapters that follow.

Table 5.1 Summary of methods of analysis for different sections of the study

Stage of survey	Section of study	Quantitative method	Qualitative method
Stage I	Disputes on outsourced O&M contracts (Chapter 6)	Used	Not used
Stage II	Management issues (Chapter 7)	Used	Used
Stage II	Contractual issues (Chapter 8)	Used	Used
Stage II	Economic issues (Chapter 9)	Used	Used

For the purpose of studying the current situation of outsourcing for O&M work where there is no time ordering to the variables under investigation, the research was designed on a cross-sectional basis (Bryman, 1989; Bryman & Bell, 2003). Unlike experimental research, cross-sectional research carries inherently weak internal validity. But, the survey procedures, selection of respondents, administration of research instruments and data analysis were conducted with rigor in order to deliver results with high reliability and replicability (Bryman & Bell, 2003). Rather than for establishing cause-and-effect relationships, this research is basically a correlational study. It is useful for examining the relationships among the multiple factors concerning O&M outsourcing (Sekaran, 2003).

5.4 Research Model

Based on the reviewed literatures, it was decided to take a holistic approach to probe into three key facets of outsourcing for building O&M work, namely economic, contractual and management considerations (Figure 5.1). Economic issues, largely about benefits and costs, are crucial to the selection between in-house and outsourcing. Contractual considerations are about formation and execution of appropriate means for procuring O&M services. Management issues including how to organise the procured works and how they are coordinated with and monitored by the in-house team are of vital importance to their outcome performance.

By collecting data about O&M expenditure and building income, the economic performance of outsourced contracts can be evaluated. To investigate the management issues which are influential to effective administration of the contracts, the study aimed to find out the management practices which are crucial to the quality of O&M work. The holistic investigation of the outsourcing issues would not be complete without researching into various problematic contract conditions and statutory requirements imposed on O&M work in existing buildings. Through analyzing these findings, the merits and problems with outsourcing for O&M work would be revealed. These critical elements would help make clear the success and failure attributes, which are imperative for formulating a framework of guidelines to aid practitioners to make outsourcing decisions.

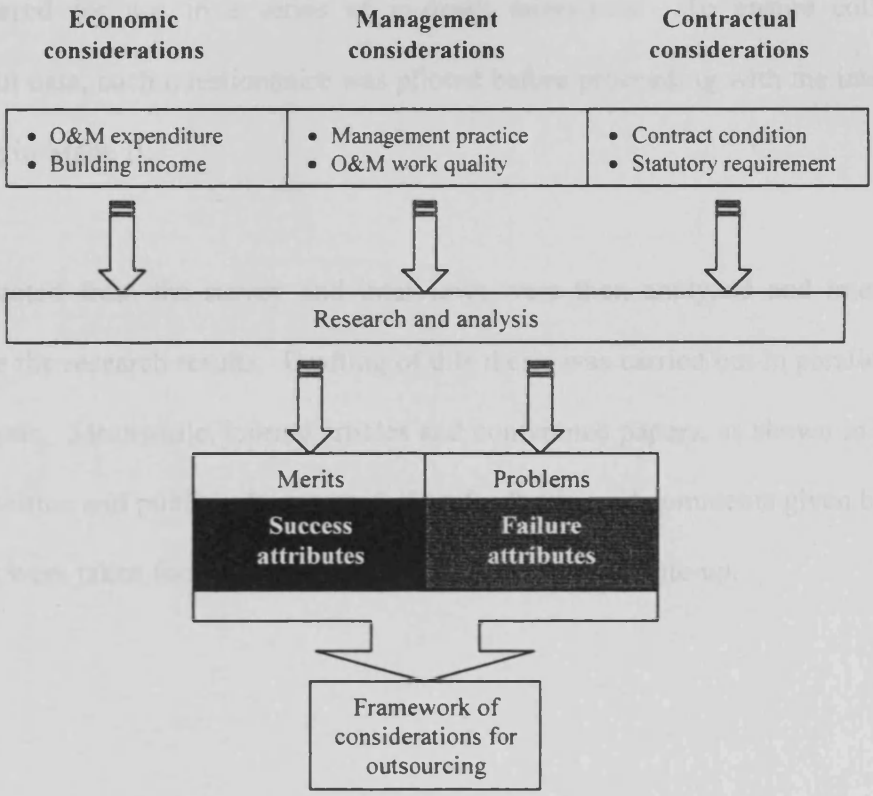


Figure 5.1 The research model

5.5 Overall Research Process

As unveiled from the literature review, little precedent research focusing on outsourcing for O&M work in buildings seemed to exist. The essential factors and their considerations leading to a rational decision for O&M outsourcing are therefore uncertain, if not unknown. To start with, a questionnaire survey (Stage I) was conducted, aiming to test whether problems commonly exist in outsourced O&M contracts and how serious the consequences are (Figure 5.2). Drawn from the results of Stage I and the information obtained from the reviewed literatures, a detailed questionnaire containing questions on the economic, management and contractual considerations in outsourcing for O&M work was prepared for use in a series of in-depth interviews. To ensure collection of meaningful data, such questionnaire was piloted before proceeding with the interviews in full-swing in Stage II.

Data collected from the survey and interviews were then analyzed and interpreted to synthesize the research results. Drafting of this thesis was carried out in parallel with the data analysis. Meanwhile, journal articles and conference papers, as shown in Appendix A, were written and published/presented. The feedbacks and comments given by the peer reviewers were taken for enhancing the final version of this write-up.

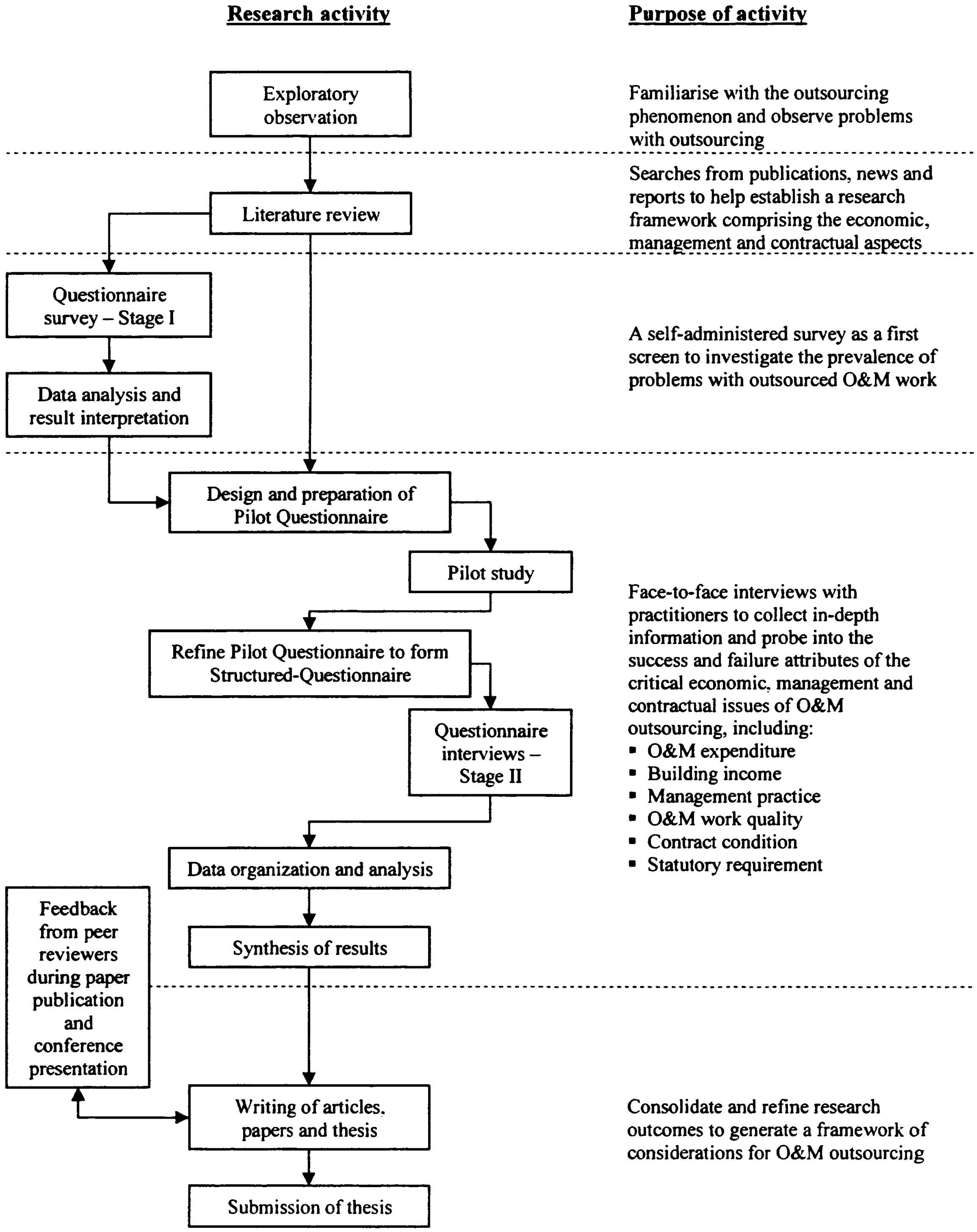


Figure 5.2 **Overall research process integrated with the research framework**

5.6 Questionnaire Survey (Stage I)

The questionnaire survey conducted in Stage I aimed to: investigate the prevalence of practitioners encountering disputes on outsourced O&M contracts; obtain a clearer picture about the extent to which common contract terms such as "fair wear and tear" and "vandalism" are used in the contracts; and study whether their use has led to serious contractual problems.

The questionnaire designed for the survey comprised three sections; a sample of which is enclosed as Appendix B. The first section was meant to gather demographic information about the respondents, which includes their age and academic and professional qualifications; business nature of the companies they worked for and their job positions; and for how long they had worked in the field of building services O&M.

The next section contained questions that enquired into whether the respondents had specified or come across with maintenance contracts that specified that the contractor shall be responsible for any work arising from "fair wear and tear" at no extra costs to the client; what was their interpretation of the term "fair wear and tear" and from which sources they learned the meaning of the term; and if they had come across with disputes over the meaning of the term, the consequences of the disputes and how the disputes were settled. Additionally, the respondents were asked to indicate, among a list of incidences, if they considered any of them results of "fair wear and tear".

The questions in the last section were similar to those in the second except that instead of "fair wear and tear", the questions addressed "vandalism". Except where there were contradictions, the respondents were asked to select as many choices in the list of answers as they thought appropriate and/or to give their own answers.

Distribution of the questionnaire to the O&M practitioners was self-administered, which made a successful collection of 55 useful returns out of 56 responses. The detailed method used for this stage of survey and the demography of its respondents are elaborated in Chapter 6.

5.7 Questionnaire Interviews (Stage II)

At this stage, the detailed questionnaire was prepared based on the problems identified from the exploratory observations, the relevant literatures and the findings from the questionnaire survey in Stage I. The questions included in this questionnaire (see Appendix C), which were designed for interviewing the O&M practitioners, targeted to investigate in depth the economic, management and contractual aspects concerning outsourced O&M work.

5.7.1 In-depth Face-to-Face Interviews

It is obvious that the terms "in-depth telephonic interview" and "in-depth postal interview" are self-contradictory (Welman, 2001). In-depth interviews are always conducted face-to-face personally at the workplace of the interviewees (Ritchie & Lewis, 2003) with the use of purposely-designed interviewing protocols. Since there involved the interviewees providing some confidential and sensitive information about their companies, the contracts and their own particulars, therefore personal interviewing is used to help establish their trust with the interviewer (Fowler, 2002).

The advantages of personal interview, as described below, are multifold (Welman, 2001; Fowler, 2002; Zikmund, 2003). First, it allows a good control over responding. The interviewer can be in complete control of the interview situation, and the respondent's first response as well as any changes to it can be recorded. Second, it can ensure that someone else does not provide the responses on the respondent's behalf. Third, the interviewer would be able to notice and to clear up any misunderstanding of the questions; explain any questions that may be apparently unclear to the interviewee; and follow up on incomplete and vague responses. Fourth, it would be more likely to achieve a high response rate. There would be less chance of the respondent eluding the interview, because the interviewer physically confronts the respondent. Last, the respondents, who may be unwilling to complete a questionnaire or provide sensitive information to an anonym, may be entirely prepared to talk to a known interviewer.

Despite the well-known advantages and the fact that all the interviews were carried out by the author alone, there are drawbacks in using personal interview as a research tool (Welman, 2001; Fowler, 2002; Zikmund, 2003). Essentially, it would be time consuming and costly to conduct personal interview, not only because the transportation to and from the workplace of the interviewee would incur significant time and cost, but also due to the burden to fix an appointment convenient to both the interviewer and the interviewee. Furthermore, the interviewer cannot conduct personal interviews anonymously. The lack of anonymity may risk collecting non-genuine responses and opinions as a result of the interviewee anticipating the kind of answers that the interviewer would expect.

5.7.2 Purposive Sampling of Participants

The interviewees would be required to spend a considerable amount of time (around 1.5 hours) to attend the face-to-face interview. In addition, they must be the 'right persons' who can comprehend the questions, have got the relevant work experience and be able to access the required information. More importantly, they must be willing to retrieve and gather the detailed and sensitive information into which the questionnaire enquires. Therefore, at the sacrifice of external validity which is achievable by means of probability sampling (Bryman & Bell, 2003), it was decided to purposively sample the targets (Ritchie & Lewis, 2003; Sekaran, 2003) and to make pre-interview communication with the individual interviewees on telephone in order to establish a good rapport which would help smooth the actual interviewing process (Bryman & Bell, 2003).

There is no straightforward answer as to the sample size required for a research study. The decision on such, nonetheless, has to take into the practicality consideration of time and cost as well as the richness of the data obtained (Bryman & Bell, 2003; Ritchie & Lewis, 2003). A total of 28 stratified homogenous samples (subgroups: owner, building management and O&M contractor), comprising the practitioners with whom the researcher had contacts and those who were solicited from the membership of a relevant local professional society, Building Services Operation and Maintenance Executives Society (BSOMES), were selected for the in-depth interviewees. The risk of having unreal answers was minimized as the interviewees were all invited to participate in the interviews voluntarily. The interviewees, being the key and experienced personnel who manage, administer and/or execute O&M work for commercial buildings, were purposively sampled in order to collect appropriate field data. Based on an incremental approach, samples were taken until further increase in number did not provide new/different information. This helped enhance the representation of the response. In order to maximise the variety of the samples, selection of the buildings for the survey ensured that different types of premises namely office, retail and hotel were covered by the buildings and not more than two buildings belonged to the same dominant owner.

5.7.3 Design of the Questionnaire

As shown in Appendix C, the ultimate version of the questionnaire comprises 2 parts (Parts A and B); each of which contains 4 sections. The questionnaire was structured to embrace questions for investigating both qualitative and quantitative issues. For the ease of asking questions and recording and analysing the response (Bryman & Bell, 2003), closed questions with definite options were generally used for both the qualitative and quantitative contexts.

Nonetheless, an option of "others" and/or a blank was provided in most of the questions to allow the respondents to indicate answers not covered by the forced-choices and to freely express their opinions, enabling flexibility for exploration of questions in depth (Bryman & Bell, 2003; Ritchie & Lewis, 2003). In addition to asking the preset questions, the interviewer recorded the characteristics of the visited buildings and asked the interviewees to describe the level of user demand and quality of the O&M services provided for the buildings.

In Part A, the questions set in the first and the second sections enquired into the age, academic and professional qualifications, work nature, level and experience of the interviewee, and the business nature of the company in which the interviewee was working. Its third section asked for information about the building under investigation, including its gross floor areas, age, ownership(s), capacities of building services installations, O&M trades which were outsourced, in-house O&M costs (number, grade, salary and time spent of staff involved), electricity costs and building incomes (rental rates and management and air-conditioning fees). The last section in this part included questions to solicit the O&M practices such as the means for communicating O&M information and tracking O&M activities, the sharing of productivity data among the stakeholders and any deferred maintenance backlog.

The first section of Part B asked about the trade of the contract work, the property covered by the contract and the contract period. The subsequent sections aimed to investigate into the three main facets of outsourcing for O&M work. The "economic" section inquired into the contract sum, any contingency sum, outsourced O&M costs (number, grade, salary and time spent of personnel involved), O&M budgets, budgeting period, frequency of budget review, contract concepts and pricing structures, tendering methods, and the practitioners' perceived importance of the economic attributes contributing to the success of the contract.

The ensuing "management" section contained questions on the contract management structure; type of service provision; the level of communication between the O&M parties; frequency, duration of performance review meetings and the meeting representatives; frequency of customer satisfaction survey; level of satisfaction with the service quality; frequency, duration of O&M audit and the representatives involved; type of contractual relationship achieved; the interviewees' opinion on the optimum mix between in-house and outsourced resources and; their perceived importance of the management attributes to a successful contract.

The final section in Part B is about "contractual" issues. It questioned on the form of contract being used; areas and contract clauses where disputes arose; factors associated with the specification for statutory O&M requirements; severity of disputes in terms of time, cost and quality; consistency of common practice in contract interpretation; and the importance of contractual attributes perceived by the interviewees. The last question asked the interviewees to indicate the level of success of the contract they handled.

5.7.4 The Questionnaire Interviews

Piloting can ensure the questionnaire functions well as a whole and provide the interviewer with some experience of using it (Bryman & Bell, 2003). Three of the target interviewees, each from the groups of "building owner", "building management company" and "O&M contractor", were invited to participate in the pilot interviews which lasted for around 2 hours each with an intermediate 10-minute break. The pilot interviewees were encouraged to freely suggest their views and opinions about the questions. The suggestions so obtained helped not only generate appropriate fixed-choice answers but also formulate penetrating questions for further investigation (Welman, 2001; Bryman & Bell, 2003). The feedback and experience obtained from the pilots were taken to refine the questionnaire for use in the subsequent full-scale interviews.

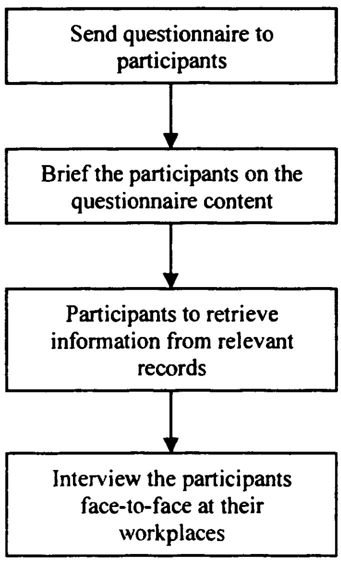


Figure 5.3 Sequence of the questionnaire interviews

Since the information sought was voluminous, the questionnaire was sent to each interviewee before the interview, followed by a phone call to brief the content, to allow interviewees time to retrieve the required information. To enable convenient retrieval of information from document records, the interviews, each lasted for around 1.5 hours, were conducted at the workplace of the interviewees; during which an interim 5-minute break was allowed in order to avoid fatiguing the interviewee. The interviews were conducted individually to help obtain true and accurate data, although the anonymity of the participants was sacrificed (Welman, 2001; Sekeran, 2003).

Figure 5.3 summarizes the general sequence for carrying out the questionnaire interviews. All the briefings and interviews were conducted solely by the author. This ensures consistency of explaining the questions, interpreting and recording the responses.

5.7.5 Difficulties Encountered during the Questionnaire Interviews

Notwithstanding the arrangements made, the survey work still encountered the following difficulties:

1. Although most of the interviewees, especially those at top management or managerial level, did not hesitate to disclose the salary of their subordinates, some of them demurred to disclose their own salaries. A few interviewees at managerial level were also unsure about the salaries of their superiors. In such cases, the interviewees were asked to indicate just approximate figures.

truth and completeness of the given information, they were asked to provide contract cost data for one system only – the air-conditioning system. Although this choice restricted the cost analysis to the air-conditioning O&M cost, it was made because among commercial buildings in Hong Kong, the air-conditioning system is typically the most cost-intensive when energy cost is taken into account.

3. Obtaining data about resources input for O&M work was difficult. The data needed include the time that different ranks of in-house staff spent on execution of O&M work and, where applicable, on managing and supervising outsourced O&M work. Even though the latter can be hard to quantify, it should not be simply ignored (Prager, 1994; Quinn & Hilmer, 1994). To make it easier for the interviewees to provide the needed information, they were asked to quantify the time spent in terms of full-time equivalents (FTE – the fraction of the overall work hours dedicated to the relevant O&M work). Even so, the interviewees still found it difficult to provide accurate estimates because many of them were handling O&M work of multiple trades (e.g. air-conditioning, electrical, fire services, etc.) and some also for multiple buildings but no records of the time spent were kept. Some were also uncertain about the FTEs of their colleagues. Nonetheless, the interviewees were helpful enough to patiently assess the FTEs of their own and their subordinates, as well as to enquire about those of their seniors.

4. Nine of the interviewees could not provide rental information for their buildings because the information was in the custody of the leasing department of the property companies. Fortunately, it was possible to obtain the missing data later from an alternative source: a real estate agency.

5. Many interviewees had spent considerable time to gather together the requested information, especially the monthly electricity cost data, which might need to be obtained from another department (e.g. the accounting department). In many cases, at the conclusion of the interviews, the data obtained remained largely incomplete. Missing data had to be solicited subsequently, through several follow-up contacts.

6. Although provision of sub-meters for recording separately the energy use of different systems in a building is regarded as essential (e.g. CIBSE, 1999; HK-BEAM, 2004), some of the surveyed buildings had only a single energy meter for all the landlord services (Figure 5.4). In a few cases, although there were sub-meters, individual meters covered the energy use of a mix of systems (Figure 5.5). These made it difficult to single out the air-conditioning energy use (the dominant energy end-use and the dominant variable load in commercial buildings in Hong Kong) from those of other systems.

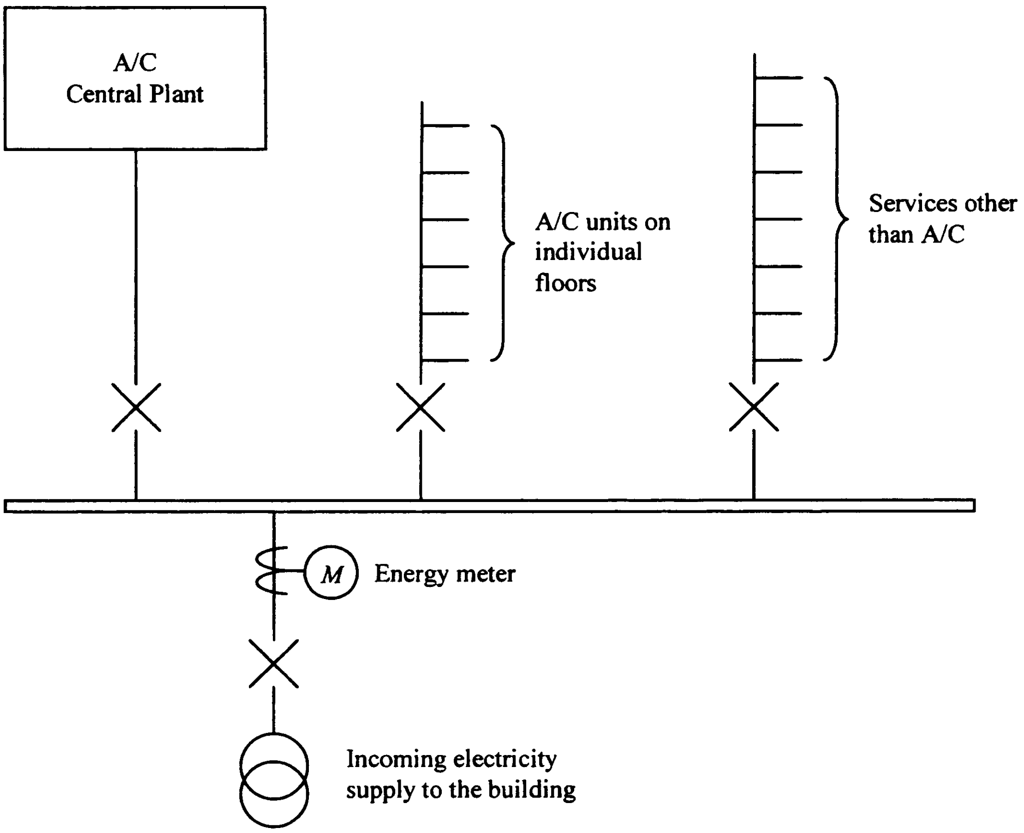


Figure 5.4 **Building using a single energy meter for all the landlord services**

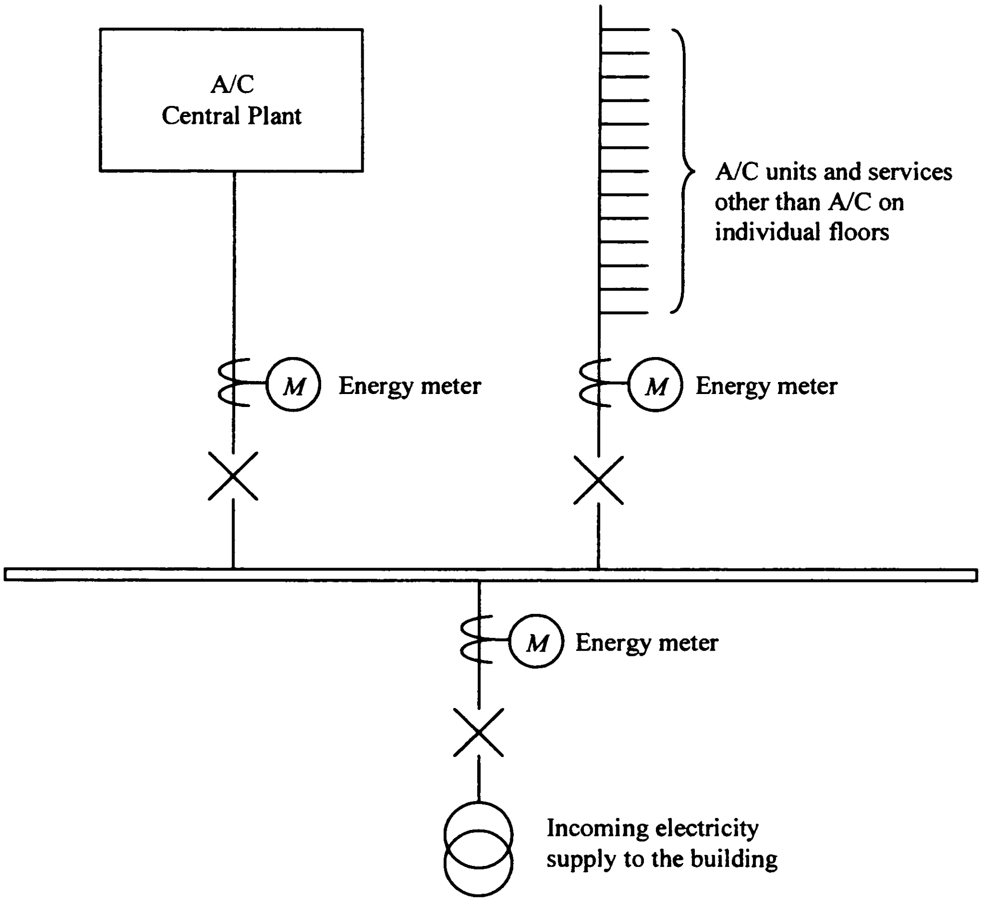


Figure 5.5 Building using sub-meters which cover a mixed use of energy

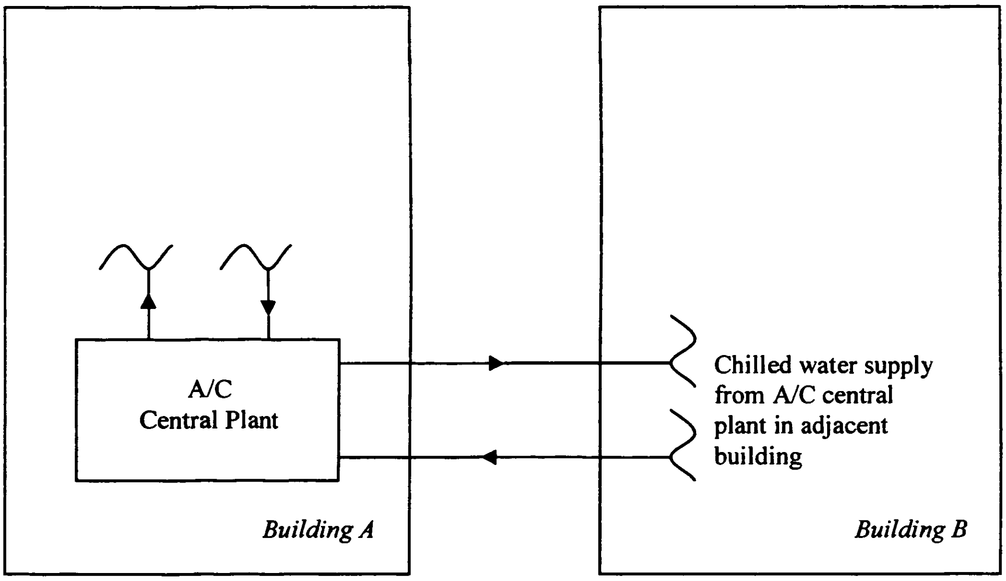


Figure 5.6 **Chilled water for building supplied from the central chiller plant of the composite development**

7. In a particular case where the central chiller plant served all the buildings in a composite development, the interviewee could not provide the air-conditioning electricity use of his building (Building B in Figure 5.6) due to the lack of data about its share of the total chilled water supply.

8. Two interviewees declined to provide electricity consumption data for their buildings. The common reasons for refusal to such requests include: higher than normal energy use figures may imply deficiency of the staff in up-keeping energy efficiency of the buildings; and it may give rise to complaints if the air-conditioning fees are found to be disproportionate to the costs.

9. In addition to sharing their experience and opinions, the practitioners were requested to provide copy of relevant contracts for reference. However, worrying that this may divulge the confidential information in the contracts, most of them refrained from providing contract details. Fortunately, a few of them were kind enough to provide selected sections of the contracts for inspection.

5.7.6 Demography of Response

Altogether 28 interviews were conducted based on the information of 26 outsourced O&M contracts pertaining to 21 commercial buildings. While every effort was made to collect the data, for one reason or another not all the interviewees were able to provide the required information. Table 5.2 displays a summary of the information included in the analyses in Stage II of the survey. The demography of the data for each section of the management, contractual and economic considerations is detailed in corresponding chapters that follow.

Table 5.2 Summary of information included in the analyses in Stage II

Section of study	Information included in the analyses		
	No. of buildings	Building types	No. of O&M contracts
Management issues (Chapter 7)	20 buildings	6 office, 13 office-retail, 1 hotel	26 O&M contracts
Contractual issues (Chapter 8)	20 buildings	6 office, 13-office-retail, 1 hotel	26 O&M contracts
Economic issues (Chapter 9)	17 buildings	5 office, 11 office-retail, 1 retail	17 air-conditioning O&M contracts

5.8 Chapter Summary

The rationales behind the research strategy selected according to the nature and purpose of the study have been explained. The study was on the basis of cross-sectional rather than longitudinal. It aimed to study the correlations among the interweaving factors associated with outsourcing. A two-stage questionnaire was used for the study. The questionnaire survey in the first stage intended to preliminarily enquire into the problems with outsourcing for O&M work. Targeted on the purposively sampled practitioners, the interviews in the second stage purported to probe into the critical management, economics and contractual considerations for O&M outsourcing. The problems encountered in collecting the data and hence their limitations have also been explained.

Chapter 6

DISPUTES ON OUTSOURCED O&M CONTRACTS

6.1 Introduction

Before probing into the considerations which are crucial to making an outsourcing decision for building O&M work, it was decided to conduct a questionnaire survey (Stage I) to test if there are any problems with the O&M contracts in practice. Rather than touching on a wide range of issues at this initial stage, the survey centered on two commonly used contract terms, namely "fair wear and tear" and "vandalism", to investigate whether they give rise to problems with defining the contractual responsibilities and thus any disputes between the contracting parties.

The design of the questionnaire has been elaborated in Chapter 5. This chapter reports the demography of the samples and analyzes the response in respect of the questions about the common contract terms. The chapter also discusses the common causes for disputes arising from different perceptions of work scope by the contracting parties, before giving some recommendations on how the disputes can be avoided.

6.2 The Surveyed Sample

The questionnaire survey was conducted from April to May 2003. The target respondents were O&M practitioners at strategic level (e.g. directors, heads of department), managerial level (e.g. senior manager, manager) and supervisory level (e.g. assistant mangers, supervisors, officers). Copies of the questionnaire were distributed to the target respondents and a total of 55 returns were obtained.

The first group of maintenance practitioners invited to participate in the survey were acquaintances of the author. They were then requested to invite their companions or colleagues who were also maintenance practitioners to participate. This method of data collection can ensure the response rate will be high and quality information will be obtained, as only the right persons will be invited to respond, but at the sacrifice of anonymity of the respondents (Sekaran, 2003). Through this method, 38 returns were collected, with only one of the returned questionnaires discarded due to incomplete answers.

The second group of respondents were from the audience of a seminar who were invited to participate in the questionnaire survey on voluntary basis. The seminar, entitled "Building services maintenance: Statutory requirements and best practice", was presented by the author in May 2003. It was targeted at maintenance practitioners and the content had no direct relationship with this part of the study. The other 18 completed questionnaires were collected through this method.

The distributions of the respondents' age, academic and professional qualifications and years of relevant experience were as summarised in Table 6.1. Among the 55 respondents, 21 were qualified professionals, such as Registered Professional Engineers, Chartered Engineers, Chartered Surveyors, Authorised Persons or corporate members of HKIE, CIBSE, IMechE or IEE.[1]

Table 6.1 Age, qualifications and work experience of respondents

Age		Academic qualifications		Professional qualifications		Relevant work experience	
<31	22%	Postgraduate	29%	Professional	38%	<6 years	27%
31-40	40%	Degree	36%	Non-professional	62%	6-15 years	42%
41-50	31%	Sub-degree	35%			>15 years	31%
>50	7%						

Statistics of the respondents' positions at work were: 16% at strategic level; 27% at managerial level; and 57% at supervisory level. The major group of respondents (42%) had practised in the field for 6 to 15 years; 31% were highly experienced practitioners, having been in the field for more than 15 years; and 27% of them had less than 6 years of experience.

[1] These are abbreviation of professional institutions, including HKIE: The Hong Kong Institution of Engineers; CIBSE: Chartered Institution of Building Services Engineers, UK; IMechE: Institution of Mechanical Engineers, UK; and IEE: The Institute of Electrical Engineers, UK.

6.3 Fair Wear and Tear

In spite of its frequent appearance in maintenance contracts, a precise definition for the term "fair wear and tear", also referred to as "normal wear and tear", can hardly be found in the literature; not even in the well-known BS 3811:1993 – glossary of maintenance management terms (BSI, 1993). The Oxford Advanced Learner's Dictionary of Current English (Hornby, 1987) explains "wear and tear" as: "*Damage, loss in value, from normal use*". The Oxford Dictionary of Law (Martin, 1997) uses the term to demarcate responsibilities of tenants: "*... a tenant is not obliged to repair fair (reasonable) wear and tear occurring during his tenancy, he must nevertheless do any repairs to prevent consequential damage resulting from the original wear and tear ...*". However, in the context of maintenance contracts, this meaning is irrelevant because, unlike the tenant, the contractor is not the user of the premises who caused the wear and tear.

42% of the respondents confirmed that they, when working as agents of building owners, had specified or seen specifications in contracts that required the maintenance contractors to be responsible for maintenance work arising from "fair wear and tear" at no extra costs to the owner. Even more respondents (64%), when engaged in maintenance contract work, had encountered maintenance contracts that contain such a requirement.

The majority of the respondents (77%) considered themselves to be clear about the meaning of "fair wear and tear" in maintenance contracts. However, 64% of this majority had experienced disputes over the implications of this term to the responsibilities of contractors. Besides, most of them acquainted with the meaning from "common trade practice" (Table 6.2), which means anecdotal. With the respondents grouped according to different attributes – academic qualifications, professional qualifications and maintenance work experience, the answer patterns remain very similar: the majority learned the meaning of "fair wear and tear" from common trade practice, followed by their own perception (thinking or understanding of the term according to the respondents' own believes or interpretations) and then literature. This indicates that significant correlations among the attributes exist.

For testing the consistency of the respondents' understanding of the term, they were asked to indicate, for each of the common defects in building services installations presented to them in the questionnaire, if they regarded the defect as arisen from "fair wear and tear". Table 6.3 summarises the intriguing result.

Table 6.2 **Source from which the meaning of "fair wear and tear" was learnt**

Source	Academic qualifications			Professional qualifications		Maintenance experience		
	Sub-degree	Degree	Post-graduate	Non-professional	Professional	<6 years	6-15 years	>15 years
Literature	3	2	3	4	5	1	4	4
Common trade practice	**15**	**12**	**7**	**25**	**9**	**9**	**14**	**12**
Own perception	5	6	6	12	7	6	7	6
Not sure	0	0	1	0	1	0	1	0
Others	2	2	1	1	4	1	1	3

* *Figures in table represent the number of counts. Bold figures indicate the modes.*

Table 6.3 **Vote counts of defects regarded as results of "fair wear and tear"**

Trade	Defect	Count
Electrical	A light bulb is burnt	42
Plumbing/drainage	A pipe hanger is loosened	13
Fire services	A closed hose reel nozzle is leaking water	16
HVAC	A pump bearing is damaged	27
Lift	A lift car call button is defaced	19
Security	The lens of a CCTV camera gives unclear image	15
-	Not sure	0
-	None of the above	3

Except the first option (i.e. "A light bulb is burnt") which received a high degree of consensus, all the other options recorded a significant and comparable number of agreeing counts. This indicates large variance in the interpretation of the meaning of "fair wear and tear", notwithstanding that all the listed defects take place frequently in buildings under "normal" use. Although the unit costs for the associated repair or replacement work might be small, they may add up to a significant amount if the same recurs frequently over a long contract period or where a contract covers an extensive building or estate.

Six out of ten of the respondents indicated they had experienced arguments/disputes over the meaning of "fair wear and tear". This reveals a common problem that maintenance practitioners have been facing. As shown in Figure 6.1, the percentages of respondents who had encountered such disputes increase with both the level of their work positions (supervisory level: 55%; managerial level: 66%; strategic level: 67%) and their period of work experience in maintenance (<6 years: 40%; 6-15 years: 57%; >15 years: 71%). A possible explanation for this observation is that the disputes involved contractual and legal considerations and thus required experienced maintenance practitioners or senior staff at strategic level to handle.

