A Framework of Knowledge Processes for Professional Quantity Surveying Firms in Hong Kong

by

Choi Kit Yung Sonia

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CERTIFICATE OF ORIGINALITY

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ABSTRACT

Knowledge is increasingly recognised as a competitive advantage of organisations. In view of the essence of knowledge, this research seeks to explore the knowledge processes which are being undertaken in professional quantity surveying firms in Hong Kong. As quantity surveying firms are characterised by their professional identity and knowledge-driven nature, knowledge is highly crucial to their successes in the competitive and dynamics business environment. Owing to the phenomena that knowledge management is still in its infancy in the construction industry and structured knowledge management processes have probably not yet been well deployed in the surveying discipline, this research focuses on implicit knowledge management processes.

A framework of knowledge processes was developed from a detailed literature review with an attempt to enhance the knowledge flow in Hong Kong professional quantity surveying firms. The applicability and validity of the framework were verified by qualitative and quantitative research methods. Three individual interviews were conducted with selected experienced practitioners in firms of different sizes with a view to reveal the prevailing implicit knowledge management processes in the surveying discipline from their perspectives. Findings of the individual interviews indicated the presence of such processes and similar practices in different firms. On the basis of these interview findings, a questionnaire survey was then conducted to study the opinion of professional quantity surveyors on the details of these processes and the questionnaire was returned with a response rate of

42.6% (111 out of 260). By these means, qualitative and quantitative approaches both reported consistent findings.

Taking advantage of the findings collected in the individual interviews and the questionnaire survey, this research identifies and derives six knowledge management processes in the quantity surveying firms, namely acquisition, creation, store, distribution, use and maintaining. These processes interact with one another to form a powerful tool for sustaining the competitiveness of the firms.

Moreover, this research also reveals that the awareness of managing knowledge in Hong Kong professional quantity surveying firms still remains low. In addition, results of statistical analyses suggest that firm size and experience of professional practice have some bearing on quantity surveyors' perception of how knowledge is managed in their workplace.

The content of chapter four “Interview Findings” of this research thesis has been adopted in the compilation of an academic paper “Implicit Knowledge Management Processes in Knowledge-based Organisations: A Qualitative Study” which was submitted to “Construction Management and Economies” in April 2005.

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1. INTRODUCTION

1.1 Background

Knowledge is increasingly regarded as a survival tool in a dynamic and competitive environment (Laudon, 2000). Drucker (1993, p.7) shares this view and states in his text, "Post-Capitalist Society", that "the basic economic resource is no longer capital, natural resources, nor labour. It is and will be knowledge". Therefore, there is always a pressing need in every knowledge-intensive organisation for knowledge to be well managed to cope with the shortcomings arising from the common uneven distribution of knowledge in these organisations. This is fully echoed by Nissen (2004, p.186), who emphasises that "efficient knowledge flow is critical to enterprise performance".

In line with other knowledge-intensive organisations in Hong Kong, like accounting, engineering and legal firms, quantity surveying firms place heavy reliance on their wealth of knowledge in their business. Despite the existence of lots of variants in form and context, it is evident that this wealth of knowledge invariably injects substantial influence into the firms' operation and project deliverables. For instance, exchanges of ideas and discussions are normal scenes in corridors and across meeting tables. Reference to archives of useful cost data and contract document templates almost constitutes an indispensable process in the compilation of every contract document.

Ironically, in spite of its inherently crucial role, knowledge is often not managed in a systematic manner, and its contribution to firm success is commonly overlooked. These firms may hold a belief that investment in knowledge processes would rarely boost the firms' business and generate proportionate financial returns. Thus it would seem that

most have barely anything more than a “minimum provision” to manage knowledge – a library and a librarian.

Nevertheless, in the execution of their highly professional duties, quantity surveyors inevitably create, apply and transform knowledge, and are thus associated with knowledge management (Gupta et al., 2004). In the absence of the assistance of comprehensive and systematic facilities for knowledge, quantity surveyors normally have to resort to their personal databases. These personal databases may only comprise poor organised collections of newsletters, job reference sheets, obsolete project quotations, etc. Depending on one’s initiative and self-discipline, the extent to which these personal databases are regularly reviewed and updated may vary greatly from one to another. As such, these firms can by no means wholly ensure the quality and consistency of their output.

Quantity surveying firms not only are knowledge-intensive firms but also possess the characteristics of professional services organisations. Theoretically, the issue of managing knowledge should have attracted much attention in quantity surveying firms, as only those that can best manage knowledge are able to preserve their competitive advantage (Hiebeler, 1996). To the contrary, little is known about the current practice adopted in quantity surveying firms. Even worse, despite the emergence of various frameworks of knowledge management processes advocated by different scholars, there is so far no similar framework specifically representing how knowledge is managed in quantity surveying firms.

1.2 Research Contributions and Objectives

This research focuses on the processes of managing knowledge in quantity surveying firms in Hong Kong. The drive for the research clearly originates from the prevailing paradoxical view of managing knowledge in the field as illustrated in the previous section. Further, as indicated by the Vocational Training Council (2003), the population of construction professionals in Hong Kong has reached 14,080. 14% (i.e. 1,966) are professionals practising in the quantity surveying discipline. Similarly, the membership statistics of The Hong Kong Institute of Surveyors (HKIS) also reveal that quantity surveyors dominate the spectrum of surveyors in the Institute. In view of the dominance of quantity surveyors practising in both the construction industry and the surveying discipline and the intermingled relationship between knowledge and quantity surveying firms, a study of the process of how quantity surveying firms manage knowledge seems to be of significant and practical importance. Apart from this, the benefit of the research is also considered to be multifold.

First, process is one of the basic elements in knowledge management (KMWG, 2001). In addition, In addition, Palaniappan (2004, p.124) emphasises the indispensable role of process in knowledge management and suggests that "the presence of the 'right' culture but lack of reliable and appropriate processes that can capture and disseminate knowledge would be equivalent to having a complex task assigned to a person who is extremely willing but is not competent enough". By a thorough investigation of how quantity surveying firms manage their knowledge, the research should develop a practical reference for the implementation of knowledge management processes in the quantity surveying discipline.

Second, a conceptual framework of knowledge processes in quantity surveying firms in Hong Kong is proposed in this research on the basis of the investigation findings with regard to the relevant processes adopted by these firms. This conceptual framework is also formulated with reference to the published literature in relation to knowledge management processes in the past ten years. As a result, it is contended that this research has some theoretical implications for other published knowledge management literature, particularly that with emphasis on knowledge management processes.

Despite its general focus on quantity surveying firms, this research conclusion may also apply to other surveying disciplines, such as general practice surveying and building surveying.

In view of the above considerations, the overall aim of this research is to ascertain how professional quantity surveying firms in Hong Kong implicitly manage knowledge. The specific objectives of this research are as follows:

- To ascertain the degree of awareness of managing knowledge in quantity surveying firms;

- To investigate the knowledge managing activities / actions generally undertaken in quantity surveying firms;

- To develop a conceptual framework of managing knowledge for professional quantity surveying firms;

- To analyse the influence of firm size and experience of professional practice on quantity surveyors' perceptions of how knowledge is managed in their firms.

1.3 Structure of the Thesis

This thesis is organised into six chapters. Chapter 2, following this introductory chapter, provides a critical review of the theoretical aspects of knowledge, quantity surveying firms, knowledge management processes and the proposed conceptual framework of managing knowledge in quantity surveying firms. In addition, some research hypotheses are also established on this footing. Following Chapter 2, there is a detailed discussion of the research design philosophy in Chapter 3. Individual interviews, which are the first test of validity for the said proposed conceptual framework, are also presented with a thorough analysis of the findings in Chapter 4. Chapter 5 extends the discussion to an analysis of the survey data. Finally, Chapter 6 concludes this research with a summary of findings, some recommendations for quantity surveying firms and the limitations of this research study.

2. THEORETICAL PERSPECTIVES

2.1 Introduction

An extensive review of the literature regarding managing knowledge in professional quantity surveying firms, frameworks of knowledge management and the influence of firm size and length of experience is presented in this chapter. The first section focuses on the essence of knowledge to quantity surveying firms and the awareness of managing knowledge in the construction industry and the surveying discipline. The second section illustrates the development of the proposed framework of knowledge processes on the basis of various frameworks revealed in past literature. The last section concentrates on factors affecting quantity surveyors' understanding of managing knowledge in their workplace.

2.2 Managing Knowledge and Quantity Surveying Firms

2.2.1 Managing Knowledge

Nowadays, knowledge is considered as an input potentially more influential than the traditional factors of production such as land, labour, capital and raw materials (Liao and Yau, 2001). Therefore, before proceeding to a discussion of how to manage knowledge, the definition of knowledge has to be established by some means. However, knowledge itself is an abstract concept and thus cannot be defined in simple terms. Although knowledge originates from a hierarchical scale with "data", "information" and "wisdom", attempts to identify the definition of knowledge by adopting these distinctions are considered far from satisfactory (Kamara et al., 2002).

On the other hand, some scholars suggest that knowledge can instead be identified by reference to its functions. Sveiby (1997, p.38) believes that "knowledge is a capability to act", and this view is also supported by Roth (2002, p.13), who defines knowledge as:

> "…the evaluating and incorporating of new experiences and information. It is a set of insights, experiences, and procedures that guide thoughts, behaviours, actions and decisions. Action is a choice made on the basis of knowledge."

In the same vein, Fernie et al. (2003, p.179) posit that "a universal definition of knowledge remains elusive and knowledge is ultimately an individual's ability to make judgements". On the whole, the value of knowledge lies in its influence on decision making processes and implementation of assignments.

A close examination of the knowledge in a firm can enable us to arrive at a more delicate classification. It can be categorised into two distinct stocks of knowledge, namely private and public stocks. This concept of private and public stocks of knowledge was introduced by Matusik (2002). He states that "private knowledge is unique to the firms … which can be a source of competitive advantage whereas public knowledge resides in public domain … not unique to any one firm and is public good" (Matusik, 2002, p.458).

Evans (2003, p.3) is concerned with private knowledge and asserts that "knowledge is now considered the key strategic business asset". Further, quantity surveying firms in Hong Kong are operating as private enterprises and competing among themselves. In order to differentiate itself from others, every quantity surveying firm has to strive to demonstrate its competitive advantage to potential clients by promoting the wealth of knowledge residing in the firm's output. This wealth of knowledge generally represents

the organisational memory of the firm, which is a fruit of the experience and knowledge gained by quantity surveyors over time.

The debate about the definition of knowledge does not cease at this point. Among numerous schools of thoughts, some scholars have proposed that knowledge is indeed either tacit or explicit (Polyani, 1966; Nonaka, 1994). Tacit knowledge is subjective and personal. It is hard to articulate as it resides in the minds of individuals in the form of crafts, insights and intuitions, beliefs and mental models. It can only be abstracted from a long period of exposure. On the other hand, explicit knowledge is objective, formal and can be codified in the form of words, models, and formulae for communicating to others (Nonaka and Takeuchi, 1995).

In view of the above, knowledge itself is basically an intangible concept. The demarcation line differentiating it from other entities is sometimes too fine to be identified. After all, as indicated above, it can still be sensibly defined in different contexts and perspectives.

2.2.2 Implicitly Managing Knowledge

In recent years, academic literature has placed a strong emphasis on the crucial role of knowledge in organisations. This is because knowledge management is gaining importance in organisations and is well proved to shorten production time, improve customers' satisfaction and minimise cost (Leonard, 1998). Given the widespread interest in knowledge management, a wide variety of definitions of knowledge management have emerged (Broadbent, 1998; Gartner Group, 1988; Srikantaiah, 2000; APQC, 2002) and are continuing to develop (Skyrme, 2001).

Nevertheless, knowledge management is still in its infancy in the construction industry. It is common for firms to somehow be involved in knowledge management, but often it is implemented implicitly and informally (Gamble, 2001). Although knowledge management is perceived by the majority as a way to enhance knowledge and to establish competitive advantage, knowledge management in the Hong Kong surveying industry has not been extensively adopted. This phenomenon is well reflected by the observation of Fong and Cao (2004) that knowledge management in general practice surveying firms has received limited awareness and application. Owing to the fact that formal knowledge management, such as employing knowledge management consultants, importing knowledge management practice and establishing internal knowledge management departments, is less likely to be observed in the Hong Kong surveying industry, the focus of this research is to reveal how professional quantity surveying firms implicitly manage knowledge, i.e. the underlying aspects of knowledge management practice.

2.2.3 Quantity Surveying Firms

Most quantity surveying firms in Hong Kong operate as private partnerships. The entry barrier into the professional quantity surveying field lies in one's academic qualification and training. In most cases, university graduates with a major in quantity surveying basically fulfil the entry requirements. After that, these novice quantity surveyors are assigned to teams with existing staff under the supervision and direction of an associate or a partner. When these firms are commissioned by clients to provide cost and contractual expertise for construction projects, the partner in charge will appoint team members, comprising associates and quantity surveyors, to fulfil the professional duty. As such, it can reasonably be deduced that quantity surveying firms predominantly adopt quantity surveyors' expertise, knowledge and skill to satisfy their clients' needs.

Therefore, quantity surveyors can be considered a key component of the wealth of knowledge in their firms. Undoubtedly, they should be given a clear and precise definition. An authoritative organisation, The Hong Kong Institute of Surveyors (2004, p.17), provides a clear indication in this respect. It states that:

> "Quantity surveyors are professionals who have been trained as construction cost consultants. They have expert knowledge of costs, values, labour and material prices, finance, contractual arrangements and legal matters in the construction field."

In general, the value of quantity surveyors lies in their ability to fulfil the need to control expenditure and to strive for the best value for their clients' investment in building and civil engineering projects. On the other hand, the duty of quantity surveyors is multifold and can easily be identified in many reference books. For instance, quantity surveyors in the United Kingdom are often involved in the selection of construction materials. By contrast, quantity surveyors in Hong Kong seldom provide such service. As this research is confined to the study of implicit processes for managing knowledge in quantity surveying firms in Hong Kong, the duty of quantity surveyors should be defined with due regard to the practice in Hong Kong construction industry. Reference to the definitions as stipulated on the websites of The Hong Kong Institute of Surveyors (www.hkis.org.hk) and some Hong Kong quantity surveying firms such as www.levettandbailey.com and www.dlshk.com gives a clear indication of the role of quantity surveyors in the Hong Kong construction industry.

In a typical construction project cycle, the involvement of quantity surveyors usually commences early, at the feasibility stage, by providing preliminary estimates to establish

a realistic budget. In the course of the design development by architects and engineers, preliminary cost advice is also prepared by quantity surveyors based on initial schematic drawings. Besides, cost studies on alternative design options, material selections, construction sequences and structural schemes constitute a useful tool to determine the most economical design option. Apart from these, value management and life cycle costing are often adopted by quantity surveyors to analyse the cost and value implications of alternative design options. With the information above, detailed cost plans for budgetary control can be established and prove helpful in enabling clients to foresee their future financial involvement.

The duty of quantity surveyors is not limited to this. At the tender stage, quantity surveyors prepare tender documents and bills of quantities to select the most promising contractor for a construction project. Bills of quantities translate the drawings, plans and specifications into bid documents which enable contractors to calculate their tender prices on the same basis. Preparing tendering methods and contractual arrangements are also within the ambit of quantity surveyors' duties. Through the tendering process, competitive prices from selected contractors can be obtained. Quantity surveyors then appraise the tenders with respect to contractual obligations and cost issues.

At the post-contract stage, quantity surveyors value the work in progress at an agreed period for certifying payments to contractors. Cost implications of any variations are also assessed by them. On a regular basis, they issue financial statements so as to keep clients fully informed of the financial status with reference to the project outlay.

In addition, the scope of the duty of quantity surveyors also comprises contractual advice to clients and architects with respect to administration of contracts and interpretation of contract clauses. Particular attention is often drawn to minimising claims from contractors. Where projects are substantially completed, quantity surveyors have to settle final accounts with contractors and sub-contractors. To do so, they have to examine, assess and negotiate any contractors' claims that may arise from the performance of contracts. Hence, they are also employed to provide their expertise and knowledge on dispute resolution.

Among the above traditional services, some value added specialist services have gradually emerged and stretched the duty of quantity surveyors outside the traditional frame. For instance, with their knowledge of costs and construction methods, quantity surveyors are sometimes assigned to take the role of project managers. In these circumstances, they coordinate and settle all matters related to construction projects and ensure timely completion within budgets. Risk management is another new service in quantity surveying firms. Quantity surveyors have to assess, evaluate and quantify different sorts of risks involved in construction projects for the worst and the best scenarios, so that clients are given sufficient information for their decision making and budgetary control.

On the whole, quantity surveyors perform an influential role in construction projects by utilising their knowledge and expertise in cost issues and contractual aspects. Their importance can be deduced from the dominance of quantity surveying practitioners in the surveying discipline, based on the statistics of the Vocational Training Council and The Hong Kong Institute of Surveyors.

The survey by the Vocational Training Council (2003, p.77-78) reveals that the population of construction professionals in Hong Kong has reached 14,080. 14% of them, that is 1,966, are professionals practising in the quantity surveying discipline. Membership statistics of The Hong Kong Institute of Surveyors (HKIS) also indicate a similar trend. They reveal that quantity surveyors dominate the spectrum of surveyors in the Institute. Table 1 depicts the distribution of surveyors practising in different disciplines as at 26th August 2004. In the table, Professional Grade consists of Fellows (FHKIS) and Members (MHKIS), whereas Technical Grade is composed of Technical Associates (TAHKIS) and Training Grade comprises Probationers, Technical Trainees and Students. Members of the Institute are further categorized by reference to their professional practice into five domains, namely, Building Surveying, General Practice, Land Surveying, Quantity Surveying and Planning and Development.

Based on the statistics in Table 1, the percentage distribution of surveyors in the five divisions is derived in Table 2. The population of Student Members is not considered in the calculation as they are not full time practitioners engaged in the surveying industry.