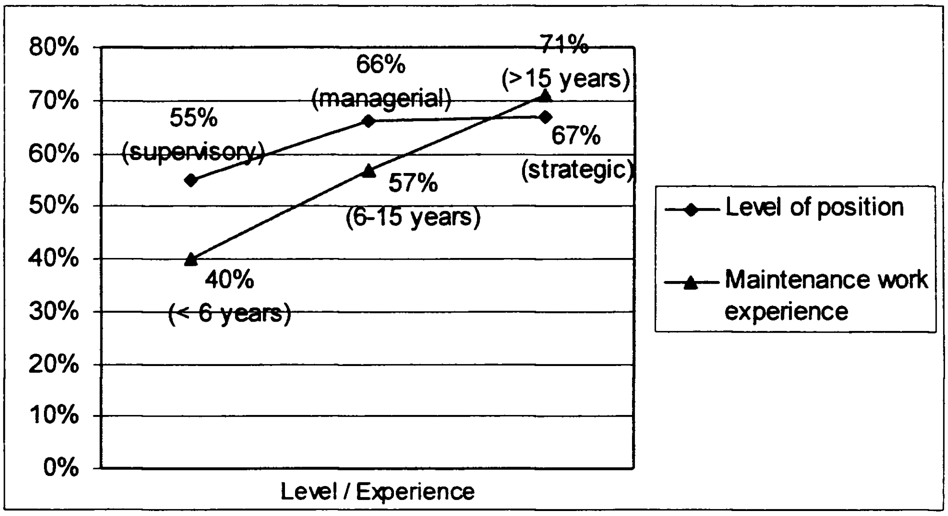


Figure 6.1 **Percentage of respondents encountered disputes arising from divergence in interpretation of "fair wear and tear"**

Concurring with the expectation of Smith (1992), the respondents indicated that most of the arguments/disputes they encountered were settled through negotiations in meetings. However, two respondents reported that they had come across with cases that had to be settled finally by mediation or arbitration. In Hong Kong, there are, so far, no records of dispute cases that are related specifically to building services maintenance contracts but the number of dispute cases under the category of construction that had been referred to the Hong Kong International Arbitration Centre increased from 5 in 1985 to 90 in 2002 (HKIAC, 2003). Although there is apparently a rising trend in the number of construction-related dispute cases, no cases had to be resolved through litigation. It is probable that the cost implications of the work under dispute were generally not high enough to justify the costly legal proceedings.

Although the financial impacts of the repair or replacement work might be tolerable, the side effects in the realm of service quality may not be. The responses to the last-but-one question in this part of the survey reveal that 88% of the disputes upheld work until the disputes were settled, or when an instruction from the respondents' superior was given (which does not necessarily mean the disputes had already been settled, as the contractor could agree to resume work but would reserve the right to claim for variations later), whilst some had led to work suspension (Table 6.4).

Table 6.4 Consequence of the maintenance work resulting from the disputes

Consequence	**Fair wear and tear** (Count)	**Vandalism** (Count)
Work not proceeded at all	1	0
Work upheld until an instruction from the superior	9	4
Work upheld until the dispute was settled	23	14
Not sure	1	0
Others	3	0

Furthermore, only 5 out of the 33 respondents indicated that the disputes they encountered did not incur any extra payment or delay in work completion; the rest expressed that the consequences involved extra payments to contractors, delays in work completion or complaints from building occupants, singly and in combination (Table 6.5).

Table 6.5 Overall effect on the maintenance work resulting from the disputes

Consequence	**Fair wear and tear** (Count)	**Vandalism** (Count)
Extra costs payable to the contractor	12	9
No extra costs incurred	5	2
Work completion delayed	16	10
No delay in work completion	4	1
Complaints from the users	11	6
Not sure	1	0
Others	3	1

6.4 Vandalism

A definition for "vandalism" is also unavailable in BS 3811:1993 (BSI, 1993). The Oxford Advanced Learner's Dictionary of Current English explains "vandalism" as the behavioural characteristic of vandals – persons who wilfully destroy works of art of public and private property, spoils the beauties of nature, etc. (Hornby, 1987). A similar explanation for "vandalism" is given in Mills (1994). Note that this definition excludes any damage caused by unintentional acts. In the Oxford Dictionary of Law (Martin, 1997), the meaning of "vandalism" is given as: "*Defacing or damaging property. There is no offence of vandalism as such, but it will usually constitute an offence of criminal damage*".

Compared with "fair wear and tear", use of the term "vandalism" in maintenance contracts was found to be less common; only 13% of the respondents (when working as the owner's agent) were involved in specifying the condition of requiring the contractor, without extra costs to the owner, to be responsible for maintenance work arising from "vandalism". However, more (31%, when undertaking the role of a contractor or a contract administrator) had encountered maintenance contracts that contained such conditions.

The percentage of the respondents (80%) who expressed that they were clear about the meaning of "vandalism" in maintenance contracts is comparable to the percentage (77%) in the case of "fair wear and tear". In distinguishing the maintenance responsibilities, the percentage of respondents who opined that they were clear about the meaning of "vandalism" while having encountered disputes on the meaning was 32%, which is about half that in the case of "fair wear and tear".

Similar to "fair wear and tear", the majority indicated that they learned about the meaning of "vandalism" from common trade practice (Table 6.6). However, in lieu of "own perception", the option "literature" had the second highest number of counts.

Table 6.6 Source from which the meaning of "vandalism" was learnt

Source	Academic qualifications			Professional qualifications		Maintenance experience		
	Sub-degree	Degree	Postgraduate	Non-professional	Professional	<6 years	6-15 years	>15 years
Literature	8	6	3	11	7	5	8	5
Common trade practice	**9**	**14**	**9**	**18**	**14**	**6**	**14**	**12**
Own perception	5	4	6	11	4	5	6	4
Not sure	0	0	1	0	1	0	1	0
Others	2	0	1	1	2	1	0	2

** Figures in table represent the number of count. Bold figures indicate the modes.*

To test the congruency in the interpretation of the meaning of "vandalism", in a list of cases that involved an external lighting luminaire being damaged, which is a common defect in buildings, the respondents were asked to indicate if they considered each of the cases a result of "vandalism". The interpretations of the damage vary considerably (Table 6.7).

Table 6.7 Vote counts of defects regarded as consequence of "vandalism"

Option	Defect	Count
a	An external lighting luminaire on the road side is damaged as a result of being struck a truck	15
b	An external lighting luminaire on a playground is damaged as a result of being struck by a basketball	18
c	An external lighting luminaire is damaged as a result of being broken by a thieve who steals the light bulb inside	43
d	An external lighting luminaire is damaged as a result of being hit by a falling object	12
e	Not sure	2
f	None of the above	2

The kind of wilful destruction described by option "c" in Table 6.7 is an example of vandalism, which can be avoided if security control is adequate and appropriate. A maintenance contractor is normally not required to provide security control service. However, it is increasingly common that packaged facilities management contracts embrace not only engineering maintenance service, but also property management services of which security control is a part. In the latter kind of contract, it would be reasonable to require the contractor to be responsible for damages arising from vandalism. On the contrary, if the same is required in a maintenance contract which does not cover security control while a separate security service contract is made between the employer and a third party, the maintenance contractor should not be responsible by virtue of the doctrine of privity under contract law.

On the other hand, options "a", "b" and "d" should not be regarded as damages resulting from vandalism unless it can be proved that the damage caused by the collision by a truck, the collision by a basketball or the object fallen from height was originated from intentional acts. In general, compensation for funding the required rectification work should be available if a proper Property-All-Risks Insurance with appropriate terms and coverage is secured by the building management (HAD, 1999).

In demarcating the maintenance responsibilities, almost 30% of the respondents had encountered arguments/disputes on the meaning of "vandalism". Numerically, the problem is half that of the situation in "fair wear and tear". Nonetheless, this does not imply that the severity of individual disputes or the aggregate effect of cases is one half. The overall effect would depend on the extent of the implications associated with the disputes.

Distinct from the case of "fair wear and tear", there is no consistent relation between the percentage of respondents who had experienced disputes with their work positions (supervisory level: 26%; managerial level: 20%; strategic level: 56%) and their years of work experience in maintenance (<6 years: 27%; 6-15 years: 30%; >15 years: 29%). This may be ascribed to the fact that the number of respondents who had come across with such disputes was not large enough to unveil a notable pattern. Out of the 16 respondents who had encountered disputes in this relation, 15 pointed out that the disputes were settled through discussion in meetings; no cases of dispute had to be resolved by way of litigation, arbitration or mediation.

In all the dispute cases, work were upheld either until they were settled (14 counts out of 16 respondents) or an instruction from the respondents' supervisor was given (4 counts out of 16 respondents) (see Table 6.4). Resulting from the disputes, only two respondents indicated that no extra payment were incurred for resolving the disputes and one respondent expressed that there was/were case(s) where no delay in work completion had been incurred. On the contrary, as shown in Table 6.5, there are relatively high counts for cases that required extra payment to the contractor (9); caused delay in work completion (10); and gave rise to complaints from building occupants (6). These results highlight the adverse effect that can result from disputes originating from differences in the interpretation of the meaning of "vandalism" in contracts.

6.5 Perceived Work Scopes and Disputes

A contract is formed when two rational parties believe that there are gains from the trade by either party, as a result of their differences in belief, preferences and/or comparative advantages (McMillan, 1992). The contracting parties make such decision based on the information they have at the time of the transaction while the contract terms and conditions are vital.

In the law of contract, custom may be used in case where a particular word or phrase used in a particular trade does not accord with its obvious meaning (*Smith v Wilson (1832)*). But, in the absence of unified interpretation of certain contract terms such as "fair wear and tear" and "vandalism" in the literature, most maintenance practitioners regard their understanding as what is implied by "common trade practice" (see Tables 6.2 and 6.6) which in fact varies considerably (see Tables 6.3 and 6.7) and can have impacts on the scope of work perceived by the employer and the contractor, as depicted in Figure 6.2.

Ideally, work scope perceived by the employer (S_E) coincides perfectly with that perceived by the contractor (S_C). Practically, such a perfect match does not exist, as no contract is complete for it is impossible to specify every detail nor to include all contingencies; only some extent of consensus (S_O) in the perceived work scope would appear. A rational contractor should be willing to do what he perceived to be his scope (S_C).

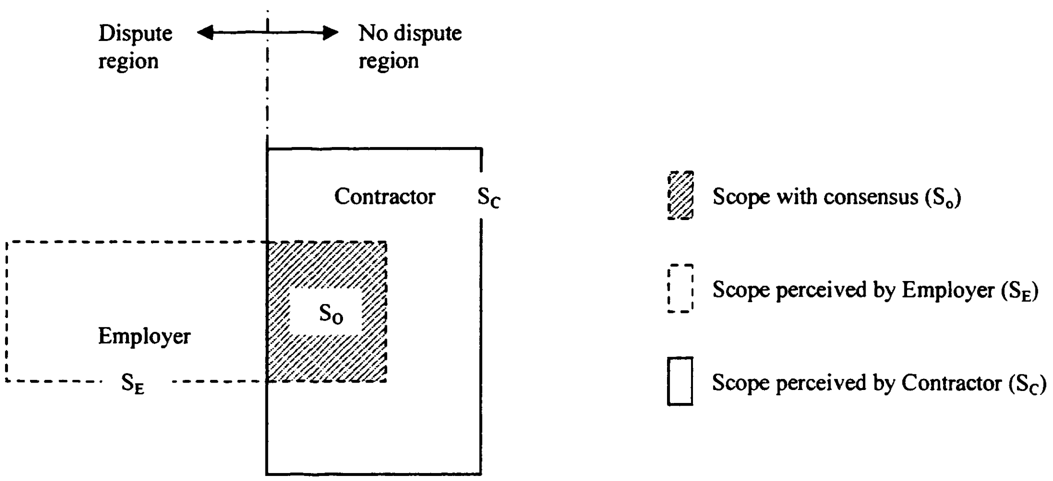


Figure 6.2 Consensus and differences in perceived work scopes

Disputes over the scope of work would arise when that perceived by the employer (S_E) does not overlap with that by the contractor (S_C). Nevertheless, it does not mean that any such disputes would incur financial losses to the contractor. There can still be profit to the contractor as long as the resources that the contractor was prepared to spend to deliver S_C exceeds that required for undertaking S_E. Arguments and uncooperative actions, in the form of work suspension or lowered service/work quality, often arise because contractors always strive to maximise their profit. Contractors would be cautious about consenting to shoulder any work beyond his perceived scope, especially when this would set precedence making him responsible for any similar incidents that may occur throughout the contract period and thus, the associated costs may accumulate to intolerable level.

Enlarging the overlapping region of the perceived scopes (S_O) would reduce the occurrence of disputes. Diagrammatically, this can be achieved by either minimizing S_E or maximising S_C. The former choice is unrealistic unless the employer engages other contractors or requires in-house workers to carry out the outstanding scope of work. The latter option is feasible but would inevitably result in an elevated contract price as the contractor is required to be responsible for a wider work scope. An optimised solution is to transform S_C to become S_E and the key to this is bilateral communications of perceptions with the will to make the contract terms and conditions crystal clear to both parties.

6.6 Clearing the Knots

Vague contract terms create knots that hinder smooth execution of contracts. Terms like "fair wear and tear" and "vandalism" may be regarded as of minor importance, but may turn out to be the opposite, which would ruin contractual relations between the contracting parties. Building owners use these terms in maintenance contracts to free themselves from having to deal with numerous small items of maintenance work and from the uncertainties in the cost that such work would incur. In lieu of unilaterally averting the risk of expending beyond budget due to unexpected amount of defects arising from "fair wear and tear" and "vandalism", building owners should communicate clearly and openly with the contractors during contract negotiation (Deckelman, 1998).

As discussed earlier, the meaning of "vandalism" can be made clear relatively easily, and the contractor should not be responsible for defects due to this cause unless the contract embraces provision of security service for preventing wilful destructions. Nanayakkara (2003) recommends introducing model exclusions in comprehensive-type maintenance contracts, paving a way for remunerating contractors for undertaking work arising from unknowns and uncertainties.

For defects arising from "fair wear and tear", a scrupulous approach is needed. In addition to seeking appropriate legal advice, consulting experienced professional practitioners in drafting maintenance contracts is beneficial. Maintenance supervisors and operatives familiar with the existing installations should have first-hand knowledge about past occurrence patterns of defects and should be asked to make such information available. This will provide a reference for defining the scope of work and such information may form part of the tender document, minimizing discrepancies between the scopes of work perceived by the employer and the contractor.

Even if comprehensive and accurate past records are available, it is always possible to have undefined and unexpected amount of defects arising during the contract period, which fall outside the scope that the contractor perceived. For new installations, such information will be unavailable. Under such circumstances, it should be fair and reasonable to measure the extra work and reimburse the contractor the associated cost. The risk may also be shared by negotiating for a lower than normal unit rate for quantifying the amount to be paid by the client for any work exceeding the initial estimate, which will also be used to determine the amount of claw back in case the actual work undertaken is less than the estimate. This arrangement also provides incentives to the contractor to perform better to minimize wear and tear.

6.7 Chapter Summary

The survey results have unveiled the widespread discrepancies in interpretation of the terms "fair wear and tear" and "vandalism" in maintenance contracts, which have led to disputes over the implied scope of work of the contracting parties. It points to a lack of standard knowledge in maintenance management and to the casual tradition of forming contracts, which could save time and costs for contracts formation but would present irregularities or inadequacies that are causes of disputes. Although costly litigations may not be required, unnecessary transaction costs are often incurred from time-consuming arbitrations/discussions for reconciling the parties under dispute. It also defeats the prime purpose of economizing transaction costs (Williamson, 1979) through outsourcing maintenance contracts.

Avoiding disputes hinges not only on discarding vague contract terms, in order to allow the conditions to be properly enforced (*Scammel v Ouston (1941)*); but more importantly a mutual consensus on the perceived work scopes between the contracting parties. This necessitates communicating the contract requirements explicitly to the contractor. The customary way of using versatile but unenforceable contract clauses to cover latent or undefined work and the reliance on common trade practice in interpreting the conditions have become obsolete. If such practice is not improved, contractual disputes are doomed to arise and their implications on both contracting parties can be onerous, both financially and in terms of service quality.

Outsourcing building O&M work does not mean inviting the contractor to gamble with the employer over the uncertainties. Quality service will be delivered only if the contractor can work under a fair and reasonable contract arrangement, which requires clear definition of contractual responsibilities and means to deal with unexpected situations.

The results in this section have shown the existence of problematic contract terms in defining the contractual responsibilities in outsourced O&M contracts. The forthcoming chapters would further research into the management, contractual and economics issues in detail.

Chapter 7

MANAGING OUTSOURCED O&M WORK IN PRACTICE

7.1 Introduction

The Stage I questionnaire survey, with its findings reported in the foregoing chapter, has revealed that problems were commonly found with outsourced O&M contracts. On the other hand, few study findings have been available to tell the practices of executing O&M work such as how common they are outsourced and how they are managed. The appropriateness of these management practices and arrangements is crucial to the performance of the procured work.

As reviewed in Chapter 3, outsourcing for building O&M work has both merits and demerits. A particular mode of outsourcing may run perfectly well in one situation but fail in another. Management factors which influence the performance of the outsourced contracts include range, scale and complexity of O&M work, end user requirements and O&M service standards, competence of the contractor, coordination between the in-house team and the contractor, and the service culture etc. Drawn from the information collected through the in-depth face-to-face interviews (Stage II), this chapter presents the practices for managing outsourced O&M work for the surveyed commercial buildings, including the common scopes of outsourced O&M work, contract management structures, means for communicating O&M information and management tools used for contract monitoring. In addition to examining the importance of the management attributes which contribute to a successful contract, the chapter also tests the relative agreement of perceived importance of the attributes among different groups of practitioners.

7.2 Demography of the Samples

Since 6 of the 28 interviews in Stage II were with incomplete information for studying the management issues of this section, therefore only data collected from 22 interviews, which were based on 26 O&M contracts pertaining to 20 commercial buildings (6 'office'; 13 'office-retail' and 1 'hotel'), were included in this part of analysis. The majority of the interviewees were experienced practitioners, with around half working at managerial level or above. The aggregate gross floor areas (GFA) of the buildings are: 711,631m^2 (office); 122,588m^2 (retail); 23,098m^2 (hotel) and 67,039m^2 (car park). The age of the buildings ranged from 6 to 32 years; three wholly occupied by the landlord while the rest were variously occupied by the landlord, multiple-owners and tenants.

7.3 Execution of O&M Work

In spite of the traditional practice of undertaking building O&M work largely by in-house staff employed directly by the building owners, the increasing extent of outsourcing in recent years has given rise to the common use of a mix of in-house and outsourced resources for executing O&M work. Figure 7.1 shows a typical O&M work demarcation between the in-house team and the contractor, where overlapping and segregation of work scopes vary from organisation to organisation in which the staffing arrangement would be dependent on the O&M policy and strategy (Armstrong & Saville, 2005).

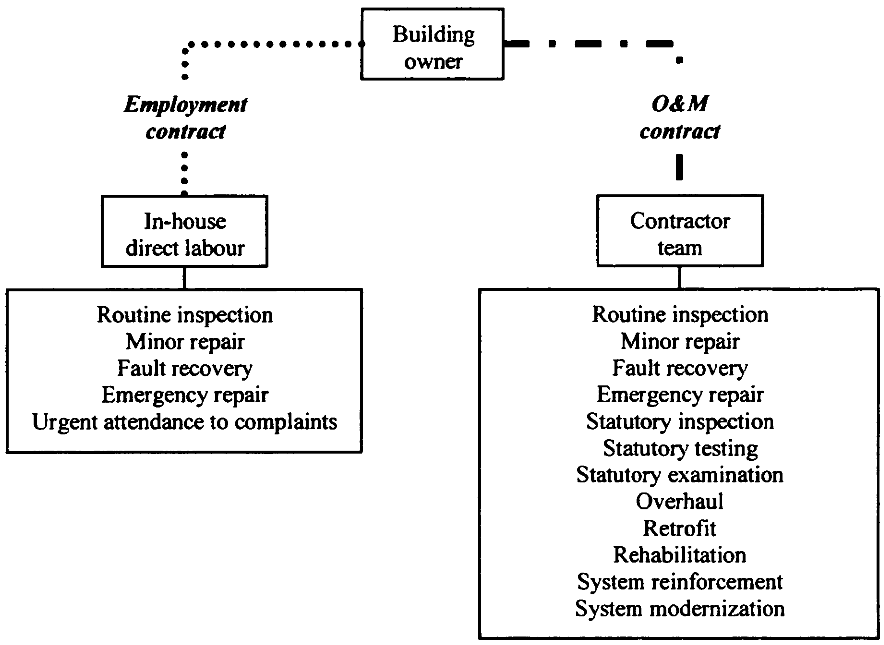


Figure 7.1 Typical demarcation of O&M work

Direct labour is particularly desired where security is of high priority or prompt recovery of breakdowns is required. Monitoring the work done by in-house direct labour is relatively straight-forward, as the employer can clutch an immediate and direct control over the workers. However, in case of work requiring specialist skills and knowledge or an extensive work demanding execution by temporary workforce within a short period, an outside contractor is usually engaged.

It has been advocated to pull together the facilities management industry to standardize contracting practice (Alexander, 1992). In practice, building owners generally outsource O&M work by appointing a managing agent who manages the owner's employees and individual service providers; a managing contractor who manages some or all service providers; or a total facilities management contractor who provides a turnkey support services package (Atkin & Brooks, 2000). In the surveyed commercial buildings, O&M work was often outsourced directly to contractors who are capable of carrying out specialist trades of building services works or, resourced to building management companies who provide turnkey facilities management services including cleaning, horticulture, maintenance and security etc. In the former case, a limited number of in-house O&M staff were required to administer the outsourced contract, supervising and monitoring the contractor's performance. Whereas in the latter scenario, O&M service was usually provided by the building management company who subcontracts the work to specialist contractors or, procured via the management company. In any case, a proper contract between the employer and the contractor needs to be properly managed.

Table 7.1 O&M work outsourced for the sample buildings

Services requiring O&M work	Outsourced	No. building(s) without the installation
Electrical	14	0
Generator	18	1
Air-conditioning	19	0
Building management system	12	4
Fire services	18	0
Lift and escalator	20	0
Plumbing and drainage	11	0
SMATV and CABD system	14	2
Security and access system	14	0
Boiler installation	2	16

Table 7.1 summarises the number of buildings in the sample with outsourced O&M work for various types of services installations, in whole or in part. Among these buildings the two highest counts are respectively for air-conditioning installations, which demand labour-intensive O&M work, and for lifts and escalators, which involve servicing and repair of proprietary components and need to be conducted in compliance with onerous statutory requirements (Lai & Yik, 2004).

7.4 Outsourcing Modes and Scopes

Two extremes of outsourcing modes and scopes for O&M work were observed: one Grade C office building with gross floor area (GFA) less than 3,000m^2 had all the preventive O&M works entirely carried out by in-house staff (but those required by legislations to be undertaken by competent or registered professionals were outsourced) whereas one Grade A office building with GFA exceeding 70,000 m^2 had outsourced all its O&M works (Figure 7.2).

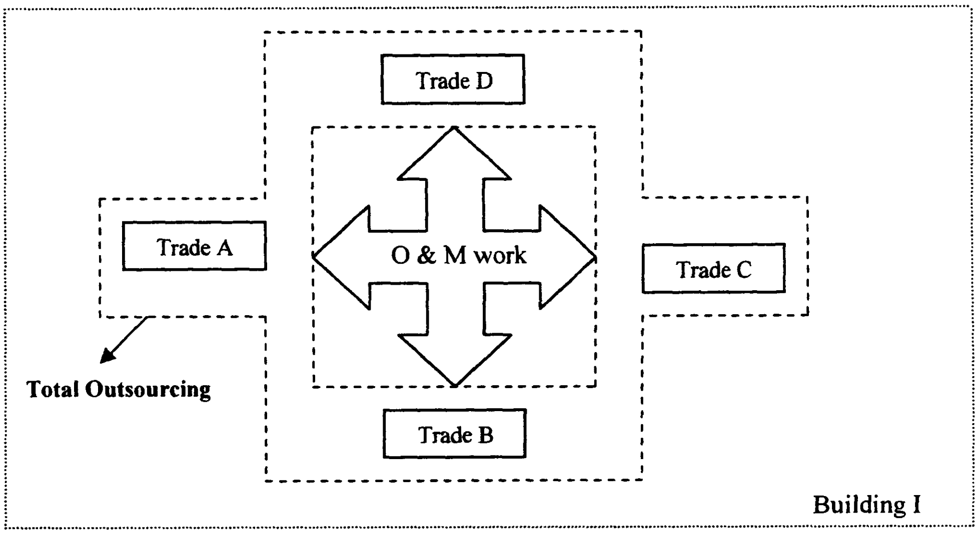


Figure 7.2 **Total outsourcing**

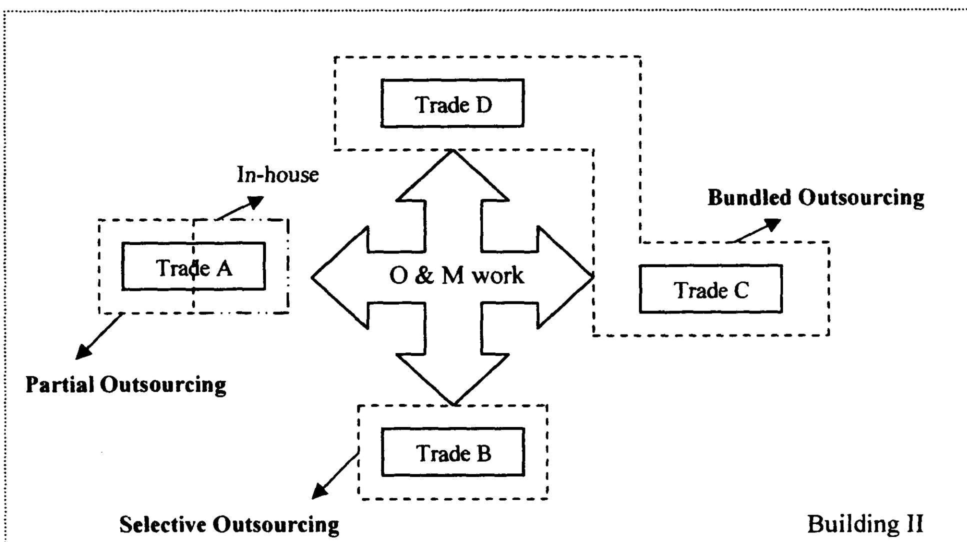


Figure 7.3 **Partial, selective and bundled outsourcing**

For the rest of the surveyed buildings, one or a combination of partial, selective and bundled outsourcing (Figure 7.3) was common. Most building owners outsourced the works that have to meet statutory requirements and works that demand large manpower or specialist skills leaving the in-house workforce with the non-statutory and less labour-intensive preventive works. Unlike among public-sector buildings where District Term Maintenance Contracts (HKHA, 2004a) are widely used, no cross-boundary outsourcing (Figure 7.4) was found in the sample. This may be ascribed to the fact that the surveyed private commercial buildings are either owned by single owners who possess a limited number of buildings, which makes economies of scale unavailable; or jointly owned by multiple-owners, which renders costly transactions for apportioning O&M expenses unjustifiable.

All the surveyed contracts made use of either "centralized" or "partially grouped" contract management structure where a manager looks after all or a mix of O&M trades. None of them adopted a "dispersed" management structure under which the contracts are managed by individual personnel (Atkin & Brooks, 2000). This implies that the sample contained no organizationally immature companies and the absence of cross-boundary outsourcing did not justify the existence of single-discipline contract managers.

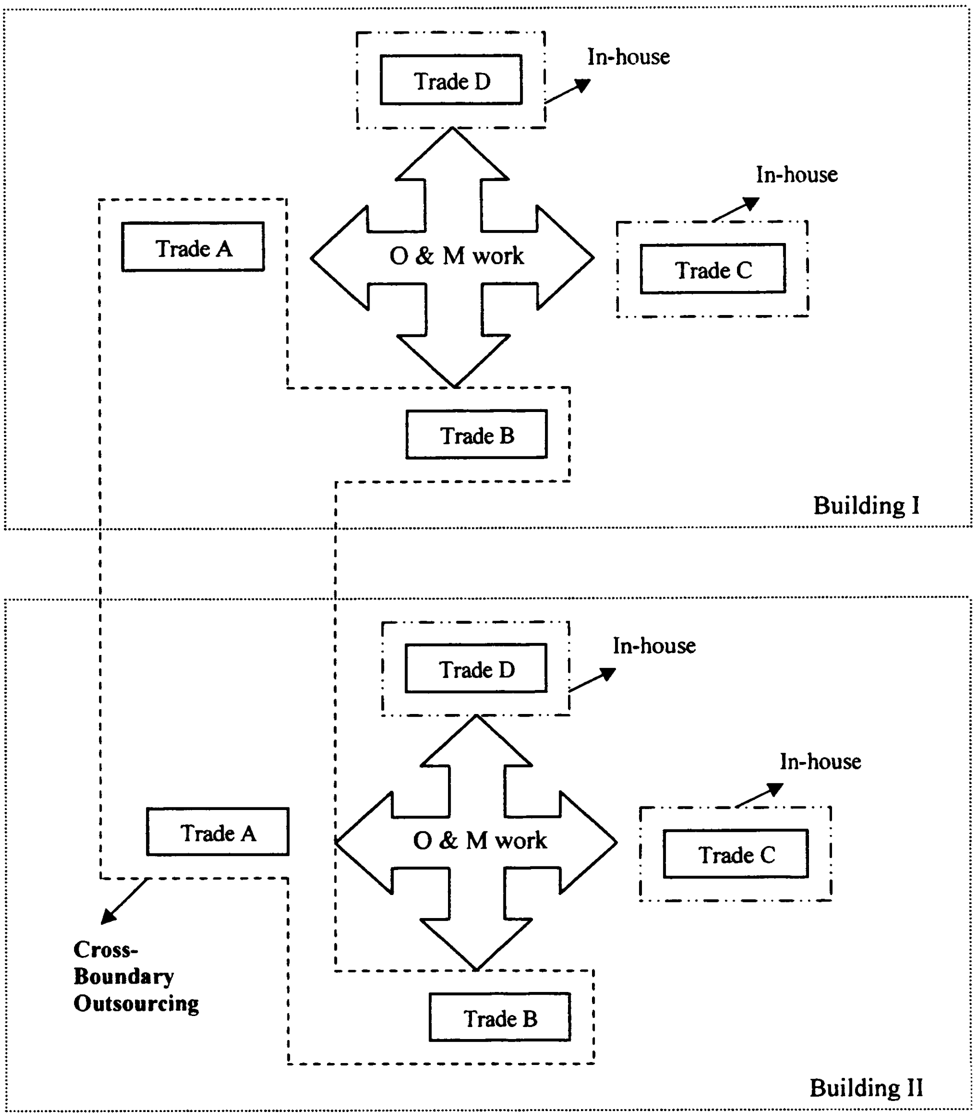


Figure 7.4 Cross-boundary outsourcing

In contrast with the total outsourcing modality where all the O&M works would be executed by a contractor and its subcontractors, building management service may be provided by engaging a *managing agent* who, being an external organization or individual, manages the client organisation's own employees (Atkin & Brooks, 2000). Although this latter arrangement is popular with some overseas government departments (Williams, 2002), it was not found in the sampled private commercial buildings. Except in the two extreme cases as mentioned above (i.e. either total in-house execution or total outsourcing), a *managing contractor* was commonly employed to manage a range of O&M trades via subcontracts. In addition, it was common that the managing contractor has to coordinate and monitor some specialist contractors' work (e.g. O&M for lifts and escalators, illustrated as Trade C in Figure 7.5) although there was no direct contractual relationship between them.

7.5 Communication of O&M Information

A pre-requisite of quality maintenance work is effective communication between the client and the O&M management team, and between this team and the workforce (Nanayakkara & Smith, 1997). Among 75 types of management skills and knowledge, 'communication' (oral or written) was ranked only second to 'leadership' in general construction, and was perceived by senior managers as the topmost important skill/knowledge in refurbishment work (Egbu, 1999). Generally, communication of O&M information can be identified at two interfaces of three strata. For instance, a request for maintenance may be raised by the building users to the O&M management team; who in turn would inform the O&M contractor to execute work if it lies within their scope, or otherwise command the in-house labour to do so.

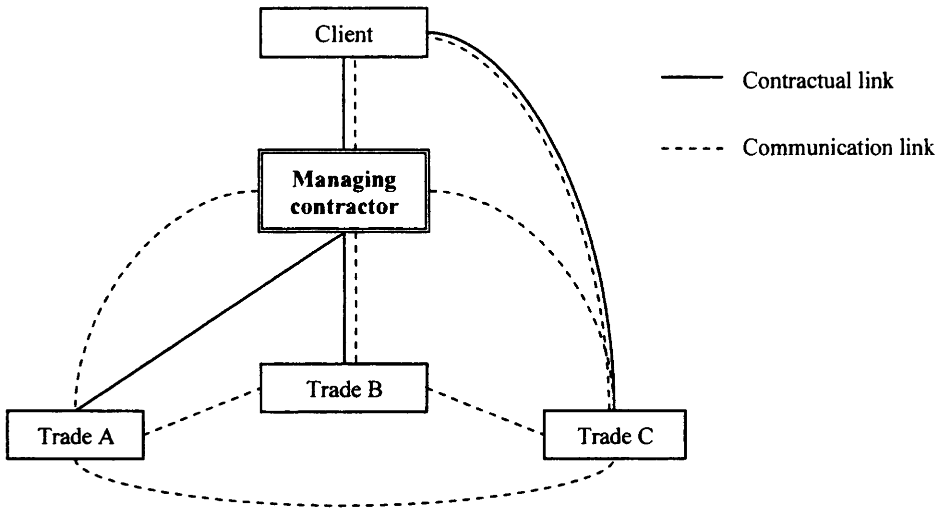


Figure 7.5 **Contractual and communication links in a management contract**

The practices of communicating O&M information correlate very well between the "User – Management" and "Management – Contractor" interfaces (Figure 7.6). Interestingly they are comparable to the benchmarks reported by IFMA (2001): "Fill out paper request" (38%); "Use a call center" (70%). However, it was less common in sending O&M request electronically (compared with 68% in IFMA (2001)) despite economical information technology has been available for some time.

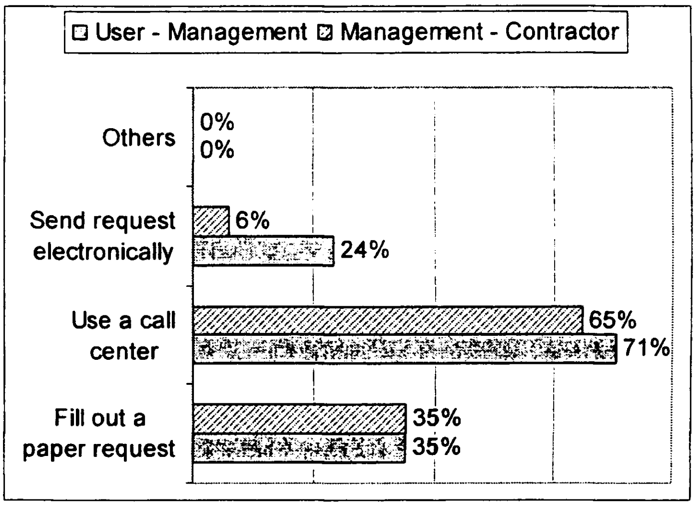


Figure 7.6 **Means for communicating O&M information**

Computerized maintenance management system (CMMS) can facilitate effective communication and tracking of O&M activities (Sullivan et al., 2002). In contrast with the common practice (64%) in North America (IFMA, 2001), only 24% of the surveyed companies made use of CMMS, notwithstanding that the most experienced user has already been using it for 14 years. The summary in Table 7.2 further categorizes the practices adopted by the companies for communicating O&M activities. Different from the practices revealed by IFMA (2001), it is evident that the O&M practitioners in Hong Kong relied heavily on 'manual-tracking', which may contribute significantly to the deferred maintenance backlogs experienced by 56% of the interviewees in the preceding 12 months.

Proper tracking of productivity data would allow effective assessment of O&M performance (Wireman, 1998) while sharing such data among members of the service production team is crucial to attaining total quality (Grigg, 1996). Similar to the IFMA's

(2001) findings, maintenance productivity data were seldom shared with the customers (18%) and contractors (24%). The limited extent of sharing, which was mainly among the senior management (41%) and managerial staff (53%) in addition to the staff who undertake the work (53%), shows a distinct difference from the practice common in manufacturing and process industries (e.g. Pintelon & Van Puyvelde, 1997; Arts, et al., 1998), although there has been an increasing concern in hospitality buildings in Hong Kong (e.g. Chan et al., 2001).

Table 7.2 Practices for communicating and tracking O&M activities

Activities	CMMS	Manually	Not tracked	Unknown
Repair work requests	24%	76%	0%	0%
Preventive work requests	18%	71%	6%	5%
Project work requests	12%	82%	0%	6%
Contractor work requests	12%	76%	6%	6%
Repair parts and supply costs	18%	76%	0%	6%
Maintenance tool records	12%	71%	12%	5%
Daily rounds activities	24%	71%	0%	5%
Building and equipment records	18%	76%	0%	6%
Periodic activity reports	6%	76%	6%	12%

The respondents were asked to rate on a Likert scale of 1 (very poor) to 5 (very good) separately for the management performance of the contracts; and the achieved communication in three different aspects, namely inter-communication between the O&M management team and the contractor, internal communication among the O&M management team members and that within the contractor team. To help ensure the consistencies of the collected opinions, the following representations of the Likert scale were explained to the interviewees to guide them rate their perceptions about the items being considered:

Likert scale	Representation
1	Very poor – item perceived as totally unacceptable.
2	The perception is in between Likert scale "1" and "3".
3	The perception is neutral (i.e. not good or poor).
4	The perception is in between Likert scale "3" and "5".
5	Very good – item perceived as the top of the class.

The results (Figure 7.7) demonstrate positive correlations between communication and management performance of contract.

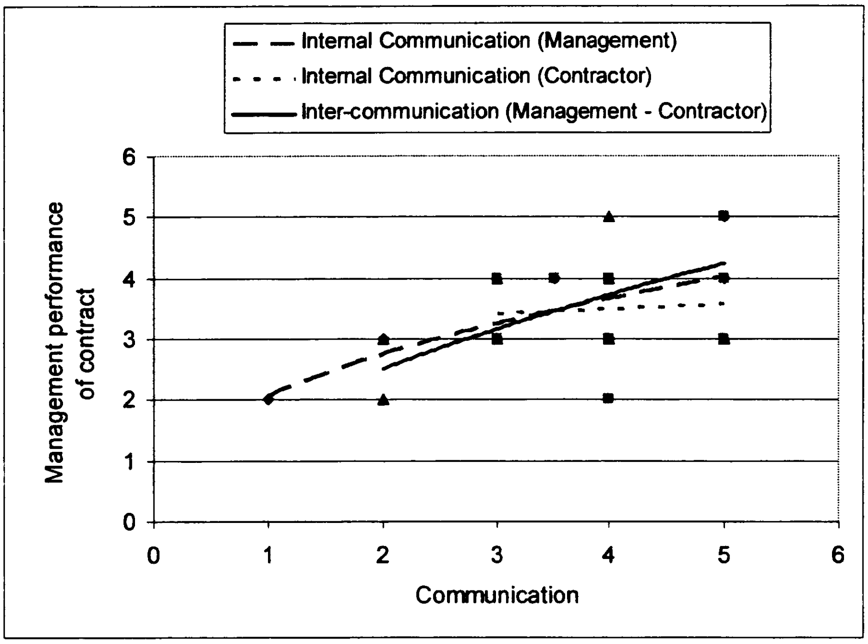


Figure 7.7 **Management performance of contract and communications among O&M personnel**

7.6 Management Performance and Management Attributes of Contract

Under the research model of this study, management consideration is one of the three main facets affecting the overall performance of the outsourced O&M work. The ratings (from 1: very poor to 5: very good) given by the respondents on the management performance of the contract ranged from 3 (average) to 5 (very good), except in two particular contracts the performance was rated as very poor and correspondingly unsatisfactory levels of communication among the O&M management team (rating = 1) and that between the management team and the contractor (rating = 2) were recorded. Calculated by using Equation (7.1), the respondents on average rated 3.59 on a 5-point scale (1: very poor to 5: very good) about the management performance of the contracts.

$$R(A_M) = \frac{\sum_{c=1}^{N} r_c}{N} \tag{7.1}$$

$$W = \frac{12S}{m^2(n^3-n)-m\sum_j (u_j^{\,3}-u_j)} \tag{7.2}$$

$$S = \sum_{i=1}^{n}\left[R_i - \frac{m(n+1)}{2}\right]^2 \tag{7.3}$$

$$S_r = 1 - \frac{6\sum_{c=1}^{N} d_c^{\,2}}{N^3 - N} \tag{7.4}$$

Factors attributing to the management performance of contracts may vary from one case to another, and therefore are difficult to identify. Based on the searched literature and feedback from the pilot survey, a list of management attributes was included in the final question to ask the respondents to indicate their perceived importance (r_c = 1 for 'not important' to 5 for 'very important') on each of the management attributes (A_M) contributing to the success of the outsourced contract. Similar to the preceding Likert scale for rating between "very poor" to "very good", the following representations were explained to the interviewees to guide their choices of perceptions:

Cardinal scale	Representation
1	Not important – item perceived as non-essential.
2	The perception is in between cardinal scale "1" and "3".
3	The perception is neutral (i.e. not non-essential or indispensable).
4	The perception is in between cardinal scale "3" and "5".
5	Very important – item perceived as indispensable, no compromise acceptable.

The respondents were also allowed to suggest any attributes that they thought important in addition to the listed attributes, but no such suggestion was indicated from the response. The average rating for each of the attributes, $R(A_M)$, was calculated by using Equation (7.2). The results are shown in Table 7.3.

The respondents expressed that "effective communication" ($R(A_M)$ = 4.41) is the most paramount key to contract success. Second to it is "relevant past experience of contract team" ($R(A_M)$ = 4.32) followed by "relevant professional qualification of contractor team" ($R(A_M)$ = 4.30); both of which are also two key criteria recommended by PCICB (2003) for inclusion in tender assessment. The respondents regarded "relevant academic qualification of contractor team" ($R(A_M)$ = 3.09) as a relatively less important attribute. This may be ascribed to the fact that most O&M practitioners in Hong Kong were used to enrich themselves through on-the-job training as there has been no formal education program formulated for producing O&M engineers (Mou, 1999).

Table 7.3 Perceived importance of management attributes

Management attributes	Overall		Owner		Property management		Contractor	
	$R(A_M)$	Rank	$R_O(A_M)$	Rank	$R_P(A_M)$	Rank	$R_C(A_M)$	Rank
Effective communication	4.41	1	4.50	2	4.33	1.5	4.50	1
Relevant past experience of contract team	4.32	2	4.83	1	4.08	3	4.25	4.5
Relevant professional qualification of contractor team	4.30	3	4.25	4	4.33	1.5	4.25	4.5
Good reputation of the contractor	3.95	4	4.33	3	3.75	6	4.00	8.5
Large number of contractor team's members	3.73	5	3.17	11.5	3.83	4.5	4.25	4.5
Regular performance review meeting	3.59	6.5	3.17	11.5	3.83	4.5	3.50	11
Top management's recognition of the customer satisfaction with O&M service	3.59	6.5	3.50	6	3.42	8	4.25	4.5
Regular O&M audit	3.50	8	3.83	5	3.25	10.5	3.75	10
Cooperative contractual relationship	3.36	9.5	3.17	11.5	3.25	10.5	4.00	8.5
Partnering contractual relationship	3.36	9.5	3.33	8	3.08	13.5	4.25	4.5
Large company scale of the contractor	3.27	11	3.33	8	3.50	7	2.50	15
Regular customer satisfaction survey	3.18	12	3.17	11.5	3.17	12	3.25	12
Relevant academic qualification of contractor team	3.09	13	2.83	14.5	3.33	9	2.75	13.5
Traditional contractual relationship	2.91	14.5	3.33	8	2.75	15	2.75	13.5
Alliance contractual relationship	2.91	14.5	2.67	16	2.58	16	4.25	4.5
Availability of accredited quality assurance scheme (e.g. ISO9000)	2.86	16	2.83	14.5	3.08	13.5	2.25	16

Regardless of the widespread recommendation on the need of a quality assurance system, "availability of accredited quality assurance scheme (e.g. ISO 9000)" was rated as the least important attribute ($R(A_M)$ = 2.86), indicating that the respondents did not rely on a quality *documentation* but they valued the importance of quality *people* who actually undertake the work. This finding concurs with one of the CIRC's (2001) recommendations, which states that bureaucratic quality control procedures should be streamlined and paperwork documentation should only be maintained at a minimum required level for establishing accountability.

With a coincident average rating of 2.91, the respondents considered that 'traditional' or 'partnering' contractual relationship is of little importance to contract success. They rather preferred to run outsourced contracts with a cooperative or partnering relationship (both rated as 3.36). Among the moderately important attributes, "good reputation of the contractor" ($R(A_M)$ = 3.95) was rated as one of the top tier while "large number of contractor team's members" ($R(A_M)$ = 3.73) and "large company scale of the contractor" ($R(A_M)$ = 3.27) were considered as comparatively less important. This suggests that the end users judge more from the perspective of what the contractor has actually performed in the past rather than their scales, although the latter may be important to large construction projects which would require contingency resources to cope with workload surges from time to time.

The relative agreement of the perceived importance ratings given by different groups of the practitioners was tested by using Equation (7.2) to calculate the Kendall coefficient of concordance (W), which ranges from 0: "no community of preference" to 1: "perfect agreement" (Kendall & Gibbons, 1990). The sum of the squares of the deviations (S) of the row rank sums (R_i) from their mean value $m(n+1)/2$ pertaining to the n attributes rated by the three (i.e. m = 3) groups of practitioners is determined by Equation (7.3), where u_j is the number of consecutive members of the j^{th} tied rank. The computed W is 0.658, representing a significantly high level of agreement among the importance of the attributes perceived by the different groups although, by nature of their work, they may have different perspectives and interests.

To further test if there exists significant correlation between pairs of the perceptions of different groups of the practitioners, the Spearman's rank correlation coefficient (S_r) was computed by Equation (7.4) where d_c is the difference in rank between pairs of the items under examination, c is the contract number (1, 2, 3, ..., N) and N is the total number of surveyed contracts. The value of S_r ranges from "-1" which represents no community of preference, to "1" which indicates perfect agreement (Kendall & Gibbons, 1990).

Concurrently significant correlations were found; with $S_r = 0.611$ between the owner and property management groups; $S_r = 0.580$ between the property management and contractor groups; and $S_r = 0.476$ between the owner and contractor groups. These moderate values of the coefficients imply that while different groups of stakeholders may have different practices and orientations in the management of contracts, their perceived importance of the management attributes are neither perfectly matched nor totally inconsistent.

7.7 Optimum Mix between In-house and Outsourced Resources

It has long been suggested that an optimum mix between in-house and outsourced resources for service delivery should be determined (e.g. Barrett & Owen, 1993; Barrett & Bayley, 1993). However, it is by no means straightforward, for it requires multi-attribute considerations of the factors associated with individual circumstances.

Based on the outsourced air-conditioning O&M work, the interviewees were asked to indicate the mix, in terms of percentage, between in-house and outsourced resources they considered as optimum for delivering quality work. The average percentage of the response, as summarized in Table 7.4, shows that on average the optimum mix rated by the interviewees ascends from the owner to the building management and the contractor group. This suggests that the contractors would like to have more business opportunities while the owner's in-house staff were concerned about maintaining their workload and hence job security or, they had reservation about relying on the contractors to undertake the O&M work.

Table 7.4 Optimum mix between in-house and outsourced resources

Resources	Owner group	Building management group	Contractor group
In-house	55%	34%	18%
Outsourced	45%	66%	82%

Table 7.5 Contingency table of response to optimum percentage of outsourced resources

Group	Outsourced resources		
	0 - 33.3%	33.3% - 66.7%	66.7% - 100%
Owner	3	2	1
Building management	1	1	5
Contractor	0	1	3

The results were further scrutinized by showing the frequency of response which lies in three equal ranges (out of 100%) of outsourced resources (Table 7.5). Since some of the calculated expected frequencies are less than 5, the testing of the practitioners' preference toward outsourcing by the Chi square test was not pursued (Saunders & Cooper, 1993). Nonetheless, inspection from the results reveals that the owner group favors 'less outsourcing' while the building management and contractor groups show their preference on the contrary.

7.8 Performance Review Meeting

Outsourcing for O&M work would bring along quality service at lower cost only if there is adequate and appropriate review or monitoring of the contractor's performance (Greaver II, 1999). There has been evidence that good contractor service was ruined by the lack of performance monitoring (e.g. Angelici et al., 1995). In addition to monitoring the contractor's performance, the prime purpose of performance review meeting is to allow both contracting parties to communicate bilaterally any issues that may arise during the contract period and thus can identify any changes necessary to smooth the operations and to meet the user needs better. Therefore, performance review meeting should be regarded as a regular mechanism for improving service performance rather than for satisfying bureaucratic policies and procedures.

However, "regular performance review meeting" was considered by the respondents only as a fairly important attribute to the success of contract ($R(A_M)$ = 3.59, see Table 7.3). In more than one-third of the sample contracts in which the contractor's work was monitored by a building management company, performance review meetings were held only on an ad-hoc basis. This, according to the opinions of the interviewees, is mainly due to the following:

1. The contractor performs satisfactorily without requiring regular review by the management company;

2. The two parties have good working relationship such that they can communicate effectively through telephone and email etc. without meeting face-to-face in regular time intervals; and

3. For resource saving purpose, the management company would prefer to meet with the contractor only when the latter's performance is intolerable or when important issues need to be resolved through meetings.

Monthly meetings were regularly conducted in another one-third of the contracts of which the majority was directly managed by the owner's in-house team in lieu of a building management company. To this, the following are the key factors:

1. The building owner takes great care about the contractor's performance and hence the quality of service delivered to the users, because the in-house team would be directly exposed to any complaint of dissatisfaction from the users.

2. The in-house team has adequate time resource for reviewing the contractor's performance face-to-face.

Surprisingly, over 20% of the contracts did not have any performance review meeting despite it has been commonly recommended that such meeting should be held monthly for progress review and at least annually for forecasting future developments or changes (Angel, 2003). These contracts carry one or both of the following characteristics:

1. The contract period is short. For example, a contract lasted for only one to two months during which the contractor was required to calibrate and tune some critical equipment (e.g. temperature and pressure sensors of the chiller plant). In fact, the in-house team intensively monitored the contractor's work during the short contract period, which makes the conduction of performance review meetings trivial.

2. The in-house team was in lack of technical knowledge. For instance, none of the management team members possessed relevant O&M knowledge; forcing them to offer the contractor free hands to perform.

Similar to the frequency of performance review meeting, its duration also varied. The case of total outsourcing recorded the highest duration: 48 meeting hours per year. This is sensible given the substantial contract scope. While "putting all eggs into one single basket", the owner would need to keep a close eye on the contractor's performance to prevent it from becoming unbearable.

Apart from frequency and duration, delegating the right person(s) is imperative to economize on the transaction cost incurred for attending the performance review meetings (C_m). Such cost, with respect to the in-house team or the contractor, can be determined by using Equation (7.5) where F_{pm} is the frequency of meeting (number of meeting during the contract period); D_{pm} is the duration of meeting (hours each); N_j, S_j, Dm_j and Hd_j are respectively the number, monthly salary, working days per month and working hours per day of representative at work level j attending the meeting; and j is 1 (top management), 2 (managerial) 3 (supervisory) or 4 (operational).

$$TC_{pm} = F_{pm} \times D_{pm} \times \sum_{j=1}^{4} N_j \left(\frac{S_j}{Dm_j \times Hd_j} \right) \qquad (7.5)$$

Table 7.6 displays the mean and range of representatives from the management and contractor teams who participated in the performance review meetings. At managerial, supervisory and operational levels, both the management and contractor sides assigned, on average, similar number of representatives to the meetings. However, the contractor's top management had never joined the meetings. This suggests that the top management of the management team is comparatively more caring about the performance of the contract work while the counterpart of the contractor team considers his accountability for the outcome performance as relatively small. In addition, it also implies that the contractor had comparatively limited human resources at top management level which could be deployed for the meetings.

Table 7.6 Number of representatives attending performance review meetings

Work level	Management team		Contractor team	
	Mean	Range	Mean	Range
Top management	0.3	0 - 1	0.0	0 - 0
Managerial	0.7	0 - 4	0.9	0 - 2
Supervisory	1.3	0 - 2	1.1	0 - 3
Operational	0.6	0 - 6	0.6	0 - 3

Besides, the higher involvement of supervisory and operational staff suggests that the meetings were commonly regarded as a means for resolving issues mostly about supervision and execution of the work, while strategic decision of the top management was not a common focus of the meeting agenda.

7.9 Customer Satisfaction Survey and Service Quality

Past experiences, word of mouth, and advertising contribute to the service expectation of customers (building end users), whose satisfaction is a result of comparing the perceived service with the expected service (Kotler, 2003). Customer satisfaction survey is an essential tool for understanding the customer need which may vary among individuals and would change over time (Bandy, 2002). For benchmarking purpose, it is important to regularly conduct such survey to find out the customers' perceptions, expectations and satisfactions (Kennedy, 1996; Bandy, 2002). Through regular survey, remedial actions can be taken to continually improve the service for total quality (Alexander, 1993a, 1993b; Grigg, 1996; Roberts, 2002). Meanwhile, the competitive advantage for the service contractor can be enhanced (Bröchner, 2000).

Quality of O&M service provided by contractors would be experienced by customers, including not only the occupants, but also building visitors as well as other stakeholders (Langston & Lauge-Kristensen, 2002) such as the personnel who manage the contractor. Parasuraman et al. (1985) submits that service quality comprises five dimensions (or qualities) whose satisfactory performance would help reduce *ex post* transaction costs (Bröchner, 2000). Berry & Parasuraman (1991) consider their importance in descending order as follows:

1. *Reliability.* The ability to perform the promised service dependably and accurately.

2. *Responsiveness.* The willingness to help customers and to provide prompt service.

3. *Assurance.* The knowledge and courtesy of employees and their ability to convey trust and confidence.

4. *Empathy.* The provision of caring, individualized attention to customers.

5. *Tangibles.* The appearance of physical facilities, equipment, personnel, and communication materials.

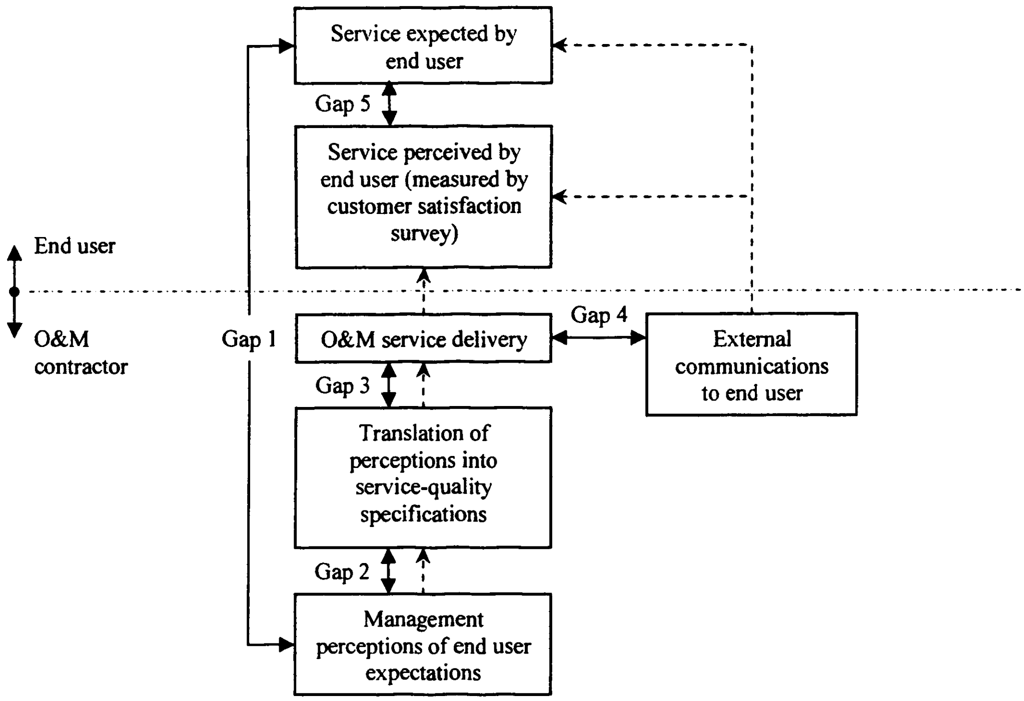


Figure 7.8 O&M Service-Quality Gaps (adapted from Parasuraman et al., 1985)

The SERVQUAL model (Parasuraman et al., 1985; 1988), which identifies five gaps that may contribute to unsuccessful service delivery, was adopted in Siu et al. (2001) to unveil the service quality gap between the performance of building services maintenance contractors and the client's expectation. Likewise, the model can be adapted for use in measuring the service quality for building O&M work (Figure 7.8). However, the model is inadequate when it is applied for measuring the quality of products which, according to Garvin (1988), should be gauged by the following dimensions:

1. *Performance*. Performance on primary operating characteristics.

2. *Features.* Number of bells and whistles that supplement primary characteristics.

3. *Reliability.* Probability of failing or malfunctioning.

4. *Durability.* The life of the product.

5. *Serviceability.* Ease of repair, and the speed, courtesy, and timeliness of personnel.

6. *Aesthetics.* How the product looks, feels, and sounds.

7. *Conformance to specifications.* Degree to which the product meets production benchmarks.

8. *Perceived quality.* A catchall category that includes the effects of brand image and other intangible factors that influence customers' perceptions of quality.

Since O&M work is accomplished by delivering the required O&M *service* (e.g. certain specific skills and manners of O&M personnel) with the use of certain *products* (e.g. air-conditioning units, electrical switches, water pumps etc.), integrating the above to develop a model to measure the quality of O&M work should be viable. This, however, has not been an objective of the current study and therefore would not be further pursued here.

The frequency of conducting customer satisfaction survey on O&M service quality varies among the surveyed contracts (Table 7.7). Despite the well-documented benefits, customer satisfaction survey had never been carried out in most of the contracts (40%) or, it had been done only once a year (30%); concurring with the relatively low importance ratings given on the attributes "regular customer satisfaction survey" ($R(A_M)$ = 3.18) and "top management's recognition of the customer satisfaction" ($R(A_M)$ = 3.59) (see Table 7.3). Echoing with the critics made by Bandy (2002) and Pratt (2003), these results have uncovered the general lack of attention being paid to the importance of establishing a 'culture of service'.

Table 7.7 Frequency of customer satisfaction survey

Frequency	Percentage of sampled contracts (%)
None	40
Monthly	0
Quarterly	5
Half yearly	15
Yearly	30
Others	10

Alternative to the common gauging of customer satisfaction at fixed intervals in all the office and office-retail buildings, in the hotel case the guests were invited to participate in the survey during their stay. In an office-retail building, such surveys were carried out on a jobbing basis where the tenants were asked to express their perceived satisfaction with the work completed by the O&M contractor.

Among one-third of the contracts, the interviewees were unaware of the customer satisfaction survey result, reflecting that the results were not shared among them or they paid little attention to the results. For those who could indicate the results, the average overall service quality as reflected from the latest customer satisfaction survey was 76%.

When asked to rate using a Likert scale of 1 (very poor) to 5 (very good), none of the respondents indicated a difference exceeding "1" between the service quality of work done by in-house workers and those by the contractor; indicating no unilateral superiority of the quality of work executed by either parties. Furthermore, O&M service quality was rated as "average" to "very good" by the respondents, except in two cases where the contractors rated the service quality accomplished by the in-house team as "poor". In both such cases, the respondents perceived a 'traditional' contractual relationship being established and gave low ratings on the communication achieved among the management team and that between the management team and the contractor. This suggests that communication is crucial to the contractual relationship and hence the contractor's perception about the management team's performance.

$$TC_{cs} = F_{cs} \times \sum_{j=1}^{4} Tcs_j \times N_j \left(\frac{S_j}{Dm_j \times Hd_j} \right) \qquad (7.6)$$

To gauge the transaction cost incurred for undertaking customer satisfaction surveys (TC_{cs}), Equation (7.6) can be used where F_{cs} is the frequency of the surveys during the contract period, Tcs_j is the time of staff at rank j devoted to the survey task. Unlike performance review meetings in which both the in-house team and the contractor would involve, customer satisfaction survey would normally be carried out by either the former or, the latter if the outsourced contract requires the contractor to do so.

7.10 O&M Audit

BSI (1993) defines an audit as *a systematic examination of, for example, documents, reports accounts, stock holdings or quality attributes*. Note however that the term audit often varies with the function being audited. Without a well-established definition, O&M audit may be regarded as (Nanayakkara & Smith, 1997; Donaldson & Armstrong, 2000):

> "a systematic examination carried out to check whether operation and maintenance activities are carried out as planned and whether the results of these activities yield the anticipated benefits".

Unlike an audit for a quality assurance system (e.g. ISO 9000) which focuses on checking compliance of procedures on paper, an O&M audit extends to cover physical examination of work (Nanayakkara & Smith, 1997). This is essential for safeguarding the quality and workmanship of O&M work, especially for some hidden work (e.g. installation of a concealed conduit) and servicing (e.g. visual check on the running of equipment) which could be costly and sometimes impracticable to verify after their completion.

Despite that O&M audit had never been done in 82% of the contracts (Table 7.8), "regular O&M audit" was rated by the respondents as a fairly important management attribute ($R(A_M)$ = 3.50) which influences the success of contract (Table 7.3). In the remaining cases, O&M audit was carried out either monthly, half yearly, yearly or biannually.

Table 7.8 Frequency of O&M audit

Frequency	Percentage of sampled contracts (%)
None	82
Monthly	5
Quarterly	0
Half yearly	5
Yearly	5
Others (biannually)	5

Only in two cases where O&M audit was conducted comprehensively in one whole working day (around 8 hours), while in other audited cases only brief O&M audits were conducted in 1 to 3 hours. In all the audits, generally one to two supervisory or managerial staff of the in-house organization were involved. None of the cases had employed an external (third party) auditor. This part of the results suggests that the resources deployed for O&M audits were usually minimal and the importance of engaging professionals for independent O&M audits was not commonly recognized.

Similar to performance review meeting, O&M audit would incur transaction cost (TC_{ad}), which can be determined by Equation (7.7) where F_{ad} is the frequency of O&M audit (number of audit during the contract period) and D_{ad} is the duration (hours each). While it is known that external consultant has not been commonly hired for conducting O&M audit, the consultant fee, if any, should be added to the transaction cost.

$$TC_{ad} = F_{ad} \times D_{ad} \times \sum_{j=1}^{4} N_j \left(\frac{S_j}{Dm_j \times Hd_j} \right) \qquad (7.7)$$

The above has shown how the resources incurred for the three management tools, namely performance review meeting, customer satisfaction survey and O&M audit can be determined. However, it must be noted that Equations (7.5) to (7.7) only account for the involved human resources but not the other costs associated with the activities, e.g. overheads, sundries etc. Furthermore, since undertaking the management tools is not costless, they should only be used effectively. Otherwise, the costs so incurred may exceed the gain in quality of O&M work, making the management of contract inefficient.

7.11 Chapter Summary

The survey has uncovered that O&M works which are commonly outsourced are those which require intensive labour resources, specialist knowledge or skills to deal with proprietary components, or where the laws has imposed strict controls. Building managing contractors are usually employed by owners to mediate various specialist trades but packaged contracts covering O&M work across building boundary are not used in the private commercial sector. Neither total in-house 'production' nor total outsourcing for building O&M work is a common practice. Most commercial buildings make use of a mix of partial, selective and bundled outsourcing. A "centralized" or "partially grouped" contract management structure is typically adopted for looking after a wide range of O&M work.

Effective communication among in-house staffs of the O&M management team, the O&M contractor team members and that between the former and the latter groups is regarded as highly important to the management performance of outsourced contracts. The practices of communicating O&M information correlates very well with the IFMA (2001)'s findings. In particular, O&M requests are most commonly communicated through telephone to a call center. However, the use of CMMS for tracking O&M activities is still embryonic and sharing of O&M productivity information with the contractors and building end users remains rare.

Besides 'effective communication' which the practitioners perceived as of paramount importance to the management performance of contract, the intrinsic attributes of the contractor such as past experience, professional qualification, reputation and size of workforce were regarded as very important to contract success. In contrast, relevant academic qualification of the contractor team and their adoption of an accredited quality assurance scheme for documentation purpose were considered unimportant to the contract performance.

The use of management tools (e.g. performance review meeting, customer satisfaction survey) to manage the contractor's performance was perceived as of moderate importance. Unlike in large-scale work or service contracts where it is common to regularly conduct performance review meetings, the O&M practitioners generally regarded it as a tool for resolving issues on an "as-needed" basis in view of the relatively small scope of work and limited resources. Attendance of the meetings by practitioners at strategic level is also rare. Customer satisfaction survey has not been popularly used for measuring O&M service quality. This would disable the feedback of needs from the user and the opportunity for the contractors to continually improve their service. O&M audit has only been implemented occasionally, showing the neglected evaluation of the effectiveness and productivity of O&M resources.

Management tools are crucial to the performance of outsourced contracts. The human resources deployed for their implementation can be determined. The transaction cost so added should be optimized. Its unnecessary use would render the management of contract inefficient.

Chapter 8

CRITICAL CONTRACTUAL ISSUES

8.1 Introduction

In Hong Kong, building construction works are categorized into twenty-two trades under the categories of structural, civil and finishing, and additionally into twenty-two electrical and mechanical trades (PCICB, 2004a). Likewise, O&M of buildings embraces a wide range of works for building components (e.g. roofing, façade and internal finishes) and a range of specialist engineering services (e.g. air-conditioning, electrical, fire services, plumbing and drainage and lifts and escalators). Vocational training in Hong Kong inclines toward producing highly specialized rather than multi-skilled tradesmen. There are tertiary education programmes that are purported to produce multi-disciplinary building services engineers but none are dedicated to building O&M. Notwithstanding that specialization is a manifestation of the benefit of division of labour, fragmentation of the construction industry could distract efficiency (Egan, 1998).

Most buildings are served by an in-house O&M team typically comprising a number of practitioners each specialized in one or a few trade(s). O&M works that require licensed personnel or intensive labour resources are commonly outsourced through discrete rather than bundled contracts (see Chapter 7). Therefore, efficient organization of O&M work requires contracts that well-define the scope of the outsourced works, with clear demarcation between the outsourced work and those to be executed by the in-house team, as well as effective coordination between the in-house team and the contractors.

The economic recession in the late 90's in Hong Kong has led to fewer new building developments but it has not affected the growth of the ageing building stock (RVD, 2004). Nonetheless, the recession triggered more building owners to outsource for O&M works and the trend is expected to continue (see Chapter 4). Although more companies and practitioners have joined the O&M industry (HKAPMC, 2004; VTC, 2004), studies that look into the realm of building O&M have been scarce. The recent outsourcing trend calls for greater attention to contractual issues of outsourced O&M work but this has rarely been studied into. What factors affect the O&M contract performance has been uncertain, if not unknown.

This chapter begins with reviewing the economic literatures; in particular those in the transaction cost economics (TCE) regime which are essential to studying the contractual issues of outsourced O&M works. Based on the theories, an analysis of the relation between transaction costs and contract performance is presented. Then, the chapter reports the findings of reviews of relevant literatures and analyses of information collected through the face-to-face interviews in Stage II about the critical contractual issues of outsourced O&M work for commercial buildings. These include: the benefits and drawbacks of making available standard forms of contract; the commonly used contract formation methods; common perceptions of contract of the practitioners; and the domains within contracts that are common subjects of disputes. The chapter further explains the causes for disputes over the scope of contract work due to overlapping between the scopes of in-house and outsourced works and incompleteness of contracts; elaborates how inefficiencies of contract due to *ex post* opportunistic behaviour can be minimized; reveals the common irregularities in contract clauses that stipulate statutory maintenance requirements; unveils the common contractual relationships; and analyses which choice of governance structure is appropriate for O&M contracts; and examines the perceived importance of contractual attributes to the success of O&M contracts among different groups of practitioners.

8.2 Transaction cost economics, incomplete contracting and relational contracting

Grounded on the seminal work of Coase (1937), Williamson (1975, 1979, 1981) advanced the TCE theory by taking an interdisciplinary approach which joins economics with organisation theory and contract law. The model of Williamson (1979) frames that an appropriate choice of governance structure is dependent on investment characteristics (asset specificity), frequency and uncertainty of the transactions. These factors affect the amount of transaction costs, including the *ex ante* (before entering into a contact) resources required to search information for drafting contract document, and to negotiate with tenderers; and the *ex post* (after entering into a contact) costs incurred for measurement and monitoring of contract performance, and for enforcement of the contract.

The theory of incomplete contracting, an extension of the TCE theory, asserts that contracts are unavoidably incomplete because the contracting parties (human) are subject to bounded rationality and are given to opportunism (Williamson, 1985; 1993). The incomplete contracting theory has attracted critics (e.g. Maskin & Tirole, 1999) and also supports (e.g. Hart & Moore, 1999). Since contractual environments have become more complex, it has been increasingly consented that the realization of complete contract is hindered by the significant transaction costs required for defining *ex ante* the contingencies and their *ex post* renegotiations (Hart & Moore, 1988; Al-Najjar, 1995; Segal, 1999), and for enforcing the contract by an outsider (the court) (Segal, 1999; Tirole, 1999; Klein, 2002).

The relational theory of contract (Macneil, 1974; 1978) emphasizes the relations that the parties to a contract intended to establish. Greater reliance on relational contracts helps overcome problems with incomplete contracts and reduces the risk of dispute between the contracting parties, and thus can help save both *ex ante* and *ex post* transaction costs.

Application of the above theories to studies in the service industry has grown, e.g. on banking relationship (Paulin et al., 1997) and on competition in estate agency (Bishop & Megicks, 2002). Using a slightly different strategy from Williamson (1985), Stinchcombe (1990) stressed that the earliest future information, although is uncertain, is crucial to the structure of organisations. With particular reference to the construction industry, the theories have been increasingly used to explain how firms and contracts should be economically organised and managed. Earlier applications include Eccles (1981), which used Williamson's (1975, 1979) approach to analyse the existence of quasifirm in the construction industry. Winch (1989) submitted that rather than the socio-technical, organizational or project management perspectives, a transaction cost approach should be taken to analyse construction management. Walker & Chau (1999) explained the benefits of combining the TCE theory with project management theory in construction management studies. While pointing out the deficiencies of those previous attempts in applying the TCE theory to establish conceptual frameworks for studying the construction industry, Winch (2001) introduced a framework which incorporates the different transactions throughout the project life cycle. In addition, Turner & Keegan (2001) took a transaction cost perspective to explain the necessity of having different roles played by a broker and a steward for large projects in the engineering construction industry. Turner & Simister (2001) used a transaction cost analysis to show when different contract pricing terms would be adopted. Turner (2004) further used a four-dimensional vector (incentive intensity, adaptiveness, reliance on monitoring and control, reliance on the courts), which was adapted from the TCE literature, to analyse the governance efficacy of different types of construction contract.

Yet, few works take a transaction cost approach to study O&M contracts for existing buildings, whose small, routine and repetitive characteristics are contrasted with the large, transient and unique features of project contracts (Turner & Müller, 2003; Turner, 2004) for construction of new buildings. Furthermore, although there have been empirical evidences supporting the TCE predictions in a broad range of industries (Shelanski & Klein, 1995) and statistical studies on transaction-cost economics have been popular (e.g. Domberger et al., 1995; Abraham & Taylor, 1996), using in-depth empirical data to test transaction-cost propositions in the context of building O&M contracts is yet to be seen, for transaction costs are difficult to measure (Buckley & Chapman, 1997) and the required data are hard to obtain (Masten, 1996; Cheung, 1998), as has been experienced in Lai & Yik (2005).

8.3 Transaction Costs and Contract Performance

Rather than to examine contract performance by using quantified transaction costs associated with building O&M contracts, based on the above theories this section analyses the relation between transaction costs and contract performance.

The transaction costs associated with a building O&M contract include the *ex ante* resources (TC_1) required to search information (C_S) for drafting contract document (C_D), and to negotiate with tenderers (C_N) before contract award; and the *ex post* costs (TC_2) incurred for measurement (C_M), monitoring (C_{MO}) and enforcement (C_E) of the contract. Figure 8.1 depicts the disposition of these cost elements along the contract timeline in the presence of dispute; with the total transaction cost (TC) represented by Equation (8.1).

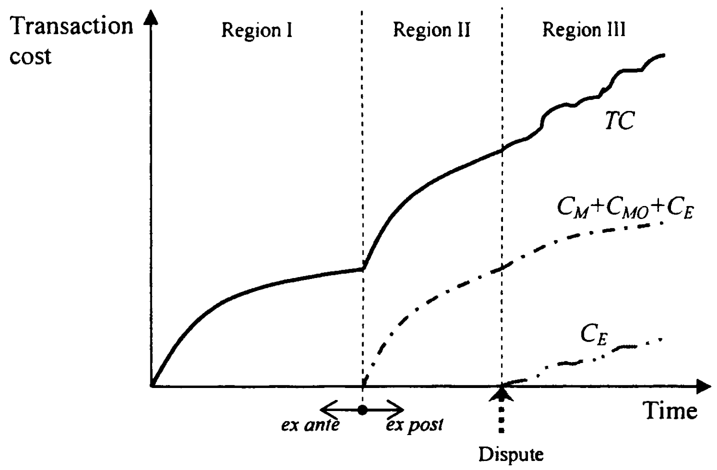


Figure 8.1 Transaction cost elements on a contract timeline

Let *CP* be the monetized value of contract performance. It can be adversely affected by the time, cost and quality implications of disputes and the frequency of their occurrence. Equation (8.2) expresses this relation where the monetary amount of the impact ($I(j)$) can be regarded as a product of frequency (F) and severity of disputes ($S(j)$), and j represents the implications in terms of time (t), cost (c) and quality (q). As Equation (8.3) depicts, if no dispute arises, $I(j)$ would be trivial and hence *CP* approaches CP_{max} (i.e. perfect contract performance).

$$TC = \begin{cases} TC_1 = C_S + C_D + C_N \text{ (Region I)} \\ TC_1 + TC_2 = TC_1 + C_M + C_{MO} \text{ (Region II)} \\ TC_1 + TC_2 = TC_1 + C_M + C_{MO} + C_E \text{ (Region III)} \end{cases} \quad (8.1)$$

$$I(j) = F \times S(j) \quad \text{where j = t, c, and q} \quad (8.2)$$

$$CP = CP_{\max} - I(j) \quad (8.3)$$

$$I(j) = \frac{k}{TC} \quad (8.4)$$

$$CV = CP - TC \tag{8.5}$$

More *ex ante* resources (TC_1) would yield more proper contracts that would help avoid consequences of disputes. However, if disputes are in prospect or have actually arisen, more *ex post* resources input (TC_2) becomes necessary to promptly resolve them. These relations are represented by Equation (8.4), where $TC = TC_1 + TC_2$ and k is a constant dependant on the characteristics of the contract under investigation.

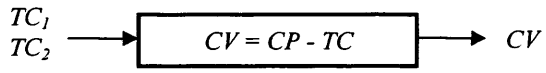


Figure 8.2 A cost-performance-value model for contract

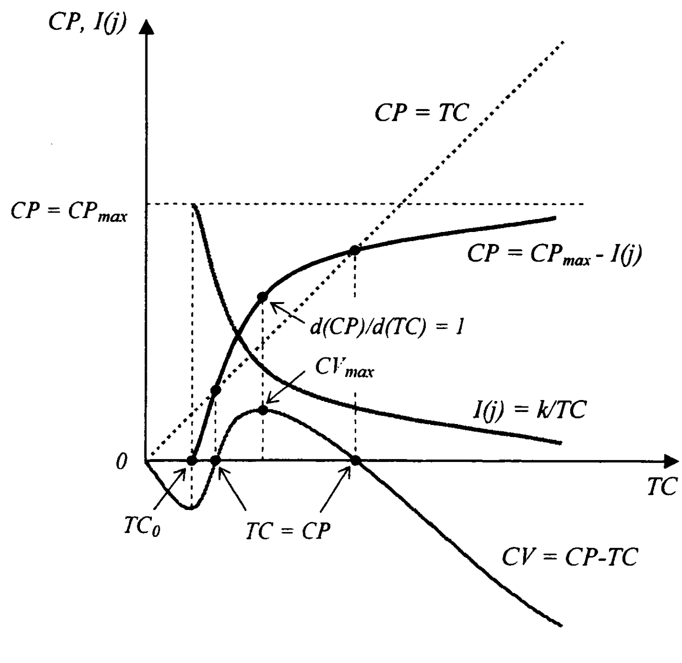


Figure 8.3 Relation between transaction costs and contract performance

Assuming that the contract will be completed no matter how high the *ex post* transaction costs are, the resultant value of a contract work (CV) can be taken as its performance with the incurred transaction costs discounted, as represented by Equation (8.5). Grounded on the model in Figure 8.2, the relation between the input resources (transaction costs) and the impact of dispute (hence the contract performance) is shown in Figure 8.3. When the input resources are minimal, the contract would not be able to perform; rendering a negative contract value. It requires a threshold input of transaction cost (TC_0) before the performance of a contract could be realized.

A marginal input of transaction cost is said to be efficient as long as it brings along a greater marginal gain in contract performance (i.e. $d(CP)/d(TC) > 1$). Conversely, it would be inefficient when $d(CP)/d(TC) < 1$. Using more resources to form and to manage a contract would definitely help achieve better contract performance. But when the transaction costs exceed the contract performance (i.e. $TC > CP$), the contract would become economically inefficient, giving a negative contract value. Since disputes commonly arise in outsourced O&M contracts (see Chapter 6), further increase in transaction cost may or may not be able to make the contract performance perfect. While a contract would be most economically efficient at $d(CP)/d(TC) = 1$ where the contract value is maximum ($CV = CV_{max}$), how much contractual resources should be utilized would depend on the quality of work required to meet the user needs and hence the strategic O&M objective of the building owner (outsourcer).