As Table 2 delineates, 44% of the members practise in quantity surveying. Therefore, it is shown that quantity surveyors actively participate in the Hong Kong construction industry. Moreover, the significance of their knowledge and expertise to the success of construction projects is well recognised by clients. Thus, the number of quantity surveyors in both the construction industry and the surveying discipline is found to be substantial.

HKIS Membership Statistics as at 26 August 2004					
Division	**Fellow**	**Member**	**Technical Associate**	**Probationer**	**Student**
Building Surveyor	77	589	-	581	36
General Practice	154	1218	1	431	37
Land Surveying	36	155	28	88	4
Planning & Development	3	4	-	1	-
Quantity Surveying	179	1294	8	1259	29
Total	449	3260	37	2360	106

Table 1 HKIS Membership Statistics as at 26 August 2004

HKIS Membership Statistics as at 26 August 2004		
Division	**Member (Excluding Student Member)**	**Percentage**
Building Surveyor	1247	20
General Practice	1804	30
Land Surveying	307	5
Planning & Development	8	1
Quantity Surveying	2740	44
Total	6106	100

Table 2 Percentage Distribution of HKIS Members Practising in Different Disciplines

2.2.4 Knowledge-based Organisations

Like other businesses, quantity surveying firms are enterprises striving for business opportunities. But their survival skills distinguish one from another. In this respect, two influential papers by Winch and Schneider define knowledge-based organisations as organisations which “have only the expertise of their staff as assets with which to trade”

(Winch and Schneider, 1993b, p.469). The characteristics of knowledge-based organisations are also described in the papers. With reference to the definition of knowledge-based organisations given by Winch and Schneider (1993a & 1993b), quantity surveying firms can reasonably be regarded as knowledge-based organisations, as illustrated below.

Probity is one of the distinctive competences of knowledge-based organisations. It represents the act of "performing an essentially transactional role in that they act as third parties to the transaction between the two principal parties" (Winch and Schneider, 1993a, p.925). Quantity surveyors respond and satisfy clients' needs by deploying their expertise on cost issues and contractual arrangements in the construction industry. In a construction project, a builder (sometimes called a contractor) enters into a contractual relation with a client to implement a construction project for a monetary reward. Quantity surveyors are employed by the client as a member of the consultant team to provide professional advice on the construction cost and contractual problems involved. Thus the involvement of quantity surveyors can ensure fairness for both the client and the contractor.

With reference to the nature of their duty, quantity surveying firms are professional organisations. Similar to other professional consulting team members, such as architects and engineers, the accreditation and competency of quantity surveyors are regulated and maintained by professional institutions – The Hong Kong Institute of Surveyors (HKIS) or The Royal Institution of Chartered Surveyors (RICS). Entrants of quantity surveying firms are mostly university graduates eligible for probationer membership. When the training and experience of a probationer is proved to fulfil the requirements as stipulated

by the HKIS, a probationer can elect to sit for the Assessment of Professional Competence (APC). The RICS also establishes similar assessment procedures for the award of professional status. This professional status as Corporate Members (so-called Chartered Status) is granted after having passed the APC. This framework is designed to ensure that quantity surveyors are equipped with appropriate skills and competence and also satisfactorily fulfil the attributes of professional status as defined by Bennion (1969), i.e. intellectual body of knowledge and governing professional institution(s).

Becher (1999) asserts that professionals must exhibit professionalism in their service. Quantity surveyors are construction cost and contractual consultants who perform advisory roles and specialised services. Their service output in construction projects is intangible and is not presented in the form of tangible products, such as building, bridges, roads, etc. In simple terms, clients pay consultation fees to quantity surveyors for their ability to produce a service rather than a tangible product.

Further, the nature of services offered by quantity surveyors is heterogeneous and unique (Løwendahl, 2000) as different practitioners are in charge of different projects and clients on a case- by-case basis. The problems encountered by quantity surveyors and demands from clients present new challenges to quantity surveyors.

The production and consumption of quantity surveying services are also inseparable. This was first defined by Parasuraman et al. (1985), who emphasised that service cannot be stored. Advice on cost and contractual problems is affected by price levels at certain periods of time, as well as by the relevant latest legal principles, so that quantity

surveyors' output cannot easily be stocked and isolated from the fast-changing environment.

In the above paragraphs, the nature of quantity surveyors' service is shown to coincide with the various essential characteristics of knowledge-based organisations asserted by Winch and Schneider (1993a & 1993b). The uniqueness of quantity surveying firms is derived from probity, and the fact that they are professional services organisations; their heterogeneous nature differentiates quantity surveying firms from other types of organisations. In addition, quantity surveying firms provide an advisory service by taking advantage of the knowledge and expertise of their staff, so that they can fairly be treated as knowledge-based organisations.

2.2.5 Professional Services Firms

Carr-Saunders (1966, p.4) stated that:

> "A profession may perhaps be defined as an occupation based upon specialised intellectual study and training, the purpose of which is to supply skilled service or advice to others for a definite fee or salary".

Similarly, professional services firms (PSFs) are knowledge-intensive organisations that provide expert advice and professional knowledge to clients (Løwendahl, 2000; Mainster, 1997). The organisational assets reside in the experience and knowledge of staff rather than plant and equipment. The services offered by professional services firms often vary in nature so as to address diverse clients' needs and demands (Nachum, 1999; Maister, 1993).

Despite the fact that the characteristics of professional services firms (PSFs) have not yet been clearly defined, they can be derived by analogy to the discussions on the definitions of "professional", "professional organisations (firms)" and "professional service". Tables 3, 4 & 5 give a comprehensive collection of the assertions by various scholars on this issue.

From the tables, it is observed that the characteristics of professional services firms (PSFs) are somehow similar to those of knowledge-based organisations. To summarise the definitions of "professional", "professional organisations (firms)" and "professional service", four distinct features, namely their knowledge-intensive nature, their advisory nature, in fact that their competence is governed by institutions and that there is a code of conduct regulating the behaviour of the PSFs, are identified.

Scholars	Propositions of the Characteristics of "Professional"
Six Attributes to Qualify for Professional Status ***(Bennion, 1969)***	▪ Requirement of an intellectual body of knowledge ▪ Work of an advisory nature ▪ Existence of a private practice ▪ A tradition of service ▪ A suitable of code of conduct ▪ A governing professional institution(s)
A Collection of Definitions of Profession ***Løwendahl (2000) & (Blau and Scott, 1962; Hughes, 1958 and Vollmer & Mills, 1966)***	▪ A vocation founded in a body of knowledge, typically a higher (academic) education ▪ A vocation concentrated on the application of knowledge and experience to provide an altruistic service to clients ▪ A vocational organisation based on a common code of ethics
Characteristics of a Professional ***Becher (1999) & the Monopolies Commission (1970)***	▪ Practitioners apply a specialist skill to offer a specialised service ▪ The skill has been acquired by an intellectual and practical training in a well defined area of study ▪ The practitioners are organised in bodies which are concerned to provide machinery for testing competence and regulating standards of competence and conduct

Table 3 Characteristics of Professional

Scholars	Propositions of the Characteristics of "Professional Organisations/ Firms"
Characteristics of a Professional Organisation ***(Bots & Bruijn, 2002)***	▪ Indivisibility of projects/services ▪ Highly situation-specific decision
Characteristics of Professional Organisations (Firms) ***Løwendahl (2000)***	▪ More than 50% professional employees ▪ High priority for professional goals ▪ High degree of respect for professional norms ▪ Emphasis on creation as well as application of knowledge ▪ Professionals in charge of key decisions and activities

Table 4 Characteristics of Professional Organisations / Firms

Scholars	Propositions of the Characteristics of "Professional Service"
Characteristics of Professional Service ***Løwendahl (2000)***	▪ Highly knowledge-intensive, delivered by people with higher education ▪ High degree of customisation ▪ High degree of discretionary effort and personal judgement by expert(s) ▪ Substantial interaction with client firm representatives ▪ Within the constraints of professional norms of conduct

Table 5 Characteristics of Professional Service

As illustrated in the following paragraphs, quantity surveying firms accomplish the four essential characteristics of professional services firms.

- Knowledge-intensive nature

A higher educational qualification is an element of professions (Løwendahl 2000; Blau and Scott, 1962; Hughes, 1958; Vollmer and Mills, 1966). This is reflected from the common belief in the industry that a body of knowledge originates from academic study and practical training in professional services firms. Quantity surveyors' skills and expertise are thus the talent of quantity surveying firms and also contribute highly to firms' reputations. As a result, practitioners in these firms are associated with impressive

academic backgrounds, which are supported by either accreditation of professional status from professional institutes or academic achievement in recognised academic institutions.

- Advisory Nature

It is claimed that altruistic and specialised services to clients are the core services of professionals (Becher 1999; the Monopolies Commission 1970). Quantity surveying firms in Hong Kong are mostly private practices that seek to offer consultancy to clients in construction projects. As mentioned in previous sections, the scope of their services is stretching beyond the traditional framework to suit clients' ever increasing demands. In contrast to, for example, a toy factory, quantity surveying firms have to shape their products to adapt to different clients and business scenarios. Hence, the quality of situation-specific decisions (Bots and Bruijin, 2002) is a useful indicator to reflect the competence of a professional organisation. To discharge their professional duties, quantity surveyors have to apply their knowledge and expertise to provide impartial and objective advice and analyses to clients. The quality of their decisions depends to a large extent on their appropriate exercise of expert discretion and professional judgement in relation to cost control and contract administration for construction projects. As a result, with clients' needs well communicated between clients' representatives and quantity surveyors in advance, it is usual that clients receive excellent professionalism from quantity surveyors.

- Competence Governed by Institutions

It is essential to a professional service that a governing professional body is established to maintain the competence and control the standards of conduct of the profession (Bennion, 1969). Therefore, the title of chartered membership is taken as a recognition of professional competence. The competence of professionally qualified quantity surveyors is well established and regulated by professional institutions, The Hong Kong Institute of Surveyors (HKIS) or The Royal Institution of Chartered Surveyors (RICS). The admission requirements of different grades of memberships are precisely stated and strictly followed. According to the rules of the Institutions, Professional Grade consists of Fellows (FHKIS) and Members (MHKIS). Although a lot of practitioners claim to be quantity surveyors, the titles of chartered quantity surveyor are only awarded to those who have passed the professional competence test set by the Institutions. Therefore clients can have some assurance of the standard of the intangible service they are purchasing under this system.

- Code of Conduct

In addition to the grades of membership established in the Institutions, every member receives a copy of the Code of Conduct and Professional Ethics. Since quantity surveyors are often involved in managing confidential information, such as tender sums submitted by contractors in construction projects and payments to contractor for work done on site, they have to be fully alert and to abide by provisions in the Standard of Conduct and Professional Ethics.

The Council of the Law Society (1974, p.1&2) further defines a profession as "identifiable by reference to some register", "recognised as having a special skill …, the standards of skill being prescribed by the profession itself" and "voluntarily submitting themselves to standards of ethical conduct beyond those required of the ordinary citizen by law". Similarly, the qualification of practitioners in quantity surveying firms is well controlled and recorded under the registers of the Institutions. Further, quantity surveying firms present cost and contractual expertise to clients. The heavy reliance on the expertise and knowledge of staff poses a hurdle for outsiders to imitate. Freidson (1994) describes theses kinds of professional service as esoteric services.

To summarise, the above discussions illustrate with sufficient substantiation that quantity surveyors are indeed professionals. This exactly matches the advocacy of NEDO (1976), which expressly stated that they had arrived at the same conclusion. Hence it can be concluded that, similar to other PSFs, quantity surveying firms also specialise in providing expert advisory services to the construction industry.

2.2.6 Knowledge in Quantity Surveying Firms

Knowledge is essential to the survival and success of quantity surveying firms. Therefore it is interesting to explore the content of quantity surveying firms' knowledge. Owing to the fact that knowledge applied by quantity surveyors varies at different stages in a project cycle, a simple but representative example of the preparation of an estimate may be useful to illustrate the tacit and explicit nature of knowledge in quantity surveying firms.

Where quantity surveyors are assigned to prepare a cost estimate, they collect all relevant information, such as its scope, plot ratio, site layout, site boundary, site location, project standard, specifications and preliminary architectural and structural drawings, etc. The quantity of each material item shown on the drawings, such as concrete, formwork, sanitary fittings, windows, etc., is measured, and the rate of that item is inserted in the estimate. An estimate checklist which lists out all items with cost implications is extremely important to ensure the accuracy of the estimate. It serves as a reminder for quantity surveyors so that they can identify any missing items by a simple check of the output against the list. This type of estimate checklist is not an imported knowledge but instead an accumulation of explicit knowledge which is codified from the quantity surveyor's tacit knowledge.

In assigning the rates to quantities, a detailed and thorough understanding of building standards, site layout and site situation nearby is of utmost importance. This is due to the fact that the price level of the same material may vary from one project to another. For instance, a unit rate ($ X /m^3) of concrete supply to a site with convenient access is likely lower than that of a site with difficult or restricted access. The judgement on the unit rates of materials mainly relies on the responsible quantity surveyor's past experience and awareness of all relevant information. This process falls within the application of tacit knowledge. As such, tacit knowledge plays a crucial role in determining project variables, like location factor, level of contingency, price fluctuation, etc., in preparing a cost estimate. Thus it explains the situation that a group of specific quantity surveyors (called estimating team) are responsible for final checking of all estimating output of the firms. The wealth of knowledge embedded in that group of quantity surveyors is not easy to be codified and articulated to other colleagues.

2.2.7 Relation between Knowledge and Quantity Surveying Firms

Løwendahl (2000) asserts that organisations can be classified into three types, namely, knowledge-intensive organisations, labour-intensive organisations and capital-intensive organisations. This classification is shown in Figure 1. In the figure, professional services organisations are taken as a sub-group of knowledge-intensive organisations while consulting is quoted as an example of professional services firms. This advocacy draws a strong correlation between knowledge and professional services firms. The terms, organisations and firms, are adopted interchangeably since the distinction between organisations and firms has no material effect on the classification (Løwendahl, 2000).

The aim of allocating so much effort to highlight the association of quantity surveying firms with knowledge-based organisations is to emphasise the significance of knowledge in quantity surveying firms. It is clear that knowledge performs a crucial role in the survival of quantity surveying firms as they are both knowledge-based organisations and professional services firms.

In spite of the evidence of quantity surveyors' active role in both the construction industry and the surveying discipline and the significant value of knowledge to quantity surveying firms, little attention has been given to the knowledge aspect in this field. To the contrary, research on knowledge aspects of architecture and engineering are abundant in academic literature, such as journal papers. Some relevant examples are listed below:

- Managing the knowledge-based organisation: the case of architectural practice (Winch and Schneider, 1993a)

- The strategic management of architectural practice (Winch and Schneider, 1993b)

- Knowledge management in the architecture, engineering and construction industry (Kamara and Augenbroe, 2002)

- Knowledge management in the AEC (architectural, engineering and construction) sector: an exploration of the mergers and acquisitions context (Carrillo and Anumba, 2002)

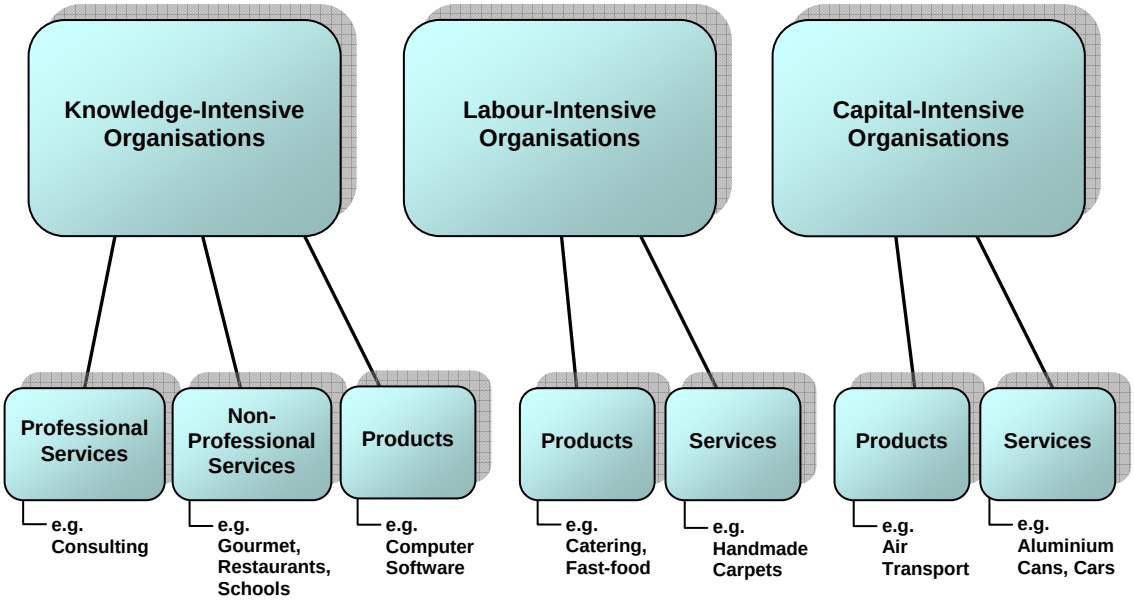

Figure 1 Types of Organisations (Løwendahl, 2000, p.21)

A number of scholars have already stated that knowledge management has been implemented in construction firms to some extent. However, solid statistical research bases of this assertion as to the situation in Hong Kong construction industry and particularly in quantity surveying firms still remains relatively scarce. Therefore, to seek an understanding of how Hong Kong quantity surveying firms manage their knowledge,

it is essential that sufficient empirical evidence has to be harnessed as proof of the scope of such underlying activities in quantity surveying firms to manage knowledge.