8.4 Demography of the Samples

Among the 28 face-to-face interviews, 22 of them which provided complete and useful information for the contractual issues were included in this part of analysis. On average, the interviwees practiced O&M work for 13 years; with around half having attained undergraduate qualification and worked at managerial level or above. The interview response was based on 26 building O&M contracts pertaining to 20 commercial buildings (6 'office'; 13 'office-retail' and 1 'hotel') which the practitioners looked after. The buildings aged from 6 to 39 years and comprised in aggregate gross floor areas of: 711,631m^2 (office); 122,588m^2 (retail); 23,098m^2 (hotel) and 67,039m^2 (car park). The contracts amounted to an annual turnover of HK$11 million.

8.5 Forms of O&M Contract

For procurement of buildings in both the public sector (e.g. HKSAR, 1999a, b; HKSAR, 2000) and the private sector (e.g. HKIA, 2005a, b) in Hong Kong, standard forms of contract are widely used. Some government organizations (e.g. Housing Authority), public corporations (e.g. the Mass Transit Railway Corporation) and large private developers (Hills, 1998) developed and use their own standard contract forms for building construction works. A number of standard forms for minor or subcontract works (e.g. HKCA, 1994; HKG, 1994; HKSAR, 1999c; RICS, 1992) are also available. PCICB (2004b) has also issued guidelines on standard forms of domestic subcontracts for the basic trades. So far, there is no standard form of contract purposely written for building

O&M work. Among the standard forms and conditions summarised in Table 8.1, the General Conditions of Contract for Term Contracts for Electrical and Mechanical Engineering Works (1994) seems to be the most suitable for application to building O&M contracts. However, it contains conditions which would work well in government buildings only but would not in private commercial buildings.

Table 8.1 Standard forms or conditions of contract for minor or subcontract work in Hong Kong

Form / Conditions of Contract	Usage	Publisher
Standard Form of Contract for Minor Works (1992)	• For projects valued at an agreed lump sum up to HK$5,000,000 (at 1992 prices). • For works which are minor in nature and where a Contract Administrator has been appointed to supervise the Contract on the Employer's behalf.	Royal Institution of Chartered Surveyors (Hong Kong Branch)
Standard Form of Domestic Subcontracts (1994)	• No specified limit on contract value. • For use alongside Government Standard Forms of Main Contract for Building Works; can be considered for use alongside civil engineering standard Government forms, as well as in the private sector.	Hong Kong Construction Association
General Conditions of Contract for Design and Build Contract (1999)	• No specified limit on contract value. • For works requiring the contractor to undertake both 'design' and 'build' duties.	The Government of Hong Kong Special Administrative Region
General Conditions of Contract for Term Contracts for Electrical and Mechanical Engineering Works (1994)	• No specified limit on contract value. • For electrical and mechanical engineering works over a defined period during which the contractor would be demanded to undertake works as detailed in any Works Order issued on a jobbing basis.	The Government of Hong Kong

Table 8.2 Standard forms of contract for building O&M work in the UK

Form of Contract	Usage	Characteristics
Daywork Term Contract *GC/Works/6 (1999)*	For procuring work of a jobbing nature.	• Labour charge based on hourly rate. • Materials are paid for on a cost plus basis.
Measured Term Contract *GC/Works/7 (1999)*	For procuring maintenance service over a fixed period.	• Orders are issued to the contractor as and when required. • Work done is measured based on a schedule of rates. • Typical contract period: 3 to 5 years.
Specialist Term Contract for Maintenance of Equipment *GC/Works/8 (1999)*	For use where specified maintenance of equipment is required and can be priced per task.	• The contractor prices a schedule of work and interim payments are based on the measured work actually done. • Typical contract period: 3 years.
Lump Sum Term Contract for Operation, Maintenance and Repair of Mechanical and Electrical Plant, Equipment and Installations *GC/Works/9 (1999)*	For a single establishment or a complex of buildings close enough to be conveniently covered by a single contract.	• The contract price includes one-off repairs up to a specified maximum cost per repair. • Typical contract period: 1 to 5 years.

PACE (1999a, b, c, d) introduced a set of standard forms of contract applicable to O&M work for buildings in the UK, as listed in Table 8.2, which has long been awaited (Armstrong, 1990). Besides, some other forms of contract, which are primarily written for general building work, may be modified for use in building services maintenance contracts. These include JA/C 90 Conditions of Contract for Building Work of a jobbing nature, MTC 98 Standard Form of Measured Term Contract, and Chartered Institute of Building's Facilities Management Contract 1999 (Marsh, 2003). The latter was modified in 2001 to better incorporate the Transfer of Undertaking (Protection of Employment) Regulations and the partnership spirit (CIOB, 2002). However, all the above contract forms were tailored for the UK built environments. They would not be fit for use in Hong

Kong without substantial adaptations to account for differences in, for example, local trade practices and statutory requirements for ensuring health and safety.

Although some standard forms of contract formulated for construction work in the UK have been adapted for use in Hong Kong (e.g. HKCA, 1994), the interviews unveiled that none of the standard forms in Tables 8.1 and 8.2 was adopted or adapted for use in the sampled contracts. They generally followed the same modality of their predecessors in using either some quotations written with layman terms and conditions or, some domestic contract formats prepared by amending part of the standard forms for building construction work. This would save time and cost from drafting contracts from scratch but, as reported in Chapter 6, disputes frequently arise if the contractual responsibilities are vaguely defined. If it is to modify some standard forms of construction contracts for O&M work, flawless contracts would hardly be formed without making enormous effort to warily amend the preset terms and conditions because the characteristics of construction and O&M works are intrinsically different.

Preparing precise O&M contracts is difficult due to the following intrinsic nature of the service:

1. O&M work involves many miniature works (e.g. greasing pump bearings, tightening loosened cable trays etc.), making it impossible to specify precisely every detail of the works in the contract.

2. The types of services required to satisfy the demand of building end users may change from time to time within a contract period, which may give rise to demands for works that fall outside the scope defined in the contract.

3. Execution of O&M work will inevitably disrupt normal system operation and activities. Measures for minimization of such disruptions incur extra costs which are difficult to estimate accurately.

4. Changes in statutory maintenance requirements may demand for works outside the original contract scope and for practices different from what the contractor is used to.

While it has been increasingly submitted that contracting for construction work should rest on partnering relationship between the contracting parties rather than relying on written contract conditions (Latham, 1994; Egan, 1998), the spirit of partnering is formalised by way of standard forms of contract such as ACA (2000; 2005). On the other hand, standard forms of contract for building O&M work in Hong Kong have long been outstanding. On top of the recent development of standard forms in the UK, the need of standardized documentation for O&M contract is also supported by the promotion of Job Order Contracting for work with an indefinite-demand-indefinite-quantity nature (CJOC, 2003; Cotts, 2003a, b), which has proven success in the US (Kashiwagi, 1999; Kashiwagi & Byfield, 2002a, b).

Using standard contract forms which contain preset clauses should economize on the *ex ante* costs for drafting contract and negotiating with the contractor on the terms and conditions. Moreover, they are handy for use in successive contracts and within which the well-established clauses can facilitate timely settlement of *ex post* disputes. Nevertheless, the use of standard forms of contract is not mandatory. Their formulation in the first place would require substantial resources. Direct use of a generic standard form for O&M contracts which differ among the numerous trades would be difficult. The difficulty is further exacerbated by the need to meet the dynamic needs of the end users in different buildings as well as the unforeseen changes in O&M technology and relevant statutory requirements. In any case, the standard contract clauses would need to be modified to suit individual cases.

8.6 Contract Formation and Contract Concepts

It has been common to label the type of contract according to the tendering method used for contractor selection. From the sampled contracts, it was found that the majority was formed via competitive tendering (Table 8.3), which the interviewees regarded as a custom conducive to anti-corruption. In addition, most of the interviewees expressed that competitive tendering would enable obtaining the best price for the contract work. They were concerned little with the transaction costs incurred for arranging and assessing the submitted tenders.

Table 8.3 **Methods used for forming the sampled contracts**

Contract formation	Characteristics	Number of contracts
Competitive	• A number of competitive offers made by tenderers based on a common set of contract conditions and specifications • A widely used tendering means for achieving a "low-bid" contract price	21
Negotiated	• Only one contractor is involved in negotiating the contract price • Applicable to specialist contracts for maintaining proprietary systems	5
Continuation	• Extending an existing contract beyond its original life • Applicable where the contractor has good past performance record or bargaining advantage	1
Serial/running	• For a number of identical items of work over a long period of time • Charged as performed	0

Many outsourcers have maintained an internal list of approved contractors. When it comes a competitive tendering for certain O&M work, batches of such contractors would be selected on a random-rotation basis for participation. In order to stay on-list, the interested contractors have to pay a recurrent registration fee, which forms part of their opportunity cost. When preparing tenders, they would price in such cost whereas the outsourcers would regard it as necessary to recover the relevant administration cost for screening and assessing the quality of the contractors. Caution, however, should be taken to prevent the outsourcers from charging part of the fee as a source of profit. Apart from corruption, the risk of bribery and extortion (see Fletcher & Brown (2002) for their differentiations) associated with the qualifying process should also warrant prevention. The sunk costs so incurred for these issues can be significant; causing the tender price inherently uncompetitive.

On the other hand, only a small number of contracts were procured through negotiation. The only contract which was formed by way of continuation also required negotiating with the contractor on the contract sum. Furthermore, none of the samples was serial/running contract. While in principle, these methods are suitable for forming contracts for building O&M work which requires the operation and maintenance of proprietary systems over a long period of time and, during which a number of identical items of work would also need to be executed. These observations suggest that the practitioners perceived the advantage of using competitive tendering as dominant or; the merits of using negotiated, continuation and serial/running contracts were not fully realized.

As more practitioners who were used to take part in construction work have shifted to the O&M sector since the recession of the construction industry in the late 90's, it would not be surprising that some of the contract concepts used for construction work (see Hills (1998) for details) have been adopted or adapted for use in O&M contracts. Table 8.4 highlights the characteristics of these concepts and those suggested by BSRIA (1992) as applicable to building services maintenance contracts.

Table 8.4 Contract concepts used in the sampled contracts

Contract concept	Characteristics	Number of contracts
Fixed price	• Price for each portion of works is fixed • Price varies only when there is variation to the specification • Fixed price is usually valid for a limited period of time	2
Lump sum	• An all-in price including contingencies for the works as a whole • Price may be fixed or adjusted according to some pre-determined formulae	22
Price adjustment	• Price adjusted according to some formulae • A long time may be elapsed between tender and contract, or the contract runs for a long period	0
Cost plus percentage	• Work done charged for the actual costs plus a percentage to cover overheads and profit • Can be a form where the employer sets the base rate and the tenderers offer their percentage marked up or down	2
Cost plus fixed fee	• Work done charged for the actual costs plus a fixed fee to cover overheads and profit • The fee is fixed and will not be affected by the costs	1
Cost plus fluctuating fee	• Work done charged for the actual costs plus a fluctuating fee to the contractor • The fee paid to the contractor fluctuates in inverse ratio according to whether the total final cost is more or less than the agreed estimate of cost	0
Target cost	• Need to prepare a reliable estimate of the probable cost for the work • A target cost is agreed for the work	0
Shared saving or cost	• Any saving or over-spending from the target cost will be shared with the contractor	1
Bill of quantity	• Usually used in construction projects but also commonly adopted for large-scale maintenance work of similar nature (e.g. refurbishment, renovation etc.) • A bill of all the materials and work to be done is priced at the outset of a measured term contract • Any item of the work done is charged according to the bill	2
Schedule of rates	• A part of the bill of quantity listing priced items of work • May be used in a term contract where the tenderer submits a tender by quoting a percentage adjustment which will be applied to the pre-priced schedule of rates	10
Package deal (turnkey)	• An all-in-one contract embracing several facilities management functions such as cleaning, maintenance and security • Commonly used in contracts for securing packaged property management service	0
Comprehensive	• Require the contractor to cater for the specified as well as any contingent works	4

The interviewees were asked to indicate the contract concepts being used. However, further conversations with the interviewees revealed that the indications in a few cases were not a full representation of the contact concepts involved. For instance, in a building where the various types of O&M work were totally outsourced, the interviewee only indicated that the contract was on a shared saving/cost basis while in fact a target cost was agreed when forming the package deal which is comprehensive in nature and allows saving or cost to be shared between the contracting parties. Whether the practitioners were confused with the large number of applicable concepts or they indicated their response according to the foremost concept they perceived is worth investigating in further studies.

The answers given by the respondents were summarized in Table 8.4. Contract concepts such as price adjustment, cost plus fluctuating fee, target cost and turnkey, which are commonly adopted for large-scale construction work, were not used among the contracts. Application of concepts like fixed price, cost plus percentage, cost plus fixed fee, shared saving/cost and bill of quantity was also unpopular. In contrast, schedule of rates was commonly incorporated in the contracts; serving as a basis for accounting any addition or omission of work during the contract period. Furthermore, the lump sum concept was widely used, for it allows the outsourcer to transfer to the tenderer the burden of estimating the required resources for the contract work. However, the tender price would have counted in this cost estimation effort, and the accuracy of the estimation would depend on whether the contractual specification is precise and adequate. This, as will be discussed later, is critical to the performance of contract.

8.7 Contract Areas where Disputes Arise

Although standard forms of contract were not used for the sampled contracts, an O&M contract should consist of the four basic sections listed in Table 8.5 (BSRIA, 1992; Nanayakkara, 2003). The interviews found no problem of disputes with Articles of Agreement, which is for laying down particulars such as company names and addresses of the contracting parties, contract sum and date of contract signing. Nevertheless, disputes were commonly encountered on Conditions of Contract which is for setting the legal framework of a contract; and were more widespread with Specification which should stipulate the precise details of the contract work.

Table 8.5 Contract sections where disputes arise

Contract sections	Number of contracts
Articles of agreement	0
Conditions of contract	17
Specification	19
Schedule of rates	6

The rate of disputes on Schedule of Rates was significant. This may be ascribed to the absence of commonly adopted market rate for measuring O&M work in the private commercial sector. Even though ASD (1997a, b) have published some standard schedules of rates, the rates determined in accordance with the work quality acceptance standard for government buildings are inappropriate for use in private commercial buildings where the demand on O&M work quality varies considerably with their grades.

Table 8.6 **Clauses of conditions of contract where disputes arise**

Contract clause	Number of contracts
Definitions	2
Payment	2
Scope of the work	13
Duration of contract	3
Determination	0
Termination	0
Assignment of contract	0
Sub-letting/sub-contracting	1
Statement of law enactment	0
Arbitration	0
Indemnity	1
Insurance	3
Right of access	0
Safety	6
Materials	8
Workmanship	10
Warranties	4

Table 8.7 **Clauses of specification where disputes arise**

Contract clause	Number of contracts
Scope of works	9
Sites and equipment	3
Related documents	2
Regulations	0
Definitions	1
Facilities to be provided by client	0
Access to sites and plant	3
Noise, nuisance, pollutions and interference	11
Hours of attendance	3
Call-out/Emergency procedures	3
Personnel	1
Quality assurance	3
Materials, equipment and spares	7
Site documentation	3

According to BSRIA (1992), an O&M contract should basically contain the clauses as shown in Tables 8.6 and 8.7. In the Conditions of Contract section, disputes were common on the contract clauses which detail the scope of the work, workmanship and materials. While it is well-known that specification details are important for governing the contractor's performance and making outsourcing decisions (Pearson, 2002b; Nellore & Söderquist, 2000), the Specification clauses which stipulate the noise, nuisance, pollutions and interference requirements; scope of works; and materials, and equipment and spares often gave rise to disputes (Table 8.7).

As in construction contracts, the difficulty in defining exactly the required workmanship and thus the quality of work products (HKCA, 1992) may well explain the relatively high rate of disputes on workmanship. In contrast to construction contracts, it has been a common trade practice that materials used for repair or replacement work are on a "like-with-like" basis rather than prescribed by precise specification. This supports the significant rates of disputes concerning materials in both sections of Conditions of Contract and Specification. The particularly high rate of disputes arisen from the contract clause which specifies the requirements on noise, nuisance, pollutions and interference highlights not only the necessity but also the difficulty in implementing measures to mitigate disturbance created by O&M work to the existing occupants.

8.8 Scope of Work

Both the results in Tables 8.6 and 8.7 tell that most of the disputes came from the section *Scope of the Work* or *Scope of Works* (collectively hereinafter referred to as "scope of work"). This spells out the importance of drafting proper scope of work for contracts. However, different literatures have recommended somewhat different contract formats with which the scope of work should be incorporated. For example, Smith (1992) emphasizes that scope of work under the Conditions of Contract should briefly describe the extent of the work envisaged to be covered Conditions and that the same heading under the Contract Specification must clearly state the maintenance policy to be followed, the type of maintenance to be employed and any additional task which may also be included in the contract. But, Nanayakkara (2003) states that scope of work is to provide a brief description of the overall objectives of work while a broad description of work activities should be stated in the Description of Works.

Regardless of the above discrepancies, the law of contract requires that clear and enforceable conditions must be used to properly define the scope of work in contracts. If the conditions are set with uncertainty, as demonstrated in *Scammel v Ouston (1941)*, the courts cannot enforce the contract. In particular, express terms used to specify the scope of work must be crystal clear without ambiguity, and properly constructed for them to be enforced. If, however, the written document contains an ambiguous word or phrase as in *Robertson v Jackson (1845)*, other evidence may be given as to what was actually intended. When the outsourcer and the contractor are contracting at arms length, it would be their own fault if they agree to unfavourable terms even if they are ambiguous; as the court would expect them to take care of the obligations to which they commit. In case of disagreements as to what it was intended to mean, the court will assess objectively the genuine intention of the contracting parties (Stone, 2000).

Frequently the root causes of disputes in construction contracts are not sufficiently understood (Yates & Hardcastle, 2003). It is no exception in building O&M contracts especially where construction contractors are involved in some large scale of improvement work. The questionnaire survey in Stage I found that using vague contract terms to define the contractual responsibilities had often given rise to discrepant work scopes perceived by the outsourcer and the contractor, but did not articulate whether the disputes arose from mistake which is unintentional or self-interested behaviour which is wilful. Their distinction, as elaborated below, is critical to the consequence and resolution of the disputes in the common law regime.

A misrepresentation, which must be an untrue statement of fact which induces a party to make contract with another, would make a contract voidable. But a mistake, if it is reasonable and fundamental, would be operative and thus render a contract void (Chui, 1988; Ho, 1994). However, a "common" mistake occurs where both contracting parties make the same mistake based on a false assumption; and there is still a genuine agreement. The work scope perceived from a "common" mistake would be different from that on the face of the contract, but there would be no difference in the work scope perceived by the contracting parties. Thus, no dispute on the scope of work would arise.

If the mistake arises where each contracting party misunderstands the other ("mutual" mistake) or where one party is aware of the other making a serious contractual mistake ("unilateral" mistake), there is no genuine agreement at all and the contract is void (Fisher, 1996). However, there were precedents where, for example in *Bowser v. Hamilton Glass Co. (1953)*, the court excused a unilateral mistake where it is known to the other contracting party. In this case, the law of equity stepped in and as Kronman (1978) pointed out, whether a mistake (information) ought to be disclosed is subject to whether the information is casually acquired or it requires deliberate search.

Unlike mistakes, self-interested behaviour of the contracting parties is not regarded as a factor that would vitiate a contract. It is a common business tactic in real-world contracts and is referred to as opportunism, which is one of the major factors that leads to loss of efficiency and added transaction costs (Williamson, 1985; 1993). In this context, before the contracting parties entering into a contract, an adverse selection due to the outsourcer (employer) who bases on his private information to intentionally misdirect the prospective contractor would give rise to an unfair contract. This happens, for instance, when the contractor perceived *ex ante* his scope of work from the explicit contractual specification while he is then required to undertake *ex post* some implicit work which was not communicated *ex ante* (Figure 8.4). Disputes would arise when the contractor is asked to perform any work beyond the scope he perceived.

Figure 8.4 Difference in work scopes due to adverse selection

Besides, asymmetric information may be made known to the contractor *ex post.* For example, an outsourcer would honour the explicitly specified work scope in the contract while the contractor, by virtue of his familiarization with the O&M condition of the installations during the contract period, may have realized some implicit work scope which is unknown to the outsourcer. In this case, the contractor may behave self-interestedly to confine his work to the explicit scope, leaving the implicit scope which he has possessed *ex post* unreported to the outsourcer (Figure 8.5).

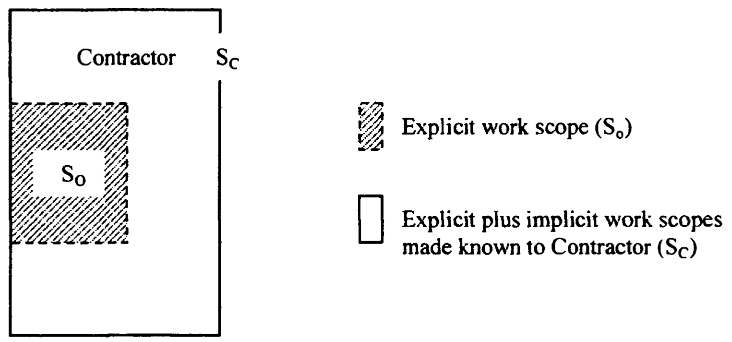


Figure 8.5 Difference in work scopes due to asymmetric information

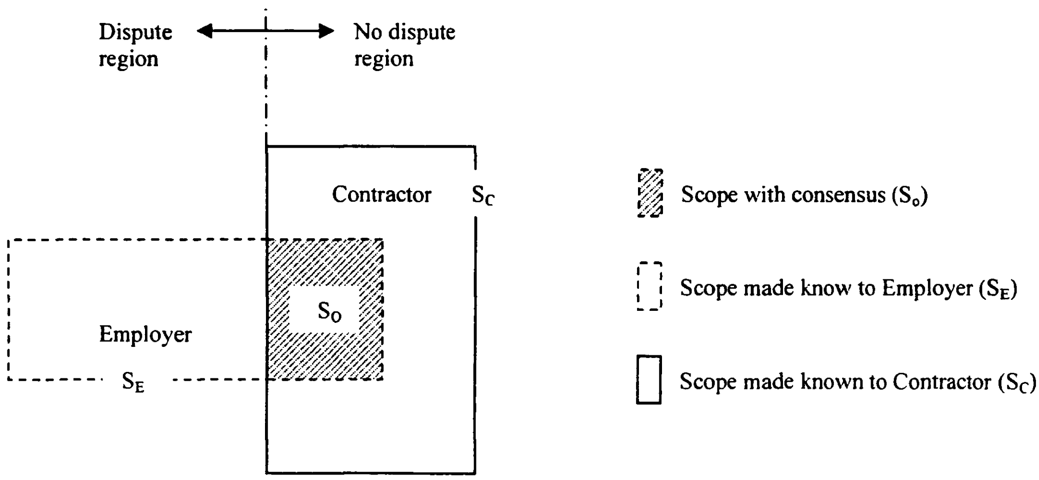


Figure 8.6 Consensus and differences in perceived work scopes

Merging Figures 8.4 and 8.5 gives Figure 8.6, which replicates the situation as analysed in Chapter 6. Dispute would arise if the contractor is required to carry out works beyond the scope he perceived (i.e. where $S_E - S_O$). The contractor would undertake the work lying in the scope with consensus (S_O), but would avoid any implicit work which is unknown to the outsourcer (i.e. where $S_C - S_O$).

8.9 Inefficient and Incomplete Contract

The extreme case of total outsourcing or total in-house provision for building O&M work has not been common in Hong Kong. It is more often to execute the work by a hybrid of in-house and outsourced resources (see Chapter 7). In such arrangement, the *ex post* opportunistic behaviour of the contractor, delineation between the in-house and outsourced work scopes and the completeness of the contract are crucial to the economic efficiency of the contract work.

Apart from asymmetric information, moral hazard is an *ex post* opportunistic behaviour which would render the outsourced O&M work not being done completely, as the contractor would shirk his liabilities in order to maximum his profit (Cheung, 2002). This takes place when, for example, the contractor is required under contract to undertake some routine inspections of the building installations. This kind of task is repetitive and therefore its close monitoring by the outsourcer is onerous. Whether such work has been completed would rely largely on the contractor's self-reporting mechanism, and it is difficult and costly to verify after its completion. The *ex post* transaction cost required for overcoming such moral hazard problem is significant, thus reducing the economic efficiency of the contract.

Unless the contract is drafted with extreme care, delineating the outsourced scope of work without overlapping with that to be undertaken in-house is seldom successful (Figure 8.7). When there are overlaps between the scopes of the outsourced and the in-house works, the contractor could get remunerated for the work accomplished by the in-house team and vice versa. The extra price paid by the building owner, although is unnecessary, is not wasted and thus economic efficiency has not been impaired. However, once the overlap is discovered, the attempt to recover the extra payment made and to redefine the work scopes could lead to disputes. The use of re-measurement contract, which allows reimbursing the contractor for the actual work done according to the contract schedule of rates, can help avoid this problem. Nevertheless, the measurement and verification costs associated with re-measurement contract may be burdensome, depending on the scale and complexity of the work.

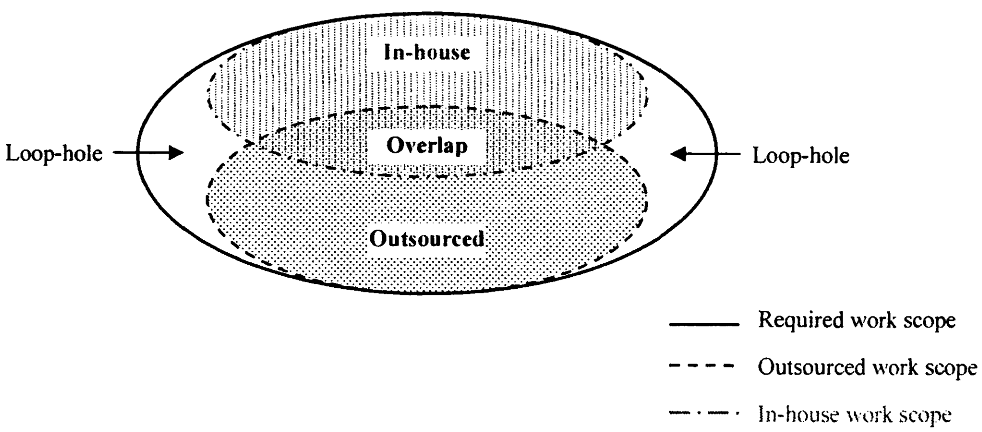


Figure 8.7 Loop-holes and overlapping of work scopes

Of great essence to a successful contract is not merely a clear delineation of the scope of work for which the contractor is responsible, but also a mutual understanding of such scope between the contracting parties. Without proper communication, difference in the perceived work scopes would arise (see Chapter 6); leading to disputes and hence the following common consequences:

1. The work would be pending for resolving the dispute. The delay so caused would result in losses from vacant premises and consequential claims from the end users. In addition, the time and cost spent on the dispute resolution can be substantial. If the dispute develops to a stage that leads to legal proceedings, the cost implications could exceed the resources saved from drafting improper scope of work and even the face value of the contract.

2. When the contractor is forced to undertake the additional work and presumes failure in getting relevant reimbursement. The work would be carried out with sub-standard quality or the quality of other parts of the contract work would be compromised. Extra cost would be incurred for subsequent rectification or improvement works.

Loop-holes exist in incomplete contracts (Figure 8.7). In contract where the loop-holes are silent, they may be filled out by custom in a particular trade, as in *Hutton v Warren (1836)*. However, a custom may not be used where it clearly contradicts with the contract terms, as held in *Palgrave, Brown & Son Ltd v SS Turid (Owners) (1922).* In any case, the employer would need to pay on a *quantum meruit* basis if he demands the contractor to carry out any additional work beyond the contract scope, as in *Costain Civil Engineering Ltd and Tarmac Construction Ltd v Zanen Dredging and Contracting Company Ltd (1996)*; or the contractor may refuse to undertake it if the contract does not allow for such scenario (Hanson, 1999).

Ideally, a contract is complete if it is drafted in a way that the prescribed actions can be flexibly adjusted to the contingencies. Such contingencies, however, increase with the complexity of the transaction (Al-Najjar, 1995). This is particularly true for O&M contract as it is often impracticable to specify all contingent work required for meeting the ever-changing O&M needs of the building occupants and activities. It was found that only 3 of the 26 sampled contracts contained provisions for contingency. This is a key reason for the occurrence of disputes when the contractor is asked to take up contingent work without remuneration.

Cost saved from drafting an incomplete contract *ex ante* would give rise to loss due to *ex post* disputes over the missing or vaguely defined contractual responsibilities. An optimal contract design is a trade-off between these two opposing forces. Some empirical findings support that the degree of incompleteness of a contract represents the desire of the contracting parties to minimize the economic costs associated with the contract (e.g. Crocker & Reynolds, 1993). Rather than drafting complete contract, contracts which are formed intentionally incomplete can be economically efficient.

8.10 Statutory Maintenance Requirements

No matter for which trade of maintenance work for buildings, the relevant statutory requirements are the baseline with which the work must comply. Such work can be classified into two types in legal sense. The first type is the mandatory maintenance activities expressly stated in statutes. The requirement for periodic maintenance of lifts (HKG, 1997a) is an example. Building owners commonly outsource for this type of work (see Chapter 7). Specifying the contract scope of such work by referring to the relevant regulations seems to be straightforward but the wide-ranging sources of regulatory controls have created confusions and difficulties with their compliance (Lai & Yik, 2004).

The other type refers to the statutory requirements such as the health and safety rules (HKG, 1997b) that need to be observed when the contractor undertakes the preceding type of work. Additionally, the law of tort requires the contractor to take reasonable duty of care of the lawful visitors in the premises during work execution.

On the whole, the interviewed practitioners recognized their obligation to comply with statutory maintenance requirements; being more aware of the first type which is usually stated in contract than of the second type which in many cases is unstated. In addition, inspections on the clauses of the selected contract sections unveiled the following irregularities:

1. Statutory maintenance requirements that apply to the contract work were not specified.

2. Cited ordinances or regulations were outdated or even irrelevant to the contract work.

3. Clauses were laid down to hold the contractor responsible for all kinds of works for fulfillment of all relevant statutory requirements throughout the contract period.

4. Non-regulatory maintenance best practices were mistakenly referred to as statutory requirements.

The first two irregularities reflect the less than satisfactory legal knowledge of the practitioners and the non-stringent practice of contract drafting. The other two suggest that risk-averse outsourcers would safeguard their interest through averting to the contractors any unpredictable additional work that may arise from overlooked or tightened statutory requirements. In fact, contractors are obliged under common law to comply with all relevant statutory requirements even if they are not expressly stated in contracts (Hanson, 1999). Any extra cost incurred as a result of changes in statutory requirements can be borne either by the outsourcer or the contractor, but this should be agreed *ex ante*.

8.11 Contractual Relationship

A relational contract would incur less transaction costs than a transactional contract (Macneil, 1974; 1978). Moreover, the costs incurred *ex ante* and *ex post* for a contract are interdependent (Rao, 2003). A smaller amount of *ex ante* transaction costs (TC_1) leads to higher *ex post* transaction costs (TC_2), and vice versa. Figure 8.8 diagrams the inter-relationships of these concepts. For a transactional contract, the *ex ante* resources (TC_{1T}) required to draft the contract specification would be greater than that for a contract in which the outsourcer relies more on a cooperative relationship with the contractor (TC_{1R}). Even though a less comprehensive contract specification is drafted, less costly dispute is expected if the contracting parties cooperate under a relational contract to effectively resolve any disputes. The *ex post* transaction cost (TC_{2R}) would also be less than that incurred for a transactional contract (TC_{2T}).

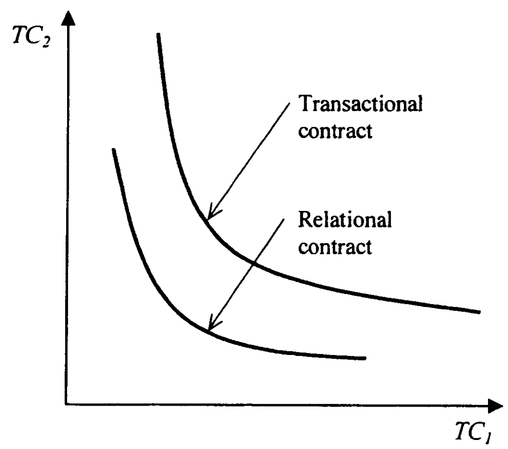


Figure 8.8 Relation between *ex ante* and *ex post* transaction costs

From a transaction cost perspective, O&M contracts should be transacted with bilateral governance in view of their characteristics, which are analysed with reference to the TCE model of Williamson (1979) as follows:

1. *Asset specificity.* Besides requiring intensive labour who unnecessarily possess specialist skills to carry out routine O&M tasks (e.g. cleaning of air filters), provision of O&M service sometimes necessitates the use of specialist trade practitioners (e.g. licensed plumber) and specific equipment (e.g. mobile elevated platform for accessing work at height). Therefore, the investment is non-trivial, and carries a 'mixed' rather than 'idiosyncratic' or 'nonspecific' characteristic.

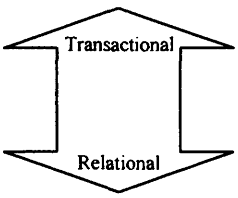
2. *Transaction frequency.* O&M work involves repetitive delivery of services for satisfying the needs of occupied buildings. Throughout the building life, not only routine O&M activities would repeat (e.g. monthly inspection of lifts) but also O&M contracts with limited length would recur. In other words, the transactions are recurrent and thus frequent especially when the contract period is short.

3. *Uncertainty of transaction.* Unforeseeable scenarios cannot be accurately anticipated. O&M service possesses exactly this nature in that the functions of a building and the needs of its occupants are ever-changing. Unlike transactional exchange for simple commodity whose specification can be precise and rigid, O&M contracts require flexible conditions to cater for unpredictable contingency. Such uncertainty brings along risks to the contracting parties.

Putting the theories into practical guidelines, many literatures advocate that outsourcing for building support services should be grounded on "partnering" (e.g. Atkin & Brooks, 2000; HKHA, 2004b), or even "alliance" (e.g. ANAO, 2001; PMRC, 2001; Incognito, 2001) rather than on traditional or cooperative relationship, although the classification of contractual relationship sometimes varies among the literatures (e.g. ANAO, 2001; Roe & Jenkins, 2003). Yik & Lee (2004) further put forward that the contracting parties should jointly work under a partnership for better building energy performance contracting.

Table 8.8 Relationship achieved in the sampled contracts

Relationship	Number of contracts
Traditional	19
Cooperative	5
Partnering	2
Alliance	0



Running in opposite to both the theories and the practical guidelines, the response from the interviewees shows that traditional contractual relationship prevailed (Table 8.8). Only a limited number of contracts were run with a cooperative relationship. Even fewer were working under a partnering or alliance contractual relationship. On one hand, most of the interviewees who played the role of building owner or property management indicated their satisfaction with the traditional contractual relationship. On the other hand, all the interviewed contractors expressed that the traditional 'master-and-servant' relationship created significant sense of contractual inequality. Perceiving more obligations than the rights, the contractors refused to devote their utmost to perform under the contract.

8.12 Contractual Attributes Contributing to Contract Success

The interviews also solicited the interviewees' perception about the importance of the critical contractual attributes (A_C) (shown in Table 8.9). The interviewees were asked to use a cardinal scale (r_c = 1 for 'not important' to 5 for 'very important') to represent their perceived importance of the attributes that contributed to the success of the outsourced contract they handled. To provide guidance for the interviewees in responding to the question, the same representations for the cardinal scale as described in Chapter 7 were explained. The average ratings $R(A_C)$, summarized in Table 8.9, were calculated by using Equation (8.6) where i is the contract number (1, 2, 3, ..., N) and N is the total number of contracts.

$$R(A_C) = \frac{\sum_{c=1}^{N} r_c}{N} \qquad (8.6)$$

The relative agreement of the perceived importance ratings given by different groups of the practitioners was tested by using Equation (7.2) to calculate the Kendall coefficient of concordance (W), which ranges between 0: "no community of preference" and 1: "perfect agreement" (Kendall & Gibbons, 1990). The sum of the squares of the deviations (S) of the row rank sums (R_i) from their mean value $m(n+1)/2$ pertaining to the n attributes rated by the three (i.e. m = 3) groups of practitioners is determined by Equation (7.3), where u_j is the number of consecutive members of the j^{th} tied rank. The computed W is 0.849, representing a high level of agreement among the importance of the attributes perceived by the different groups although, by nature of their work, they may have different perspectives and interests.

Table 8.9 **Perceived importance of the critical contractual attributes**

Contractual attributes	Overall		Owner		Property management		Contractor	
	$R(A_C)$	Rank	$R_O(A_C)$	Rank	$R_P(A_C)$	Rank	$R_C(A_C)$	Rank
Appropriately drafted scope of work	4.77	1	4.67	1	4.83	1	4.75	1.5
Appropriately drafted specification	4.59	2	4.33	3	4.75	2	4.50	3
Appropriately drafted conditions of contract	4.41	3	4.33	3	4.33	3	4.75	1.5
Adequacy of contract in stipulating relevant statutory requirements	4.00	4	4.17	5	3.92	4	4.00	5.5
Consistency of common trade practice in contract interpretation	3.91	5	4.33	3	3.58	7.5	4.25	4
Ease of complying with relevant statutory requirements	3.73	6	3.83	7	3.58	7.5	4.00	5.5
Using suitable form of contract	3.73	6	4.00	6	3.83	5.5	3.00	9.5
Appropriately drafted articles of agreement	3.64	7	3.67	8	3.83	5.5	3.00	9.5
Using suitable standard form of contract	3.45	8	3.50	9	3.42	10	3.50	7.5
Uncomplicated relevant statutory requirements	3.36	9	3.00	10	3.50	9	3.50	7.5

Overall, "appropriately drafted scope of work" was rated the most important ($R(A_c)$ = 4.77) among the attributes; echoing with the findings in Tables 8.6 and 8.7. The interviewees also expressed that appropriate Specification ($R(A_c)$ = 4.59) and Conditions of Contract ($R(A_c)$ = 4.41) are of comparable importance. These results support the findings in Table 8.5. While the consistency of common trade practice in contract interpretation varied (see Chapter 6), the interviewees rated it as significantly important ($R(A_c)$ = 3.91). This implies the need to improve the trade practice.

The low rating given on "appropriately drafted articles of agreement" ($R(A_c)$ = 3.64) may be explained by the fact that none of the interviewees had experienced disputes on such area (Table 8.5). The respondents considered the ease of complying with relevant statutory requirements and the use of a suitable form of contract as moderately important ($R(A_c)$ = 3.73), but a suitable standard form of contract was regarded as relatively less important ($R(A_c)$ = 3.45). This suggests that they preferred to use proper contracts with appropriately drafted scope of work, conditions of contract and specification, rather than relying on standard forms of which the preset conditions would anyway need to be modified to suit individual cases.

Despite the respondents considered that it is important to have adequate stipulation of relevant statutory requirements in the contracts ($R(A_c)$ = 4.00), they rated "uncomplicated relevant statutory requirements" as the least important ($R(A_c)$ = 3.36). As reported earlier, the practitioners well-recognized the obligations to fulfill such requirements as their intrinsic duty.