The construction industry is experience-oriented (Yau and Yang, 1998) whereas "knowledge-based industry relies heavily on the knowledge input by different participants in a project team" (Carrillo and Anumba, 2002, p.150). Hence "knowledge within an organisation needs to be managed as a vital resource" (Buckner and Shah, 1991, p.75). However, the issue of how quantity surveying firms handle and protect this valuable asset is rarely discussed. With an understanding of managing knowledge, quantity surveying firms are able to benefit from (Robinson et al., 2001):

- Improving continuously
- Transferring good practice among practitioners
- Retention of tacit knowledge of key staff
- Reducing abortive work
- Responding quickly to clients

An exploration of how quantity surveying firms deal with knowledge can help understand and identify any processes of managing knowledge that have been implemented for a long time but in an unnoticeable manner. The findings can subsequently assist directors / partners in quantity surveying firms in reviewing their

existing means of maintaining, developing and protecting knowledge assets and seeking enhancement.

2.2.8 Research Hypotheses

Based on the above literature review regarding the intermingled relation between knowledge and quantity surveying firms and the insufficient awareness of knowledge aspect in these firms, two hypotheses are put forward as below:

- The awareness of managing knowledge in quantity surveying firms is not satisfactory.

- There is underlying scope of activities/actions undertaking in quantity surveying firms to manage knowledge.

2.3 Proposed Framework of the Knowledge Processes

2.3.1 Contrasting Views on Frameworks of Managing Knowledge

KMWG (2001, p.8) proposes that knowledge management is associated with three major components, i.e. people, process and technology. These three components do not only serve distinct functions, but also interact with one another. For instance, “people create, share and use knowledge; processes acquire, create, organise, share and transfer knowledge; and technology stores and provides access to knowledge” (KMWG, 2001, p.8). Besides, Joshi and Sarker (2003) also pinpoint that knowledge management is not a single activity but a series of knowledge activities, such as knowledge acquisition, knowledge creation and knowledge use.

To advance further, this research aims to present a framework of managing knowledge processes for professional quantity surveying firms. The proposed framework is derived from an analysis of a variety of processes described in academic literature and is further substantiated by the findings of a combination of individual interviews and detailed statistical surveys. In the light of the ever growing demand for knowledge innovation and the fast changing nature of knowledge managing frameworks, it is sensible to confine the discussion to managing knowledge processes prevailing in the past ten years so as to maintain the validity of the research.

It is interesting to note that there are different schools of thoughts advocating different frameworks of knowledge activities, such as ‘process’, ‘model’, ‘life cycle’, ‘element’, ‘methodology’, ‘activity’, ‘view’, etc. Notwithstanding the absence of a consensus on labelling, all these frameworks bear the same ultimate aim – the transformation of knowledge into an organisation’s assets. Table 6 outlines the activities of different frameworks of managing knowledge quoted in the recent literature and draws a comparison matrix among them. Recourse to the findings of the comparative study will be made in establishing the proposed framework of how professional quantity surveying firms manage knowledge in later sections.

Model			Activity A	Activity B	Activity C	Activity D	Activity E	Activity F	Activity G	Activity H	Activity I	Activity J	Activity K	Activity L
Knowledge Management Process	Marquardt	(1996)		Acquisition		Creation		Storage	Transfer	Utilization				
Knowledge Management Model	O'Dell	(1996)	Identify	Collect	Adapt	Create	Organize		Share	Apply				
Knowledge Management Process	Beckman	(1997)	Identify	Capture	Select	Create		Store	Share	Apply	Sell			
Basic Operation Processes on Knowledge	Van Der Spek & Spijkervet	(1997)				Developing new knowledge	Combing available knowledge	Securing new and existing knowledge	Distribute knowledge					
Knowledge Management Life Cycle	Ruggles	(1997)				Generation	Codification		Transfer					
Knowledge Management Cycle	Davenport & Prusak	(1998)				Generate	Codify		Transfer					
Ability on Knowledge Assets	Teece	(1998)		Assemble		Create	Integrate		Transfer			Exploit		
	Skyrme & Amidon	(1998)				Create			Transfer	Use				
Knowledge Management Cycle	Nissen	(1999)		Capture			Organize/ Formalize		Distribute	Apply				
Basic Elements of Knowledge Utilization	Tiwana	(2000)		Acquisition					Sharing	Utilization				
Amalgamated Model of Knowledge Management Life Cycle	Nissen et al.	(2000)				Create	Organize/ Formalize		Distribute	Apply		Evolve		
Knowledge Management Process	Lee & Yang	(2000)		Acquisition		Innovation	Integration		Dissemination					Protection

Table 6 Comparison of Various Framework of Managing Knowledge

Model			Activity A	Activity B	Activity C	Activity D	Activity E	Activity F	Activity G	Activity H	Activity I	Activity J	Activity K	Activity L
Knowledge Management Cyclic Process	Fischer & Ostwald	(2001)				Create	Integration		Dissemination					
Knowledge Engineering Processes	Preece et al.	(2001)		Capture				Storage		Deployment				
Components of Knowledge Management	KMWG	(2001)		Acquire		Create	Organize	Store	Share/Transfer/Provide assess	Use				
Knowledge Methodologies	Kululanga & McCaffer	(2001)		Acquiring		Creating		Storing	Sharing	Utilising intellectual assets				
Core Process of Knowledge Management	Heisig	(2001)				Generate		Store	Distribute	Apply				
Knowledge Management Activities	Holsapple & Joshi	(2002)		Acquiring/ Selecting		Generating		Internalizing		Using	Externalizing			
Knowledge Management Cycle	Liebowitz & Megbolugbe	(2003)		Capture		Creation			Sharing	Application				
The Content Lifecycle	British Standards Institution	(2003)		Capture/ Harvest		Create	Prepare		Share				Maintain /Purge	
Process View of Knowledge Management	Rollett	(2003)				Creating	Integrating	Organising	Transferring				Maintaining/Planning/ Assessing	
The Proposed Framework of Managing Knowledge				***Acquire***		***Create***		***Store***	***Distribute***	***Use***			***Maintain***	

Table 6 Comparison of Various Frameworks of Managing Knowledge (Continued)

Among the frameworks listed in Table 6, it is observed that not all of the scholars introduce the activities of their proposed frameworks on the basis of an explanation or rationale. Therefore, it is inappropriate to construe the meaning of an activity merely from the literal interpretation of the label. Even worse, a term may mean differently in different literature and a process delivering the same function may be named differently at different places. Consequently, it is quite inevitable that such literal interpretation sometimes results in great inaccuracies and misunderstanding. In view of the above deficiency, eight representative frameworks which bear detailed explanation are identified and selected to be discussed in this research. Apart from introducing the individual framework, comparisons of these frameworks are also presented. They are listed below:

- Basic Operation Processes On Knowledge by Van Der Spek and Spijkervet (1997)
- Basic Elements Of Knowledge Utilisation by Tiwana (2000)
- Knowledge Management Processes by Lee and Yang (2000)
- Knowledge Management Cyclic Process by Fischer and Ostwald (2001)
- Knowledge Engineering Processes by Preece et al. (2001)
- Knowledge Methodologies by Kululanga and McCaffer (2001)
- Knowledge Management Activities by Holsapple and Joshi (2002)
- Process View of Knowledge Management by Rollett (2003)

2.3.1.1 Basic Operation Processes on Knowledge

In their propositions, Van Der Spek and Spijkervet (1997, p.40) suggest four basic operation processes in managing knowledge as indicated in Figure 2. Among them, the first process is “Developing New Knowledge” in which new knowledge is generated by making use of the creativity, failure, daily experiences and contribution of research & development departments. Next comes another process - “Securing New and Existing Knowledge”. This process is commonly adopted to ensure the accessibility of organisational knowledge. In addition, the process “Distributing Knowledge” aims at disseminating knowledge through defined channels to knowledge users. They also place significant weight on the contribution of effective and expedient distribution of knowledge to the success of business. The last process “Combining Available Knowledge” highlights the significance of combining the available stock of knowledge.

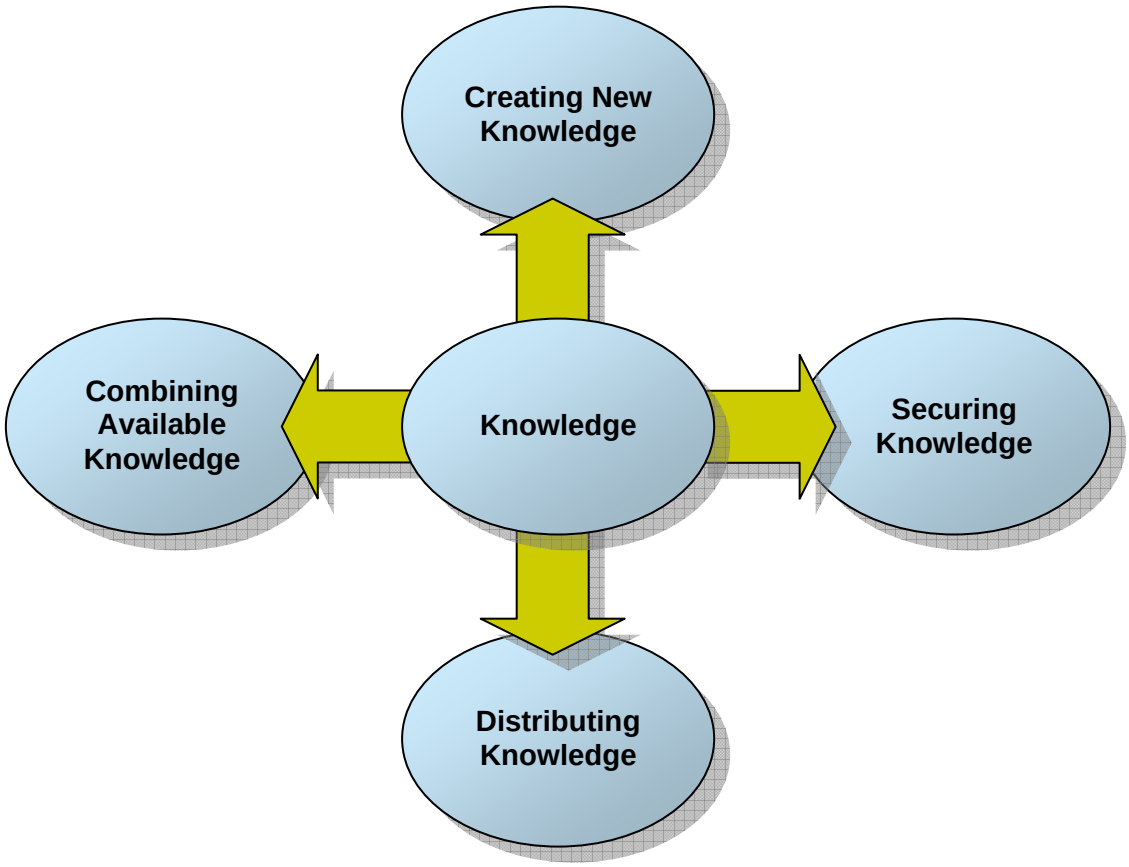

Figure 2 Four Basic Knowledge Operations (Van Der Spek and Spijkervert, 1997, p.40)

Van Der Spek and Spijkervet (1997)'s notion, i.e. developing new knowledge, securing new and existing knowledge, distributing knowledge and combining available knowledge, is fairly different from that of some scholars, such as Beckman (1997) and Preece et al. (2001). The former clearly generalises the knowledge activities in their dissection of knowledge processes. The latter, on the other hand, demonstrates a broad and inclusive approach to embrace other processes, like capturing, storing and applying knowledge in their knowledge processes.

2.3.1.2 Basic Elements of Knowledge Utilisation

Tiwana (2000) joins the research arena by illustrating three fundamental steps of knowledge utilisation. They consists of knowledge acquisition, knowledge sharing and knowledge utilisation. “Knowledge Acquisition” focuses on “the process development and creation of insights, skills, and relationships” (p.72) while “Knowledge Sharing” concentrates on “disseminating and making available what is already acquired” (p.72). Ultimately, “Knowledge Utilisation” constitutes the step in which knowledge is made available and applied in an organisation.

Despite Tiwana’s (2000) proposition and its delicate justification, he may overlook the significance of knowledge creation as raised by Van Der Spek and Spijkervet (1997). Indeed, knowledge creation is often considered an inevitable part of the knowledge processes as the validity of knowledge may deteriorate with time and some may even fade out in a knowledge provider. New knowledge, acquired or created, then supplements obsolescent knowledge in the knowledge repository. Therefore, knowledge creation should deserve particular attention from knowledge-intensive firms.

2.3.1.3 Knowledge Management Processes

The efforts of Lee and Yang (2000) are devoted to identifying the factors influencing knowledge performance as indicated in Figure 3. Organisations are advised to “track down and analyse all the information and explicit knowledge that is available by searching and organisational learning” (p.788). Besides, “Knowledge Acquisition”, “Knowledge Innovation” should never be overlooked. Lee and Yang (2000, p.788) describes it as “a process that ‘organisationally’ amplifies the knowledge created by individuals and crystallizes it as a part of the knowledge network of the organisation”.

Furthermore, the presence of "Knowledge Protection" is of utmost importance since it safeguards the creativity and ownership of knowledge. In addition, Lee and Yang (2000) also lends support to the crucial role of "Knowledge Integration" in the knowledge management processes. He asserts that it functions to "translate this raw knowledge into actionable knowledge by means of an acute understanding of their business context … to synthesise their experience and integrate it with knowledge acquired from outside sources" (p.788) . Eventually, knowledge is systematically delivered to the knowledge users in a process termed "Knowledge Dissemination".

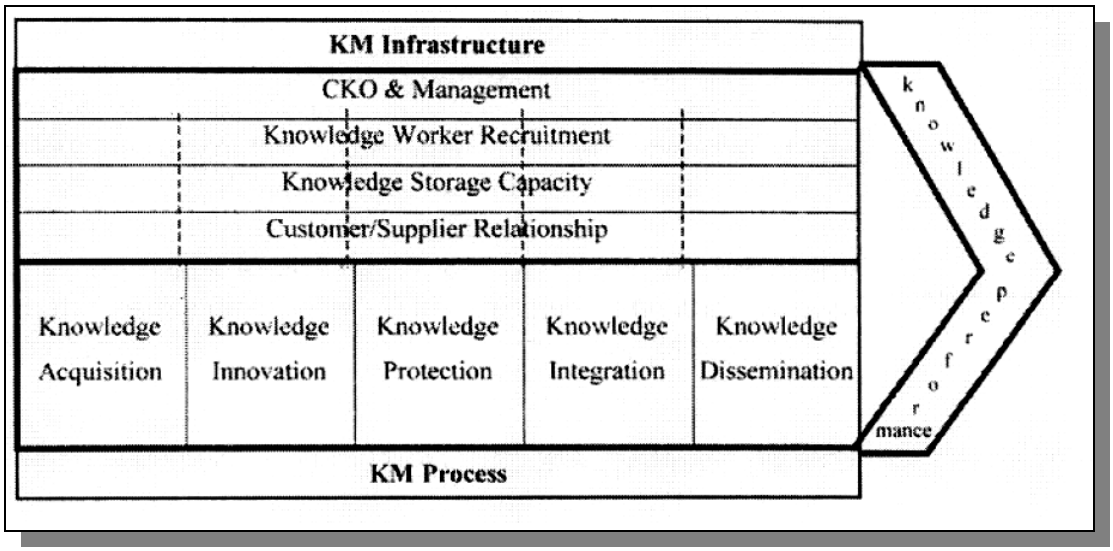

Figure 3 Knowledge Value Chain Model (Lee and Yang, 2000, p. 788)

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In contrast with the promotion of the significance of knowledge store and knowledge use (Heisig, 2001; KMWG, 2001; Kululanga and McCaffer, 2001), the advocacy of Lee and Yang (2000) seems to have undervalued their contribution. In other words, these processes may rank low in Lee and Yang's proposition. Despite this, it is not sensible to allow knowledge to be preserved in a manner that prevents people from retrieving and using it conveniently. In this case, the value of knowledge may be undermined no matter how perfect the processes of knowledge acquisition, innovation, protection, integration

and dissemination are conducted. Moreover, there is always an immense need to encourage and motivate people to apply appropriate knowledge in their jobs and decision-making processes. This is because knowledge would have no value if people are reluctant or unwilling to take advantage of it. Hence organisations should instead treat knowledge use as the paramount aim of managing knowledge in precisely the same manner as a chef prepares delicious food for the ultimate satisfaction and enjoyment of customers.

Further to the above, "Knowledge Integration" illustrated by Lee and Yang (2000) is highly recommendable. His proposition reminds people the fact that there is no universal method to integrate knowledge and knowledge should thus be processed according to an organisation's distinct needs.

2.3.1.4 Knowledge Management Cyclic Process

Similar to the approaches taken by other scholars, Fischer and Ostwald (2001) take knowledge management as a cyclic process and dissect it into three processes as shown in Figure 4. Where existing knowledge has no application to resolve problems, creation of new knowledge will take place. Integration generally follows and functions to assimilate new knowledge into the existing stock of knowledge. This cyclic process ends up with knowledge dissemination which "makes information in the organisational memory available to workers to help resolution of problems" (p.61).