8.13 Formation of More Efficient and Complete Contract

Standard forms of contract should be made available to cover some basic and common contract conditions for building O&M work. Their preparation would incur substantial drafting cost, as represented by the concave section in Figure 8.9. Such cost, nonetheless, can be economized when it is shared among numerous discrete contracts to which the standard forms are applicable. Yet, it is inevitable to modify the standard clauses to suit individual circumstances which require different work scopes and hence contract conditions. Once the practitioners have familiarized with the standard clauses, the adaptations can be made readily; as indicated by the steep portion of the curve. Since contracts are incomplete, further attempt to draft more complete contracts would be inefficient; as shown in the far end of the curve.

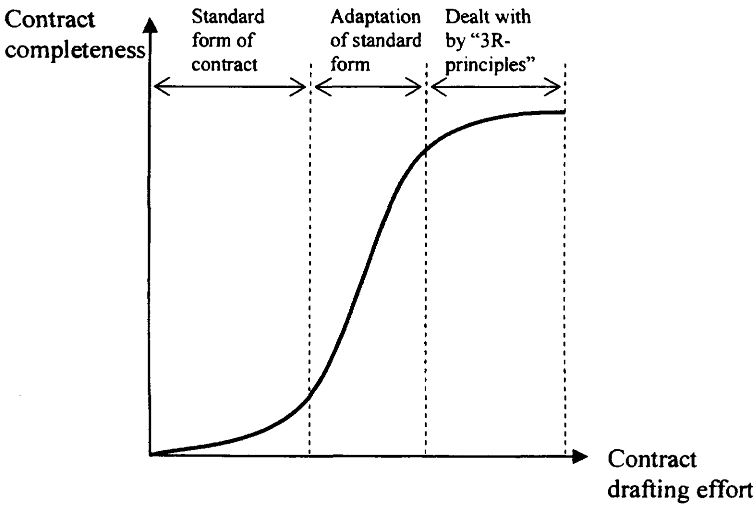


Figure 8.9 **Recommended effort in drafting building O&M contract**

Rather than looking for a complete contract, it would be economical to form a *Pareto* efficient contract with which the contracting parties are satisfied *ex ante*. While court-enforced explicit contract conditions, which are a necessary evil (Klein, 2002), should be communicated bilaterally between the contracting parties, the principles of *re-*

1. *Re-measurement.* Since it is unrealistic to specify unpredictable incidents, appropriate provision should be allowed for efficient and effective re-measurement of any work which lies in the loop-holes of contract. In addition to saving effort for writing contracts complete, this would help prevent disputes on unspecified work.

2. *Risk-sharing.* Risk-absorbing parties are virtually non-existing in real-world business. The contracting parties, be they risk-neutral or risk-averse, should share the risk of shouldering *ex post* variation work. This can be done by, for example, agreeing on a lower than normal unit rate *ex ante* for any work exceeding the initial estimate. In case the actual work undertaken is less than the estimate, the rate can also be used to determine the amount of claw back (see Chapter 6). Cognizant use of an equitable risk-sharing contract strategy would also help prevent the contracting parties from having mistaken perception of the contract scope in addition to minimizing the risk of opportunistic behaviours.

3. *Relational contracting.* A relational contract is preferred to one which is transactional. It would incur less *ex ante* transaction costs, for it does not rely on drafting a complete contract. Despite disputes are often unavoidable, relational

cooperation between the contracting parties would help resolve the disputes, and thus reducing the *ex post* transaction costs.

8.14 Chapter Summary

Taking a transaction cost approach, a process model for contract performance has been introduced and used as a basis for analysing the relation between transaction costs (*ex ante* and *ex post*) associated with an outsourced contract and its performance. It suggests that neither an inadequate nor excessive, but an optimum input of transaction costs would be beneficial to the value of contract.

The interviews have uncovered that no standard forms have been written specifically for O&M contracts in the private commercial sector. The customary practice of forming O&M contracts is rather loose and improper. Spending more effort to form proper contracts would help minimize disputes that may arise from ambiguous contractual responsibilities. However, this does not mean using standard contract form is indispensable, provided that the contract content is properly drafted.

The practitioners did not show a clear understanding of the contract concepts applicable to building O&M work. They generally adhered to the custom of using competitive tendering, while the full range of its associated costs appears to be neglected. Other contract formation methods which in principle are more suitable for O&M work, however, have not been popularly practiced.

Scope of work, being the heart of a contract, most commonly gives rise to disputes. The chapter has distinguished their root causes as to whether due to unintentional mistakes or self-interested behaviours of the contracting parties. In addition, it has been elaborated that the economic efficiency of contract would be impaired by the need of resources to overcome *ex post* opportunistic behaviours, the cost wasted as a result of remunerating the contractor for the overlapped work scopes accomplished by the in-house team, and the incompleteness of contract.

While statutory maintenance work is commonly outsourced, the irregularities found from its contract specification have shown that the practitioners have limited legal knowledge and the outsourcers are generally risk-averse. Although an appropriately drafted scope of work is considered as the most important attribute contributing to a successful contract, a relational contract which does not over-rely on the contract specification is useful to deal with the inherent deficiencies of written contract. Adapted use of standard form of contract to suit individual circumstances can enable efficient formation of contracts, and incorporating them with the "3R-principles" can help enhance their completeness.

Chapter 9

O&M EXPENDITURE AND BUILDING RENTAL INCOME

9.1 Introduction

Proper operation and maintenance (O&M) is crucial to ensuring good building performance and thus to preservation of the economic rent of buildings. For commercial buildings, the major O&M cost elements are energy costs, wages of in-house staff and costs for outsourced services and replacements of built assets. Rather than a means to uphold rent, O&M work is regarded as a kind of facilities management services that the landlord or the management company provide for building tenants. Accordingly, on top of the rent, tenants are charged separately a management fee and possibly other fees as well (e.g. air-conditioning fee) for recovering the O&M costs. Separating the fees from the rent can help ensure tenants are content to pay reasonable fees for the O&M services, even though the rent may fluctuate largely with the economic climate, thus ensuring there will always be sufficient incomes to cover the O&M costs.

In practice, however, the purposes of rental charges and fees are often intertwined. Rather than solely for recovering costs, the fees charged may exceed the costs in order that the rental rates may appear competitive. The O&M budget is often the target when there is a need to cut cost to sustain income, although this may lead to poor building performance which could seriously trench upon the economic rent of the building. Furthermore, rental rates may not truly reflect the prices of occupying building premises as rental contracts may provide prolonged fitting-out periods for which rents are waived. Therefore, most building owners and management companies are unwilling to disclose their incomes and O&M expenditures.

The lack of reliable data makes it very difficult to evaluate whether O&M work is value-for-money, not to mention to benchmark O&M performance (Lai & Yik, 2005). Publications on building rental performance are typically confined to statistical evaluation or forecasting of rental values (e.g. Matysiak & Tsolacos, 2003). Empirical analyses tended to focus on comparing a few ballpark cost indicators (e.g. JLL, 2004c, d; BOMA, 2005; BSRIA, 2005). Although greater emphasis has been given to the value of post-occupancy studies (Cohen et al., 2001; Leaman & Bordass, 2001), studies on the cost-effectiveness of O&M and its impact on the financial performance of buildings remain rare.

Besides investigating the common O&M budgeting practice, this part of the study examined the validity of the following hypotheses:

1. Buildings that are older, bigger or have higher cooling demand would need more operation and maintenance work, which would incur higher O&M costs;

2. If more money is spent on O&M, the building would be in a better state and thus can allow greater rental incomes to be earned; and

3. If a greater portion of the building O&M work is outsourced, the O&M expenditure would drop without affecting the building rental income.

Before reporting the key findings, this chapter outlines the demography of the samples included in this part of the analysis. Reviews and analyses are then presented on: the common O&M budgeting practices; the major air-conditioning O&M cost items, including in-house labour, outsourced contract and energy costs; the incomes from rent, management fee and air-conditioning fee, and their correlations with the O&M costs; and the relations of O&M cost and rental income with the extent of outsourcing. The income and cost analysis was based on data for 17 of the 21 surveyed buildings, excluding 4 that were either with incomplete or atypical data.

9.2 Demography of the Samples

Among the 28 interviews with the O&M practitioners, data about rents, fees and O&M expenditures for 21 commercial buildings, which are useful for studying the economic issues of outsourced contracts, were included in the analysis for this section. The 21 buildings comprised 7 office buildings, 13 office-retail buildings and one retail building. However, electricity billing data for three of the buildings remained unavailable. The energy cost data of another building, although available, was atypical because a large portion of the building accommodated some telecommunication equipment which required round-the-clock air-conditioning. These factors limited the basis for the cost and income analysis to a reduced sample of 17 buildings. Table 9.1 summarises the key information about these 17 buildings.

Table 9.1 **Key information about the sample buildings**

Building No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Building code	PW	MT	BA	NF	CE	CI	HS	AM	LK
Premises mix	O+R	O	O+R	O+R	O	O+R	O	O+R	O
Office grade	C	A	A	A	A	A	A	A	A
Air-conditioned GFA (m^2)	2,910	38,200	49,975	8,150	130,000	93,322	35,500	89,865	6,895
Age of building (years)	9	7	29	7	12	12	15	24	15
Ownership	Private	Public	Private	Private	Private	Private	Private	Private	Private
Occupancy	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Single	Multiple	Multiple
Air-conditioning system	Distributed	Central	Central	Central	Central	Central	Central	Central	Central
Air-conditioning plant capacity (TR)	35	1,280	2,400	600	5,536	5,000	2,100	5,100	337
Type of air-conditioning plant	ACDX	ACC	WCC	ACC	ACC	WCC	ACC	WCC	ACC

Building No.	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Building code	AI	UN	CY	CB	CK	RC	LM	NM
Premises mix	O+R	O+R	O+R	O+R	O	R	O+R	O+R
Office grade	A	A	A	A	A	NA	A	A
Air-conditioned GFA (m^2)	49,050	86,900	130,030	156,200	117,100	32,000	64,850	54,219
Age of building (years)	7	20	2.5	12	6	10	31	22
Ownership	Private	Private	Private	Private	Private	Private	Private	Private
Occupancy	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple
Air-conditioning system	Central	Central	Central	Central	Central	Central	Central	Central
Air-conditioning plant capacity (TR)	2,400	3,150	8,500	6,225	10,890	3,000	3,600	2,700
Type of air-conditioning plant	ACC	ACC	WCC	ACC	ACC	ACC	WCC	ACC

<u>Abbreviations</u>:

ACDX	Air-cooled direct expansion units
ACC	Air-cooled chillers
NA	Classification of office grade is not applicable
O	Office
R	Retail
TR	Ton of refrigeration (1 TR = 3.517 kW)
WCC	Water-cooled chillers

The 17 buildings include 15 Grade A buildings, one Grade C building and one retail building which is not amenable to the 'office' grade classification (see Table 1.1). Note, however, that because the essential features and provisions in Grade A and Grade B buildings are not highly distinctive, owners of the latter class of buildings may claim their buildings as Grade A. The buildings, comprising office or retail premises, or a mix of the two, ranged between 2.5 and 31 years old. One of the buildings was owned by a public corporation and another occupied solely by the owner company and its subsidiaries; all the rest were privately-owned and multi-tenanted. Except the only Grade C building, which uses distributed air-cooled direct expansion units, all the buildings were served by a central air-conditioning plant, which was either air-cooled or water-cooled.

9.3 O&M Budgeting in Practice

As the budget determines the resources input and thus the cost for building O&M, the O&M budgeting practices of the interviewees are discussed first. A proper O&M budget should be prepared in advance, based on cost estimates for the programmed O&M works. The work programme should be formulated taking into account: analysis of information collected during regular in-situ condition surveys and risk assessment (Pitt, 1997; Nanayakkara, 2000; Straub, 2002); the relevant legislative and safety requirements; and operational requirements of the businesses (Smith & Tate, 1998).

However, few facility personnel practice proper budgeting (Cotts, 2004). Rather than setting budgets to address needs, i.e. 'zero-based budgeting' where O&M resources are estimated from scratch for every fiscal year (Booty, 2003), building maintenance strategies are often budget-driven (Horner et al., 1997). Budgets are often prepared by simply modifying previous budgets to account for changes in the programmed O&M activities and anticipated inflation (Spedding, 1987). The programmed works are often prioritised such that only those at the top of the list which amount to a total cost that stays within the budget will be selected for execution (Shen, 1997; Bana e Costa & Oliverira, 2002), the less will be selected the smaller the budget. More works will be deferred or skipped when confronted with a budget cut as would happen during economic downturns.

The practitioners participated in the survey all indicated that they had been preparing budgets by modifying budgets for the last period. Those managing outsourced O&M work would typically request the serving contractor to informally quote an estimate for the same services for the next period, even though procurement of O&M services would be through competitive tendering. Therefore, compared to other tenderers, a serving contractor has asymmetric information (familiarity with the work environment and conditions of the installations), and would often be able to tender at the lowest price which, in turn, would allow the estimated budget to mirror the eventual contract sum.

In addition to imminent expenditures for short-term O&M needs, an adequate budget should cover long-term needs to pre-inform the owner about the foreseeable expenditures. However, only a few interviewees were accustomed to preparing budgets that span for 2 or 3 years, and only two worked on 5-year budget plans that covered substantial improvement or replacement of existing installations. Without long-term planning, annual budgets that exceed regular resources allocation would often be turned down by senior management, which would deter practitioners from preparing estimates that reflect genuine O&M needs. Most of the interviewees also indicated that they would make effort to ensure the allocated funding would be exhausted at the end of a budget period, fearing that any surplus would lead to budget-cut for the next period.

9.4 Air-conditioning Operation and Maintenance Costs

As mentioned above, a compromise had been made between the comprehensiveness of the data that could be obtained and the burden on the interviewees for gathering the required data, which would affect the likelihood that the required data would ultimately be obtained. Consequently, rather than obtaining complete information on the whole building O&M costs (Table 9.2), efforts were made to solicit the O&M cost data for the air-conditioning installations. Nonetheless, the study should still be able to reflect a good picture of O&M costs in commercial buildings in Hong Kong because air-conditioning systems, as indicated by the interviewees (and will be verified by the cost analysis later), are the dominant O&M cost item in such buildings.

Table 9.2 **Typical expenses of commercial buildings (Loo, 1991; Young, 1992; HKIR, 2000)**

O&M expenses	Administration cost	Government levy, reserve and others
Air-conditioning maintenance	Management staff salaries	Rates
Lift and escalator maintenance	Year-end bonus provision	Sundry
Electrical maintenance	Medical allowance	Reserve fund
Fire services maintenance	Long service payment provision	Bad debt
Plumbing and drainage maintenance	Provident fund expenses	Depreciation
CCTV, CABD maintenance	Audit fee	
Miscellaneous E&M maintenance	Accountancy charge	
Building structure and fabric maintenance	Manager's remuneration	
Landscaping		
Electricity charge		
Water charge		
Telephone charge		
Insurances		
Security guard service		
Cleaning service		

The routine monthly total O&M cost for the air-conditioning installation in a building (*TC*) was taken as the sum of the in-house staff cost (*IC*), the contract sums for any outsourced services (*OC*), the material cost (*MC*), the replacement cost (*RC*) and the energy cost (*EC*) (Equation (9.1)). The monthly in-house staff cost (*IC*) was computed from the number (N_j) and monthly salaries (S_j) of staff at different ranks (j; j = 1: top management, 2: managerial, 3: supervisory and 4: operational), and the average time that they devoted to O&M of the air-conditioning system, measured in full-time equivalents ($\overline{FTE}_j$), as shown in Equations (9.2) and (9.3), where N is the number of cases for which relevant information was available. Table 9.3 summarises the average monthly salaries of O&M personnel and the average full-time equivalent values as found from the survey. Due to the varying extents of outsourcing (as will be detailed later), the range of FTE varies largely, especially in the rank of operational staff.

$$TC = IC + OC + MC + RC + EC \tag{9.1}$$

$$\overline{FTE}_j = \frac{N_j \times FTE_j}{N} \tag{9.2}$$

$$IC = \sum_{j=1}^{4} N_j \times S_j \times FTE_j \tag{9.3}$$

$$AEC = \sum_{n=1}^{12} E_n \tag{9.4}$$

$$EC = \frac{AEC}{12} \tag{9.5}$$

$$EOGFA_e = SF_e \times GFA_e \tag{9.6}$$

$$ECI = \frac{AEC}{\sum_e EOGFA_e} \tag{9.7}$$

$$TC = \sum_{j=1}^{4} N_j \times S_j \times FTE_j + OC + \sum_{n=1}^{12} \frac{E_n}{12} \tag{9.8}$$

Table 9.3 In-house staff salary and FTE for the building air-conditioning O&M work

Staff rank	Average monthly salary (HK$)	Average FTE	Minimum FTE	Maximum FTE
Top management	69,433	0.014	0	0.2
Managerial	40,528	0.070	0	0.5
Supervisory	22,063	0.514	0	2.0
Operational	11,773	1.761	0	9.0

Because the in-house staff hours spent on visual checking and inspection, switching on and off of equipment, oiling moving parts, cleaning clogged filter and clearing strainer etc. dominate the routine air-conditioning O&M work, the comparatively insignificant cost for materials (e.g. lubrication oil, bolts and nuts, paint etc.) (*MC*) was neglected in the calculation. Although the cost for replacing equipment (e.g. chiller, air-handling unit, pump etc.) can be substantial, such replacements are occasional and may happen in different years among the buildings. Since data for just the past year were available and the focus of the study was not to analyse the O&M life cycle costs, therefore, the replacement cost (*RC*) was discounted in estimating the routine total air-conditioning O&M cost.

Where sub-metered readings were available, the annual air-conditioning electricity cost (*AEC*) borne by the landlord of a building was determined from the monthly consumption figures for twelve consecutive months (E_n) and the average tariff rate, which was then averaged to yield the average monthly energy cost (*EC*), as shown in Equations (9.4) and (9.5). Statistics show that air-conditioning generally accounts for 30% to 50% of the total energy use in commercial buildings in Hong Kong (EMSD, 2005). This percentage range, however, is based on whole building energy use (those of the landlord and all tenants). The air-conditioning energy cost as a fraction of the total energy cost borne by the building landlord only, therefore, will be much higher. By making reference to a previous detailed energy audit for a typical commercial building (Yik et al, 1998), the *AEC* value of each of the five buildings where sub-metered air-conditioning electricity consumption data were unavailable was taken as 73% of the annual electricity cost of the landlord electricity bills.

Since the energy use intensity (*EUI*) (energy use per unit floor area) of an office is significantly lower than that of a retail premises while different buildings may comprise a different area mix of the two types of premises, the gross floor areas (*GFA*) of different types of premises in each of the buildings were each converted into an equivalent office gross floor areas (*EOGFA*), as shown in Equation (9.6), where *e* equals "1" for office and "2" for retail. The scaling factor (*SF*) values used were 1.48 for retail premises and 1.00

for office premises which were based on results of past energy survey and simulation studies (SRCI, 1997; Yik et al., 2001a; b). The total $EOGFA_e$ for all types of premises in a building was used as the denominator in Equation (9.7) in computing the air-conditioning energy cost intensity (*ECI*) for the building, to allow comparisons across buildings. Equations (9.2) to (9.5) were further combined into Equation (9.8), which was used to calculate the total air-conditioning O&M cost.

Figure 9.1 shows that, among the buildings in the sample, the average monthly air-conditioning O&M cost would generally increase with the air-conditioned GFA and with the EOGFA of the buildings, although variations exist among the buildings. Because the retail portions in the buildings accounted for just a relatively minor fraction of their total GFA (13% on average), plotting the costs against the floor areas in EOGFA did not show a significant difference. The monthly total air-conditioning O&M costs for the buildings range between HK\$0.2/m^2 and HK\$36.7/m^2, with a mean value of HK\$17.3/m^2. The one with the lowest O&M cost was the Grade C building, as the energy and O&M costs for the split-type air-conditioners were borne by individual tenants. Figure 9.2 shows a more consistent trend when the total O&M cost was related to the air-conditioning plant capacity, measured in tons of refrigeration (TR; 1 TR = 3.517kW). The better correlation implies that the plant size, which would determine the quantity and power demand of equipment, would be a better normalisation factor to use to bring the O&M cost data of different buildings to an equal basis. Hence, the installed plant capacities of the respective buildings were used to normalise the air-conditioning O&M costs in the ensuing analysis to facilitate cross comparison.

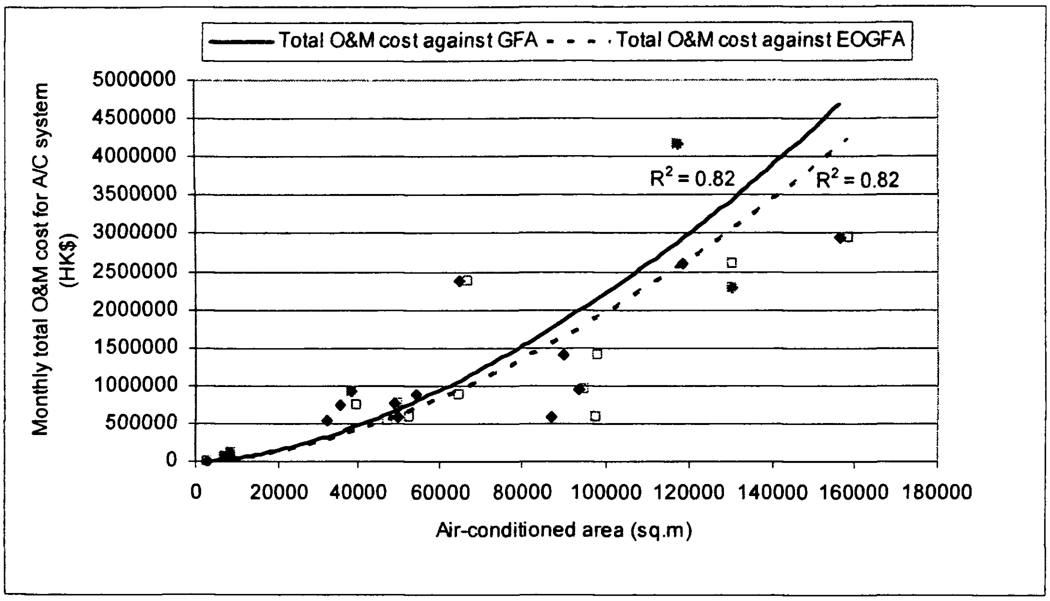


Figure 9.1 Total O&M cost and air-conditioned area

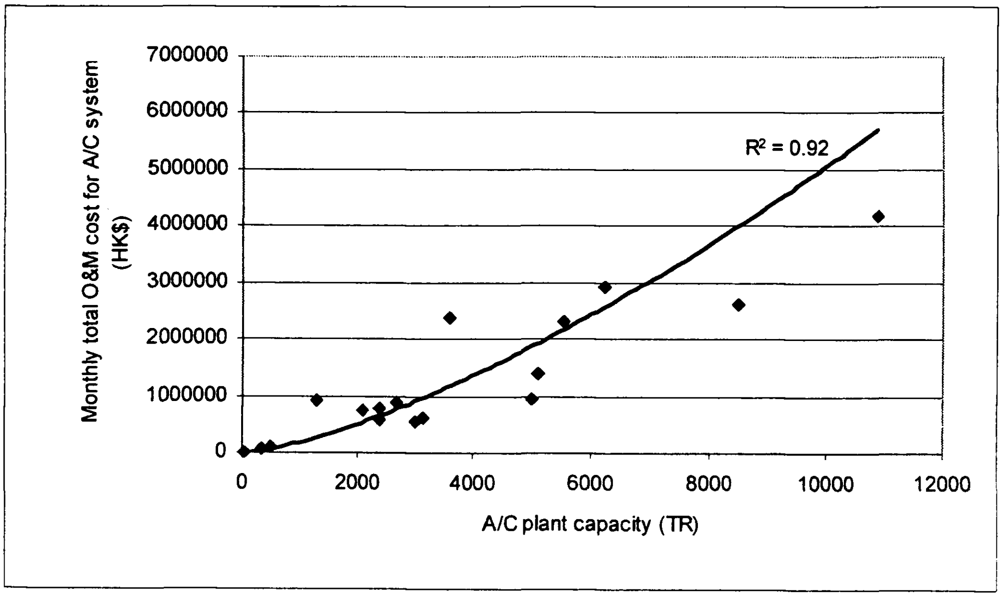


Figure 9.2 Total O&M cost and air-conditioning plant capacity

Figure 9.3 shows that the total air-conditioning O&M cost of the buildings bore no apparent correlation with the building age. The majority of the buildings spent less than HK$400/TR, but two with particularly high O&M cost were noted: i) the relatively new building (MT) was owned by a public corporation which required an O&M standard higher than that of the remaining privately-owned buildings; ii) Building LM, located at a central business district (CBD), was the oldest building which required high O&M expenditures to satisfy its demanding users.

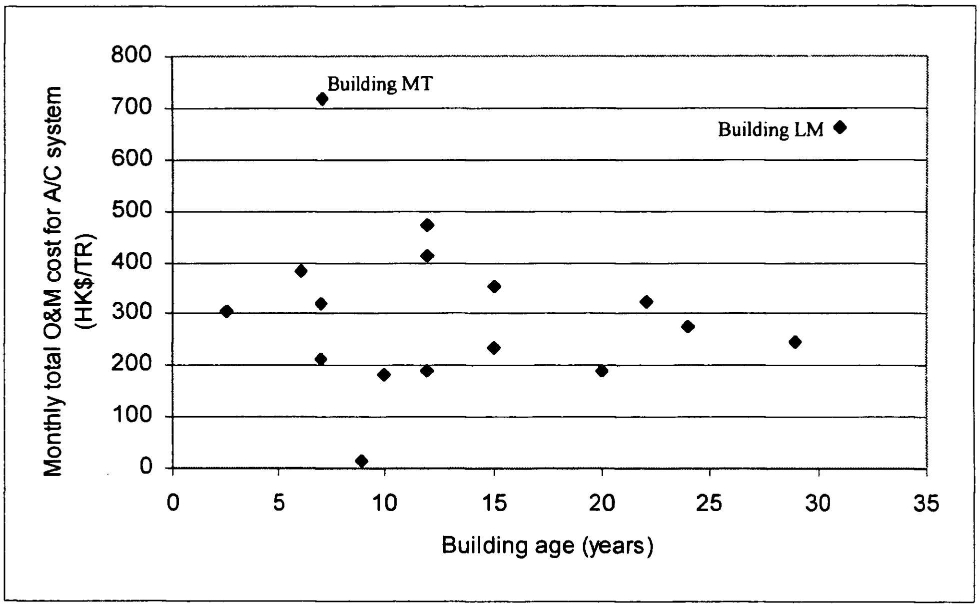


Figure 9.3 Air-conditioning total O&M cost and building age

Additionally, the following should be the major reasons for the large fluctuations in the O&M costs:

1. Older equipment should generally require more maintenance but, as reported in Davies (2000), less money would be spent on maintaining buildings approaching the end of their economic lifespan, probably because of the lower return anticipated. The lifespan of air-conditioning equipment is significantly shorter than that of a building (CIBSE, 2000) and thus might be on list for replacement within the building lifespan. Once there is plan to replace equipment, less maintenance work for the equipment would be undertaken. After replacement, the new equipment would also demand less maintenance work.

2. As discussed earlier, O&M budgets are seldom prepared based on the conditions of existing installations. During a recession, building owners would set a budget ceiling to cover only those pressing maintenance works while deferring those which are non-critical.

3. As shown in Table 9.1, different types of air-conditioning plant (heat rejection methods, i.e. air-cooled or water-cooled) largely influence their energy efficiencies and hence the energy costs.

9.5 In-house and Outsourced Labour Costs

As shown in Figure 9.4, the running energy cost aside, none of the buildings spent less than HK$15/TR each month on O&M of the air-conditioning systems, which may be taken as the minimum cost for the relevant human resources, including in-house and outsourced.

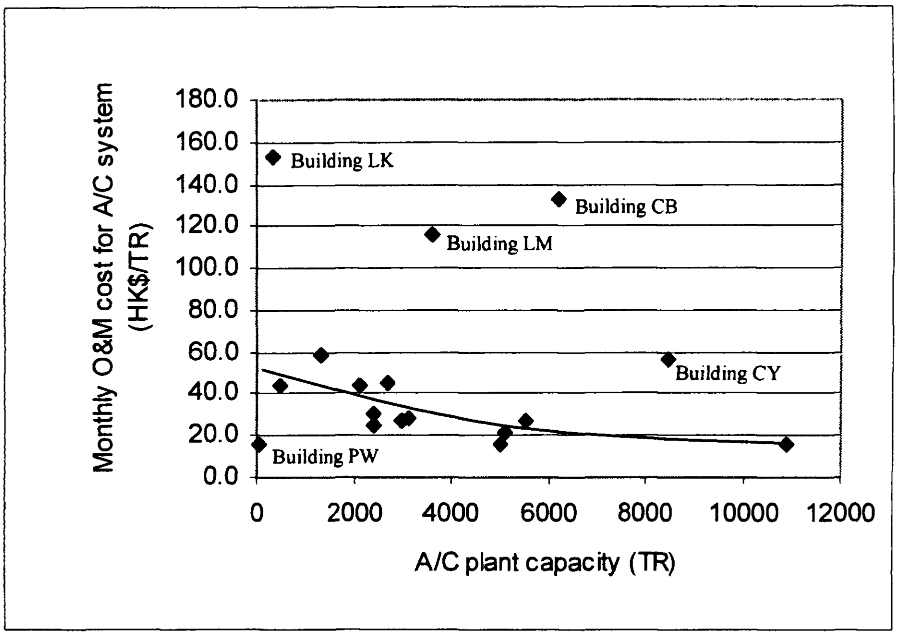


Figure 9.4 **O&M cost (excluding energy cost) and air-conditioning plant capacity**

The several outliners observable from Figure 9.4 were further examined. The owner of the small-scale building (LK) prescribed the engagement of a quality contractor who charged at a high monthly rate (HK$153/TR). Both Buildings LM and CB accommodated demanding tenants; a huge in-house team and hence high staff cost was incurred for delivering quality O&M service. In contrast, Building CY, being a prestige development with O&M services also maintained at high standards, its O&M expenditure was much lower than that of Building CB. As Building CY was the most recently built, it should require less burdensome maintenance for its air-conditioning equipment. The water-cooled air-conditioning plant of Building CY, which is more energy efficient than the air-cooled chillers serving Building CB, should also be an important factor to its lower O&M expenditure. Building PW was the Grade C building in which minimal O&M resources were deployed. Discounting the outliners, the downward trend that Figure 9.4 exhibits may be taken as a manifestation of economies of scale.

Given the high density of buildings in Hong Kong and the well-run transportation and communication facilities available, the advantage of economies of scale can be further maximized if O&M contracts for the same trade are bundled across building boundaries, as has long been practiced in the public sector, e.g. the use of District Term Maintenance Contracts by the Hong Kong Housing Authority for its public housing estates (HKHA, 2004a). Nevertheless, the transaction costs associated with measurement of contractual performance (Williamson, 1985; Buckley & Chapman, 1997; Cheung, 2002), resolving contractual disputes (see Chapter 6) and apportioning O&M expenses among buildings of multiple owners could be problematic (see Chapter 7), which are hurdles to be overcome.

9.6 Energy Cost

As has been widely reported (e.g. Yik et. al, 1998; Lam et al., 2003; EMSD, 2005), air-conditioning is the dominant energy end-use in commercial buildings in Hong Kong. This study examined further its dominance in the total air-conditioning O&M cost. As Figure 9.5 shows, among the surveyed buildings, the average shares of the total air-conditioning O&M cost were 3% for in-house staff, 10% for outsourced resources and 87% for the energy use. Generally, energy costs increase with air-conditioning plant capacities (Figure 9.6), but the uncertainties associated with the energy cost estimation due to improper metering arrangements (as mentioned earlier) should be a factor to the non-uniform upward trend. Figure 9.7 further illustrates that the higher the total O&M cost, the more dominant the energy cost.

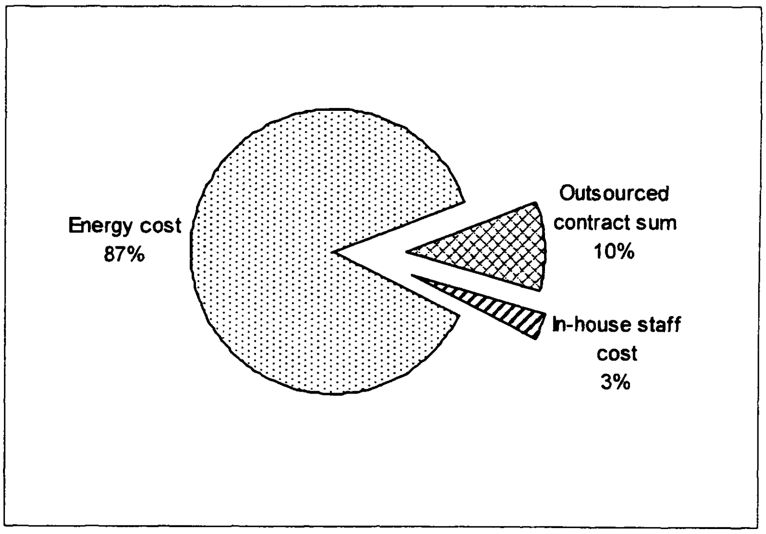


Figure 9.5 **Distribution of air-conditioning O&M costs**

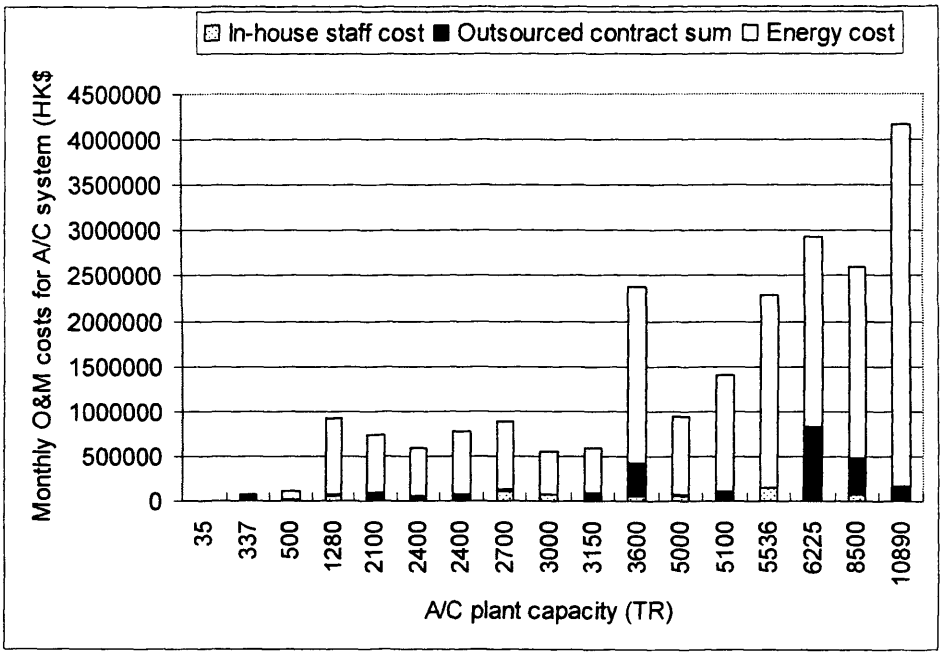


Figure 9.6 **Monthly O&M costs for the air-conditioning systems**

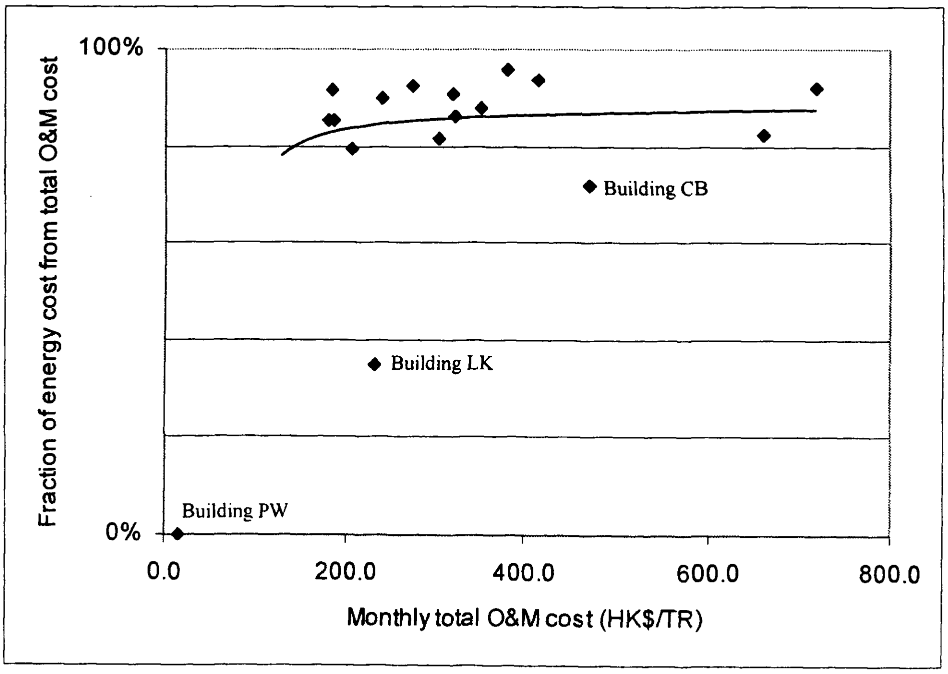


Figure 9.7 **Fraction of energy cost from total O&M cost for the air-conditioning systems**

Among the outliners, Building PW was a Grade C building in which individual tenants paid the energy cost for the split-type air-conditioners serving their own premises. For Building LK, the costly outsourced service (as explained above) is the major reason for the low fraction of energy cost. The high in-house staff cost also explains for the low energy cost proportion for Building CB.

The predominance of the energy cost highlights the importance of reducing energy use in any attempts to minimise building running cost. While there has been an increasing trend of regulating energy consumption of existing buildings worldwide (e.g. Higgins, 2004), relevant regulatory control in Hong Kong has been confined to limit the overall thermal transfer value (OTTV) for the design of envelope for new buildings (BD, 1995). When confronted with a need to cut cost, building owners would resort to shed in-house staff cost via pay cut, downsizing or outsourcing, or deal with service providers for lower O&M contract prices. These myopic tactics may lead to instant cost saving but the amount would be small compared to the energy cost. Consequently, O&M service quality may suffer, which could ultimately lead to an increase in energy cost that outweighs the cost saving and, even worse, to termination or non-renewal of tenancy contracts by angry tenants. The cost for ameliorating the service quality afterwards could also be high.

Figure 9.8 shows that the energy cost intensity (ECI: energy cost per unit floor area) of the majority of buildings surveyed in the present study is below HK\$300/m^2-yr. This is similar to the findings of previous studies which yielded the figure of around 300kWh/m^2 per annum (Yik et al., 2002), given that the electricity tariff in Hong Kong has been around HK$0.9-1.0/kWh. Lacking the required expertise has been identified to be a barrier to improving energy efficiency (Yik et al., 2002), which would apply especially to small building owners. The two most energy intensive buildings (CK and LM), however, belonged to big properties companies and were operated and maintained by professionals. This suggests that other influential factors existed in these buildings.