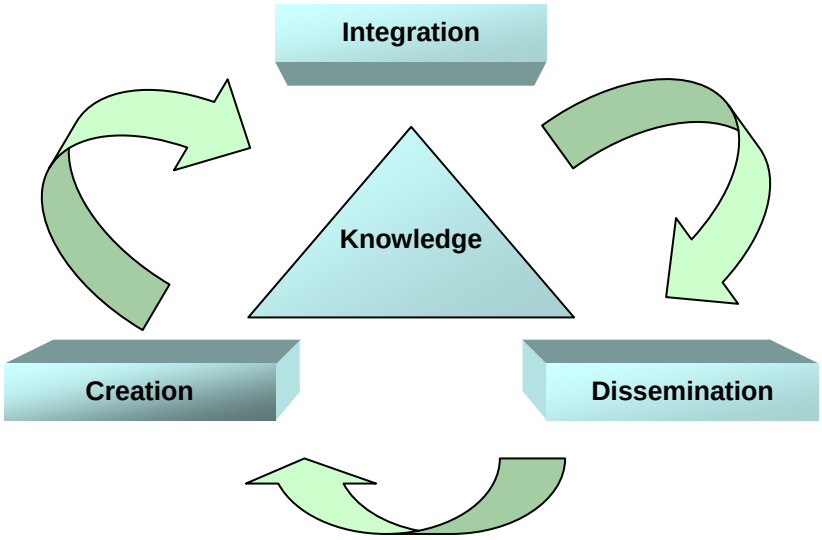


Figure 4 Knowledge Management as a Cyclic Proces (Fischer and Ostwald, 2001, p.61)

Although the nourishing effect of knowledge acquisition is addressed by Nissen (1999), Tiwana (2000), Preece et al. (2001), Holsapple and Joshi (2002) and British Standards Institution (2003), knowledge acquisition may fail to attract the attention of Fischer and Ostwald (2001). When the creativity of an organisation is exhausted or limited, learning and seeking knowledge through outsourcing or external purchasing are effective means of supplementing and flourishing the existing stock of knowledge. Therefore, knowledge acquisition coupled with knowledge creation can enrich the "soil" of an organisation more effectively than relying on knowledge creation alone.

In spite of this shortcoming, knowledge integration, which pinpoints the connection of new knowledge with the existing stock in repositories, is inspiring. They propose that the fate of obsolete knowledge should not be bound to a simple elimination under the

emergence of knowledge innovation. They can indeed be adopted as an effective platform to generate or develop new knowledge.

2.3.1.5 Knowledge Engineering Processes

Regarding the ways of managing knowledge, three knowledge processes has been suggested by Preece et al. (2001, p.36). The proposition of "Knowledge Capture" raises the awareness that the capture process should be conducted in a systematic manner. The captured knowledge can then be stored or archived in a knowledge repository by codifying it in various knowledge bases in "Knowledge Storage". Consequently, staff can refer to the knowledge bases for queries. It is known as "Knowledge Deployment".

Although the value of knowledge creation has been a subject of debate among some scholars (Marquardt, 1996; Teece, 1998; KMWG, 2001; Heisig, 2001), knowledge creation is not considered in details by Preece et al. (2001) and Tiwana (2000). In fact, it is worth highlighting the fact that the key for an organisation to sustain competitiveness and secure leading role in the dynamic market lies in a continuous input of new ideas and innovations. This view is also shared by Nonaka and Takeuchi (1995, p.50) who point out that "the organisation that wishes to cope dynamically with the changing environment needs to be one that creates information and knowledge, not merely processes them efficiently".

2.3.1.6 Knowledge Methodologies

Kululanga and McCaffer (2001, p.348-349) view knowledge activities in another perspective and identify five knowledge methodologies. Like other models of managing knowledge proposed by various scholars, processes, namely acquiring, creating, sharing,

storing and utilising, are collectively incorporated into the knowledge methodologies. They consider that "Knowledge Creation" is of generative nature whereas "Knowledge Acquiring" is of adaptive nature.

Useful information should be imbibed inside and outside the business environment through "Knowledge Acquiring". Coupled with "Knowledge Acquiring", "Knowledge Creation" should be implemented at all levels and functions of an organisation. Furthermore, "Knowledge Creation" is also composed of a wide spectrum of activities and involves inspiration of new intuitions, new experiments and codification of hidden theories. In order to fully realise the value of knowledge, knowledge should never be merely transferred but consciously conveyed and perceived. On the other hand, knowledge is recommended to be preserved for easy retrieval. Certainly, the ultimate aim of spending effort on managing knowledge is to utilise it. Hence, the power of knowledge should be illustrated in the form of changes and enhancement of operation process.

A thorough understanding of managing knowledge is demonstrated by Kululanga and McCaffer (2001) in various aspects. However, the knowledge methodologies can perhaps further be developed to enhance the value of knowledge should aspects, like the ways how obsolete knowledge is handled and how knowledge repositories are maintained for retrieval, are considered.

2.3.1.7 Knowledge Management Activities

Six knowledge management activities addressed by Holsapple and Joshi (2002, p.56-58) are shown in Figure 5. To seek knowledge externally, "Acquiring Knowledge" is the

first activity which includes a transformation to make it fit for internal use. On the other hand, "Selecting Knowledge" is devised to dig up a unit of knowledge from internal knowledge resources and present it in a form which is helpful to knowledge seekers. Apart from knowledge acquisition inside and outside the office, "Generating Knowledge" by means of developing existing knowledge is also capable of satisfying the needs of knowledge seekers. With the newly acquired knowledge and generated knowledge, the content of knowledge repository is subsequently modified. This process is called "Internalizing Knowledge". In contrast, another activity, termed "Externalizing Knowledge", is also observed by Holsapple and Joshi (2002). They describe "Externalizing Knowledge" as a delivery of organisational output to markets. Furthermore, "Using Knowledge" utilises existing knowledge to create new insight and delivers output.

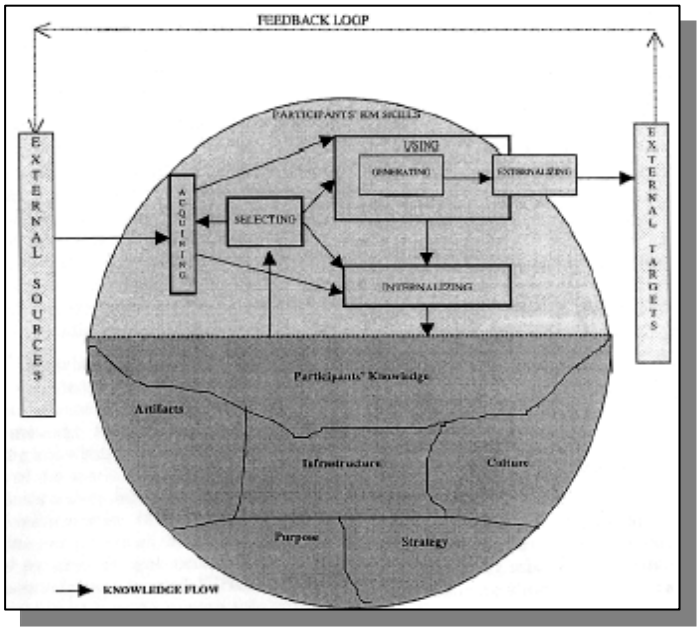


Figure 5 Major Knowledge Management Activities (Holsapple and Joshi, 2002, p.56-58)

Compared with other models, Holsapple and Joshi (2002) introduce two valuable knowledge activities – "Internalizing Knowledge" – the incorporation new knowledge

into the knowledge base and "Externalizing Knowledge" – the adoption of knowledge as project output. However, knowledge dissemination should deserve a place in the design of their knowledge processes. If knowledge is neither transferred nor shared, the effort to manage organisational knowledge will be trivial. Hence the purpose of managing knowledge is to establish an environment for people to adopt the right knowledge at the right time and at the right cost. As a result, it can be deduced that the larger the population of people apply managed knowledge in an appropriate manner, the more observable benefits the organisation will gain.

2.3.1.8 Process View of Knowledge Management

Rollett (2003, p.10-12) presents seven process views of knowledge management as indicated in Figure 6. Among them, planning is adopted to set a formulation of a knowledge management strategy that directs an organisation to achieve specific knowledge objectives. These established objectives should be regularly reviewed and revised in the knowledge management strategy to suit any changing conditions. Apart from this, an atmosphere or culture that generates initiatives for people to create is also essential to the success of the strategy. Only in this environment, new knowledge can be effectively developed from knowledge creation and transformation of the existing knowledge. Knowledge integration, on the other hand, denotes the delivery of existing knowledge to knowledge users, the external acquisition of knowledge and the integration into existing knowledge. With the stock of knowledge, organising work is required to establish a knowledge structure in accordance with the context of the knowledge. The knowledge is then exchanged and shared by different modes of transfer within the organisation. To keep the wheel rolling, the knowledge processes has to be properly maintained. This embraces a wide variety of activities with an aim to bring forward the

"reviewing, correcting and updating, refining, preserving, and removing knowledge … in peoples' heads and the content and structure of repositories". The effectiveness and efficiency of the knowledge processes are required to be assessed by reference to its performance. Therefore, as proposed by Rollett, assessing should be devised to "check the extent to which knowledge targets have been reached".

The activity "maintaining" addressed by Rollett (2003) above is considered valuable in managing knowledge as the knowledge pool in people's heads and other repositories are regularly reviewed. Continuous and excessive knowledge inflow by knowledge acquisition and creation instead deters knowledge retrieval and use because people are required to spend extra time in digging up the relevant, updated and accurate knowledge. Hence, it is worth promoting maintaining as one of the crucial and alternative modes in the knowledge processes.

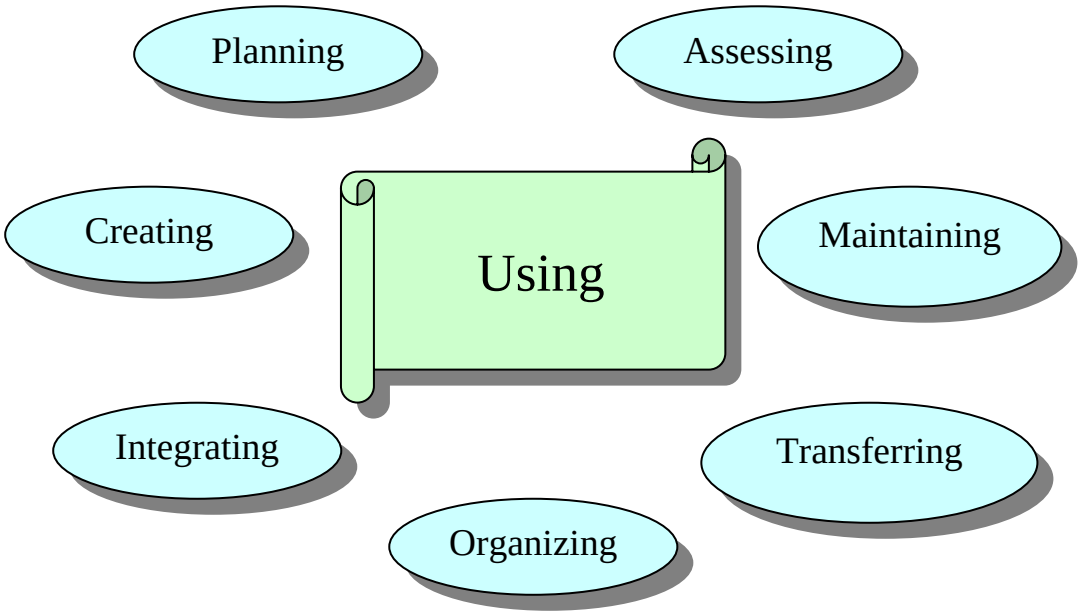


Figure 6 Process View of Knowledge Management (Rollett, 2003, p.10)

In the previous section, a variety of frameworks of managing knowledge have been discussed and thoroughly reviewed. They are summarised in Table 7.

Knowledge Process Framework	Scholar	Process/Model/Life Cycle/ Element/Methodology/Activity/View
Basic Operation Processes on Knowledge	Van Der Spek and Spijkervet (1997)	▪ Developing new knowledge ▪ Securing new and existing knowledge ▪ Distribute knowledge ▪ Combining available knowledge
Basic Elements of Knowledge Utilization	Tiwana (2000)	▪ Acquisition ▪ Sharing ▪ Utilization
Knowledge Management Process	Lee and Yang (2000)	▪ Acquisition ▪ Integration ▪ Innovation ▪ Protection ▪ Dissemination
Knowledge Management Cyclic Process	Fischer and Ostwald (2001)	▪ Creation ▪ Integration ▪ Dissemination
Knowledge Engineering Processes	Preece et al. (2001)	▪ Capture ▪ Storage ▪ Deployment
Knowledge Methodologies	Kululanga and McCaffer (2001)	▪ Acquiring ▪ Creating ▪ Sharing ▪ Storing ▪ Utilising intellectual assets
Knowledge Management Activities	Holsapple and Joshi (2002)	▪ Acquiring ▪ Selecting ▪ Internalizing ▪ Using ▪ Generating ▪ Externalizing

Knowledge Process Framework	Scholar	Process/Model/Life Cycle/ Element/Methodology/Activity/View
Process View of Knowledge Management	Rollett (2003)	▪ Planning ▪ Creating ▪ Integrating ▪ Organizing ▪ Transferring ▪ Maintaining ▪ Assessing

Table 7 Summary of Various Frameworks of Managing Knowledge

2.3.2 Design of the Proposed Framework of the Knowledge Processes

Based on the previous discussions on the eight frameworks, it is noted that each framework seems to have its strengths and deficiencies. It is the reason why none of the above frameworks is directly adopted as the proposed framework in this research. Nevertheless, they mark the ambit of the present academic development and serve as lighthouses to inspire directions of further researches. Hence the activities of the proposed framework in this research are developed from the advocacies of about twenty scholars rather than a direct citation of any of them. Furthermore, the content of the activities in the proposed framework is not a simple documentary statement of the propositions of the scholars but a collection of purposes of what specific activities serve (see Figure 7).

As delineated in Figure 7, the first step of deducing the proposed framework of the knowledge processes in professional quantity surveying firms has been thoroughly discussed in ***Section 2.3.1 Contrasting Views on Frameworks of Managing Knowledge.*** It bears a far-reaching implication to the basis of this research and establishes a firm basis

for the knowledge framework design development. Besides, the comparative study provides sound bases and solid grounds to substantiate the fact that a universal and comprehensive knowledge framework is still absent. Hence a direct citation of any one of the frameworks can rarely satisfy the purpose. Nevertheless, the findings offer lots of threads for establishing the rationale of a two-stage design for the formulation of the proposed framework. From another point of view, the frameworks also serve as valuable academic references to the content and functions of the activities in the proposed framework. Following the first stage, ***Section 2.3.3 Identification of Common Activities in Various Frameworks of Managing Knowledge*** is devoted to a detailed description of the development of six common activities for the proposed framework of managing knowledge as shown in Table 6.

This two-stage design of the proposed framework of knowledge processes manipulates the whole formation by means of two approaches. The first stage takes a microscopic view of the processes with due regard to the actual content and functions of the activities while the second stage diverts its attention to a macroscopic perspective of the knowledge processes to identify the common activities in the frameworks. This design is aimed at eliminating undue reliance and possible misconceptions on any models. For instance, labels describing the same activity may differ in various literature. To illustrate this, it is observed that Holsapple and Joshi (2002) describe alternation of knowledge resources as “Knowledge Internalising” whereas Preece et al. (2001) elect to describe the same as “Knowledge Storage”. The fact that none of the frameworks is specifically designed for the use of professional services firms, knowledge-based organisations, or the surveying discipline makes the argument more convincing. As a result, a direct citation of any of the frameworks in academic literature is by no means justified.

In the next section, the second stage of the knowledge framework design for professional quantity surveying firms is elaborated in details.

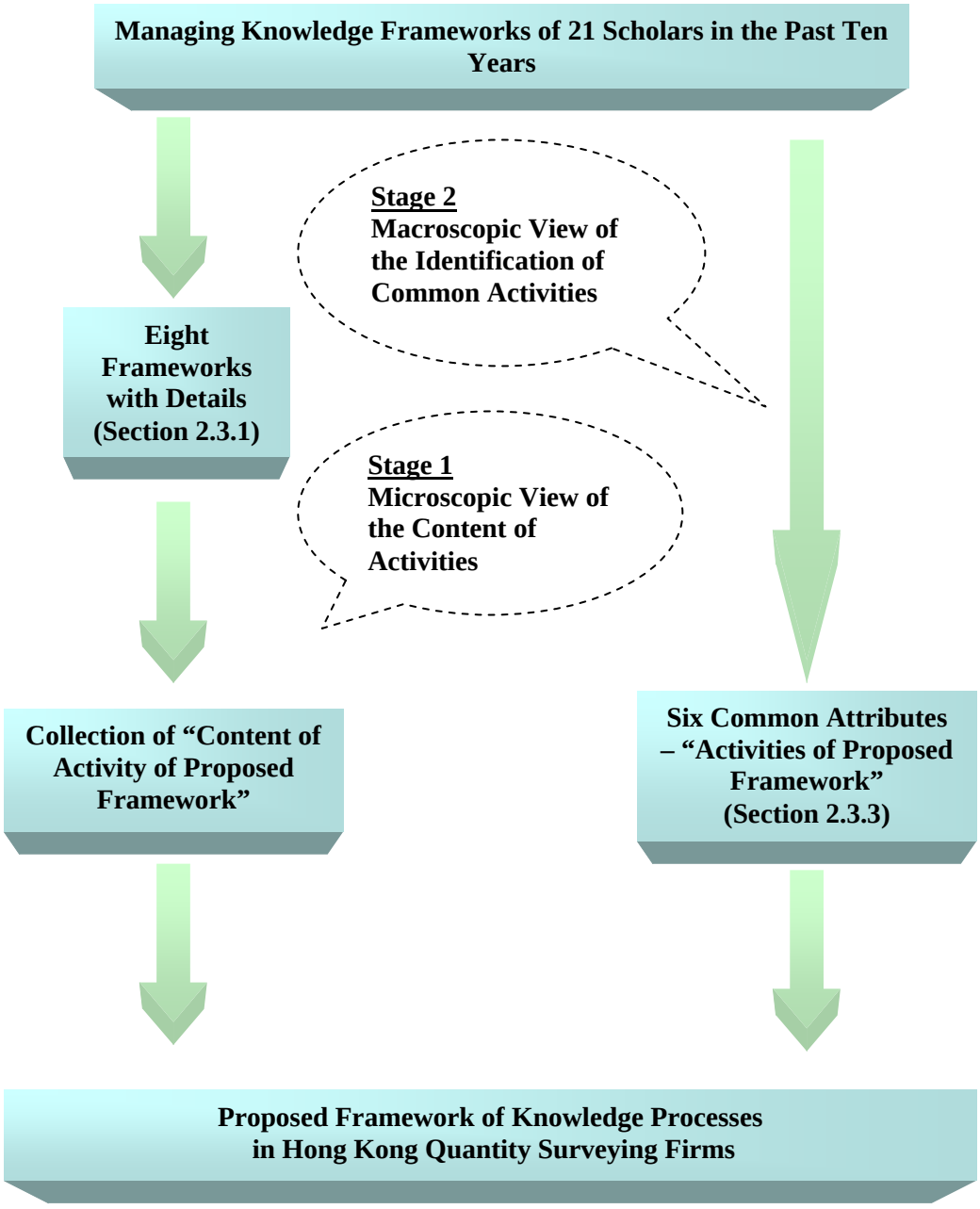


Figure 7 Flowchart for the Design of the Proposed Framework

2.3.3 Identification of Common Activities in Various Frameworks of Managing Knowledge

Table 6 presents a collection of academic literature in relation to the processes of managing knowledge. Those associated activities with similar functions are grouped under the same activity heading. For instance, creating, developing new knowledge, generating, and innovation denote a similar spectrum of knowledge activities and are thus put under Activity D. These activities possess a common creative nature of knowledge production and have received substantial recognition from scholars. Consequently, these features make them the core activity under this heading. However, some other activities proposed by scholars prompt rigid classification difficult. Selling, raised by Beckman (1997), and externalising, as proposed by Holsapple and Joshi (2002) are typical examples. These activities are collectively grouped under Activity I as these two processes both constitute the task of delivering the outcome of knowledge use outside office.