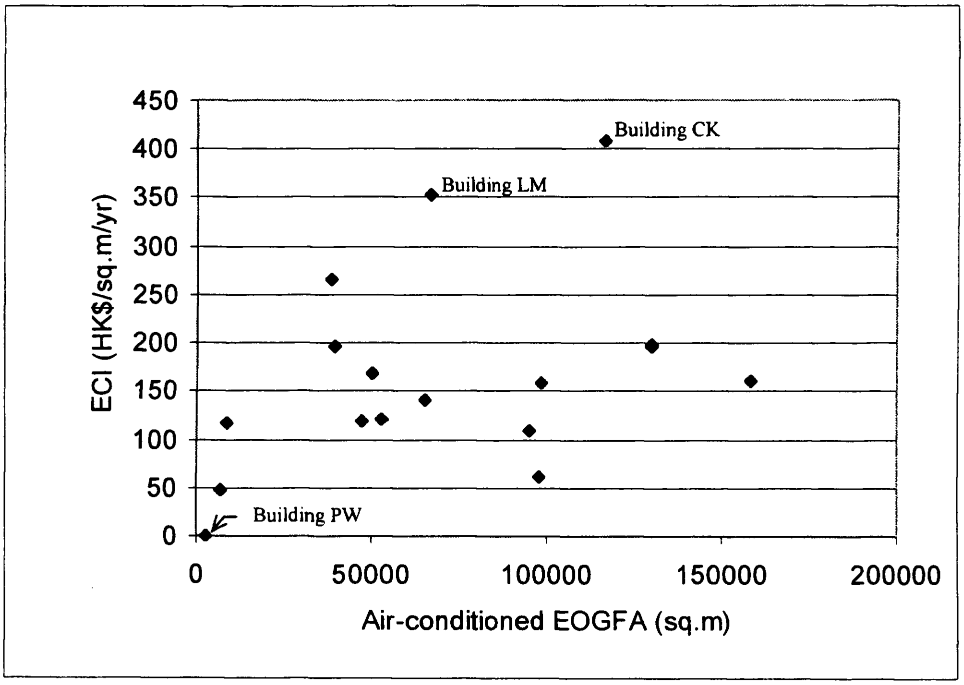


Figure 9.8 **Energy cost intensity of the air-conditioning systems**

For Building LM, which was the oldest among buildings in the sample, energy performance degradation of the ageing equipment should have been the reason for its high energy use. Although building CK was the second newest building, the high energy consumption level could be ascribed to two factors. First, it was the tallest sample building with a relatively small floor area per storey, which would lead to more intensive envelope heat gains and thus higher air-conditioning energy use. Second, it was not a particularly large building (area) but was equipped with the biggest installed cooling capacity, suggesting that its air-conditioning plant was over-sized, which would result in poor part-load energy performance.

Even with the outliners ignored, a consistent trend of variation of *ECI* with building size was still unobservable from Figure 9.8. Fluctuations in the *ECI* of the buildings may be ascribed to different characteristics of the buildings such as orientation, materials of building fabric, occupant intensity, and hours of use etc.; and varied configurations of air-conditioning systems, including heat rejection method, energy recovery system, chilled water pumping system and air distribution system, and automatic control systems, etc. As finding out the root causes of the differences in the *ECI* of the buildings requires detailed audit studies involving thorough analysis of comprehensive historical energy data for the buildings, it was not possible to explore further on this issue in the present study.

9.7 Rent, Management Fee and Air-conditioning Fee

As mentioned above, the incomes of commercial buildings include a basic monthly rent (I_r) and either or both a management fee (I_m) and an air-conditioning fee (I_a). For composite buildings, the rates vary with the type of premises (i.e. office or retail). It follows that the monthly total income from the office (I_O) and the retail (I_R) portions of a building are as expressed in Equations (9.9) to (9.12).

$$I_O = I_{r,O} + M_O \qquad (9.9)$$

$$I_R = I_{r,R} + M_R \qquad (9.10)$$

$$M_O = I_{m,O} + I_{a,O} \qquad (9.11)$$

$$M_R = I_{m,R} + I_{a,R} \qquad (9.12)$$

In the majority of the sample buildings, all-in management fees inclusive of air-conditioning fee were levied on the office (M_O) and retail (M_R) tenants, but tenants in four of the buildings had to pay a separate air-conditioning fee. For the one that was occupied solely by the owner company and its subsidiaries, notional rental figures – derived from comparable market rents and adopted for internal accounting purpose, were included in the data analysis.

Unlike in some overseas countries where transacted rents are distorted by landlords' contributions to fitting-out costs (e.g. Orr et al., 2003), this has not been common in Hong Kong. The accuracy of the collected income data is nonetheless impaired by the common practice of building owner granting variable rent-free refurbishment periods (typically around 3 months) to tenants before they actually move in.

To account for the variations in the proportions of office and retail areas among the buildings, the rental incomes of the commercial buildings were normalised, based on the concept of equivalent office gross floor area ($EOGFA_i$), as in the energy analysis described above. However, a different set of scaling factors (SF_i) (Equation (9.13)) was used, which was determined based on the rental index in 2003 for office (74.6) and retail

(86.5) premises (RVD, 2004). Hence, SF_i was taken as 1.00 for office and 1.16 for retail areas. The normalised monthly rental incomes, namely total rental ($\bar{I}$), rent ($\overline{I_r}$) and management fees ($\overline{M}$) were calculated using Equations (9.14), (9.15) and (9.16). The results are summarised in Table 9.4.

$$EOGFA_i = SF_i \times GFA_i \tag{9.13}$$

$$\bar{I} = \frac{GFA_O \times I_O + GFA_R \times I_R}{\sum_i EOGFA_i} \tag{9.14}$$

$$\overline{I_r} = \frac{GFA_O \times I_{r,O} + GFA_R \times I_{r,R}}{\sum_i EOGFA_i} \tag{9.15}$$

$$\overline{M} = \frac{GFA_O \times M_O + GFA_R \times M_R}{\sum_i EOGFA_i} \tag{9.16}$$

Table 9.4 Monthly total O&M cost, energy cost, management fee, rent and total rental

Building No.	*TC* (HK$/TR)	*EC* (HK$/TR)	$\overline{M}$ (HK$/sq.m)	$\overline{I_r}$ (HK$/sq.m)	$\bar{I}$ (HK$/sq.m)
1	15.3	0.0	25.6	112.4	138.0
2	719.4	661.4	62.6	107.6	170.2
3	243.9	219.4	50.8	192.7	243.4
4	210.4	167.0	38.8	124.5	163.2
5	414.6	387.8	64.6	215.2	279.8
6	187.9	172.3	65.3	175.3	240.5
7	353.2	309.7	50.9	141.3	192.2
8	276.3	254.9	37.9	159.9	197.8
9	234.9	82.0	43.0	182.9	226.0
10	321.5	291.7	44.3	185.3	229.5
11	189.3	161.4	29.0	129.9	159.0
12	306.6	250.5	77.9	175.8	253.7
13	471.8	339.1	75.7	238.9	314.6
14	382.3	366.3	79.6	484.2	563.8
15	183.1	156.1	50.1	371.0	421.1
16	660.8	545.3	80.4	452.3	532.7
17	325.0	280.2	20.6	97.2	117.8

Note, however, should be taken that the accuracy of the results was limited by the assumptions made in the calculations that the mean rental incomes were applicable to all rented areas in the respective portions (office or retail) of individual buildings, although the actual rental figures varied with orientation and level (hence the view available), size and headroom, and the length of the lease period of the premises, and the financial status and reputation of the tenant, etc.; and that the buildings were assumed to have negligible vacant premises.

Pearson product-moment correlation coefficients (r) (Lind et al., 2000) were computed by using Equation (9.17), to unveil if significant correlations exist among the income components. The results are summarised in Table 9.5. Strong positive correlation (r = 0.993) between the rent and the total rental income was found, as a result of the high portion that rent accounted for in the total income, which ranged between 63% and 88%. Moreover, the dominance of energy cost in the total O&M cost, as shown in Figure 9.7, also led to the high positive correlation (r = 0.913) between the two. Additionally, the management fee demonstrates moderately strong positive correlation with rent and total rental income (r = 0.632 and 0.717), which suggests that buildings that can be rented at higher rates tended to charge higher management fees as well.

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}} \qquad (9.17)$$

Table 9.5 **Pearson product-moment correlation matrix of O&M costs and rental incomes**

	TC	EC	$\overline{M}$	$\overline{I}_r$	$\overline{I}$
Total O&M cost (TC)	1.000	0.913	0.600	0.331	0.363
Energy cost (EC)		1.000	0.573	0.291	0.347
Management fee ($\overline{M}$)			1.000	0.632	0.717
Rent ($\overline{I}_r$)				1.000	0.993
Total rental ($\overline{I}$)					1.000

However, the total O&M cost and energy cost bore insignificant correlations with the rent and the total rental income (r ranged between 0.291 and 0.363 only). This may be because the overall building performance, which determines the rental value, is an aggregate of physical, functional and financial performances of the building assets and provisions (BWA, 1994). Although air-conditioning O&M work quality is one of the factors contributing to good performance, the cost paid and the performance achieved may not necessarily bear a strong correlation. The correlations of the air-conditioning O&M and energy costs with the management fee, though still not very high, were comparatively stronger (r = 0.600 and 0.573). This is attributable to the dominance of the air-conditioning O&M costs, which, on average, amounted to 31% of management fee, despite the variations of the O&M costs among the buildings (Figure 9.9) and the large number of typical cost items that need to be disbursed out of the management fee (see Table 9.2).

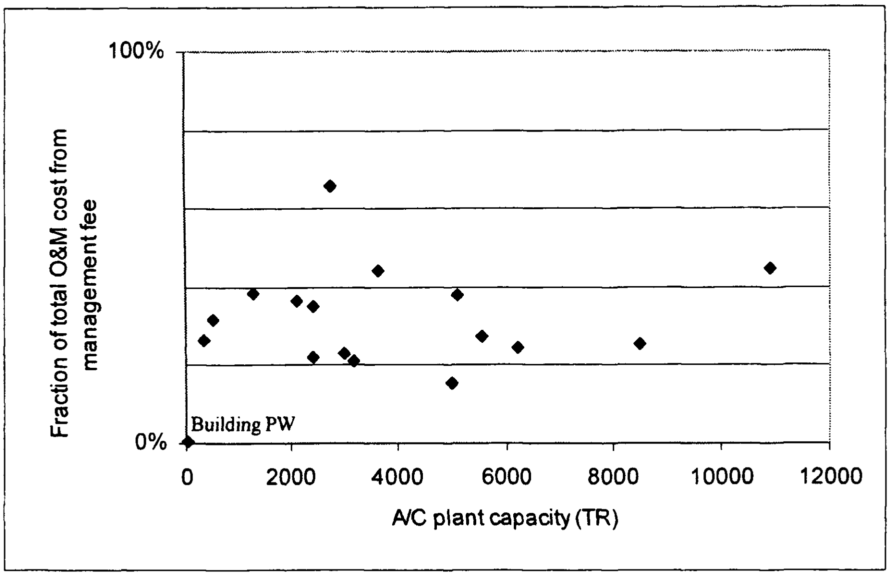


Figure 9.9 Fraction of air-conditioning total O&M cost from management fee

9.8 Extent of Outsourcing

Whether building O&M work should be outsourced or executed in-house, and their merits and drawbacks, have been widely discussed (e.g. Campbell, 1995; Bragg, 1998; Atkin & Brooks, 2000). It appears that an optimum mix of in-house and outsourced O&M services can be achieved (e.g. Barrett & Owen, 1993; Barrett & Bayley, 1993) but empirical findings that inform the extent to which O&M work should be outsourced remain limited.

In the present study, the extent of outsourcing (E_O) is expressed as the ratio of the outsourced contract sum (OC) to the in-house staff cost (IC^*) for the O&M of the air-conditioning system, as shown in Equation (9.18). Note that even if the O&M work for a building is totally outsourced, in-house staffs at managerial level and above will still need to oversee and manage outsourced contracts. Therefore, IC^* is taken as the sum of supervisory (*j=3*) and operational (*j=4*) staff costs incurred for the O&M work produced internally but excludes the staff cost at managerial level and above, as represented by Equation (9.19). Since $OC \geq 0$ and $IC^* \geq 0$, therefore $0 \leq E_O \leq 1$; where $E_O = 0$ for total in-house production whereas $E_O = 1$ for total outsourcing.

$$E_O = \frac{OC}{OC + IC^*} \qquad (9.18)$$

$$IC^* = \sum_{j=3}^{4} N_j \times S_j \times FTE_j \qquad (9.19)$$

Figure 9.10 shows the extent of outsourcing among the surveyed buildings. The absence of an evident pattern suggests that the air-conditioning plant capacity is not a factor that dictates the extent to which the O&M work would be outsourced. Moreover, unlike other trades of building services (e.g. fire services, lift installations, etc.) where licensed contractors are prescribed to undertake some specific maintenance activities, little statutory requirement is imposed on air-conditioning maintenance work (Lai & Yik, 2004), allowing the building owners ample freedom to determine the extent of outsourcing.

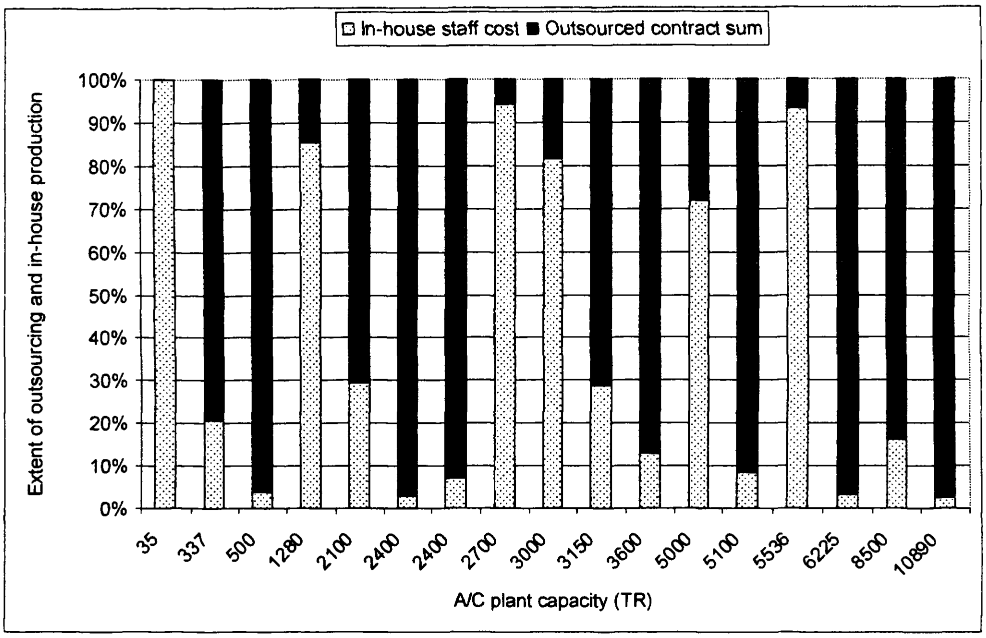


Figure 9.10 Extent of outsourcing and in-house production for O&M work

The law of constrained maximisation in economics dictates that a building owner will go for outsourcing if it would lead to a net benefit, which could be an increase in rental income or a reduction in the O&M cost or both (Figure 9.11a). Conversely, one would forgo outsourcing if producing the O&M work in-house can reduce cost or induce more rental income or both (Figure 9.11b). However, no consistent pattern was observable from the empirical data (Figure 9.12). Further analysis of the cost and income data, shown in Table 9.6, revealed that the extent of outsourcing did not bear significant correlation with both the total O&M cost (r = 0.212) and the total rental income (r = 0.281).

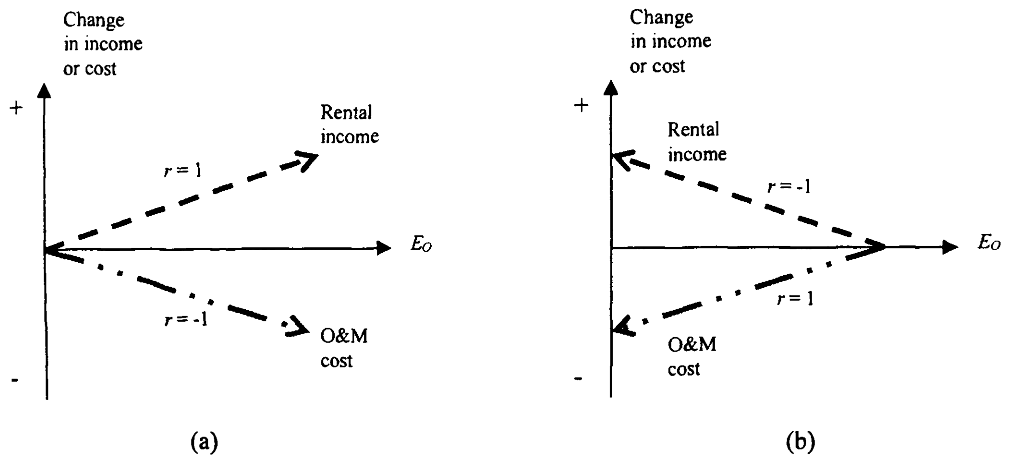


Figure 9.11 Outsourcing favourable (a); In-house production favourable (b)

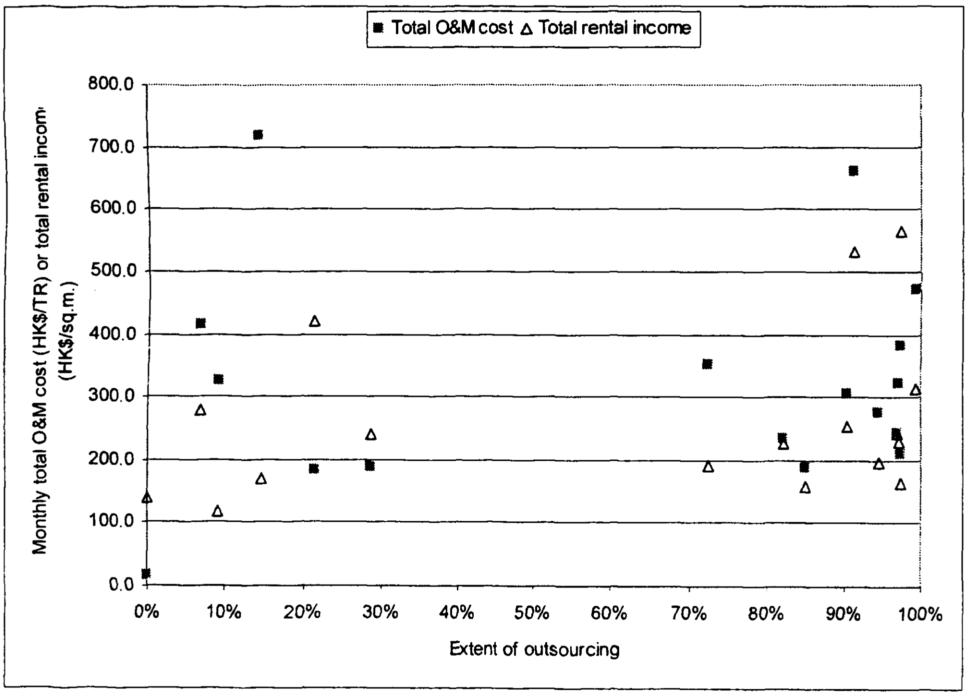


Figure 9.12 Performance of total O&M cost and total rental income against extent of outsourcing

Table 9.6 **Extent of outsourcing, O&M costs and total rental income**

Building No.	IC^* (HK$/TR)	OC (HK$/TR)	E_O	TC (HK$/TR)	$\bar{I}$ (HK$/sq.m)
1	4.8	0.0	0%	15.3	138.0
2	49.6	8.5	15%	719.4	170.2
3	0.8	23.8	97%	243.9	243.4
4	1.1	41.7	97%	210.4	163.2
5	24.9	1.8	7%	414.6	279.8
6	11.0	4.4	29%	187.9	240.5
7	11.7	30.7	72%	353.2	192.2
8	1.1	19.6	95%	276.3	197.8
9	26.6	121.0	82%	234.9	226.0
10	0.8	27.8	97%	321.5	229.5
11	3.5	19.8	85%	189.3	159.0
12	5.0	47.1	90%	306.6	253.7
13	0.9	128.5	99%	471.8	314.6
14	0.4	15.6	97%	382.3	563.8
15	18.5	5.0	21%	183.1	421.1
16	9.6	100.6	91%	660.8	532.7
17	25.9	2.6	9%	325.0	117.8

It is interesting to note from Figure 9.12 that the data clustered at the two ends, i.e. rather than having a mix of comparable proportions, the building owners tended to either outsource or conduct in-house the vast majority of the O&M work. This implies that, due to its scale, scope and complexity, O&M work for air-conditioning systems in commercial buildings can be economically supplied only if it is either largely outsourced or mainly executed in-house. This is understandable because high transaction costs would be incurred for co-ordinating the outsourced and the in-house works, including demarcation of the responsibilities between the two teams, when both account for a significant portion of the total work, which would rule out the choice of a nearly equal mix.

9.9 O&M Costs Before and After Outsourcing

Whether to go for outsourcing depends not only on how much can be saved, but also on how much the building value can be enhanced. The preceding section has shown that outsourcing for O&M work is not promising for the latter purpose. If the building value is impaired due to lowered quality of the contract service, the cost for amelioration may outweigh that saved from outsourcing. Even if value is added to the building, it should be evaluated against the added transaction costs associated with the outsourced contract. Outsourcing is really economical only when there is a net gain in benefit.

However, such evaluation is not practically simple. First, accurate assessment of the changes in the building value is infeasible because it is subject not only to the performance of O&M work, but also other conditions of the built environment (e.g. market supply and demand of the building type). Second, quantifying the benefits and impacts, some of which being non-monetary and intangible, would normally involve making assumptions which are arguable. Even if only the monetary cost items are considered, it is not straightforward as omission of hidden costs and inclusion of sunk costs can often lead to a false evaluation (IC, 1996; Eschenbach, 2003). Although it is impossible to precisely determine the costs that would actually be incurred after the O&M work is outsourced, one can refer to the following to roughly compare the costs before and after outsourcing.

Equation (9.20) depicts mathematically the case of total outsourcing where all the O&M works are undertaken by a service provider. But, partial outsourcing is more common and can be represented by Equation (9.21), where IC_b is the in-house cost before outsourcing and that after outsourcing is IC'_a. The latter is the sum of the in-house cost for executing the work (IC_a) and the transaction cost (TC) incurred for managing the contract by the in-house team. OC denotes the outsourced contract sum. From an economic viewpoint, an outsourcing decision is just if the total O&M cost after the work is outsourced is less than that before (Equation (9.22)), where d is the discount rate and t is the time difference between the costs are evaluated before and after outsourcing.

$$TC + OC < IC_b \tag{9.20}$$

$$\frac{IC'_a + OC}{(1+d)^t} < IC_b \tag{9.21}$$

$$\frac{IC_a + TC + OC}{(1+d)^t} < IC_b \tag{9.22}$$

Adding altogether the costs of labour, material and overhead gives the total in-house cost for performing the O&M work (Equation (9.23)), where x is a (after outsourcing) or b (before outsourcing); and C_i represents the amount of in-house cost element where i is '1' for labour, '2' for material and '3 to N' for overheads. Rearranging Equations (9.22) and (9.23) gives Equation (9.24) and thus Equation (9.25).

$$IC_x = \sum_{i}^{N} C_{ix} \tag{9.23}$$

$$\frac{TC + OC}{(1+d)^t} < \sum_{i=1}^{Q} C_{ib} - \sum_{i=1}^{P} \frac{C_{ia}}{(1+d)^t} \tag{9.24}$$

$$TC + OC < \Delta C_{1,b-a} + \Delta C_{2,b-a} + \sum_{i=3}^{Q} C_{ib}(1+d)^t - \sum_{i=3}^{P} C_{ia} \tag{9.25}$$

$$\Delta C_{1,b-a} = \left[\sum_{j=1}^{4} N_j \times S_j \times FTE_j\right]_b - \left[\sum_{j=1}^{4} N_j \times S_j \times FTE_j\right]_a \tag{9.26}$$

In most cases, minor maintenance demands a level of labour for routine inspection, cleaning and lubrication etc. which dominate the cost of materials used. The change in labour cost ($\Delta C_{1,b-a}$) can be identified based on Equation (9.26) where N_j is the number, S_j is the monthly salary, FTE_j is the full-time equivalent of in-house O&M staff at different work levels (j; j =1: top management, 2: managerial, 3: supervisory and 4: operational) devoted to the work. While for major maintenance where the work is material-demanding rather than labour-intensive, any change in direct material cost ($\Delta C_{2,b-a}$) would be significant. The number of overhead cost elements before (Q) and after (P) outsourcing may vary from one firm to another and their aggregate variation would hinge on the outsourced work scope.

Generally maintenance tools deployed for building O&M work are seldom of substantial value as condition-based maintenance which makes use of precious monitoring devices is still uncommon in the building sector (Pearson, 2002c). Therefore, the cash infused from disposing of the tools would not be enormous. In addition, unless the outsourcing gives rise to dramatic organizational reform and hence down-sizing, there would not be tremendous saving in space cost, and corresponding the costs saved from the associated utilities, insurance and maintenance would not be significant.

To complete the cost comparison, one would need to comprehend both the transaction costs and the outsourced contract value. The latter can be readily obtained from the tender price, but it is impossible to precisely measure the former in monetary terms even though it has been suggested in Chapter 7 that some of the human resources incurred for implementing the contract management tools can be determined.

9.10 Economic Attributes Contributing to Contract Success

In addition to investigating the various O&M cost elements and their correlations with the building income as shown above, the final part of the questionnaire included a list of economic attributes (A_E) with an aim to find out the respondents' perceived importance of the attributes which contribute to the success of the outsourced contract they handled. They were asked to express the ratings by using a cardinal scale ($r_i = 1$ for 'not important' to 5 for 'very important') (see Chapter 7 for the representations for the cardinal scale). The average ratings $R(A_E)$, as shown in Table 9.7, were calculated by using Equation (9.27) where i is the contract number (1, 2, 3, ..., N) and N is the total number of sampled contracts.

$$R(A_E) = \frac{\sum_{i=1}^{N} r_i}{N} \qquad (9.27)$$

Table 9.7 **Perceived importance of economic attributes**

Economic attributes	Overall		Owner		Property management		Contractor	
	$R(A_E)$	Rank	$R_O(A_E)$	Rank	$R_P(A_E)$	Rank	$R_C(A_E)$	Rank
Suitable contract pricing structure	4.00	1.5	4.17	4.5	3.67	3	4.75	1
Suitable tender bidding method	4.00	1.5	4.33	1.5	3.67	3	4.50	2.5
Good financial status of the contractor	3.95	3	3.83	8	3.92	1	4.25	4
Optimum length of contract period	3.77	4	3.83	8	3.50	5.5	4.50	2.5
Low labor cost in market	3.68	5	3.67	10	3.67	3	3.75	7.5
Cost saving compared with in-house production	3.61	6	4.33	1.5	3.25	7	NA	NA
Good global economic environment	3.59	7	4.17	4.5	3.17	8	4.00	5.5
Large contract sum	3.50	8	4.17	4.5	3.00	10.5	4.00	5.5
Low material cost in market	3.41	9	3.83	8	3.08	9	3.75	7.5
Amble budget allowed	3.27	10.5	3.50	11	3.50	5.5	2.25	11
Regular budget reviews	3.27	10.5	4.17	4.5	3.00	10.5	2.75	10
Large contingency allowed	2.91	12	2.50	12	2.92	12	3.50	9

"NA" denotes the attribute is not applicable.

The interviewees considered "suitable contract pricing structure" and "suitable tender bidding method" as the most important economic attributes (both with $R(A_E)$ = 4.00) although their comprehension of the various contract formation methods and contract concepts were less than satisfactory (as discussed in Chapter 8). A similarly high importance rating was given on the attribute "good financial status of the contractor" ($R(A_E)$ = 3.95), indicating the essence of the contractor to finance the O&M work in arrears while there are time lags or delays in contract payment.

Among the second tier of attributes, "optimum length of contract period" was rated as highly important ($R(A_E)$ = 3.77). A very short contract period would mean the transaction costs for forming recurrent contracts would be incurred frequently and the trust that would be built between the contracting parties would be less. If the contract period is overlong, the client would risk tolerating the underperformance of the contractor whose incentive to provide quality service would be lowered.

The attributes perceived by the interviewees as comparably important include: low labor and material costs, good global economic environment and large contract sum ($R(A_E)$ = 3.41 to 3.68). Obviously, the client would be more likely to enjoy quality O&M service when the relevant labor and material costs that the contractor requires are lower. A better economic environment would also mean the contractors would have more market opportunities and thus better job security for the contract personnel. More importantly, building owners would be under less pressure to cut O&M budgets. If the contract sum is large, the contractor would be more able to maximize his profit by virtue of economies of scale.

While the building owners rated the cost saving achievable via outsourcing as very important ($R_O(A_E)$ = 4.33), the property management companies only rated this attribute as fairly important ($R_P(A_E)$ = 3.25). This is because the latter plays the role as a managing agent whose remuneration, unless it is provided in the contract, is independent of the amount of money that the owners could save. This attribute is certainly inapplicable to the contractors, for any cost saved is irrelevant to them given the rare use of the shared saving contract concept (see Chapter 8).

O&M stakeholders should feel more relaxed when ample budget is allowed. However, this attribute only recorded a relatively low importance rating ($R(A_E)$ = 3.27). This may be attributed to the malpractice of budgeting for resources which, as discussed earlier, were usually not figured out for meeting the genuine O&M needs. The same explains why "regular budget reviews" carried an identical importance rating. Finally, because contingency was seldom allowed in O&M contracts to cater for unforeseen scenarios (see Chapter 8), "large contingency allowed" was rated as the least important ($R(A_E)$ = 2.91). The different view of the contractor group on this attribute ($R(A_E)$ = 3.50) supports that the contractors are often required to undertake vaguely defined contractual responsibilities (see Chapter 6) and additional work lying in the loop holes of contract (see Chapter 8), while they hope that such work could be disbursed out of the contingency sum in contracts.

In addition, Equation (7.2) and (7.3) were used to calculate the Kendall coefficient of concordance (W) in order to test the relative agreement of the perceived importance ratings given by different groups of the practitioners. A moderately high level of agreement (W = 0.608) was found among the importance of the attributes perceived by the different groups, despite the different nature of work, perspectives and interests of the practitioners.

Furthermore, the Spearman rank correlation coefficients were calculated by using Equation (7.4) to test the consistency of the perceived importance ratings given by different groups of the interviewees. It was found that the correlation between the groups of owner and property management company is insignificant ($S_r = 0.110$); suggesting that they considered the economic attributes differently. This is probably because the benefit to the property management companies is not closely linked with the building owners' gain from cost saving via outsourcing for the O&M work.

On the other hand, the correlation between the property management group and the contractor group ($S_r = 0.566$) and that between the owner and contractor groups ($S_r = 0.700$) are significant. This may be ascribed to the following reasons:

1. The attribute "cost saving compared with in-house production" is not applicable to the contractors and therefore excluded from the correlation calculations. This means the above Spearman rank correlation coefficients were calculated on slightly different bases.

2. While the attributes were perceived as identically important among the different groups of stakeholder, some of them were rated comparably (e.g. "regular budget reviews" between the property management and the contractor group; and "amble budget allowed" between the groups of owner and contractor); indicating the overlapping of some similar perspectives and interests of the groups.

9.11 Chapter Summary

O&M practitioners generally used their domestic practices for budgeting O&M resources, which varied from one organisation to another. Rather than using a 'zero-based budgeting' principle, budgets are often prepared by modifying historical figures, adopting the estimations made by contractors, or being fettered by pre-determined ceilings. On such bases, the budgets so determined are unlikely to meet the genuine O&M needs.

Building incomes and expenditures on operation and maintenance (O&M) of air-conditioning systems in the 17 commercial buildings were collected and analysed. It has been unveiled that the major factors that affect air-conditioning O&M expenditures are air-conditioned area and plant capacity whereas building age is, in general, not a significant factor.

The O&M cost of air-conditioning systems are typically below HK$400 per unit installed capacity measured in tons of refrigeration, which is dominated by the energy cost (about 87%). Rather than reducing labour resources through outsourcing or negotiation for lower contract prices, the focus for cost minimisation should be to improve building energy performance.

While it is always desirable to enhance rental performance while reducing O&M expenditure, increasing or reducing the extent of outsourcing is not promising for this purpose. Building owners would either to outsource or to undertake in-house the vast impossible to exactly determine the effect of outsourcing on the building performance, it is feasible to use a simplified approach to roughly gauge the changes in the O&M costs.

Although there are variations in the perceived importance of the economic attributes among different groups of O&M stakeholders, a suitable contract pricing structure and an appropriate tender bidding method were regarded as the most important economic attributes contributing to a successful contract. On the other hand, allowing a large enough contingency sum in contract was considered as the least important. This contradicts not only with the theory of incomplete contracting, but also the unbeatable fact that unpredictable scenarios always happen in real-life contracts.

Chapter 10

CONCLUSIONS AND RECOMMENDATIONS

10.1 Introduction

The commercial building stock in Hong Kong has been ageing and enlarging. While more O&M job opportunities are expected, the market competition would also be fierce as the recent economic recession has reinforced the desire of building owners to save resources while adding value to buildings. Apart from cutting staff salary and deferring less critical maintenance, outsourcing has become a prevalent means for building owners who look for more economical but quality O&M work.

The reasons, benefits and drawbacks of outsourcing have been widely discussed in literatures, but there is a general lack of in-depth empirical evidence for their applicability on O&M work for buildings. Whether the building owners who outsourced for O&M work have actually gained or lost, monetarily or non-monetarily, appear to be uncertain and even unknown. There have been many methods suggested for making an outsourcing decision. Whether they are applicable or have in fact been used for building

O&M work are questionable. More fundamentally, before deciding to outsource for O&M work, what considerations the building management took are seldom made known.

An outsourcing decision should be made by considering holistically from different viewpoints (Heikkilä & Cordon, 2002). Likewise, the problems (failure attributes) and merits (success attributes) associated with outsourcing for building O&M work on three different facets namely management, contractual and economic have been studied into based on the research model described in Chapter 5. Hence, the crucial considerations that can help the building management to make outsourcing decision for O&M work are consolidated as follows.

10.2 Management Considerations

Outsourcing for O&M works which need to be accomplished by licensed contractors (e.g. annual inspection of the fire service system by a registered fire service contractor) is indispensable, for it is required by law. If it is mandatory to employ prescribed personnel to carry out some O&M works (e.g. periodic examination of pressure vessels by an appointed examiner), it should be more cost effective to employ them on a jobbing basis unless the amount of work can justify hiring them in-house. While transaction costs can be minimised by fully utilizing an in-house team to handle some routine O&M work and those requiring prompt actions, it would be sensible to outsource for the work which necessitates fluctuating but intensive labour resources (e.g. air-conditioning O&M).

With the typical scale of the studied commercial buildings, the range and complexity of O&M work justify the use of centralised or partially grouped rather than dispersed contract management structure. Despite the customary practice of outsourcing for the O&M work via discrete contracts according to the traditional classification of construction trades, bundling the contracts as well as outsourcing for the work on a cross-boundary (building) basis should be beneficial by virtue of scale of economies.

Table 10.1 Examples of quantifiable criteria for selecting contractors

Management attribute	Examples of criteria
Relevant past work experience	• No. of similar contracts handled in the past • No. of years during which similar contracts were being handled
Relevant professional qualification	• No. of team members attaining certain qualifications • No. of post-qualification years of relevant team members
Contractor's reputation	• No. of site accidents • No. of legal proceedings involved
Number of contractor team members	• Full-time equivalents of team members assigned for the contract

Drawn from the results in Chapter 7, the most important considerations that should be taken for selecting appropriate contractors include: relevant past work experience; relevant professional qualification; good reputation; and large number of team members. Although the management attributes are basically qualitative, some examples of quantitative criteria are suggested in Table 10.1 to assist decision-makers to judge on the attribute being considered. On the other hand, it is noteworthy that whether the contractor is of a large-scale, has an accredited quality assurance scheme in place and comprises team members with good academic qualifications, are not part of the key considerations in O&M contractor selection.

After the O&M work has been outsourced, maintaining effective communication not only among the in-house staff but also that with the contractor is of paramount importance to successful management of the work. O&M information and productivity data should also be communicated to the right parties of the stakeholders. To this end, it is imperative to properly keep track of the O&M activities to avoid backlogs and ineffective production of the work.

In spite of the fact that customer satisfaction survey for building O&M work is seldom conducted, it should be done before the work is outsourced, to serve as a reference point for future comparison. If the survey result is unsatisfactory, switching to outsourcing to look for better service is well-justified. If, however, the result is satisfactory, it would only be reasonable to outsource for the work if it is aimed at continuous improvement or, for the purpose of reducing O&M cost. Likewise, O&M audit is essential for evaluating whether the existing way of producing the work is effective. The audit result is also useful for benchmarking those that should be undertaken after outsourcing.

Regular performance review meetings, O&M audits and customer satisfaction surveys are useful to bridge service quality gaps that may exist along the service supply chain. Nevertheless, undertaking these *ex post* management tools is not costless; the resources deployed for such contract monitoring purpose should be optimized. Incorporating the following contractual considerations is definitely helpful in this connection.

10.3 Contractual Considerations

Figure 8.3, which was logically inferred from transaction cost perspective, portrays the relation between contract performance and transaction costs. Using minimal *ex ante* resources to form contract is likely to require more effort for measuring, monitoring and enforcing the contract, and thus higher *ex post* transaction costs. An optimum balance between these costs will lead to the best value of contract.

There is much room for improving the customary practice of forming loose O&M contracts for commercial buildings. Different trades of O&M work serving different buildings would carry different sets of characteristics. Making clear of such characteristics is important for considering the choice of suitable contract concept(s). A particular contract formation method would fit for some types of work which bear certain characteristics. Although some of these methods are *prima facie* more economical, the sunk costs can be onerous, making the contract inherently inefficient.

While statutory maintenance work is commonly outsourced, its full scope is not confined to the express contract clauses. Rather, any implicit work, including that governed by the law of tort, is also part of the work which the contractor is obligated to undertake. Any attempt to specify it in contract is lavish and should therefore be avoided. In order to help minimize disputes on such issues, O&M practitioners should enhance their legal knowledge and improve the consistency of trade practice in contract interpretation.

Outsourced O&M contracts, which are characterised by their "mixed" asset specificity, high frequency and uncertainty of transactions, should be transacted with bilateral governance where a relational (e.g. alliance or partnering) instead of transactional (i.e. traditional "master-and-servant") contractual relationship should be established between the contracting parties.

Using standard forms of contract is helpful especially when the contract administrators have become familiarised with the model conditions, but their use is not indispensable given that they need to be modified to suit individual circumstances. No matter what type of O&M work is to be outsourced, it is vital to have the scope of work, specification, conditions of contract appropriately drafted. Yet, real-life contracts are incomplete. Rather than to strive for drafting complete contracts, incorporating the "3R-principles" – re-measurement, risk-sharing and relational contracting into outsourced O&M contracts can help enhance the completeness of contract.