The proposition of Davenport and Smith (1999), which state that knowledge creation, distribution and use are crucial activities in managing knowledge, is well received as shown in Table 6. These processes has gained frequent occurrence in numerous scholars' academic literature. With this overwhelming support, creation, distribution and use find their way to become the foundation elements of the processes of the proposed framework of managing knowledge in this research.

As illustrated in the previous paragraph, the logical derivation sets up a rationale that culminates in the proposed framework as shown in Table 6. The proposed framework consists of six activities, namely acquisition, creation, store, distribution, use and

maintaining, the relationship of which is indicated in Figure 8. Notwithstanding twelve activities (Activities A to L) as listed in Table 6, only six of them are considered adequate to be incorporated into the proposed framework. The following paragraphs will further probe into the design development of the proposed framework.

Twelve activities, namely Activities A to L in Table 6, are identified from the representative knowledge frameworks. They are objectively assessed and six of them are adopted in the proposed framework. The justification and rationale of this selection process are presented below.

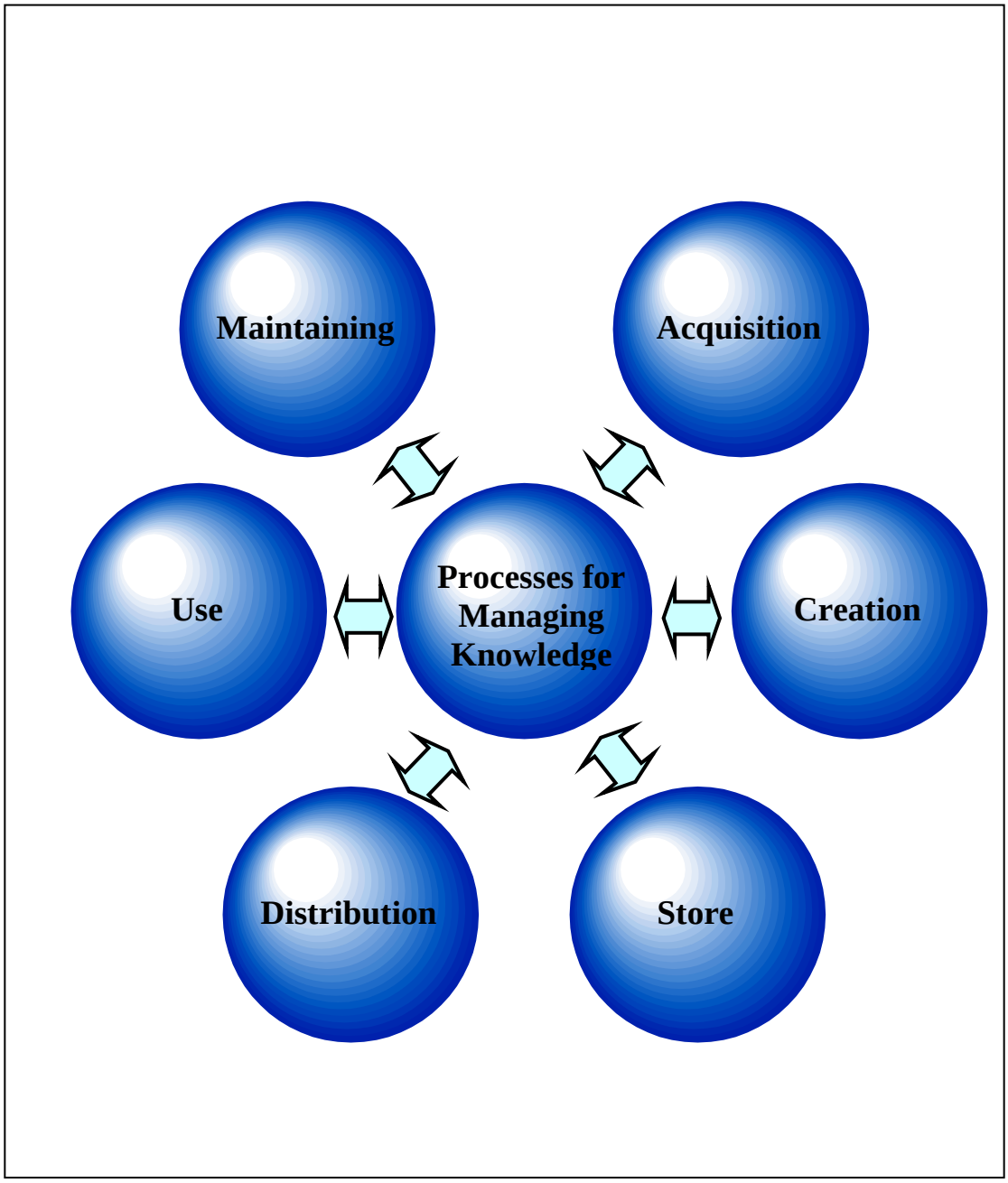


Figure 8 Proposed Framework of Knowledge Processes in Hong Kong Quantity Surveying Firms

- "Identifying" addressed by O'Dell (1996) and Beckman (1997) defines the type of knowledge that has to be acquired. According to the proposed framework, this function is indeed a subset of "Maintaining", which already concerns whether the knowledge needs of an organisation are properly planned or forecast in advance.

- "Adapting" raised by O'Dell (1996) and "Selecting" stated by Beckman (1997) refer to the screening process that generally determines the type of acquired knowledge to be further accepted or adopted by an organisation. Its presence is noted in the process "Store" in the proposed framework, which embraces the filtering process of captured knowledge prior to preservation and storage.

- "Selling" (Beckman, 1997) and "Externalising" (Holsapple and Joshi, 2002) denote the common business objective of operating a professional services firm, i.e. to produce knowledge for reward. Invariably, knowledge-intensive firms are engaged in process cycles that they strive for consultancy fees and transform their knowledge output into reports, tasks, proposals, analyses, etc. In view of the above, they merely represent the aim of the knowledge processes instead of the means of achieving that aim. Hence it is considered not appropriate to treat "Selling" and "Externalising" as unique and individual activities in managing knowledge.

- "Exploiting" (Teece, 1998) and "Evolving" (Nissen et al., 2000) both represent an essential process that optimises and develops existing knowledge for better reward and higher competitiveness. Nevertheless, they drop within the ambit of "Maintaining", which also allow the projection of future knowledge needs to be devised, and thus do not justify a place in the proposed framework.

- "Protection", as considered by Lee and Yang (2000), is worth discussing. Of around 20 scholars, only Lee and Yang (2000) places an emphasis on this process. It is understandable and commonly believed that every organisation

erects barriers to or places certain restrictions on unauthorised use and export of its knowledge to safeguard its intellectual advantage and business investment. It is a commonplace that password or permission is required to access certain types of knowledge. Therefore, "Protection" of knowledge is a task as important as the habit of people placing their valuables in safe deposit boxes. Despite its inevitable existence, it is reasonably considered as an intrinsic and default activity to the knowledge processes. This raises a presumption that it lies in every knowledge framework as an underlying process. As a result, a place in the proposed framework for "Protection" is proved inappropriate.

- "Planning", "Maintaining" and "Assessing", as outlined by Rollett (2003), are associated with a knowledge management strategy, i.e. to keep knowledge repositories in good condition and to review the actual performance of the knowledge strategy and targets. Similarly, they have already been catered for in "Maintaining" in the proposed framework.

- The activities listed under the heading "Activity E", such as "Organizing", "Combing" "Codification", "Integrating", "Formalising" and "Preparing", are devised to address the need to intake those types of knowledge that suit the business context best, to ensure the validity of knowledge and to link it with the existing stock of knowledge. Similarly, "Store" is advocated to emphasise the procedure of interpreting and screening the knowledge with due regard to the needs of knowledge users and organisations. Moreover, "Store" also requires the new knowledge in a knowledge repository to be organised in a sensible order with the existing knowledge. In view of the above, it can easily be deduced that the

substance of these processes is largely equivalent. Therefore, it is concluded that the above aspects are collectively integrated into the process “Store”.

In the above sections, the two-stage development of the proposed framework of knowledge processes is well demonstrated in a logical manner. The following section will then probe into an introduction of the layout of the proposed framework based on the result of the above development.

2.3.4 The Proposed Framework of the Knowledge Processes

At the second stage of the design development, six knowledge processes, namely acquisition, creation, store, distribution, use and maintaining, are identified as the activities in the proposed framework of managing knowledge. With a comprehensive understanding of the content of the activities in other frameworks, this section attempts to present and define the activities in the proposed framework on the basis of the findings of the two-stage design development. An activity in the proposed framework may represent a single or a collection of steps (sub-activities) which is/are serving certain purposes for an activity. For instance, in the framework of Knowledge Management Processes proposed by Lee and Yang (2000, p.788), there are two sub-activities in the activity “Knowledge Acquisition”, namely “tracking down” and another step which seeks to “analyse all the information and explicit knowledge that is available by searching and organisational learning”. Likewise, a similar disposition of sub-activities is also observed in the “Knowledge Management Activities” of Holsapple and Joshi (2002).

2.3.4.1 Acquisition

Knowledge acquisition occurs when an organisation observes that the knowledge in possession does not suffice to realise the business aims. Some scholars assert that acquiring knowledge is the adaptive learning of knowledge that is new to a particular individual or organisation (Kululanga and McCaffer, 2001; Nissen et al., 2000). No organisation can rarely gain a dominant or pioneering role in an industry without learning externally by injecting new knowledge and acquiring internally (also called 'Selecting Knowledge' by Holsapple and Joshi (2002)). To achieve this, knowledge is often identified, extracted from its sources (Nissen, 1999) and documented on paper and by electronic devices, such as intranets. However, extending the reach of the capture process to all tacit and explicit knowledge in a firm will render it uneconomical and impractical. It is thus more sensible to confine the target to those types of knowledge that meets the knowledge needs of the firm. Ultimately, knowledge capture is deemed effective if everyone acknowledges it as part of his/her daily process and recognises its benefits to both the organisation and its employees.

Internally, experienced staff and staff approaching retirement are certainly the knowledge hubs of a firm. Unimpeded flow of this valuable knowledge within the firm is essential to ensure the firm's competitiveness and output quality. Thus it is always a welcoming practice to these "brain reservoirs" to lead internal talks and seminars to distribute useful knowledge and record their valuable experience in internal circulars and practice codes.

Knowledge capture always comes with one of the knowledge management strategies – codification. Codification is defined by Hansen et al. (1999, p.63) as "knowledge is carefully codified and stored in a database, where it can be accessed and used easily by

anyone in the company". Anderson Consulting, Price Waterhouse Coopers, and Ernst & Young also set good examples of placing emphasis on a codification strategy despite its weakness in terms of time and cost involved in capturing 'good practice'.

2.3.4.2 Creation

New knowledge is a fountain of success and competitive advantage for an organisation (Quinn, 1992). Every professional services firm, which survives by selling knowledge, should strive for enriching their stocks of new knowledge. Quantity surveying firms are of no exception.

In this respect, scholars' propositions have some common grounds and take existing knowledge as the origins of creation. Holsapple and Joshi (2002, p.57) identify generating knowledge as "an activity of producing a unit of knowledge by processing existing units of knowledge", while Nonaka and Takeuchi (1995, p.59) conclude that organisational knowledge creation is "a process that 'organisationally' amplifies the knowledge created by individuals and crystallizes it as a part of the knowledge network of the organisation".

Nevertheless, different modes of knowledge creation can be adopted. Nonaka and Takeuchi (1995) deliver four patterns of interactions between tacit and explicit knowledge in knowledge building: tacit to tacit, explicit to explicit, tacit to explicit and explicit to tacit. Marquardt (2002, p.149) supplements further to clarify the dividing line of tacit and explicit knowledge by stating that tacit knowledge is "the knowledge we hold inside and may have difficulty in expressing" and explicit knowledge is "formal, systematic, easily shared knowledge".

2.3.4.3 Store

Knowledge is only meaningful if it can be classified into various categories with respect to its context so that it can be stored in different databases or repositories. Marquardt (2002, p.155) shares the same view and reinforces further that "knowledge is nothing more than unusable data unless it is coded and stored in a way that makes sense to individuals and their organisations". Besides, knowledge must be transformed in a communicable format (Tannenbaum and Alliger, 2000) and logically organised with due consideration to the nature of both new and existing knowledge. Therefore, to enhance the effectiveness of a knowledge stock, knowledge in an organisation should be confined, interpreted, filtered and preserved in such a manner that allows the needs of knowledge users to be fulfilled and retrieval to be executed simply. In the same vein, knowledge integration (Lee and Yang, 2000) echoes a similar concern that only those storage modes of knowledge that are unique to the nature of the business can maximise benefits of knowledge.

2.3.4.4 Distribution

Knowledge sharing is increasingly crucial to the success of knowledge transfer. Davenport and Smith (1999, p.293) share the same view and observe that "professional service firms increasingly evaluate, reward and promote their professionals partially on the basis of how well they share their knowledge". In fact, knowledge distribution involves intended diffusion and flow of knowledge to those who need it. Within an organisation, knowledge can be dispersed through the following ways:

- Job rotation of staff in different divisions;

- Regular courses, mentoring, information briefing sessions;
- Experience sharing and evaluation forums;
- Bulletins, reports, office manuals, guidelines and library;
- Training sessions;
- New staff induction sessions (standard practice of skills).

This activity of knowledge processes is gaining academic attention among a number of scholars. Marquardt (2002) states that the capacity to share lies in the capacity to transfer knowledge. Lee and Yang (2000) also takes particular regard to the essence of a knowledge-sharing environment to the effectiveness of knowledge dissemination.

A knowledge management strategy, termed personalisation, is usually introduced simultaneously with knowledge sharing. As defined by Hansen et al. (1999, p.63), personalisation addresses the situation that "knowledge is closely tied to the person who developed it and is shared mainly through direct personal contact. The chief purpose of computers at such companies is to help people communicate knowledge, not to store it". Only those organisations with a well designed knowledge personalisation strategy can provide clients with tailor-made solutions, and allow tacit knowledge embedded in an organisation's individual employees to be shared by networks of people.

In respect of tacit knowledge, Lee and Yang (2000, p.790) suggests that "tacit knowledge is best shared through people. The more 'valuable' the knowledge, the less sophisticated

the technology that supports it". Tacit knowledge possessed by people is often taken as an intangible key to manage knowledge. However, as tacit knowledge is usually shared through face-to-face dialogue, say during lunchtime and at office pantries, it is difficult for every organisation to formulate a rigid method of capturing and mobilising tacit knowledge. Communities of practice and yellow pages are common channels in which tacit knowledge can be transferred.

2.3.4.5 Use

Best knowledge use is the main initiative for the whole knowledge processes. Hence knowledge should be accessible by staff to enable them to effectively perform various functions: to execute their tasks, to support their decisions, to provide threads for problem resolution and to establish a platform for generating new knowledge. Although an organisation's competitive advantage is reflected by its ability to diagnose flaws, to resolve problems and to innovate new ideas, the versatility of knowledge use in an organisation should also get a place in the assessment. That is the reason why organisations keep spending a lot of resources on encouraging staff to apply knowledge.

2.3.4.6 Maintaining

Knowledge in repositories and people's heads should be regularly revised, reviewed, combined (also called integration by Fischer and Ostwald, 2001), and updated so as to keep the stock competitive and afresh. The success of the process also relies on the extent to which obsolete knowledge is identified, substituted and replaced in time. In order to cope with dynamic business environment, the knowledge strategy should be shaped by a regular review of the demand for various categories of knowledge and a timely foresight of the future need for new knowledge. But anyway, performance is always a reliable rule

to measure the effectiveness of the strategy. Hence performance evaluation with subsequent adjustment programs should be recommended. Furthermore, ill organised plans often result in abortive and inefficient use of resources. Therefore, it is prudent to ensure that users' needs are properly assessed and addressed in the formulation of the knowledge strategy.

2.3.5 Research Hypotheses

Further to Section 2.2.8, another research hypothesis can be put forward in the light of the various knowledge frameworks discussed in the previous sections:

- It is possible to derive a framework of managing knowledge for professional quantity surveying firms.