10.4 Economic Considerations

To enable sustained use of a commercial building, it requires continuous investment of resources on its O&M work. However, the varied domestic practices used for budgeting O&M resources are unreliable. In order to meet the genuine O&M needs, 'zero-based' budgets should be prepared from scratch. They should also be reviewed regularly and revised as and when appropriate. More essentially, an organization should set forth a proper O&M budgeting policy, which lays down stringent budgeting principles to empower practitioners to prepare budgets which are deferential.

As a result of economic downturn, many building owners have been under pressure to cut back O&M budgets. Among the numerous items of O&M expenses, the total air-conditioning O&M cost is the prime cost item. It embraces primarily the resources for hiring in-house staff, procuring outsourced service and energy consumption. Nevertheless, the focus of outsourcing has been to cut staff cost in addition to searching for cheaper contract service. The achievable saving can be instant but it is insignificant compared with the dominant energy cost.

Given the added *ex ante* and *ex post* transaction costs, outsourcing is not promising for saving O&M cost, as has been shown by the field findings represented in Figure 9.12. The ensuing O&M work quality, which affects the value of building, is also uncertain. Prior to reducing O&M resources, the cost-effectiveness of O&M works should be fully investigated, including the building value they contribute. Rather than to meet myopic cost reduction target, building management should invest on strategic energy conservation measures. For such purpose, the technical know-how of energy saving is no longer a significant barrier. Financial barrier and short-sighted investment strategy are the hurdles that need to be surmounted, if the building owners really desire to reduce O&M expenditure.

If it is decided to outsource for the O&M work, apart from using a suitable contract pricing structure, the building management should select a contractor who has a good financial status and allow an adequate contingency sum to cater for unforeseen contract variations. In addition, the designed contract period should be optimum. While a short contract period would be an incentive for short-sighted contractors to mark up the profit margin, the contractors' incentive to perform would diminish if the contract is too long and without incorporating some financial means for motivating their performance.

10.5 Recommended Framework of Critical Outsourcing Considerations

As reviewed in Chapter 3, the outsourcing decision-making methods suggested in the literatures are not tailored for use in considering outsourcing for building O&M work. Drawn from the identified good practices and the analysis for the common problems found from the current study, Figure 10.1 depicts a framework which summarizes the critical economic, management and contractual considerations recommended for guiding building owners and practitioners to make outsourcing decisions specifically for O&M work for commercial buildings. The considerations include not only those that should be taken before an outsourcing contract is procured, but also those that warrant continuous assessment after the service provider is engaged.

Economic Considerations

- Set forth a proper O&M budgeting policy to lay down stringent budgeting principles to empower practitioners to prepare budgets which are deferential
- Prepare 'zero-based' budgets to meet the genuine O&M needs and carry out proper budgetary controls and reviews
- Cut O&M staff cost via outsourcing only when it does not sacrifice the service quality of O&M work
- Invest on strategic energy conservation measures which can generate larger cost saving than the cost saved from reduced staff cost via outsourcing or lowered contract price through negotiations
- Fully investigate the cost-effectiveness of O&M work prior to cutting O&M resources
- Use a suitable contract pricing structure and allow an adequate contingency sum in contract in addition to selecting a financially-strong contractor
- Adopt an optimum contract period with due incorporation of appropriate financial incentives for motivating contractor performance

Contractual Considerations

- Understand clearly the characteristics of the work to be outsourced and select a suitable contract formation method with appropriate contract concept(s)
- Prepare standard form of contract and make adaptations to form *Pareto* efficient contract to suit individual circumstances
- Communicate bilaterally the explicit contract terms and implicit work scope to minimize disputes arising from adverse selection or asymmetric information
- Incorporate the "3R-principles" – *re-measurement, risk-sharing* and *relational contracting* in contract to deal with *ex post* contingencies
- Appropriately draft the scope of work, specification and conditions of contract to fit for the contract purpose although using standard form of contract is not indispensable
- Save effort from specifying statutory maintenance requirements and works governed by the law of tort, with which the contractors are obligated to comply
- Use optimum transaction costs, including those *ex ante* and *ex post*, to strive for the best value of contract

Outsourcing O&M Work for Commercial Buildings

Management Considerations

- Outsource for statutory work which requires licensed/registered contractor and employ law-prescribed workers on a jobbing basis unless the workload justify hiring them in-house
- Outsource for O&M work which needs fluctuating but intensive manpower
- Adopt a centralised or partially grouped contract management structure for O&M work
- Bundle O&M contracts across building boundary if the administration cost for apportioning relevant fees can be optimised
- Employ O&M contractors with adequate past work experience, adequate professional qualification, good reputation and large workforce dedicated to the contract work
- Conduct customer satisfaction survey and O&M audit before outsourcing; and compare their results with those conducted regularly after outsourcing
- Conduct regular performance review meetings and involve top management staff to discuss strategic contract management issues
- Optimise the conduction of customer satisfaction survey, O&M audit and performance review meetings

Figure 10.1 **Recommended framework of economic, management and contractual considerations**

10.6 Recommended Future Work

While outsourcing for O&M work on a cross-boundary (building) basis has long been practiced in the public sector, their application to private commercial buildings in Hong Kong is rare. Future study to look into such feasibility should help improve the management of building O&M work and hence the productivity of the industry at large.

Appropriate use of management tools such as performance review meeting, customer satisfaction survey and O&M audit would enable better monitoring of the contract work. To what extent they should be utilized and the effect they contribute to managing O&M contracts are worth studying. In particular, a model adapted from the SERVQUAL model has been suggested in Chapter 7 to investigate the gaps in the O&M service supply chain for commercial buildings. Its practical applicability is yet to be verified.

The study has explored the important attributes which are contributory to the success of O&M contract. Notwithstanding that many studies have attempted to develop some methods for selecting contractors for construction work, further studies are required to investigate the relative significance of such attributes and to develop some useful methods that can aid choosing O&M contractors.

Ex ante and *ex post* transaction costs associated with outsourced O&M work are interdependent. The benefit gained from less costly dispute should offset the costs incurred for formulating standard forms and their adaptation to form O&M contracts.

Future work should be commissioned to write standard forms of O&M contracts for use in private commercial buildings. In addition, more researches are necessary to study how to strike a balance between the efforts for forming and managing contracts with respect to the intended quality for different types of O&M work.

The study has unveiled the practitioners' limited understanding of contract formation methods and contract concepts. Besides the need to study how to improve the practitioners' knowledge about O&M service contract, further studies are required to investigate which or which combination of the contract concepts would be suitable for what types of O&M contracts where their scale and complexity are dependent on the trade of work required to serve the building, even though the use of lump sum contract prevailed.

The TCE theories and the best practice guidelines support the recommendation that O&M contracts should incorporate the "3R-principles" to deal with unpredictable contingency of incomplete contracts. However, it is yet to be verified by further empirical studies because all the surveyed contracts were spot contracts formed on a lump sum basis whereas only a paucity of them incorporated the re-measurement and shared saving/cost (risk) contract concepts, and the partnering relationship.

Further research may use a similar approach adopted in this study to examine the contractual issues critical to outsourced O&M contracts in other service industry sectors, e.g. production facilities and manufacturing plants etc., where their electrical and mechanical systems, although maybe of heavier duty, are of similar nature to that of the services installations in commercial buildings.

Statistical analyses and comparisons based on ballpark figures of O&M cost and building information have been popular. But the effectiveness of O&M work could hardly be evaluated without digging out the in-depth cost information. The study has analysed the influence of air-conditioning O&M expenditure on rental income of the commercial buildings. Although collecting detailed and sensitive cost information is difficult, the methodology developed for soliciting the O&M costs for air-conditioning system can be extended for application to other trades of O&M work (e.g. lifts and escalators, electrical services etc.) and the experience gained can enhance more efficient and focussed identification of the building income. When more such data are available, it should be able to obtain a broader and clearer picture about the relation between O&M expenditure and building income.

The study has researched into the outsourcing issues of a number of typical commercial buildings on a cross-sectional basis. As submitted in Chapter 9, it is possible to compare the changes in O&M costs and building value associated with an outsourcing process although it is impracticable to precisely measure the changes. Such findings, which can be obtained by studying some in-depth case studies on a longitudinal basis, should be able to complement the results of this study.

BIBLIOGRAPHY AND REFERENCES

1. Abraham, K.G. and Taylor, S.K. (1996), Firms' Use of Outside Contractors: Theory and Evidence, Journal of Labor Economics, Vol. 14, No. 3, pp. 394-424.

2. ACA (2000), PPC2000: ACA Standard Form of Contract for Project Partnering, Association of Consultant Architects.

3. ACA (2005), TPC2005: ACA Standard Form of Contract for Term Partnering, Association of Consultant Architects.

4. Alexander, K. (1992), Facilities Management Practice (Part 5), Facilities, Vol. 10, No. 5, pp. 11-18.

5. Alexander, K. (1993a), Identifying and Managing Facilities Needs, Facilities, Vol. 11, No. 3, pp. 18-21.

6. Alexander, K. (1993b), Sourcing the Facilities Service, Facilities, Vol. 11, No. 5, pp. 24-27.

7. Alexander, K. (2003), A Strategy for Facilities Management, Facilities, Vol. 21, No. 11/12, pp. 269-274.

8. Al-Najjar, N.I. (1995), Incomplete Contracts and the Governance of Complex Contractual Relationships, The American Economic Review, Vol. 85, No. 2, Paper and Proceedings of the Hundredth and Seventh Annual Meeting of the American Economic Association, Washington, DC, January 6-8, 1995 (May, 1995), 432-436.

9. ANAO (2001), Contract Management – Better Practice Guide, February 2001, Australian National Audit Office. Available at www.anao.gov.au.

10. Angel, J. (2003), Technology Outsourcing: A Practitioner's Guide, The Law Society, London.

11. Angelici, K., Struyk, R.J. and Tikhomirova, M. (1995), Private Maintenance for Moscow's Municipal Housing Stock: Does It Work?, Journal of Housing Economics, Vol. 4, pp. 50-70.

12. Armstrong, J.H. (1990), Technical Memoranda – Building Services Maintenance Management, TM17:1990, The Chartered Institution of Building Services Engineers.

13. Armstrong, J. & Saville, A. (2005), Managing your building services, The Chartered Institution of Building Services Engineers, London.

14. Arnold, C. (1995), Outsourcing Contracts: A specially commissioned Report, Pearson Professional Ltd.

15. Arts, R.H.P.M., Knapp, G.M. and Mann, L. (Jr.) (1998), Some aspects of measuring maintenance performance in the process industry, Journal of Quality in Maintenance Engineering, Vol. 4, No. 1, pp. 6-11.

16. ASD (1997a), Schedule of Rates for Electrical Works in Government Buildings, Architectural Services Department, HKSAR.

17. ASD (1997b), Schedule of Rates for Maintenance and Minor Building Works in Government Buildings, Architectural Services Department, HKSAR.

18. Atkin, B. and Brooks, A. (2000), Total Facilities Management, Blackwell Science.

19. Ball, D. (2003), A weighted decision matrix for outsourcing library services, The Bottom Line: Managing Library Finances, Vol. 16, No. 1, 2003, pp. 25-30.

20. Bana e Costa, C. and Oliverira, R.C. (2002), Assigning priorities for maintenance, repair and refurbishment in managing a municipal housing stock, European Journal of Operational Research, Vol. 138, pp. 380-391.

21. Bandy N.M. (2002), Setting service standards: A structured approach to delivering outstanding customer service for the facility manager, Journal of Facilities Management, Vol. 1, No. pp. 322-336.

22. Barrett, P. (2000), Facilities Management: Towards Best Practice, Blackwell Science.

23. Barrett, P. and Bayley, M. (1993), Contracting Out Professional Services, In Barrett, P. (ed.), Facilities Management Research Directions, RICS Books, pp. 167-171.

24. Barrett, P. and Owen, D. (1993), The Outsourcing Balance: Is there an optimum?, In Barrett, P. (ed.), Facilities Management Research Directions, RICS Books, pp. 155-166.

25. BBP (2001), Preventive Maintenance: In-House or Vendors, The Choice Is Yours, Maintenance Management, Bureau of Business Practice, March, Number 2703.

26. BD (1995), Code of Practice for Overall Thermal Transfer Value in Buildings, Buildings Department, Hong Kong.

27. Berry, L.L. and Parasuraman, A. (1991), Marketing Services: Competing through Quality, The Free Press, New York.

28. BIFM (2005), British Institute of Facilities Management, Available at: http://www.bifm.org.uk/?pd/competence.html.

29. Bishop, P. and Megicks, P. (2002), Asymmetric Information and Strategic Competition in Estate Agency, The Services Industries Journal, Vol. 22, No. 2, pp. 89-108.

30. BMI (1996), The Economic Significance of Maintenance: Maintenance Expenditure 1980-1995, Building Maintenance Information, UK.

31. BOMA (2005), Webpage of Building Owners and Managers Association. Available at: http://www.boma.org/ProductsAndResearch/Benchmarks/

32. Bon, R. & Luck, R. (1999), Outsourcing of property-related management functions in Europe and North America, 1993-1998, Construction Management and Economics, Vol. 17, No. 4, pp. 409-412.

33. Bon, R. & Luck, R. (2001), Annual CREMRU-JCI survey of corporate real estate practices in Europe and North America: 1993-2000, Facilities, Vol. 19, No. 11/12, pp. 386-395.

34. Bon, R., Gibson, V. & Luck, R. (2003), Annual CREMRU-JCI survey of corporate real estate practices in Europe and North America: 1993-2000, Facilities, Vol. 21, No. 7/8, pp. 151-167.

35. Booty, F. (2003), Facilities Management Handbook, LexisNexis, UK.

36. Bragg, S. M. (1998), Outsourcing: A Guide to ... Selecting the Correct Business Unit ... Negotiating the Contract ... Maintaining Control of the Process, John Wiley & Sons, Inc.

37. Bröchner, J. (2000), Understanding Service Qualities in Facilities Management: A Transaction Cost Approach, Proceedings of Brisbane 2000 CIB W70 International Symposium on Facilities Management and Maintenance, 15-17 November, 2000, pp. 455-459.

38. Bröchner, J. Adolfsson, P. & Johansson, M. (2001), Outsourcing facilities management in the process industry: A comparison of Swedish and UK patterns, Journal of Facilities Management, Vol. 1 No. 3, pp. 265-271.

39. Bryman, A. (1988), Quantity and Quality in Social Research, Routledge.

40. Bryman, A. (1989), Research Methods and Organization Studies, Routledge.

41. Bryman, A. and Bell, E. (2003), Business Research Methods, Oxford University Press.

42. BSI (1993), BS 3811:1993, Glossary of Terms used in Terotechnology, British Standards Institution.

43. BSOMES (2005), Building Services Operation and Maintenance Executives Society, Available at: http://www.bsomes.org.hk/history.asp

44. BSP (2004), What is Facility Management in Hong Kong?, Building Services Professional, February 2004, pp. 17-26.

45. BSRIA (1992), Maintenance Contracts for Building Engineering Services – a guide to management and documentation, Application Guide 4/89.2, Building Services Research and Information Association.

46. BSRIA (2001), UK Maintenance Market 2001: Contract Maintenance for Building Engineering Services, Building Services Research and Information Association.

47. BSRIA (2005), Webpage of Building Services Research and Information Association. Available at: http://www.bsria.co.uk/goto/content.asp?section=Services&content=fm+engineering+centre&lang=

48. Buckley, P.J. and Chapman, M. (1997), The perception and measurement of transaction costs, Cambridge Journal of Economics, 21, 127-145.

49. BWA (1994), Facilities economics: incorporating 'Premises Audits', Bernard Williams Associates, Building Economics Bureau Ltd.

50. Campbell, J.D. (1995), Outsourcing in maintenance management: A valid alternative to self-provision, Journal of Quality in Maintenance Engineering, Vol. 1, No. 3, pp. 18-24.

51. Chan, K.T., Lee, R.H.K. and Burnett, J. (2001), Maintenance performance: a case study of hospitality engineering systems, Facilities, Vol. 19, No. 13/14, pp. 494-503.

52. Chandra, M. (1999), Strategic outsourcing of service: A decision and procedural framework, PhD thesis, The University of Texas at Austin.

53. Cheung, S.N.S. (1983), The Contractual Nature of the Firm, Journal of Law & Economics, vol. XXVI, April.

54. Cheung, S.N.S. (1998), The Transaction Costs Paradigm: 1998 Presidential address Western Economic Association, Economic Inquire, Vol. XXXVI, October, pp. 514-521.

55. Cheung, S.N.S. (2002), Economic Explanation Book III, The Choice of Institutional Arrangements, Hong Kong: Arcadia Press.

56. Chui, C.P. (1988), Law of Contract in Hong Kong, China and Hong Kong Law Studies Ltd.

57. CIBSE (1999), TM22 Energy Assessment and Reporting Methodology: Office Assessment Method, The Chartered Institution of Building Services Engineers.

58. CIBSE (2000), Guide to ownership, operation and maintenance of building services, The Chartered Institution of Building Services Engineers.

59. CIOB (2002), Facilities Management Contract: Guidance Notes, The Chartered Institute of Building.

60. CIRC (2001), Construct for Excellence, Report of the Construction Industry Review Committee, Hong Kong, January 2001.

61. CJ (2002), FM market to grow '10% a year', Contract Journal, 5 September, Vol. 413, Issue 6376, p3, 1/8p.

62. CJOC (2003), Center for Job Order Contracting, Available at: http://construction.asu.edu/ace/cje.htm,

63. Coase, R.H. (1937), The Nature of the Firm, Economica, November, pp. 386-405.

64. Cohen, R., Standeven, M., Bordass, B. and Leaman, A. (2001), Assessing building performance in use 1: the Probe process, Building Research & Information, 29(2), 85-102.

65. Corbett, M.F. (1998), Outsourcing: Beyond buying services, Facilities Design & Management, Jan 1998, pp. 40-43.

66. Cotts, D. (2003a), Innovative Contracting, Facilities Design & Management, Jan 2003; 22, 1; p.28.

67. Cotts, D. (2003b), Innovative Contracting, Facilities Design & Management, Feb 2003; 22, 2; p.35.

68. Cotts, D.G. (2004), The facility manager's guide to finance and budgeting, American Management Association.

69. Crocker, K.J. and Reynolds, K.J. (1993), The Efficiency of Incomplete Contracts: An Empirical Analysis of Air Force Engine Procurement, The RAND Journal of Economics, Vol. 24, No. 1 (Spring), 126-146.

70. Davies, H. (2000), Occupancy Costs in Hong Kong, Proceedings of the Brisbane 2000 CIBW70 International Symposium on Facilities Management and Maintenance, 15th-17th November 2000.

71. Deckelman, B. (1998), Strategic outsourcing: the contractual perspective, Available at: http://www.outsourcing-journal.com/issues/may1998/legal.html.

72. Dobb, L.S. (1998), Bringing it all back home: insourcing what you do well, The Bottom Line: Managing Library Finances, Vol. 11, No. 3, pp. 105-110.

73. Domberger, S., Hall, C. and Li, E.A.L. (1995), The determinants of price and quality in competitively tendered contracts, The Economic Journal, 105 (November), pp. 1454-1470.

74. Donaldson, C. and Armstrong, J. (2000), Toolkit for Building Operation Audits, Application Guide AG 13/2000, Building Services Research and Information Association.

75. Dunn, R. L. (2002), Contract maintenance update, Plant Engineering, December, pp. 47-50.

76. Eccles, R.G. (1981), The Quasifirm in the Construction Industry, Journal of Economic Behavior and Organization, 2: 335-357.

77. Egan, J. (1998), Rethinking Construction: the report of the Construction Task Force to the Deputy Prime Minister, John Prescott, on the scope for improving the quality and efficiency of UK construction, Department of the Environment, Transport and the Regions, London.

78. Egbu, C.O. (1999), Skills, knowledge and competencies for managing construction refurbishment works, Construction Management and Economics, Vol. 17, pp. 29-43.

79. Eileen, M. (2003), Outsourcing ..., Facilities Design & Management, February, Vol. 22, Issue 2, p2, 1p.

80. Embleton, P.R. & Wright, P.C. (1998), A practical guide to successful outsourcing, Empowerment in Organizations, Vol. 6, No. 3, pp. 94-106.

81. Edmond, M. (1994), Oil companies turn to TBA specialists, National Petroleum News, January, p. 47.

82. EMSD (2004), Hong Kong Energy End-use Data: 1992-2002. Electrical and Mechanical Services Department, HKSAR, Available at: http://www.emsd.gov.hk/emsd/c_download/pee/hkeeudb_1992-2002_-trad4d.pdf

83. EMSD (2005), Energy Efficiency and Conservation for Buildings, Electrical and Mechanical Services Department, HKSAR.

84. Eschenbach, T.G. (2003), Engineering Economy: Applying Theory to Practice, Oxford University Press.

85. ETWB (2003) Environment, Transport and Works Bureau, HKSAR, Available at: http://www.etwb.gov.hk/FileManager/EN/whats_new/asd.pdf

86. EU (2003), Serving the Community by using the Private Sector: A General guide to Outsourcing, Efficiency Unit, HKSAR.

87. Fan, Y. (2000), Strategic outsourcing: evidence from British companies, Marketing Intelligence & Planning, Vol. 18, No. 4, pp. 213-219.

88. Fisher, M. (1996), Contract Law in Hong Kong: Cases and Commentary, Sweet & Maxwell.

89. Fletcher, R. and Brown, L. (2002), International Marketing: An Asia-Pacific Perspective, Prentice Hall.

90. Fowler, F.J. (2002), Survey Research Methods, Sage Publications.

91. Frost, Y. (1996), A Study of the Contribution of Outsourcing of Services to Adaptation in Organisations, PhD Thesis, Brunel University.

92. Frost, Y. (1997), Outsourcing – a route to improved service delivery?, International Journal of Facilities Management 1(2), pp. 67-76.

93. Garvin, D.A. (1988), Managing Quality: The Strategic and Competitive Edge, The Free Press.

94. Greaver II, M.F. (1999), Strategic Outsourcing: A Structured Approach to Outsourcing Decision and Initiatives, American Management Association.

95. Grigg, J. (1996), Quality management, In Alexander, K. (ed.), Facilities management: Theory and Practice, E&FN Spon, London, pp. 57-70.

96. HAD (1999), Building Management, Home Affairs Department, HKSAR.

97. Hanson, M. (1999), Guide to Facilities Management Contracts, Asset Information Ltd, Cambridge.

98. Hart, O. and Moore, J. (1988), Incomplete Contracts and Renegotiation, Econometrica, Vol. 56, No. 4 (July), 755-785.

99. Hart, O. and Moore, J. (1999), Foundations of Incomplete Contracts, Review of Economic Studies, Vol. 66, No. 1, Special Issue: Contracts, 115-138.

100. Hassanain, M.A. and Al-Saadi, S. (2005), A framework model for outsourcing asset management services, Facilities, Vol. 23, No. 1/2, pp. 73-81.

101. Heikkilã, J. and Cordon, C. (2002), Outsourcing: a core or non-core strategic management decision?, Strategic Change, 11: 183-193.

102. Heywood, J.B. (2001), The Outsourcing Dilemma: the search for competitiveness, Pearson Education Ltd.

103. Higgins, P. (2004), The EU Energy Performance of Buildings Directive: Requirement and latest developments, Keynote address, The 2004 CIBSE National Conference, 29-30 September.

104. Hills, M.J. (1998), Building Contract Procedures in Hong Kong, Longman.

105. HKAPMC (2000), Yearbook 2000, Hong Kong Association of Property Management Companies.

106. HKAPMC (2004), Hong Kong Association of Property Management Companies, Available at: http://www.hkapmc.org.hk/membership/index.html

107. HK-BEAM (2004), An environmental assessment for existing building developments, version 5/04, HK-BEAM Society.

108. HKCA (1992), Guidelines for Quality System Implementation, Hong Kong Construction Association.

109. HKCA (1994), Standard Form of Domestic Subcontracts, Hong Kong Construction Association.

110. HKET (2005), News No. A37 (in Chinese), Hong Kong Economic Times, 2 September.

111. HKG (1994), General Conditions of Contract for Electrical and Mechanical Engineering Works, Government of Hong Kong.

112. HKG (1997a), Lift and Escalators (Safety) Ordinance, Chapter 327, Law of Hong Kong, Government of Hong Kong.

113. HKG (1997b), Occupational Safety and Health Ordinance, Chapter 509, Law of Hong Kong, Government of Hong Kong.

114. HKHA (2003a), Corporate Plan 2001/2002, Hong Kong Housing Authority, Available at: http://www.housingauthority.gov.hk/eng/ha/corp_01/chapter6.htm

115. HKHA (2003b), Corporate Plan 2003/2004, Hong Kong Housing Authority, Available at: http://www.housingauthority.gov.hk/hdw/content/static/file/en/aboutus/publication/corporate_plan/midreview.pdf

116. HKHA (2004a). Hong Kong Housing Authority, Available at: http://www.housingauthority.gov.hk/en/businesspartners/maintenance/0,,,00.html.

117. HKHA (2004b), Hong Kong Housing Authority, Available at: http://www.housingauthority.gov.hk/en/businesspartners/procurement/0,,,00.html#2538.

118. HKIA (2005a), Agreement and schedule of conditions of building contract for use in Hong Kong Special Administrative Region : private edition - with quantities, The Hong Kong Institute of Architects.

119. HKIA (2005b), Agreement and schedule of conditions of nominated sub-contract for use in Hong Kong Special Administrative Region, The Hong Kong Institute of Architects.

120. HKIAC (2003), Hong Kong International Arbitration Centre, Available at: http://www.hkiac.org/en-statistics, html.

121. HKIFM (2005), Hong Kong Institute of Facility Management, Available at: http://www.hkifm.org.hk/Award2004/Award2.html

122. HK IMAIL (2002a), HSBC aims to offload staff to outside service providers, Business Source Premier, Hong Kong IMAIL, 16 January.

123. HK IMAIL (2002b), Fear on PCCW contracts, Business Source Premier, Hong Kong IMAIL, 3 September.

124. HKIR (2000), Professional Practice of Property Management, Hong Kong Institute of Real Estate, Commercial Press (Hong Kong).

125. HKS (1997), Cathay tells 350 employees they won't be needed, Hongkong Standard, 24 July.

126. HKS (1998), Cathay taps HK Telecom services, Hongkong Standard, 24 November.

127. HKS (1999), Warning of declining standards, Hongkong Standard, 15 May.

128. HKSAR (1999a), General Conditions of Contract for Building Works, The Government of The Hong Kong Special Administrative Region.

129. HKSAR (1999b), General Conditions of Contract for E&M Engineering Works, The Government of The Hong Kong Special Administrative Region.

130. HKSAR (1999c), General Conditions of Contract for Design and Build Contracts, The Government of The Hong Kong Special Administrative Region.

131. HKSAR (2000), Sub-contract for Building Works, The Government of The Hong Kong Special Administrative Region.

132. HKSAR (2005), Hong Kong in Brief, Hong Kong Special Administrative Region, Available at: http://www.info.gov.hk/info/hkbrief/eng/ahk.htm.

133. Ho, B.M. (1994), Hong Kong Contract Law, 2nd Edition, Butterworths Asia.

134. Hornby, A.S. (1987), The Oxford Advanced Learner's Dictionary of Current English, Oxford University Press.

135. Horner, R.M.W., El-Haram, M.A., Munns, A.K. (1997), Building maintenance strategy: a new management approach, Journal of Quality in Maintenance Engineering, Vol. 3, No. 4, pp. 273-280.

136. Houston, A. and Youngs, G. (1996), Proactive outsourcing – a strategic partnership: Rank Xerox Technical Centre, Facilities, Vol. 14, No. 7/8, pp. 40-47.

137. Howard, M. (2000), Let's get rid of support services, Engineered Systems, Vol. 17, Issue 8, p.106.

138. HPLB (2005), Report on the Public Consultation on Building Management and Maintenance, Housing, Planning and Lands Bureau, HKSAR.

139. Hussey, D. and Jenster, P. (2003), Outsourcing: the supplier viewpoint, Strategic Change, 12: 7-20.

140. IC (1996), Competitive Tendering and Contracting by Public Sector Agencies, Report No. 48, Industry Commission, Melbourne: AGPS.

141. Idhammar, C. (2003), Contract Maintenance or not? (part 1), Available at: http://www.idcon.com/articles/cont1.htm.

142. IFMA (1999), Outlook on Outsourcing, Research Report #20, International Facility Management Association.

143. IFMA (2001), Operations and Maintenance Benchmarks, Research Report #21, International Facility Management Association.

144. IFMA (2005), Facilities Industry Study, Available at: http://www.ifma.org/research/industrysurveyreport2004.pdf

145. Incognito, J.D. (2001), Outsourcing: Ensuring survival with strategic global partners, Journal of Facilities Management, Vol. 1 No. 1 pp. 7-15.

146. Jeffers, R. (1996), Outsourcing and TUPE: problems and solutions, Facilities, Vol. 14, No. 7/8, July/August, 1996, pp. 52-56.

147. Jenster, P.V. and Pedersen, H.S. (2000), Outsourcing – facts and fiction, Strategic Change, 9: 147-154.

148. JLL (2004a), Asia Pacific Property Digest, Third Quarter 2004, Jones Lang LaSalle.

149. JLL (2004b), Asia Pacific Corporate Real Estate Impact Survey: Turning the Corner, Third Edition, August 2004, Jones Lang LaSalle.

150. JLL (2004c), Office OSCAR: Service Charge Analysis for Offices 2004. Jones Lang LaSalle.

151. JLL (2004d), Retail OSCAR: Service Charge Analysis for Shopping Centres 2004. Jones Lang LaSalle.

152. Johnson, M. (1997), Outsourcing ... in brief, Butterworth-Heinemann.

153. Jones, J. (2002), BOMA PULSE, Chicago Convention 2002, Building Owners and Managers Association (BOMA) International Research Department.

154. Kakabadse, N. and Kakabadse, A. (2000), Critical review – Outsourcing: a paradigm shift, The Journal of Management Development, Vol. 19, No. 8, pp. 670-728.

155. Kashiwagi, D.T. (1999), The Development of the Performance Based Procurement System, Journal of Construction Education, Vol. III, No. 2, pp. 204-214.

156. Kashiwagi, D.T. and Byfield, R. (2002a), State of Utah Performance Information Procurement System, Journal of Construction Engineering and Management, Vol. 128, No. 4, pp. 338-347.

157. Kashiwagi, D.T. and Byfield, R. (2002b), Selecting the best contractor to get performance: On time, on budget, meeting quality expectations, Journal of Facilities Management, Vol. 1, No. 2, pp. 103-116.

158. Katsanis, C.J. (2003), Outsourcing, In Best, R., Langston, C. & De Valence, G. (eds.), Workplace Strategies and Facilities Management: Building in Value, Butterworth Heinemann, pp. 378-394.

159. Kendall, M. and Gibbons, J.D. (1990), Rank correlation methods, 5th edition, Oxford University Press.

160. Kennedy, A. (1996), Facilities management support services, In Alexander, K. (ed.), Facilities management: Theory and Practice, E&FN Spon, London, pp. 134-44.

161. Kleeman, W.B. (1994), Out-tasking: More widespread than outsourcing in the USA, Facilities, Vol. 12, No. 2, pp. 24-26.

162. Klein, B. (2002), The role of incomplete contracts in self-enforcing relationships, in Brousseau, E. and Glachant, J.M. (eds.), The Economics of Contracts: Theories and applications, pp. 59-71, Cambridge University Press.

163. Kotler, P. (2003), Marketing Management, Prentice Hall.

164. Kronman, A.T. (1978), Mistake, Disclosure, Information and the Law of Contracts, Journal of Legal Studies, Vol. VII, Iss. 1, pp. 1-34.

165. Lai J.H.K. and Yik F.W.H. (2004), Law and building services maintenance in Hong Kong, Transactions, The Hong Kong Institution of Engineers, Vol. 11, No. 1, pp. 7-14.

166. Lai, J.H.K. and Yik, F.W.H. (2005), Benchmarking Operation and Maintenance Cost, Performance and Value for Commercial Buildings in Hong Kong, Proceedings of Joint (HKIE/CIBSE/ASHRAE) Symposium 2005: New Challenges in Building Services, Hong Kong SAR, 15 November.

167. Lam, J.C., Li, D.H.W. and Cheung, S.O. (2003), An analysis of electricity end-use in air-conditioned office buildings in Hong Kong, Building and Environment 38: 493-498.

168. Langston, C. & Lauge-Kristensen, R. (2002), Strategic Management of Built Facilities, Butterworth Heinemann.

169. Lankford, W.M. & Parsa, F. (1999), Outsourcing: a primer, Management Decision, 37/4, 310-316.

170. Latham, M. (1994), Constructing the Team: Final report of the government / industry review of procurement and contractual arrangements in the UK construction industry, HMSO, UK.

171. Lau, K.Y. (2001), Housing Privatisation: Some Observations on Disengagement and Delimitation Strategies, Housing Express, November, pp. 11-16.

172. Leaman, A. and Bordass, B. (2001), Assessing building performance in use 4: the Probe occupant surveys and their implications, Building Research & Information, 29(2), 129-143.

173. Lee, R.H.K. (2002), Development of operation and maintenance strategy for hospitality engineering systems, The Hong Kong Polytechnic University, M.Phil. thesis.

174. Lind D.A., Mason, R.D. and Marchal, W.G. (2000), Basic Statistics for Business and Economics, McGraw-Hill.

175. Loo, F.K. (1991), A Guide to Effective Property Management in Hong Kong, Hong Kong University Press.

176. Macneil, I.R. (1974), The Many Futures of Contracts, Southern California Law Review, 47(688): 691-816.

177. Macneil, I.R. (1978), Contractors: adjustment of long-term economic relationship under classical, neoclassical and relational contract law, Northwestern University Law Review, 72(6), 854-906.

178. Marcum, J.W. (1998), Outsourcing in libraries: tactic, strategy, or 'meta-strategy?', Library Administration & Management, Vol. 12, No. 1, pp. 15-25.

179. Marsh, C. (2003), Building Services Procurement, Spon Press.

180. Martin, E.A. (1997), Oxford Dictionary of Law, Oxford University Press.

181. Maskin, E. and Tirole, J. (1999), Unforeseen Contingencies and Incomplete Contracts, Review of Economic Studies, Vol. 66, No. 1, Special Issue: Contracts, 83-114.

182. Masten, S.E. (1996), Empirical Research in Transaction Cost Economics: Challenges, Progress, Directions, In Groenewegen, J. (ed.), Transaction Cost Economics and Beyond, Kluwer Academic Publishers.

183. Matysiak, G. and Tsolacos, S. (2003), Identifying short-term leading indicators for real estate rental performance, Journal of Property Investment & Finance, Vol. 21, No. 3, pp. 212-232.

184. McIvor R. (2000), A practical framework for understanding the outsourcing process, Supply Chain Management: An International Journal, Vol. 5, No. 1, pp. 22-36.

185. McMillan, J. (1992), Games, Strategies and Managers, Oxford University Press.

186. McMorrow, E. (2003), Outsourcing…, Facilities Design & Management, Feb 2003, Vol. 22, Iss. 2, p. 6.

187. Mills, E. (1994), Building Maintenance & Preservation: A guide to design and management, 2nd Edition, Butterworth.

188. Mosher, D. (1999), Outsourcing maintains its momentum, Facilities Design & Management, Nov 1999, Vol. 18, Iss. 11, pp. 30-33.

189. Mou, C.S. (1999), Maintenance: Preventive or Predictive?, Asia Engineer, September, pp. 18-21.

190. Nanayakkara, R. (2000), Condition Survey of Building Services: Application Guide AG 4/2000, Building Services Research and Information Association.

191. Nanayakkara, R. (2003), Specification for the Procurement of Building Services Operation and Maintenance, Building Services Research and Information Association.

192. Nanayakkara, R. and Smith, M.H. (1997), Operation and Maintenance Audits, Application Guide AG 24/7, Building Services Research and Information Association.

193. Nellore, R. and Söderquist, K. (2000), Strategic outsourcing through specifications, Omega, The International Journal of Management Science, Vol. 28, pp. 525-540.

194. OED (2005) Oxford English Dictionary, Available at: http://dictionary.oed.com/

195. OI (2004), Outsourcing Institute, Available at: http://www.bizbrim.com/outsourcing/outsourcing-Institute.htm

196. Orr, A.M., Dunse, N. and Martin, D. (2003), Time on the market and commercial property prices, Journal of Property Investment & Finance, Vol. 21, No. 6, pp. 473-494.

197. Owen D.D. (1994), Contracting-out in a facilities management context, PhD thesis, Salford University.

198. PACE (1999a), Daywork Term Contract: GC/Works/6, Property Advisors to the Civil Estate, London, HMSO.

199. PACE (1999b), Measured Term Contract: GC/Works/7, Property Advisors to the Civil Estate, London, HMSO.

200. PACE (1999c), Specialist Term Contract for Maintenance of Equipment: GC/Works/8, Property Advisors to the Civil Estate, London, HMSO.

201. PACE (1999d), Lump Sum Term Contract for Operation, Maintenance and Repair of Mechanical and Electrical Plant, Equipment and Installations: GC/Works/9, Property Advisors to the Civil Estate, London, HMSO.

202. Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1985), A conceptual model of service quality and its implications for future research, Journal of Marketing, Vol. 49 (Fall), pp. 41-50.

203. Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1988), SERVQUAL: a multiple-item scale for measuring consumer perceptions of service quality, Journal of Retailing, Vol. 64 (Spring), pp. 12-40.

204. Paulin, M., Perrien, J. and Ferguson, R. (1997), Relational contract norms and the effectiveness of commercial banking relationships, International Journal of Service Industry Management, Vol. 8, Iss. 5, pp. 435-452.

205. PCICB (2003), Guidelines on Subcontracting Practice, Provisional Construction Industry Co-ordination Board, Hong Kong, March 2003.

206. PCICB (2004a), Rules and Procedures for the Primary Register of the Voluntary Subcontractor Registration Scheme, Provisional Construction Industry Co-ordination Board, Hong Kong, Version 3, August 2004.

207. PCICB (2004b), Guidelines on Standard Forms of Domestic Subcontracts for Basic Trades, Provisional Construction Industry Co-ordination Board, Hong Kong, August 2004.

208. Pearson, D. (2002a), Outsourcing: judging the pros and cons, Facilities Management, November, pp. 24-25.

209. Pearson, D. (2002b), Services contracts: why detail is vital, Facilities Management, December 2002, pp. 18-19.

210. Pearson, C. (2002c), Condition Based Maintenance in Building Services, Maintenance & Asset Management, Vol. 17, No. 2, pp. 5-10.

211. Pintelon, L. and Van Puyvelde, F. (1997), Maintenance performance reporting systems: some experiences, Journal of Quality in Maintenance Engineering, Vol. 3, No. 1, pp. 4-15.

212. Pitt, T.J. (1997), Data requirements for the prioritization of predictive building maintenance, Facilities, Vol. 15, No. 3/4, March/April, pp. 97-104.