2.4 The Influence of the Size of Quantity Surveying Firms and the Length of Experience of Quantity Surveyors

2.4.1 The Size of Quantity Surveying Firms

A review of academic literature reveals that size of firms does matter in managing knowledge. Evans (2003) highly advises knowledge-enabled organisations to consider the factor of organisational size before establishment. Davenport and Prusak (1998) are also worried that the size of firms may aggravate the burden of locating existing knowledge. As such, this research attempts to investigate the impact of the size of Hong Kong quantity surveying firms on the ways they manage knowledge. Two independent groups of firm sizes, namely small and medium quantity surveying firms and large quantity surveying firms, are identified as the subject of the study.

2.4.2 The Length of Experience of Quantity Surveyors

Williams and Noyes (2004) attempt, in the article "Effect of experience and mode of presentation on problem solving", to probe into the influence of length of experience on problem solving performance. In their study, the participants are divided into two categories according to their degrees of experience and exposure: novice and experienced. As inspired by the above study, length of experience of practising quantity surveyors at the time of filling the questionnaires is designated as an independent parameter so as to verify if it would affect their perceptions of how knowledge is managed in their workplace.

2.4.3 Other Possible Factors

Apart from the influence of firm size and experience of professional practice, other factors, such as extent of exposure and variety of job natures, possibly affect quantity surveyors' perception of the ways in which knowledge is managed in their workplace.

Quantity surveyors perhaps have different degrees of understanding of this topic owing to their different degrees of exposure to their firms' operations. For example, quantity surveyors who spend more time with experienced colleagues at social events, like lunch gatherings and organisational social functions and training sessions, may gain deeper and more thorough comprehension of other colleagues' working practice and knowledge. On the other hand, quantity surveyors on different teams may also have diverse views on managing knowledge. Their insight is probably enhanced when the variety of project natures is rich. Involvement in various project types also enriches quantity surveyors' recognition of the knowledge flow in their workplace.

However, these two factors cannot be objectively assessed and are positively linked to the length of experience. Therefore, they have not been selected as subjects for study in this research.

2.4.4 Research Hypotheses

In the light of the discussion in the previous sections, a research hypothesis is set below:

- Quantity surveyors' perceptions of how knowledge is managed in their firms are affected by the firm size and their experience of professional practice.

2.5 Summary

In this chapter, four research hypotheses have been formulated on the basis of the literature review presented. The first section has illustrated the significance of knowledge to professional quantity surveying firms in Hong Kong. The professional nature and knowledge-based characteristics of the firms have been demonstrated with detailed justification. This section has also derived two research hypotheses in relation to the low awareness of managing knowledge in the firms and the existence of underlying activities/actions in quantity surveying firms to manage knowledge.

Following the first section, the second section has provided a review of various views on frameworks of managing knowledge. In view of the strengths and weaknesses of each framework and the absence of a specific framework for the surveying discipline, a two-stage design development of the proposed framework has been devised. By this, the third

hypothesis relating to the possibility of a framework of knowledge processes is therefore articulated.

The third section extends the reach of the examination to factors which would influence the perceptions of quantity surveyors of the ways in which their firms manage knowledge. Subsequently, the fourth hypothesis concerning the impact of firm size and experience of professional practice is put forward.

3. RESEARCH DESIGN

3.1 Introduction

Chapter two has delineated the formulation of four research hypotheses. This chapter aims at testing these research hypotheses and reviewing the research design and methodology. The objective of this research is to develop a framework of knowledge processes for professional quantity surveying firms in Hong Kong. With a view to understanding and exploring the current practice adopted by the firms of managing knowledge, a qualitative research approach is employed to facilitate a rich understanding of this practice. The proposed framework of knowledge processes derived in the extensive literature review was to through an initial review by the process of interviews. The interviews were conducted to perform an initial verification of the fundamentals of the proposed framework but are never intended to serve as a sole conclusive consideration to the research conclusion. For a higher representation of the proposed framework, its various constituents are exposed to opinion polls by a wider spectrum of respondents in the questionnaire survey. By adopting qualitative and quantitative approaches, the respective strengths of each approach can thus be deployed in this research.

3.2 Research Methodology

3.2.1 Interviews

The detailed review of relevant academic literature reveals that there is so far no rigid and established authority governing the way how research into the prevailing knowledge processes in quantity surveying firms should be carried out. In view of the propositions that qualitative method best addresses the question ‘how’ and its strength in revealing

people's perceptions of a subject (Fellows and Liu, 2003; Marshall and Rossman, 1999; Schein, 1992), this method is adopted in this research. In addition, its strong capability of describing a pattern of interaction and undesirable but crucial effects also makes itself the most appropriate candidate. Amongst other variants of qualitative methods, individual interviewing is used in this research since the aim is to satisfactorily collect information that cannot be directly observed or measured. As asserted by Brenner (1985), interviews often enable the researcher to get to know the participants' life better, and to identify what is happening rather than measuring its frequency.

In this research, individual interviews are conducted in a personal and semi-structured manner so as to collect data from individuals in the targeted organisations. A relatively unstructured and informal interview environment generally produces an efficient channel for the transfer of user specific and personal data. This view is clearly evidenced by Bell's (1999) strong emphasis on the freedom to allow the interviewees to talk whatever they think important to them. Furthermore, as illustrated by Patton (1990), a semi-structured interview allows the interviewer a larger flexibility in wording questions compared with a close-ended interview. This flexibility can certainly enhance the interviewer's means to probe, redirect and clarify the questions (Guba and Lincoln, 1981).

Three semi-structured interviews, each of which lasted approximately one hour, were conducted with three quantity surveyors at different levels of the staff hierarchies of three distinct quantity surveying firms. These targeted quantity surveying firms were selected from the Company Lists (Quantity Surveying) maintained by The Hong Kong Institute of Surveyors (www.hkis.org.hk) and The Royal Institution of Chartered Surveyors 2004.

Letters of invitation to research interviews were sent to the targeted interviewees (see Appendix A). Based on the topical relevance approach introduced by Yin (1984), only those firms which indicate a particular interest in the study area were considered. Neither the firms nor the interviewees would be identified in any written documentation in this research study for confidentiality reasons.

An interview schedule (see Appendix B), which embraces a set of preliminary questions and issues, was derived in advance from a detailed review of relevant literature. This document is intended to set a comprehensive and coherent framework of the issues to be covered during the interviews and to avoid unintended omissions. In comparison with an open interview, an interview schedule is regarded a more systematic approach to the data gathering process. In order to allow the interviewees an opportunity to review the interview questions beforehand, the interview schedules were dispatched to them either by fax or email. Although some of the questions may be specifically phrased to suit different circumstances, all interviewees received the same interview schedule.

In respect of the questions and the issues in the interview schedule, they are set with an aim to gather useful information in relation to the following topics:

- The attitudes of the interviewees towards the significance of knowledge in their daily work and in the execution of their duty as quantity surveyors;

- The role and flow of knowledge in quantity surveying firms;

- Actual practice of knowledge processes in the industry.

With a preliminary agenda as set out by the interview schedule, interviews were proceeded with appropriate recording methods. Amongst many alternatives, audio recording is considered most efficient in allowing the interviewer to fully interact with the interviewees without being distracted by the note taking process. This view is also echoed by Patton (1987) in his literature. He states that though observation of facial expressions and record of verbal conservation are both recommended, the latter activity should deserve greater attention. Hence, in order to produce a more accurate and reliable interview record, audio recording devices were adopted during the interviews with the interviewees' consents.

Interviewees were selected with particular regard to the possible influence of the firm size. There were totally three individual interviews, in which two of them were held with interviewees from large firms and the remaining one was held with an interviewee from a small and medium sized firm. The classification of firm size is in accordance with that adopted by the Trade and Industry Department of the Hong Kong Special Administrative Region: "non-manufacturing enterprises with fewer than 50 employees are regarded as small and medium enterprises". In the same vein, quantity surveying firms with more than 50 employees are defined as large firms.

In addition, these interviewees were selected to reflect a balanced mix of the seniority in the staff hierarchy in a typical quantity surveying firm. Their roles and positions could range from quantity surveyors to directors. However, with a view to ensuring that the interviewees should have a thorough understanding of organisational knowledge handling methods and sufficient exposure to quantity surveying, quantity surveyors at the senior level were invited for the interviews. The said balance of seniority was not

overlooked; instead, the selection of varied targeted respondents was carried out as discussed in section 3.3. The breakdown of the interviewees' demography gives an indication of the length of their practice in the quantity surveying field. Further, the sizes of the firms involved are also presented, in terms of number of quantity surveyors employed, in later sections.

During the course of the interviews, the interviewer strived to maintain a neutral and non-judgemental attitude and avoid misleading questions and expressions. As suggested by Merriam (1988), the interviewer paid particular attention to both verbal and non-verbal communication. A five-minute casual talk, with questions on general topics, served as an overture to each interview so as to set up a comfortable atmosphere for the interviewees to freely spell out their opinions.

In addition to verbal answers to the interview questions, unconscious body language undoubtedly has some bearing on the interpretation and analysis of the findings. The conversational content of the interviews was therefore transcribed by the interviewer herself with due consideration to the non-verbal expressions of interviewees. All transcriptions by the interviewer were subsequently verified by the content recorded by tapes during the interviews.

3.2.2 Questionnaires

The information gathered in interviews is not conclusive and should further be verified by an empirical prototype. This prototype is best established by an inquiry into the views of a wider spectrum of relevant respondents. In view of this, questionnaires to quantity surveyors practising in professional quantity surveying firms are therefore proposed. The

findings derived in questionnaires allow the researcher to elaborate and refine the definition of the knowledge processes to ensure a broader representation in quantity surveying firms. Regarding the mode of the survey, it is shown that questionnaires are most popular among academic scholars. Its popularity does not stand for no reason. It does not only allow a large amount of data to be gathered in shorter time and at less cost (Sekaran, 2003), but also easily extends the reach of contact to a large number of respondents. Furthermore, its anonymous nature guarantees a secure environment for respondents to freely indicate their genuine views. Apart from these, this mode of survey also allows respondents to allocate their time to respond at their own convenience.

In respect of questionnaire design, Neuman (2000) suggests that a questionnaire, with a completion time of less than 15 minutes and three to four pages of questions, is optimal for general populations. The literature review and the interview findings are the main reference that guides the formulation of the questionnaire. A set of questions is purposely developed with an aim to probe into the knowledge practice of various professional quantity surveying firms. At the same time, the validity of the proposed knowledge framework can be tested in parallel. The questions are arranged in an order as suggested by the funnel approach (Festinger and Katz, 1966) such that the structure of the questionnaire attains a gradual transition of topical nature. Questions of general nature come first and those of more specific nature follow. Personal data is only requested at the end of the questionnaire rather than in the beginning (Oppenheim, 1986). A Likert-style scale (Likert, 1932) is followed in the response design.

A cover letter (see Appendix C), which underlies the objectives of the research study, was dispatched together with a questionnaire (see Appendix D) by postal mail to each

respondent. An introduction to questionnaire is also included to specify that responses in good faith are essential to the accuracy of the research and that there is no right or wrong answer. At the end of the cover letter, gratitude and appreciation are expressed to the respondents for their attention and time.

A special analysis technique, termed triangulated studies or simply a mix of analysis approaches, is deployed to eradicate the shortcomings of individual approaches and to take advantage of the strength of each, and even the synergy of a combination of them. Quantitative and qualitative approaches are the subjects of the triangulated study in this research to supplement and complement each other. The chemical reaction of them is best illustrated by Patton (1990) who states that qualitative methods allow the study of a specific issue to be carried out in depth and details, whereas quantitative methods serve more satisfactorily in the measurement of the reactions of a large number of subjects to a fixed question so that a statistical comparison is easily achieved.

3.2.2.1 Sampling Approach

As depicted in the previous sections so far, it has been clear that this research is dedicated to a probe into the prevailing practice of how Hong Kong quantity surveying firms manage knowledge. Therefore, it is sensible to expect practising quantity surveyors in Hong Kong professional quantity surveying firms to be the ideal candidates for the respondent population. This sampling strategy falls within the Patton's (1990) philosophy that participants are selected based on certain characteristics in purposeful sampling. Hence the pool of quantity surveyors registered under the Directory of The Hong Kong Institute of Surveyors 2001-2002 and the List of Members 2004 of The Royal Institution of Chartered Surveyors constitutes the population for sample selection.

Without the slightest exaggeration, sample size often governs the quality and reliability of survey result. Nunnally and Bernstein (1994, p.31) hold the same view and state that "… one cannot determine how many subjects should be used to obtain data for item analysis in advance without knowledge or results obtained in similar contexts … at least 200 normative subjects is a rule of thumb to provide sufficient stability to the analysis." This rule of thumb, though not authoritative and universal, still provides a useful guide for an adequate sample size. As such, 260 questionnaires are administered to quantity surveyors practising in professional quantity surveying firms in Hong Kong. The composition of those selected is determined by an entirely random ballot of the lists in the Membership Directories so as to guarantee a well graded distribution. Patton (1990) confirms random purposeful sampling as a way to produce a small and manageable sample size out of a larger one.

3.2.2.2 Data Analysis

Computer aided statistical analysis is deployed in the data analysis process. All data collected by the questionnaires is input into SPSS 11.5 (Statistical Package for the Social Sciences) in defined format. This program allows great flexibility and versatility in data processing and is widely adopted in statistical researches. To ensure sufficient accuracy, a data cleaning process, in which all data entries are printed out for error checking, is carried out in advance and acts as a fuse device. Some independent parameters, like length of respondents' professional practice and size of firms which the respondents are working in are subject to a series of statistical tests: the normality test, Mann-Whitney test and the Kruskal-Wallis test.

3.2.2.3 Descriptive Statistics

Descriptive statistics are engaged in transforming all the question items into useful indicators of various research parameters. It is intended that observation from the descriptive statistics provides sufficient threads to build up a reliable demographic profile of the respondents. As simple as the total number (n), mean values (μ), and standard deviations (σ) of the respondents for each question item are proved adequate for data interpretation.

3.2.2.4 Scale

Scaling is an indispensable part of the response design of every questionnaire. It is sometimes regarded as the life-and–death element of a successful design. DeVellis (2003) introduces a widely adopted scaling method, i.e. Likert scaling, and adds that it is renowned for its strength in measuring opinions, beliefs, and attitudes. In the light of this appealing nature, a five-point Likert scale in combination with a list of close-ended items is devised in the instrumentation design to allow a convenient quantitative expression of opinions by the respondents. The Likert scale is composed of an escalating scale from "Low (Strongly Disagree)" to High "(Strongly Agree)" with "Neither Agree nor Disagree" as the midpoint. The design rationale originates from a thorough consideration of various aspects. Some are presented as follows:

- Closed-ended items are less time-consuming to answer, thereby encourage a higher response rate;

- Gathering and processing data on a Likert scale is efficient and less complicated;

- The Likert scale restricts the range of possible responses to those pertinent to the goals of the survey (Booth-Kewley et al., 1997);

- Incorporation of a midpoint allows respondents to express their opinion accurately, gives them the option of a neutral view and prevents them from having to reluctantly take a stance on either side.

3.2.2.5 Data Processing

For each attitudinal item, the 5-point Likert scale of response is measured in a numerically coded system. This scale is composed of a linear grading classification which allows responses to be quantified in a range from 5 = Strongly Agree, 4 = Agree, 3 = Neither Agree Nor Disagree, 2 =Disagree, to 1 = Strongly Disagree. Booth-Kewley et al. (1997) favour this numerical approach and suggest that it can reduce data entry errors and make data entry quicker and easier. Moreover, numeric data coding is highly capable of translating qualitative opinions into a quantifiable format required for running the normality test, the reliability of instrument le and statistical analysis programs.

- Normality Test

The selection of any statistical tests and procedures are based on the specific distributional assumption. In this case, normal distribution is a common assumption as to the nature of the response data. All data collected is subject to a test of normality to verify if they are normally distributed. The Kolmogorov-Smirnov test of normality serves to produce an unbiased and objective assessment of this aspect. Where the significance value of the Kolmogorov-Smirnov test of a question item goes below the .05 alpha level, resorts to non-parametric statistical tests are required.

- Reliability of the instrument

Prior to any analysis of the collected data, all the question items must be tested so as to ensure that they possess adequate property of reliability. In the data analysis stage, it is necessary to incorporate the reliability of scale (internal consistency) test into the data verification process so as to ensure that a meaningful group of data has been collected. In this respect, the "Cronbach's alpha" test is adopted to evaluate the reliability of the measured items, as suggested by Nunnally (1978). This test takes a minimum level of 0.70 as the control criterion.

- Mann-Whitney Test

In this research, the Mann-Whitney test is deployed to explore the differences in the responses between quantity surveyors practising in small and medium firms and those practising in large firms. Norusis (1990, p.225) quotes this test as one that "tests the hypothesis that two independent samples come from populations having the same distribution".

- Kruskal-Wallis Test

Apart from the above testing programs, Kruskal-Wallis test is also devised to test the degree of differences between several independent samples from the same population. In this study, it is aimed to identify the variance levels among various groups in terms of length of professional practice.

3.2.2.6 Pilot Study

A pilot study is taken as a quality assurance test to verify the adequacy of the substance and the design of the questionnaire. It is purposely devised to achieve two objectives which seek:

(a) To establish a realistic estimate of how long it takes the respondents to complete the questionnaire and;

(b) To ensure that all questions and instructions are clear and unequivocal (Bell, 1999).

This effectively helps reduce the likelihood that respondents would either misunderstand the questions or refrain from completing an excessively lengthy questionnaire. Hence draft questionnaires are comprehended and examined by three quantity surveyors with different years of working experience. After that, it is reviewed and revised according to their comments.

3.3 Varied Targeted Respondents

There is no other sensible alternative than a probe into the ways how quantity surveying firms handle knowledge to conduct this research. The practice and methods of managing knowledge are, the main subjects of the study. The findings can also subject the validity and applicability of the proposed framework of knowledge processes in Hong Kong quantity surveying firms to close scrutiny and verification. With these important missions, the choice of targeted respondents is not simply a matter of subsidiary component.

This problem is further aggravated by the presence of a lot of variants in the firms' organisational structure. Quantity surveying firms can hardly turn themselves into smooth operation in the absence of human resources input, like manpower. The organisational structure of Hong Kong quantity surveying firms generally encompasses three hierarchical levels - director / partner, senior quantity surveyor / team leader and quantity surveyor as indicated in Figure 9. The members in these categories are observed to perform entirely different functions as follows:

- Directors / partners invariably seek for business opportunities and are delegated to accept business appointments from clients;

- Senior quantity surveyors act as the agents of the directors / partners to keep a close eye on quality of the firms' deliverables, work progress, project financial status, resource levels, etc.

- Quantity surveyors operate at the working level. They are expected to be involved in the actual operation and to be associated with every aspect from project inception to completion.

It is obvious that quantity surveyors at different levels perform different roles. Questions then arise as to which level of quantity surveyors can best grasp the full picture of the daily obligations of quantity surveyors and whether directors' / partners' opinions are conclusive to represent the actual practice of the firms. Answers to these questions clearly influence the composition and representation of the targeted respondents.

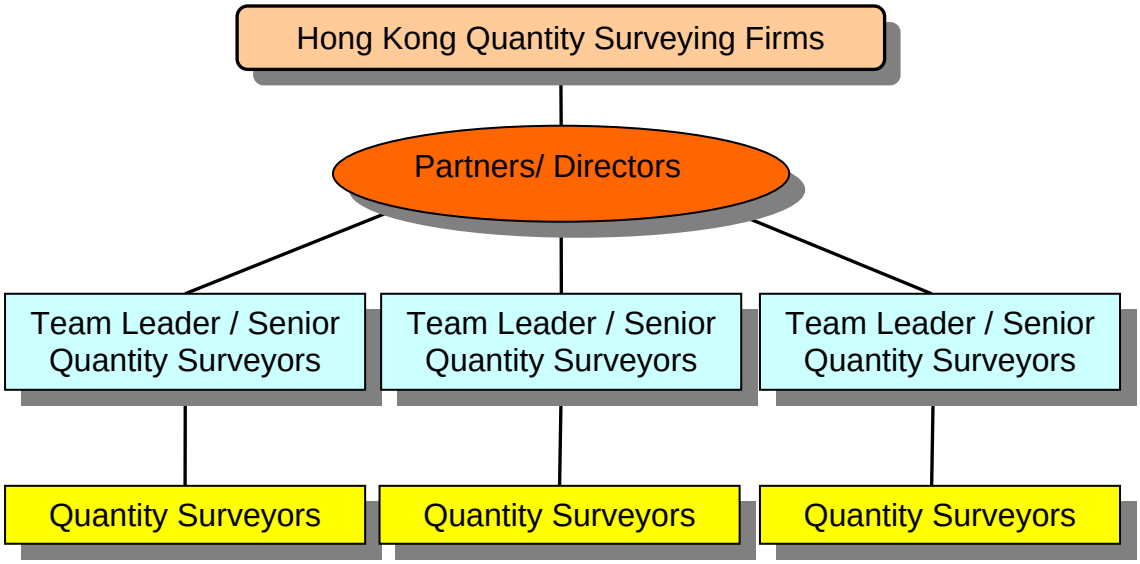


Figure 9 Typical Organisational Structure of Hong Kong Quantity Surveying Firms

As mentioned earlier, directors of quantity surveying firms direct the firms' strategy, working procedures and standards of deliverables, and are supposed to know their firms inside out. Their schedule may however be packed with overseas travels, social functions and seminars so as to promote their firms' edge and professionalism to potential clients. In this way, it is expected that existing clients are convinced of their firms' capability and may probably grant more business opportunities to them in future. As such, directors of quantity surveying firms, who are deemed suitable to represent their firms, are certainly the targeted participants of this research. Nevertheless, it is quite unlikely that this group of people could squeeze minutes or even seconds from their already packed schedules to contribute some participation to interviews. Team leaders / senior quantity surveyors, who are assigned to operate at the second level of the organisational hierarchy, on the other hand guarantee themselves a place in the most favourite targeted respondents for this research. Coupled with their close proximity to the top management, their rich experience in quantity surveying field and in-depth understanding of practice in their

firms and Hong Kong amount to valuable data for this research and supplement the possible unpopular response from directors / partners. In the light of this, quantity surveyors at senior level are invited for interviews as opposed to directors / partners. Even so, as stated in the letter of invitation to a research interview, though experienced quantity surveyors at senior level are given higher priority, it is up to the discretion of the quantity surveying firms to arrange director, team leader or senior quantity surveyor to attend the interviews. As a result, attitudes of the top management of quantity surveying firms towards the significance of knowledge in their daily work and the relationship of knowledge and their duties can be gathered.

A sole preference to the top management may lead to an anomaly as to the reason why the perceptions of quantity surveyors at other levels is overlooked. The gist of this argument lies in the fact that diverse opinions are probably present at different levels even within the same physical workplace. In terms of population, it is common that the working level of a firm represents the majority of staff in quantity surveying firms. Therefore, the attitudes and perceptions of quantity surveyors at working level should not be neglected. Despite the dominance in staff population, it remains questionable as to whether quantity surveyors strictly comply with the firms' well devised knowledge strategy and procedures in actual practice. This doubt is well illustrated by analogy to the common ignorance of drivers and passengers to fasten their seat belts even though both compulsory seat belts installation in private vehicles and legal regulation have been in place for a long time. This phenomenon may be attributed to the over reliance on the self discipline of quantity surveyors and the lack of an effective interactive link between the top management and quantity surveyors. Knowledge workers differentiate themselves from factory workers in the inherent autonomous nature of knowledge processes.

Whereas factory workers are prompt in following established routine procedures, there is rarely prescribed method for quantity surveyors to complete their tasks despite the provision of certain complementary environment and facilities. In order to tackle this situation, they generally get to learn new knowledge either by attending conferences, reading journals or sharing with colleagues. In the light of this possible variation in perceptions, it is worth investigating the opinions of quantity surveyors at working level instead of placing sole reliance on top management. Hence, it is prudent to diversify the spectrum of targeted respondents of questionnaires to all levels of quantity surveyors by random selection. Coupled with interviews, questionnaires allow responses and perceptions of all three levels of organisational hierarchies of Hong Kong quantity surveying firms to be gathered and considered.

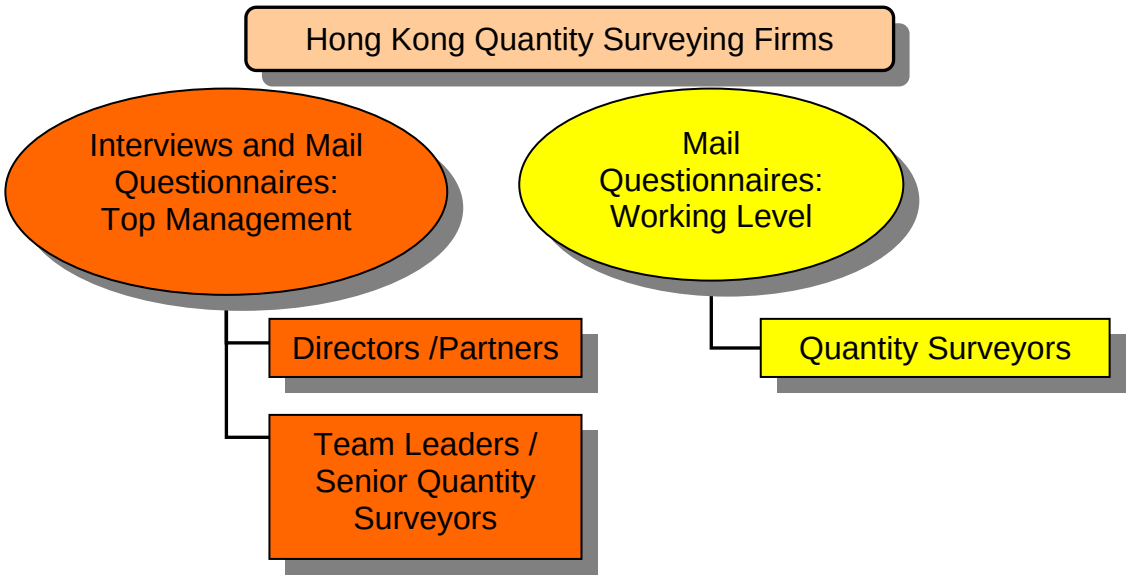


Figure 10 Interviews and Questionnaires to Targeted Respondents

As depicted in Figure 10, interviews are directed to abstract the views of top management whereas the perceptions of all quantity surveyors are considered by mail questionnaires. Thus the derivation of the proposed knowledge framework and the investigation of the

prevailing implicit knowledge processes in Hong Kong quantity surveying can found on a comprehensive and all- around representation in this profession.

3.4 Design of Questions in the Questionnaires

Previous experience and knowledge are often retrieved for solving problems and difficulties. Yau and Yang (1998, p.143) observe that the same also applies in the construction industry that "knowledge and assessments of previous experience are critical to resolving problems …". The value of knowledge is well recognised since it enables an organisation to interact with and adapt to the dynamic business environment. However, as raised by Housel (2001, p.2) that "knowledge is an ideational (i.e. conceptual rather than physical) construct generated through the agency of the human mind", proper and efficient handling processes for this valuable asset is equally essential to develop its potential benefits. Hence the ways how knowledge in an organisation is managed often dictates the merits knowledge can bring to the organisation.

In view of this, interviews and mail questionnaires are devised in an attempt to get an insight of the prevailing knowledge managing practice adopted by Hong Kong quantity surveying firms. In chapter Two, the proposed framework of knowledge processes in Hong Kong quantity surveying firms, namely Knowledge Acquisition, Knowledge Creation, Knowledge Store, Knowledge Transfer, Knowledge Use and Knowledge Maintaining, has been deduced from the critical review of relevant academic literature. The validity of the proposed framework has been firstly verified by findings from interviews. Some modifications are due to be incorporated into the proposed framework to take the interview findings into account. The proposed framework is then subject to a second test of questionnaires based on the response from a wider spectrum of

respondents. In other words, the interviews and the mail questionnaires serve as a reliable dual testing regime to verify or substantiate the proposed framework from the perspective of practising quantity surveyors.

In this section, all questions of the questionnaire are established with a detailed discussion of the associated rationales and justifications. They are particularly set to seek to confirm whether the six proposed knowledge processes are implemented in Hong Kong quantity surveying firms and to study how the processes are put into practice. In other words, the questions rank these two aspects, i.e. a proof of the scope of the proposed knowledge processes and an insight of how they take place, high in their priority list. However, difficulty may arise as to the implicit nature of the prevailing managing knowledge processes in Hong Kong quantity surveying firms. Quantity surveyors are probably unaware of their existence in their daily work. Responses to broad questions, like “Do your firm create knowledge?”, are probably biased or jeopardised. Answers, such as “No, I don’t think so” or “I have no idea”, are generally expected. Even the answer is affirmative, those respondents would get stuck with more specific questions, like “How does it happen and by what means?”. In order to evade the above anomaly, it is prudent to direct the focus of the questions to each of the knowledge processes. The respondents are then encouraged and guided to answer the same questions in an easier and more practical way by quoting reference to daily examples of such processes. As such, the construction of the question statements is framed to illustrate some familiar examples and scenes of the knowledge processes. Furthermore, it is also a sensible way to eradicate any possible misinterpretation of unfamiliar technical terms, like Knowledge Acquisition and Knowledge Use, by respondents in their comprehension of the questions.

Any positive responses to the statements amount to two simultaneous implications. They do not only affirm the existence of such processes in their daily work, but also indicate how these processes are implemented. Further to the focus on the proposed six knowledge processes, the main interests of the questions also encompass other relevant issues, including:

- The value of time, cost and quality;
- Extent of time stress;
- Job nature;
- Demand for new knowledge;
- Significance of knowledge;
- Recognition of knowledge processes

Table 8 provides a structural layout of the questionnaire with the purpose of each question clearly stated. A more detailed description for the justification of questions follows.

Knowledge Processes	Purpose of Questions	Question Number
	To indicate the attitudes towards time, cost and quality in quantity surveying firms	1, 2 & 3
	To indicate work load and time stress in quantity surveying firms	4 & 5
	To indicate job nature of quantity surveying discipline, i.e. workers in a toy factory compared to workers with decision making skill	6
	To indicate demand for new knowledge	7
	To indicate the significance of knowledge in quantity surveying firms	8
	To test the research hypotheses: awareness of how to manage knowledge is low in quantity surveying firms	9
Knowledge Acquisition	To indicate where quantity surveying firms to acquire knowledge and what kind of knowledge is acquired	10 & 11
	To indicate how quantity surveying firms acquire external knowledge and the reliance on external knowledge	12, 13 & 14
	To indicate how quantity surveying firms acquire internal knowledge	15, 16 & 17
Knowledge Creation	To indicate how knowledge is created	18 to 23
Knowledge Store	To indicate how knowledge is stored	24 to 34
Knowledge Distribution	To indicate how knowledge is disseminated	35 to 45
Knowledge Use	To indicate how knowledge is utilised	46 to 48
Knowledge Maintaining	To indicate how knowledge is maintained	49 to 53

Table 8 Justification of Question Design

Questions: 1-3 (Time, cost and quality)

It is interesting to note that time constraint assigned to a task receives much concern from the interviewees during the interviews. All three experienced quantity surveyors strongly concurred that they experienced severe burden to deliver assignments to clients within unreasonably short periods of time. Davenport and Prusak (1998, p.88) state that "organisations often hire bright people and then isolate them or burden them with tasks that leave no time for conversation and little time for thought". Probably, quantity surveyors may share similar view with Davenport and Prusak. Therefore it is worthwhile to explore how quantity surveyors cope with the tension among three intermingled elements, i.e. quality of output, time limit and resources (workforce) allocated to a task.

Questions: 4-5 (Workload and time constraints)

Dent (2004) contemplates that pressure arisen from the completion of a task under severe time constraints may discourage or weaken staff's awareness of managing knowledge. To verify this advocacy, quantity surveyors are encouraged to respond questions 4-5 so as to study the influence of workload and time constraints on their awareness of managing knowledge.

Question: 6 (Job nature)

Problem solving technique is commonly regarded as a precious asset and profitable tool. Questions in professional assessment interviews and recruitment interviews are therefore invariably directed to focus on testing candidates' ability of problem resolution. In view of the above, question 6 is intended to affirm the knowledge-driven nature of quantity

surveying as opposed to other labour-intensive industries. Should the responses to this question indicate that problem resolution remains predominately the major activities of their work, it can reasonably affirm the above proposition. On the presumption that knowledge is a prerequisite to problem solving, the significance of knowledge is then unobjectionable.

Questions: 7-8 (Demand for new knowledge and significance of knowledge)

Although value of knowledge and new knowledge are increasingly crucial for sustaining competitive advantage of an organisation, little is known about the interaction of these two aspects in quantity surveying firms. Thus questions 7-8 attempt to disclose how quantity surveying firms evaluate knowledge and their demand for new knowledge.

Question: 9 (Awareness of managing knowledge)

Davenport and Prusak (1998) observe that excessive workload is likely to distract staff from considering other relevant stuff outside the scope of their assignments. In this respect, question 9 seeks to verify the research hypothesis concerning the awareness of managing knowledge in quantity surveying firms.

Questions: 10-11 (Where and what to acquire)

Standards Australia (2001) suggests that where an organisation finds itself deficient in adequate knowledge to materialise its business aims, knowledge acquisition is justified to happen. Thus 20 options are specified in question 10 for quantity surveyors to elect their

knowledge sources in their workplace. Besides, they are also allowed to state in question 11 the types of knowledge which they think quantity surveying firms are inclined to acquire.

Questions: 12-14 (External knowledge acquisition)

Bergeron (2003) opines that capture of external knowledge is becoming more significant in knowledge organisations. To address this point, questions 12-14 are devised to explore the approaches exercised by quantity surveying firms in external knowledge acquisition. As an extension to question 7 that confirms the import of new knowledge, question 13 seeks to identify the origins of new knowledge.

Questions: 15-17 (Internal knowledge acquisition)

Departure of key and skilled knowledge workers implies a loss of staffs' knowledge and deterioration of an organisations' knowledge repository (Davenport and Prusak, 1998; Dent, 2004). Hence it is desirable and recommendable to encourage experienced staff to record their knowledge and experience so as to retain knowledge and to reduce the impact of brain drain. In view of this, the purposes of questions 15-17 are to find out how quantity surveying firms acquire knowledge internally. In addition to knowledge preservation, two alternative approaches, job rotation and experience evaluations at project conclusion are also subjects of the study in the questionnaire.

Questions: 18-23 (Knowledge creation)

A capability of knowledge innovation and invention is always an invaluable treasure trove of an organisation. This supplies sufficient fuel for an organisation to sustain its competitive advantage and deter other contenders from imitating or even pirating. To the contrary, Standards Australia (2001, p.39) observes that "many people are naturally suspicious of new ways of doing things". Thus new ideas or knowledge may not be welcomed by people in cases where prevailing methods seem to be free of flaws. Questions 18-19 are then devised to examine the atmosphere and attitudes in quantity surveying firms in respect of knowledge creation through staff interaction and sharing. It is expected that, in the process of knowledge creation, approaches that require import of new elements into existing knowledge remain dominant and instances that generate entirely new knowledge are relatively rare. The validity of this contemplation in Hong Kong quantity surveying firms is sought to be verified in question 20 in the eyes of practising quantity surveyors. In addition, organisations certainly benefit themselves from identifying best practice that is only discoverable in a robust accumulation of valuable experience. Dent (2004, p.24) concurs and concludes that "the identification of best practice into business processes benefits many aspects, such as increased business options, improvement in quality, cost saving and process optimisation". However, people lack confidence and capacity to recognise their daily tasks as best practice. Therefore, question 21 helps discover whether this problem is properly tackled in quantity surveying firms.