213. PMRC (2001), Maintenance Outsourcing Survey Results – 2001, Plant Maintenance Resource Center, Available at: www.plant-maintenance.com.

214. Prager, J. (1994), Contracting Out Government Services: Lessons from the Private Sector, Public Administration Review, March/April, Vol. 54, No. 2.

215. Pratt, K.T. (2003), Introducing a service level culture, Facilities, Vol. 21, No. 11/12, pp. 253-259.

216. Quinn, J.B. and Hilmer, F.G. (1994), Strategic Outsourcing, Sloan Management Review/Summer, pp. 43-55.

217. Rao, P.K. (2003), The Economics of Transaction Costs: Theory, Methods and Applications, Palgrave Macmillan.

218. Reuvid, J. (2002), Support Services Outsourcing for the Private Sector, In Reuvid J. and Hinks, J. (eds.), Managing Business Support Services: Strategies for Outsourcing & Facilities Management, Kogan Page, pp. 53-59.

219. RICS (1992), Standard Form of Contract for Minor Works, The Royal Institution of Chartered Surveyors (Hong Kong Branch).

220. Ritchie, J. and Lewis, J. (2003), Qualitative Research Practice – A Guide for Social Science Students and Researchers, Sage Publications.

221. Roberts, P. (2002), Procurement – Best Value Criteria for Selection, in Reuvid, J. and Hinks, J. (ed.), Managing Business Support Services: Strategies for Outsourcing & Facilities Management, Kogan Page, pp. 123-135.

222. Roe, S. and Jenkins, J. (2003), Partnering and Alliancing in Construction Projects, Sweet & Maxwell Limited.

223. RVD (2004), Hong Kong Property Review 2004, Rating and Valuation Department, HKSAR.

224. Salkind, N.J. (1996), Exploring Research, pp 10-15, 3rd Edition, Prentice-Hall.

225. Saunder, M.N.K. and Cooper, S.A. (1993), Understanding Business Statistics: An Active-Learning Approach, DP Publications.

226. SCMP (1997), Outsourcing has slow Asian start, South China Morning Post, 5 May.

227. SCMP (1998), Flexibility of Centrex boon for business, South China Morning Post, 17 March.

228. SCMP (1999), More non-core operations handed over to save costs, South China Morning Post, 22 March.

229. SCMP (2003), Hsin Chong seeks growth in facility management, South China Morning Post, 11 June.

230. SCMP (2004), Hutchison sheds 750 telecoms workers, South China Morning Post, 6 Jan.

231. Segal, I. (1999), Complexity and Renegotiation: A Foundation for Incomplete Contracts, Review of Economic Studies, Vol. 66, No. 1, Special Issue: Contracts, 57-82.

232. Sekaran, U. (2003), Research Methods for Business – A skill building approach, 4th Edition, John Wiley & Sons, Inc.

233. Shelanski, H.A. and Klein, P.G. (1995), Empirical Research in Transaction Cost Economics: A Review and Assessment, The Journal of Law, Economics, & Organization, V11, N2, 335-361.

234. Shen, Q (1997), A comparative study of priority setting methods for planned maintenance of public buildings, Facilities, Vol. 15, No. 12/13, pp 331-339.

235. Siu, G.K.M., Bridge, A. and Skitmore, M. (2001), Assessing the service quality of building maintenance providers: mechanical and engineering services, Construction Management and Economics, Vol. 19, pp. 719-726.

236. Smith, M. and Tate, A. (1998), Maintenance Programme Set-Up: Application Guide AG 1/98, Building Services Research and Information Association.

237. Smith, M.H. (1992), Maintenance Contracts for Building Engineering Services – a guide to management and documentation, Building Services Research and Information Association.

238. Spedding, A. (1987) (ed.), Building Maintenance Economics and Management, E&FN Spon.

239. SRCI (1997), Final Report – Establishment of an Energy End-use Database for Hong Kong, a Consultancy Report for Electrical and Mechanical Services Department, Hong Kong Government, SCR International, Australia.

240. Stinchcombe, A.L. (1990), Information and Orgainzations, University of California Press.

241. Stone, R. (2000), Principles of Contract Law, Cavendish Publishing Limited.

242. Straub, A. (2002), Using a condition-dependent approach to maintenance to control costs and performances, Journal of Facilities Management, Vol. 1, No.4, pp. 380-395.

243. Sullivan, D. (1993), The outsource solution, National Petroleum News, January, p. 68.

244. Sullivan, G.P., Pugh, R., Melendez, A.P. and Hunt, W.D. (2002), Operations & Maintenance Best Practices: A Guide to Achieving Operational Efficiency, U.S. Department of Energy, Available at: www.eren.doe.gov/femp.

245. TE (2002), Consignia offloads building services, The Express, 13 April.

246. TEWM (2003a), EWS resident at Ericsson sites, The Eaton-Williams Magazine, Issue Number 13.

247. TEWM (2003b), Positive result for EWS, The Eaton-Williams Magazine, Issue Number 13.

248. TEWM (2003c), Autoglass clearly focuses on EWS, The Eaton-Williams Magazine, Issue Number 13.

249. Tirole, J. (1999), Incomplete Contracts: Where Do We Stand?, Econometrica, Vol. 67, No. 4 (July), 741-781.

250. Tse, W. (2002), Maintenance practices in Hong Kong and the use of the intelligent scheduler, Journal of Quality in Maintenance Engineering, Vol. 8 No. 4, 2002, pp. 369-380.

251. Turner, C. (1996), Trans-European corporate networks: the rise of carrier-based telecommunications outsourcing, European Business Review, Vol. 96, No. 2, pp. 18-22.

252. Turner, J.R. (2004), Farsighted project contract management: incomplete in its entirety, Construction Management and Economics, January, 22, 75-83.

253. Turner, J.R. and Keegan, A. (2001), Mechanisms of Governance in the Project-based Organization: Roles of the Broker and Steward, European Management Journal, Vol. 19, No. 3, pp. 254-267.

254. Turner, J.R. and Müller, R. (2003), On the nature of the project as a temporary organization, International Journal of Project Management, 21, 1-8.

255. Turner, J.R. and Simister, S.J. (2001), Project contract management and a theory of organization, International Journal of Project Management, 19: 457-464.

256. Usher, N. (2004), Outsource or in-house facilities management: The pros and cons, Journal of Facilities Management, Vol. 2, No. 4, pp. 351-359.

257. VTC (2004) Vocational Training Council. 2003 Manpower Survey Report: Real Estate Services, HKSAR.

258. Walker, A. & Chau, K.W. (1999), The relationship between construction project management theory and transaction cost economics, Engineering, Construction and Architectural Management, 6/2, 166-176.

259. Warner, B. (2002), Two bids for £600m Sheffield deal, Contract Journal, 24 July, Vol. 414, Issue 6387, P8, 1/3p, 1c.

260. Welman, J.C. (2001), Research methodology for the business and administrative sciences, 2nd Edition, Oxford University Press.

261. Williams, B. (2002), Cost Effective Facilities Management, Building Economics Bureau Ltd.

262. Williamson, O.E. (1975), Markets and Hierarchies, Free Press, New York.

263. Williamson, O.E. (1979), Transaction cost economics: the governance of contractual relations, Journal of Law & Economics, Vol. 22, October, pp. 233-261.

264. Williamson, O.E. (1981), The Economics of Organization: The Transaction Cost Approach, The American Journal of Sociology, Vol. 87, No. 3, 548-577.

265. Williamson, O.E. (1985), The Economic Institutions of Capitalism, Free Press, New York.

266. Williamson, O.E. (1993), Opportunism and its Critics, Managerial and Decision Economics, Vol. 14, 97-107.

267. Winch, G.M. (1989), The construction firm and the construction project: a transaction cost approach, Construction Management and Economics, 7, 331-345.

268. Winch, G.M. (2001), Governing the project process: a conceptual framework, Construction Management and Economics, 19, 799-808.

269. Wireman, T. (1998), Developing Performance Indicators for Managing Maintenance, Industrial Press.

270. Yates, D.J. and Hardcastle, C. (2003), The causes of conflict and disputes in the Hong Kong construction industry: A transaction cost economics perspective, Vol. 4, No. 22, RICS Foundation.

271. Yik, F.W.H. and Lee, W.L. (2004), Partnership in building energy performance contracting, Building Research and Information, 32(3), 235-243.

272. Yik, F.W.H., Burnett, J. and Prescott, I. (2001a), Predicting air-conditioning energy consumption of a group of buildings using different heat reject methods, Energy and Buildings, Vol. 33, pp. 151-66.

273. Yik, F.W.H., Burnett, J. and Prescott, I. (2001b), A study on the energy performance of three schemes for widening application of water-cooled air-conditioning systems in HK, Energy and Buildings, Vol. 33, pp. 167-82.

274. Yik, F.W.H., Lee, W.L. and Ng, C.K. (2002), Building energy efficiency and the remuneration of operation and maintenance personnel, Facilities, Vol. 20, No. 13/14, pp. 406-413.

275. Yik, F.W.H., Yee, K.F., Sat, P.S.K. and Chan, C.W.H. (1998), A Detailed Energy Audit for a Commercial Office Building in Hong Kong, Transactions, Volume 5, No. 3, pp. 84-88.

276. Young, M. (1992), Service Charges in Commercial Property, Leaf Coppin Publishing Ltd.

277. Zikmund, W.G. (2003), Business Research Methods, Mason, Ohio : Thomson, South-Western.

Appendix A

Publications Synthesized from the Study

1. **Lai, J.H.K.** and Yik, F.W.H. (2004), Law and building services maintenance in Hong Kong, Transactions, Vol. 11, No. 1, The Hong Kong Institution of Engineers, pp. 7-14.

2. **Lai, J.H.K.**, Yik, F.W.H. and Jones, P. (2004a), Disputes arising from vaguely defined contractual responsibilities in building services maintenance contracts, Facilities, Vol. 22, No.1/2, pp. 44-52.

3. **Lai, J.H.K.**, Yik, F.W.H. and Jones, P. (2004b), Practices and performance of outsourced operation and maintenance in commercial buildings, Proceedings of the CIBW70 2004 Hong Kong International Symposium – Facilities Management & Maintenance, December 2004, pp. 357-367.

4. Yik, F.W.H. and **Lai, J.H.K.** (2005), The trend of outsourcing for building services operation and maintenance in Hong Kong, Facilities, Vol. 23, No.1/2, pp. 63-72.

5. **Lai, J.H.K.**, Yik, F.W.H. and Jones, P. (2005a), Critical contractual issues of outsourced operation and maintenance service for commercial buildings, International Journal of Service Industry Management, Vol. 17, No. 4, pp. xx-yy. (in print)

6. **Lai, J.H.K.**, Yik, F.W.H. and Jones, P. (2005b), Operation and maintenance expenditure and rental income of commercial buildings in Hong Kong, Building and Environment. (under review)

Appendix B

Questionnaire for Stage I Survey

A Survey on the Interpretation of the Coverage of Building Services Maintenance Contract Works in Hong Kong

We are conducting a study on the interpretation of the coverage of building services maintenance contract works in Hong Kong, with an aim to find out their effect on any disputes in maintenance contracts.

The attached questionnaire was designed for collecting relevant information from maintenance practitioners involving in managing/handling maintenance works in buildings. We assure you that all the raw information collected would be treated in **strict confidence** and would be used **solely for the research study**. Only aggregated data compiled from statistical analyses, which would bear no associations with individuals or individual buildings, would be published. We, therefore, hope that you would feel at ease to give the genuine answers to the questions and thank you for your time and effort in participating in this survey.

If you have any queries, please do not hesitate to contact:

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QUESTIONNAIRE FOR MAINTENANCE PRACTITIONERS

Please **circle** the most appropriate option(s).
You **may select more than one option** in each answer.
Please state your answer if you choose "Others".

Section 1 Personal Information

1.1 **Name (optional):** ____________________

1.2 **Age:** a) <31 b) 31-40 c) 41-50 d) >50

1.3 **Academic qualifications:**
a) MBA/MA in ____________________
b) MSc/MEng in ____________________
c) BSc/BEng/BA in ____________________
d) HD/HC/Diploma/Cert. in ____________________
e) Others (please state): ____________________

1.4 **Professional qualifications:**
a) MHKIE
b) MCIBSE
c) MIMechE
d) MIEE
e) MIOP
f) Others: ________
g) Registered Professional Engineer
h) Chartered Engineer
i) Chartered Surveryor
j) Authorized Person
k) Registered Electrical Worker (Grade:)
l) Licensed Plumber
m) Others: ____________________

1.5 **Company name (optional):** ____________________

1.6 **Business nature of your company:**
a) Building owner
b) Consultant
c) Contractor
d) Others: ____________________

1.7 **Current level of position:**
a) Top management (e.g. Director, Head of Department)
b) Managerial (e.g. Senior manager, manager)
c) Supervisory (e.g. Assistant manager, supervisor, officer)
d) Others: ____________________

1.8 **Work experience in maintenance:**
a) <6 years b) 6-15 years c) >15 years

Section 2 Technical Information (Part A)

2.1 Have you ever <u>specified</u> in maintenance contracts requiring the contractor, without extra costs to the owner, to be responsible for maintenance work arising from "fair wear and tear"?

a) Yes
b) No
c) Not sure

2.2 Have you ever <u>encountered</u> maintenance contracts requiring the contractor, without extra costs to the owner, to be responsible for maintenance work arising from "fair wear and tear"?

a1) Yes (My role was the contractor)
a2) Yes (My role was to monitor the contract)
b) No
c) Not sure

2.3 Are you clear about the meaning of "fair wear and tear" in maintenance terms?

a) Yes
[Meaning is (optional): ______________________]
b) No
c) Not sure

2.4 Where did you learn about the meaning of "fair wear and tear"?

a) Literature (e.g. books, journals)
b) Common trade practice
c) My own perception
d) Not sure
e) Others: ______________________

2.5 Which of the following example(s) do you think is/are arisen from "fair wear and tear"?

a) A light bulb is burnt
b) A piece of metal conduit is rusted
c) A pipe hanger is loosened
d) A closed hose reel nozzle is leaking water
e) A pump bearing is damaged
f) A lift car call button is defaced
g) The lens of a CCTV camera gives unclear image
h) Not sure
i) None of the above

2.6 In demarcating the maintenance responsibilities, have you ever experienced arguments/disputes on the meaning of "fair wear and tear"?

a) Yes (*Please continue at Q2.7*)
b) No (*Please go to Section 3*)

2.7 If your answer to Q2.6 is "Yes", through which of the following ways were the arguments/disputes settled?

a) Litigation in court [Case name/No. (optional) ______________________]
b) Arbitration/mediation
c) Discussion in meeting
d) Not sure
e) Others: ______________________

2.8 If your answer to Q2.6 is "Yes", which of the following consequence(s) about the maintenance work was/were resulted?

a) Work not proceeded at all
b) Work upheld until an instruction from your superior
c) Work upheld until the dispute was settled
d) Not sure
e) Others: ______________________

2.9 If your answer to Q2.6 is "Yes", which of the following overall effect(s) on the maintenance work was/were resulted?

a) Extra money payable to the contractor
b) No extra money incurred
c) Work completion delayed
d) No delay in work completion
e) Complaints from the users
f) Not sure
g) Others: ______________________

Section 3 Technical Information (Part B)

3.1 Have you ever <u>specified</u> in maintenance contracts requiring the contractor, without extra costs to the owner, to be responsible for maintenance work arising from "vandalism"?

a) Yes
b) No
c) Not sure

3.2 Have you ever <u>encountered</u> maintenance contracts requiring you (as the contractor), without extra costs to the owner, to be responsible for maintenance work arising from "vandalism"?

a1) Yes (My role was the contractor)
a2) Yes (My role was to monitor the contract)
b) No
c) Not sure

3.3 Are you clear about the meaning of "vandalism" in maintenance terms?

a) Yes
[Meaning is (optional): ______________________]
b) No
c) Not sure

3.4 Where did you learn about the meaning of "vandalism"?

a) Literature (e.g. books, journals)
b) Common trade practice
c) My own perception
d) Not sure
e) Others: ____________________

3.5 Which of the following example(s) do you think is/are arisen from "vandalism"?

a) An external lighting luminaire on the road side is damaged due to a collision by a truck
b) An external lighting luminaire on a playground is damaged due to a collision by a basketball
c) An external lighting luminaire is damaged as a result of the breaking of the luminaire by a thieve who steals the light bulb inside
d) An external lighting luminaire is damaged due to an object fallen from height
e) Not sure
f) None of the above

3.6 In demarcating the maintenance responsibilities, have you ever experienced arguments/disputes on the meaning of "vandalism"?

a) Yes (*Please continue at Q3.7*)
b) No (*The questionnaire ends here*)

3.7 If your answer to Q3.6 is "Yes", which of the following ways were the arguments/disputes settled?

a) Litigation in court [Case name/No. (optional) ____________________]
b) Arbitration/mediation
c) Discussion in meeting
d) Not sure
e) Others: ____________________

3.8 If your answer to Q3.6 is "Yes", which of the following consequence(s) about the maintenance work was/were resulted?

a) Work not proceeded at all
b) Work upheld until an instruction from your superior
c) Work upheld until the dispute was settled
d) Not sure
e) Others: ____________________

3.9 If your answer to Q3.6 is "Yes", which of the following overall effect(s) on the maintenance work was/were resulted?

a) Extra money payable to the contractor
b) No extra money incurred
c) Work completion delayed
d) No delay in work completion
e) Complaints from users
f) Not sure
g) Others: ____________________

!!! THANK YOU !!!

Appendix C

Questionnaire for Stage II Interviews

A Survey
on
Outsourcing for Operation and Maintenance Work
for
Commercial Buildings

We are conducting a study on the economic, management and contractual considerations in outsourcing operation and maintenance (O&M) work for commercial buildings; aiming to investigate the management practices, any problematic contractual areas and economic performance of the contracts.

The attached questionnaire was designed for collecting relevant information from maintenance practitioners who oversee, manage, administer or execute O&M contracts for buildings. Part A of the questionnaire comprises four sections covering the general information about personal, company, building and maintenance practice; Part B focuses on individual outsourced contract information.

We assure you that all the raw information collected would be treated in **strict confidentiality** and would be used **solely for the research study**. Only aggregated data compiled from statistical analyses, which would bear no associations with individuals or individual buildings, would be published. We, therefore, hope that you would feel at ease to give genuine answers to the questions and thank you for your time and effort in participating in this survey.

If you have any queries, please do not hesitate to contact:

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QUESTIONNAIRE FOR MAINTENANCE PRACTITIONERS

Please **fill in information at spaces provided**, and **circle** the most appropriate option (***more than one option may be selected***).

Interview No.: __________ (To be filled in by interviewer)
Date: __________
Time: __________
Venue:

Part A

Section 1 Personal Information

1.1 Name (optional): ____________________

1.2 Age: a) <31 b) 31-40 c) 41-50 d) >50

1.3 Academic qualifications:

a) MBA/MA in ____________________
b) MSc/MEng in ____________________
c) BSc/BEng/BA in ____________________
d) HD/HC/Diploma/Cert. in ________________
e) Others (please state): ________________

1.4 Professional qualifications:

a) MHKIE
b) MCIBSE
c) MIMechE
d) MIEE
e) MIOP
f) Others: ________

g) Registered Professional Engineer
h) Chartered Engineer
i) Chartered Surveryor
j) Authorized Person
k) Registered Electrical Worker (Grade:)
l) Licensed Plumber
m) Others: ____________

1.5 Current level of position:

a) Top management (e.g. Director, Head of Department)
b) Managerial (e.g. Senior manager, manager)
c) Supervisory (e.g. Assistant manager, supervisor, officer)
d) Others: ________________

1.6 Work experience in O&M work: _________ years

1.7 Prior work experience in new projects: ____/____ years (design/contracting)

Section 2 Company Information

2.1 Company name (optional): _________________________

2.2 Business nature of your company:

a) Building owner
b) Facilities/property management
c) Maintenance contractor
d) Others: _________________________

2.3 History of your company's current business nature: ______ years

2.4 Number of staff in your company engaged in O&M: ______

Section 3 Building Information

3.1 Building No. / Name (optional): ______________________________

3.2 Gross floor area (GFA) of the building:

		GFA			
a)	Office:	__________	m^2	Grade	_____
b)	Retail:	__________	m^2		
c)	Hotel	__________	m^2	_____	No. of rooms
d)	Carpark:	__________	m^2	_____	No. of carparks
e)	Others:	__________	m^2		

3.3 Age of the building:

a) ________ years since building completion
b) ________ years since last major renovation (contract sum exceeding HK$ 10 million)

3.4 What is the approximate percentage of the building area occupied by the Landlord, multiple owners or tenants?

a) Landlord (______) %
b) Multiple-owners (______) %
c) Tenants (______) %

3.5 Capacity of the following installations in the building:

a) **Electrical**
No. of Tx: __________
Cap. of Tx (kVA): __________

b) **Generator**
No. of generator: __________
Cap. of generator (kVA): __________

c) **Air-conditioning**
Heat rejection system type: __________
Cap. of heat rejection system: __________
Heat exchange (HX) equipment: __________
Cap. of HX equipment __________
No. of chiller: __________
Capacity of chiller (TR): __________
No. of chilled water pump: __________
Cap. of chilled water pump (motor kW, HP): __________

d) **BMS**
No. of DDC controllers: __________
No. of monitoring/control pts.: __________

e) **Fire service**
No. of FS pump: __________
Cap. of FS pump (motor kW, HP): __________
No. of Sprinkler pump: __________
Cap. of Sprinkler pump (motor kW, HP): __________
No. of jockey pump: __________
Cap. of jockey pump (motor kW, HP): __________
No. of hydrants: __________
No. of hose reels: __________
No. AFA panels: __________
No. of monitoring/control points: __________
Others: ______________________________________

f) **Lift & escalator**
No. of lift: __________
Cap. of lift (kg, p, m/s): __________
No. of escalator: __________
Cap. of escalator (people/hr, m/minute): __________

g) **Plumbing & drainage**

No. of potable water tank: ____________

Cap. of potable water tank (m^3): ____________

No. of flushing water tank: ____________

Cap. of flushing water tank (m^3): ____________

No. of potable water pump: ____________

Cap. of potable water pump (motor kW, HP): ____________

No. of flushing water pump: ____________

Cap. of flushing water pump(motor kW, HP): ____________

No. of pneumatic unit: ____________

Cap. of pneumatic unit: ____________

h) **SMATV/CABD system**

No. of satellite dish ____________

No. of TV outlets ____________

No. of FM outlets ____________

i) **Security/Access system**

No. of vehicle access system ____________

No. of CCTV ____________

No. of control gate ____________

No. of personal access system ____________

No. of CCTV ____________

No. of electric door locks ____________

No. of door contacts ____________

j) **Boiler**

No. of steam/water* boiler: ____________ (* delete as appropriate)

Cap. of boiler (kW, HP): ____________

3.6 Which of the following trade(s) of O&M work was outsourced (including those partially outsourced)?

a)	Electrical	b)	Generator
c)	Air-conditioning	d)	BMS
e)	Fire services	f)	Lift and escalator
g)	Plumbing and drainage	h)	SMATV/CABD system
i)	Security/Access system	j)	Boiler installation
k)	Others: ____________________		

3.7 Please indicate the number of <u>in-house</u> full-time equivalents (FTEs) of O&M staff devoted to <u>manage the building</u>:

Owner / Property Management / Contractor * (*delete as appropriate)

a) Top management (e.g. Director, Head of Department) ______

b) Managerial (e.g. Senior manager, manager) ______

c) Supervisory (e.g. Assistant manager, supervisor, officer) ______

d) Operational (e.g. Technician, tradesman) ______

e) Others: ______

3.8 Please indicate the number of <u>contractors'</u> full-time equivalents (FTEs) <u>stipulated</u> in the outsourced contract for <u>managing the building</u> (*answer this question only when it is a package deal contract*):

a) Top management (e.g. Director, Head of Department) ______
b) Managerial (e.g. Senior manager, manager) ______
c) Supervisory (e.g. Assistant manager, supervisor, officer) ______
d) Operational (e.g. Technician, tradesman) ______
e) Others: ______

3.9 Staff monthly salary:

	Level	Average Salary (HK$)
a)	Top management (e.g. Director, Head of Department)	______
b)	Managerial (e.g. Senior manager, manager)	______
c)	Supervisory (e.g. Assistant manager, supervisor, officer)	______
d)	Operational (e.g. Technician, tradesman)	______
e)	Others:	______

3.10 Rent (HK$/sq.m/month):

		Range	Average
a)	Office	______	______
b)	Retail	______	______

3.11 Management fee (HK$/sq.m/month):

		Range	Average
a)	Office	______	______
b)	Retail	______	______

3.12 Air-conditioning fee (HK$/sq.m/month):

		Range	Average
a)	Office	______	______
b)	Retail	______	______

3.13 Electricity consumption of (HK$):

		Monthly	Yearly
a)	A/C only	______	______
b)	Building total	______	______

Section 4 Maintenance Practices

4.1 Which of the following mean(s) has/have been adopted for communicating maintenance requests from occupants to building/maintenance management staff?

a) Fill out paper request
b) Use a call center
c) Send request electronically
d) Others: ____________________________

4.2 Which of the following mean(s) has/have been adopted for communicating maintenance requests from maintenance management staff to O&M contractor?

a) Fill out paper request
b) Use a call center
c) Send request electronically
d) Others: ____________________________

4.3 Has a computerized maintenance management system (CMMS) been used for handling O&M tasks?

a) No
b) Yes (used for : ______ years)

4.4 Please indicate the means for handling the following activities:

	Activities	CMMS	Manually	Not tracked
a)	Repair work requests	•	•	•
b)	Preventive work requests	•	•	•
c)	Project work requests	•	•	•
d)	Contractor work requests	•	•	•
e)	Repair parts and supply costs	•	•	•
f)	Maintenance tool records	•	•	•
g)	Daily rounds activities	•	•	•
h)	Building and equipment records	•	•	•
i)	Periodic activity reports	•	•	•

4.5 Has the maintenance productivity data been shared with the following parties?

	Parties	Yes	No	Unknown
a)	Senior management	•	•	•
b)	Maintenance management	•	•	•
c)	Maintenance staff	•	•	•
d)	Customers	•	•	•
e)	Contractors	•	•	•

4.6 Over the last 12 months, do you have maintenance projects that are deferred? If "yes", please indicate the priority of the deferred maintenance backlog.

a1) Yes (high priority)
a2) Yes (Medium priority)
a3) Yes (low priority)
b) No

Part B

Section 5 Contract Information

5.1 Contract No. ____________ (To be filled in by interviewer)

5.2 Contract (more than one option may be selected if it is a multi-disciplinary contract):

a) Electrical
b) Generator
c) Air-conditioning
d) BMS
e) Fire service
f) Lift & escalator
g) Plumbing &drainage
h) SMATV/CABD
i) Security/Access
j) Boiler
k) Others: ______________________

5.3 Properties covered by the contract:

Building No. (as in Q 3.1) ______________________

5.4 Contract commencement:

Year _________

5.5 Contract period:

______ years

Section 6 Economic Considerations

6.1 Contract sum:
HK$: __________________

6.2 Any contingency allowed in the contract?

a) No
b) Yes (%)
c) Yes (Lump sum:)
d) Others: ______________________

6.3 Please indicate the number of <u>in-house</u> full-time equivalents (FTEs) of O&M staff devoted to <u>manage and execute the contract work</u>:

Owner / Property Management / Contractor * (*delete as appropriate)
a) Top management (e.g. Director, Head of Department) ______
b) Managerial (e.g. Senior manager, manager) ______
c) Supervisory (e.g. Assistant manager, supervisor, officer) ______
d) Operational (e.g. Technician, tradesman) ______
e) Others: ______

6.4 Please indicate the number of <u>contractors'</u> full-time equivalents (FTEs) <u>stipulated</u> (if any) in the outsourced contract for <u>managing the contract</u>:

a) Top management (e.g. Director, Head of Department) ______
b) Managerial (e.g. Senior manager, manager) ______
c) Supervisory (e.g. Assistant manager, supervisor, officer) ______
d) Operational (e.g. Technician, tradesman) ______
e) Others: ______

6.5 Budget for the contract:

a) Last year HK$: ______________
b) Current year HK$: ______________
c) Next year HK$: ______________
d) Others: HK$: ______________
e) Process of preparing budget: _________________________

6.6 Period of maintenance budget plan:

a) 1 year
b) 2 years
c) 3 years
d) 4 years
e) 5 years
f) Others: ____________

6.7 Frequency of maintenance budget reviews:

a) Monthly
b) Quarterly
c) Half-yearly
d) Yearly
e) Others: ______________

6.8 Any change in budgets after the O&M work was outsourced (*answer this question only when the O&M work was originally done in-house*)?

a) No
b) Yes (+/- %) since year: ___________
c) Yes (Lump sum: +/-) since year: ___________
d) Others: ________________________

6.9 Which of the following kind(s) of contract pricing structure is/are adopted in the contract?

a) Fixed price
b) Lump sum
c) Price adjustment
d) Cost plus percentage
e) Cost plus fixed fee
f) Cost plus fluctuating fee
g) Target cost
h) Shared saving or cost
i) Bill of quantity
j) Schedule of rates
k) Package deal (turnkey)
l) Comprehensive
m) Others: ____________

6.10 Which of the following kinds of tendering was/were adopted?

a) Competitive
b) Negotiated
c) Continuation
d) Serial or running
e) Others: ____________________

6.11 How would you rank the <u>overall economic performance</u> of the outsourced contract?

	Very <u>poor</u>				Very <u>good</u>
a) Overall economic performance	1	2	3	4	5

6.12 How would you rank the importance of the following economic attributes contributing to the success of the outsourced contract?

		Not important				Very important
a)	Good global economic environment	1	2	3	4	5
b)	Amble budget allowed	1	2	3	4	5
c)	Regular budget reviews	1	2	3	4	5
d)	Large contract sum	1	2	3	4	5
e)	Large contingency allowed	1	2	3	4	5
f)	Optimum length of contract period	1	2	3	4	5
g)	Cost saving compared with in-house	1	2	3	4	5
h)	Low labor cost in market	1	2	3	4	5
i)	Low material cost in market	1	2	3	4	5
j)	Suitable contract pricing structure	1	2	3	4	5
k)	Suitable tender bidding method	1	2	3	4	5
l)	Good financial status of the contractor	1	2	3	4	5
m)	Others:	1	2	3	4	5

Section 7 Management Considerations

7.1 Which of the following contract management structure(s) was/were adopted?

a) Dispersed
b) Centralized
c) Partial grouped or bundled
d) Totally outsourced
e) Not sure
f) Others: ____________________

7.2 Which of the following type(s) of service provision was/were adopted?

a) Managing agents
b) Managing contractor
c) Total facilities management
d) Not sure
e) Others: ____________________________

7.3 How would you rank the internal communication and the communication between contractor team and management team?

		Very poor				Very good
a)	Internal communication (management team)	1	2	3	4	5
b)	Internal communication (contractor team)	1	2	3	4	5
c)	Communication between contractor team and management team	1	2	3	4	5

7.4 How frequent were the regular performance review meetings held among the management team and the contractor?

a) Weekly
b) Bi-weekly
c) Monthly
d) Quarterly
e) Ad-hoc
f) Others: ____________

7.5 What was the average duration of the performance review meetings?

a) _______ hour(s) <u>or</u> total per year ______ hour(s)

7.6 What was the average number of representatives involved in the performance review meetings?

		Nos.
Management team		
a1)	Top management (e.g. Director, Head of Department)	______
a2)	Managerial (e.g. Senior manager, manager)	______
a3)	Supervisory (e.g. Assistant manager, supervisor, officer)	______
a4)	Operational (e.g. Technician, tradesman)	______
a5)	Others:	______
Contractor team		
b1)	Top management (e.g. Director, Head of Department)	______
b2)	Managerial (e.g. Senior manager, manager)	______
b3)	Supervisory (e.g. Assistant manager, supervisor, officer)	______
b4)	Operational (e.g. Technician, tradesman)	______
b5)	Others:	

7.7 Was there any customer (tenants/multiple owners) satisfaction survey conducted?

a) No
b) Yes (Monthly)
c) Yes (Quarterly)
d) Yes (Half yearly)
e) Yes (Yearly)
f) Others: ____________

7.8 How would you rank the <u>overall service quality</u> as reflected from the customer satisfaction survey(s) conducted during the current contract period?

		Very <u>poor</u>				Very <u>good</u>
a)	Overall service quality as reflected from the latest customer satisfaction survey	1	2	3	4	5
b)	Not know					

7.9 Was there any O&M audit conducted?

a) No
b) Yes (Monthly)
c) Yes (Quarterly)
d) Yes (Half yearly)
e) Yes (Yearly)
f) Others: ______________

7.10 What was the average duration of the O&M audit?

a) ________ hour(s) each or ________ hour(s) per year

7.11 Were the O&M audits done by in-house staff or external company?

		Nos.
By in-house		
a1)	Top management (e.g. Director, Head of Department)	______
a2)	Managerial (e.g. Senior manager, manager)	______
a3)	Supervisory (e.g. Assistant manager, supervisor, officer)	______
a4)	Operational (e.g. Technician, tradesman)	______
a5)	Others:	______
By external		
b1)	Top management (e.g. Director, Head of Department)	______
b2)	Managerial (e.g. Senior manager, manager)	______
b3)	Supervisory (e.g. Assistant manager, supervisor, officer)	______
b4)	Operational (e.g. Technician, tradesman)	______
b5)	Others:	
b6)	**Cost per each audit (HK$):**	__________________________

7.12 How would you rank the optimum mix between in-house and outsourced resources for delivering quality O&M work?

a)	In-house (%):	0	10	20	30	40	50	60	70	80	90	100
b)	Outsourced (%):	0	10	20	30	40	50	60	70	80	90	100
c)	Others:											

7.13 How would you rank the <u>service quality</u> achieved?

		Very <u>poor</u>				Very <u>good</u>
a)	Work done by in-house staff	1	2	3	4	5
b)	Work done by contractor	1	2	3	4	5

7.14 Which of the following types of contractual relationship was achieved?

a) Traditional
b) Cooperative
c) Partnering
d) Alliance

7.15 How would you rank the overall management performance of the outsourced contract?

		Very poor				Very good
a)	Overall management performance	1	2	3	4	5

7.16 How would you rank the importance of the following management attributes contributing to the success of the outsourced contract?

		Not important				Very important
a)	Large number of contractor team's members	1	2	3	4	5
b)	Relevant professional qualification of contractor team	1	2	3	4	5
c)	Relevant academic qualification of contractor team	1	2	3	4	5
d)	Relevant past experience of contract team	1	2	3	4	5
e)	Good reputation of the contractor	1	2	3	4	5
f)	Large company scale of the contractor	1	2	3	4	5
g)	Availability of accredited quality assurance scheme (e.g. ISO9000)	1	2	3	4	5
h)	Effective communication	1	2	3	4	5
i)	Regular performance review meeting	1	2	3	4	5
j)	Regular customer satisfaction survey	1	2	3	4	5
k)	Regular O&M audit	1	2	3	4	5
l)	Traditional contractual relationship	1	2	3	4	5
m)	Cooperative contractual relationship	1	2	3	4	5
n)	Partnering contractual relationship	1	2	3	4	5
o)	Alliance contractual relationship	1	2	3	4	5
p)	Top management's recognition of the customer satisfaction towards O&M service	1	2	3	4	5
q)	Others:	1	2	3	4	5

Section 8 Contractual Considerations

8.1 Was a standard form of contract adopted?

a) No
b) Not sure
c) Yes (please state): ______________________________

8.2 Which of the following area(s) have you ever encountered disputes?

a) Articles of agreement
b) Conditions of contract
c) Specification
d) Schedule of rates
e) Others: ______________

8.3 Which of the following contract clause(s) of <u>Conditions of Contract</u> have you ever encountered disputes?

a) Definitions
b) Payment
c) Scope of the work
d) Duration of contract
e) Determination
f) Termination
g) Assignment of contract
h) Sub-letting/sub-contracting
i) Statement of law enactment
j) Arbitration
k) Indemnity
l) Insurance
m) Right of access
n) Safety
o) Materials
p) Workmanship
q) Warranties
r) Others: ______________

8.4 Which of the following contract clause(s) of <u>Specification</u> have you ever encountered disputes?

a) Scope of works
b) Sites and equipment
c) Related documents
d) Regulations
e) Definitions
f) Facilities to be provided by client
g) Access to sites and plant
h) Noise, nuisance, pollutions and interference
i) Hours of attendance
j) Call-out/Emergency procedures
k) Personnel
l) Quality assurance
m) Materials, equipment and spares
n) Site documentation
o) Others: ______________

8.5 Please rank the <u>extensiveness</u> of the relevant statutory O&M requirements:

	Not <u>high</u>				Very <u>high</u>
a) Extensiveness	1	2	3	4	5

8.6 Please rank the <u>difficulty</u> of complying with the relevant statutory O&M requirements:

	Not <u>high</u>				Very <u>high</u>
a) Difficulty	1	2	3	4	5

8.7 Please rank the <u>adequacy</u> of the contract in stipulating the relevant statutory O&M requirements:

	Not <u>high</u>				Very <u>high</u>
a) Adequacy	1	2	3	4	5

8.8 Please rank the <u>frequency</u> of encountering contractual disputes:

	Not <u>high</u>				Very <u>high</u>
a) Frequency of disputes	1	2	3	4	5

8.9 Please rank the <u>severity</u> (implications in terms of <u>time</u> delay, extra <u>cost</u> and poor <u>quality</u> of work/service) of the contractual disputes encountered:

	Not <u>high</u>				Very <u>high</u>
a) Severity of disputes (time)	1	2	3	4	5
b) Severity of disputes (cost)	1	2	3	4	5
c) Severity of disputes (quality)	1	2	3	4	5

8.10 Please rank the <u>consistency of common trade practice</u> in interpreting the O&M contract requirements:

	Not <u>high</u>				Very <u>high</u>
a) Consistency	1	2	3	4	5

8.11 How would you rank the <u>overall contractual performance</u> of the outsourced contract?

	Very <u>poor</u>				Very <u>good</u>
a) Overall contractual performance	1	2	3	4	5

8.12 How would you rank the importance of the following contractual attributes contributing to the success of the outsourced contract?

		Not important				Very important
a)	Suitable form of contract	1	2	3	4	5
b)	Suitable standard form of contract	1	2	3	4	5
c)	Appropriately drafted articles of agreement	1	2	3	4	5
d)	Appropriately drafted scope of work	1	2	3	4	5
e)	Appropriately drafted conditions of contract	1	2	3	4	5
f)	Appropriately drafted specification	1	2	3	4	5
g)	Uncomplicated relevant statutory requirements	1	2	3	4	5
h)	Ease of complying with the relevant statutory requirements	1	2	3	4	5
i)	Adequacy of contract in stipulating the relevant statutory requirements	1	2	3	4	5
j)	Consistency of common trade practice in contract interpretation	1	2	3	4	5
k)	Others	1	2	3	4	5

8.13 How would you rank the overall success of the outsourced contract?

		Not successful				Very successful
a)	Overall success	1	2	3	4	5

!!! Thank you for your participation !!!