Despite endless effort dedicated to positive flaw prevention and detection, one of the interviewees stressed that the organisational knowledge of his workplace is constantly

nourished by project reviews of successes and failures. Questions 22-23 are designed to ascertain whether past experience, including successes and failures, helps enrich the knowledge stock in quantity surveying firms.

Questions: 24-34 (Knowledge store)

Standards Australia (2001) stresses that knowledge should be articulated in a way that can be easily absorbed and learnt by users. It can be foreseen that improper knowledge organisation prior to utilisation can turn all previous effort in vain. Holsapple and Joshi (1999, p.7-6) also concur that a verbatim transfer of knowledge is not recommended since "the captured knowledge may be too extensive, raw, fragmented, or unclear for knowledge seekers". Question 24 serves to indicate the extent to which raw captured knowledge is well organised to complement the utilisation process.

Nevertheless, the mode of knowledge store should not be steered towards the needs of knowledge users alone. Lee and Yang (2000) asserts that knowledge is meaningful only if it is stored in a way that makes sense to the nature of business. Hence it is well justified to look into the details of the prevailing approaches of knowledge store in quantity surveying firms. Questions 25, 26, 27 and 29 are then set to channel the views on different courses of knowledge store, such as electronic means, printout stockpile, human brain and organisation's routines, into the survey. Further to the approaches of knowledge store, questions 28 and 30 are intended to ascertain if knowledge is stored in an organisational level or a personal level. It should be borne in mind that should knowledge be stored at a personal level, personal attributes, like social network and referral, would inevitably become crucial. Even worse, transmission of knowledge would

probably be hindered as possession of knowledge may only rest with individuals and thus makes a fully accessible knowledge stock unattainable.

Commercial advantage can drain away at an incredible speed if no secure and adequate measure is devised to protect this important intellectual property. As a result, Dent (2004) and Bergeron (2003) both pinpoint that any unauthorised access to sensitive and confidential information should be curbed and the firms should be fully alert to any malicious transfer or pirating of their knowledge. In view of the importance, questions 31 and 32 are specifically devised to study how quantity surveying firms combat this situation.

The provision of a sufficient and efficient guidance in complex repositories of information and knowledge is an ideal aid for every knowledge seekers (Standards Australia, 2001). It urges people to fully comprehend their problems before making a resort to a search engine and turning a blind eye to the nature of their problems in hand. Knowledge directory or yellow page that includes skills, experience and contacts of knowledge providers is recommended (Davenport and Prusak, 1988; Standards Australia, 2001). After all, one of the ultimate aims of knowledge store is to let people know where to find and who to ask in case of problems. Thus questions 33 and 34 help work out whether quantity surveyors encounter difficulties in dealing with various methods of depositing knowledge.

Questions: 35-45 (Knowledge distribution)

In comparison with knowledge store, knowledge distribution effectuates the delivery of knowledge in a relatively active manner. In Palaniappan (2004), mentoring and job rotation are quoted, inter alia, as classical examples of effective knowledge dissemination. In view of this, questions 35, 37, 38, 39, 40 and 45 are devised to probe into quantity surveyors' affinity to various modes of knowledge distribution, namely mentoring, electronic means, printout, daily interaction, face-to-face sharing and assigning specific expertise (specialist referral) to specific jobs. Among the said methods, face-to-face sharing enjoys a high status in Standards Australia (2001, p.23) as "knowledge tends to lose meaning and depth in transmission". With a view to verifying this citation, question 40 is particularly included to seek the extent to which face-to-face sharing takes place in quantity surveying firms. To ensure a full picture of the prevailing practice, question 36 establishes a poll among quantity surveyors on the extent of diffusion of knowledge in their firms.

The ultimate success of a mode of knowledge distribution lies in one's dedication of the associated facilities. As such, questions 42 and 44 seek to unveil the scope and versatility of the provision of such facilities, such as office layout and remote access, in quantity surveying firms. Remote access is regarded by Buckman (2004) as a powerful tool that enables an organisation to operate through days and nights outside the ambit of a physical office. Its provision is found in some engineering consultants. Therefore a consideration of its implementation in quantity surveying firms is beyond doubt.

The issue of knowledge sharing is a crucial activity in the knowledge industry (Greengard, 1998). Apart from the previous issues, the biggest challenge to managing knowledge lies in the resolution of impediments to foster knowledge share among staff. Huotari and Iivonen (2004) realise a common phenomenon that knowledge is hardly to be shared in the absence of a mutual trust. This clearly resembles the traditional relationship between teachers and apprentices in Chinese society. Under this situation, monetary reward may be a good incentive to encourage knowledge sharing. Questions 41 and 43 are set to investigate whether quantity surveying firms motivate knowledge sharing by giving reward and treating contribution to knowledge sharing as a key criterion of annual staff performance appraisals.

Questions: 46-48 (Knowledge use)

Davenport and Prusak (1998, p.101) observe that "knowledge abounds in organisation, but its existence does not guarantee its use; similarly, it is fairly common for someone to understand and absorb new knowledge but not put it to use for a variety of reasons". In order to understand if the same situation applies in quantity surveying firms, questions 46-48 are designed to reveal how knowledge is deployed.

Questions: 49-53 (Knowledge maintaining)

Store of stagnant information cannot provide an organisation sufficient competitive edge for survival under a constantly changing market (Malhotra, 1998). Question 49 concerns knowledge updates in quantity surveying firms since regular updates to knowledge

repositories are able to enhance the quality of knowledge (Standards Australia, 2001). To advance further, question 50 directs its focus on the applicability of knowledge.

Clearly, a pleasant knowledge flow is highly associated with the efficiency of sub-activities, such as acquisition, creation, transfer, etc. However, a better outcome is to be harvested should the value of knowledge be fully realised by the top management of a firm. In this aspect, question 52 opts for an insight of the perceptions of the knowledge needs of quantity surveying firms by the top management. Moreover, question 53 seeks to verify if the firms' formulation of policy or strategy on knowledge handling satisfies the increasing knowledge demand. Perhaps, a dominance of the responses to question 51 "I am able to obtain the necessary knowledge when I need" may well conclude and reflect the ultimate performance of all knowledge processes undertaking in quantity surveying firms.

3.5 Summary

This chapter has discussed the research design and methodology of this research, which attempts to derive a representative framework of knowledge processes for professional quantity surveying firms in Hong Kong. The first two sections described the advantages of qualitative and quantitative methods and the details of their actual implementations. The section on the various targeted respondents then demonstrated the consideration for selecting proper respondents with regard to different research methods and coverage of respondents. Finally, this chapter ended with a section depicting the design of the questions in the questionnaire, with emphasis on the rationale of question setting.

4. INTERVIEW FINDINGS

4.1 Introduction

Three individual interviews were conducted with three selected interviewees in April 2004. Each interview was held in a quiet and undisturbed environment in the interviewee's office, and lasted approximately one hour. All conversations and discussions generally followed the pre-planned interview schedule and were recorded by audio recording devices with the interviewees' consent. The contents of the interviews are presented in detail in the following sections.

4.2 Findings

As mentioned in the previous sections, interviewees were selected with due regard to the possible influence of the firm size and the background of the interviewees. A summary of the selected interviewees is presented in Table 9.

	Position of the Interviewee in Quantity Surveying Firm	**Length of Experience of the Interviewee in Quantity Surveying Field**	**No. of Quantity Surveyor Employed**	**Size of Quantity Surveying Firm**
Firm A	Associate Director	20 years	≥ 50	Large firm
Firm B	Team Leader	10 years	≥ 50	Large firm
Firm C	Senior Quantity Surveyor	10 years	< 50	Small firm

Table 9 Summary of Selected Interviewees

Open-ended questions and discussions were two main communication modes to collect information regarding the interviewees' perceptions of the operation and the practice of the knowledge processes in their respective quantity surveying firms. This information

has then further analysed in a qualitative manner so as to derive a typical framework of how quantity surveying firms manage their knowledge.

Firm A

Firm A, a large private partnership, was operating in a competitive market by providing contractual and cost advice to clients. Other than the supporting staff, all quantity surveyors were assigned to work in teams directed by partners of the firm. The interviewee from Firm A was an associate director, the major duty of whom was to assist the partner of the team to oversee the team's normal operation.

As indicated by the interviewee, Firm A always took a prudent approach towards the quality of their work. However scarce the time was, they insisted that quality would never be compromised. Therefore, the quantity surveyors in Firm A had to strive to perform their professional duties in the most efficient manner. As such, it had long been a commonplace in Firm A for the quantity surveyors to work around the clock. In addition to long working hours, the interviewee also observed that the knowledge and experience of the responsible quantity surveyors often helped expedite the problem solving process. In simple terms, their personal knowledge and experience often served as a lighthouse to guide their ways to produce output in satisfaction of clients and to identify problems in advance. This strict adherence to quality gradually built up Firm A's reputation among clients and thus attracted more invitations for jobs.

Further to the business incentives, the interviewee also pointed out that the knowledge attributes of the firms was also gaining weight in clients' assessments of professional consultants. They invariably regarded academic and professional achievements of the

staff as an indication of the degree of professionalism of the firm. In view of this, Firm A took a consistent approach to the compilation of bidding proposals. They spent more paragraphs to describe the capabilities and diversity of their knowledge wealth on both qualitative and quantitative bases. The description would, at least, be composed of the following items:

- A detailed description of the academic background and experience of the staff;
- A ratio of professionally qualified staff to non-professionally qualified staff;
- Approaches to maintain the validity of the knowledge wealth;
- Experience of past relevant projects.

The interviewee admitted that the influence of knowledge was apparent in the operation of the firm. Hence the need of a well organised system to manage knowledge in the firm was immense. Consequently, regular training sessions, company and office manuals were provided to the quantity surveyors to formulate the ways to handle information and knowledge. For instance, copies of tender reports and suppliers' price quotations were passed to an information unit for central processing and store. However, the interviewee stated that awareness of how to manage knowledge seldom attracted attention from the quantity surveyors or the firm. For example, time and resources consumed in knowledge search and sharing still got no place in the staff timesheets.

The interviewee put forward an illuminating example to illustrate the ways how the quantity surveyors in the firm worked with knowledge. In most standard forms of

contracts widely adopted in Hong Kong, “loss and expense” clauses were incorporated to cater for the circumstances where a client, whether intentionally or inadvertently, incurred additional losses and / or expenses to a contractor in the course of construction. Should the fault be proved on the client’s side, the client would be liable to reimburse whatever loss and/ or expense incurred to the contractor. In practice, an abuse of this apparently fair and reasonable power by contractors often turned it into an uncovered loophole for them to improve their cashflows and maximise their profit. In these cases, the quantity surveyors would utilise their expertise and investigation techniques to screen out unmeritorious claims. The interviewee stressed that this process had to be carried out with utmost care to avoid undesirable legal liability. Hence, in every claim by the contractors, the quantity surveyors would take an initial assessment of the loss and / or expense suffered by the contractors in default of the clients. The interviewee showed that agreements with the amounts of reimbursement could rarely be made at this initial stage. Nothing could be more dramatic than the debates about the definition of financial charges associated with loss and / or expense. Financial charges generally refer to any additional charges that the contractors had pay to banks or any interests lost on monies that could be invested in other ways. The assessment of any claims that fell under this heading was often subject to rigorous debates and disputes on legal interpretations. Advice from the partners in the firm and precedents cited in professional literature, in general, served as proper guides and solid grounds for the responsible quantity surveyors to conclude their decisions. Further, all endorsed reports were also circulated among other quantity surveyors in the firm for guidance and reference.

As cited above, it was evident that various knowledge processes, including knowledge acquisition, knowledge store, knowledge use and knowledge distribution, widely took

place in the firm. For instance, the quantity surveyors had to keep themselves abreast of the latest development of legal interpretations and court cases on entitlement to extra money. In practice, court decisions and interpretations were frequently adopted as powerful and convincing tools to resolve disputes in claims of financial charges. In achieving satisfactory resolutions, the interviewee admitted that intake and application of knowledge were generally inevitable. He supplemented his view by a clear example of how the quantity surveyors in the firm managed past claim assessment reports. These reports were generally regarded as a valuable wealth of knowledge and a traceable evidence of knowledge use. The quantity surveyors normally preserved copies for their future reference and circulated copies to other colleagues for distribution. By this office custom, knowledge was not only well preserved in documentation, but was also transferred in a selected manner.

As indicated by the interviewee, the business policy of Firm A took a strong affinity to projects with similar attributes, such as clients, consulting parties (other professional counterparts), nature, forms of contracts and methods of measurement. He explained that the firm, by adopting this approach, could benefit from the past experience and knowledge gained in previous projects.

The interviewee also asserted that the support staff of the firm played a key role in enhancing the smooth operation of the knowledge processes. He quoted the examples below in the interview:

- Technology support team maintained the firm's information infrastructure and ensured the smooth operation of internal and external information transfer. They

also developed computer programs to facilitate quantity surveyors to perform their professional duties;

- Librarians kept an updated archive of useful reference and knowledge and maintained a systematic means to assist quantity surveyors to locate their knowledge searches.

Finally, there was one point that deserved particular attention. Throughout the interview, the interviewee postulated that knowledge was generally not project specific and should be transferable from one project to another.

Firm B

Similar to Firm A, Firm B was also operating as a large private partnership to offer contractual and cost consultancy services to clients. This conglomerate of partners constituted the masterminds of the firm and directed daily operation of teams of quantity surveyors. The interviewee from Firm B was a team leader of one of the teams. As a senior member of the team, he took a crucial role in manipulating appropriate team resources in different projects and counselling novice quantity surveyors on technical issues.

The interviewee asserted that time and quality were two intermingled and opposing concepts. Pleasant performance could only be achieved by a wise and proper balance of them. Despite this, in this competitive market, clients' expectations seldom allowed compromises on either of them and often pushed them beyond limits. Facing these demands, the interviewee admitted that the quantity surveyors in the firm had already

accustomed themselves to keep strict discipline on time and quality in their assignments. In order to streamline the firms' operation, the firm adopted a consistent and robust approach to maintain knowledge as a convenient tool for the quantity surveyors. Further, there was a strong belief among the partners that knowledge of the quantity surveyors was the major asset of the firm and constituted one of the organisational edges. In view of this, the firm always kept a close scrutiny of the commonly accepted objective indicator of the competence and knowledge of quantity surveyors, i.e. the ratio of professionally qualified quantity surveyors to those unqualified.

The interviewee described a prominent establishment in the firm which might well distinguish it from other small and medium competitors. This establishment took the form of a committee, which was composed of all partners of the firm. They met regularly to review daily office practice and experience acquired in different projects. The standard and efficiency of the firm operation were frequently raised in the meeting agenda. Deliverables, such as practice memorandums, amendments in office manuals and revisions in methods of measurement, were often produced based on the outcome of the meetings. These deliverables would then be circulated in the firm by appropriate administrative means to keep the quantity surveyors well informed of these valuable knowledge developments.

The knowledge driven policy of Firm B did not cease at this point. The interviewee also pointed out that a knowledge manager, who was also a quantity surveyor, was deployed to coordinate and administer all knowledge related activities in the firm. His duty consisted of, inter alia, the following:

- Exploration of means of access to knowledge from external sources;

- Maintenance of a valid and updated archive of knowledge;

- Organisation of technical seminars by inviting external experts or internal experienced quantity surveyors.

The interviewee observed that the investment in managing knowledge was found rewarding. The wealth of knowledge possessed by the firm not only gained substantial recognition and respect in the profession, but also attracted numerous business opportunities from clients from time to time.

After a brief search in the encounters in his professional career, the interviewee simply raised a typical example to show how quantity surveyors interacted closely with knowledge in the execution of their professional duties. He recalled his experience in managing guaranteed maximum price (GMP) contracts. This type of contracts, which was indeed an intermediate mode between traditional building contracts and design & build contracts, gained popularity due to its inherent strength in mitigating clients' commercial risks and thus avoiding claims. However, only a few quantity surveyors had experience in managing GMP contracts. In the clients' perspective, this situation had no bearing on their expectations. They still put heavy reliance on quantity surveyors' professional judgement in recommending the most appropriate types of contracts for their projects. For quantity surveyors, it was by no means possible to evade clients' enquiries on what GMP was and when it was appropriate to be adopted. In these cases, only those quantity surveyors with sufficient knowledge of GMP contracts could properly address its applicability, advantages and disadvantages. Therefore, research in relevant

professional articles and legal cases was often found inevitable. For instance, an article in Surveyor Times issued by The Hong Kong Institute of Surveyors gave useful reference to the application of Guaranteed Maximum Price (GMP) contracts. It would be more impressive for those who could even identify the potential problems associated with GMP contracts, such as the definition of variations (change of original intention). This could undoubtedly keep the clients informed of the circumstances where the contractor would be entitled to extra money for variations. In line with its robust approach to knowledge, Firm B spared no effort to accumulate and collect experience and knowledge in relation to GMP. This ensured that the quantity surveyors had unrestricted and reliable access to this information at all times to cope with clients' demands. As pointed out by the interviewee, those quantity surveyors in need could simply contact the knowledge manager for any information and contract templates regarding GMP contracts. In addition, the knowledge manager also kept a close eye on the validity of the information and document. Alternatively, the quantity surveyors in Firm B could also acquire this information by either referring to other contract documentation or consulting other colleagues with such experience. Hence it was clear that knowledge always constituted an indispensable ingredient of satisfactory performance of every quantity surveyor.

As illustrated by the interviewee, Firm B strived to maintain a platform for unimpeded internal and external knowledge flow through a wide variety of knowledge processes, including knowledge acquisition, knowledge creation, knowledge store, knowledge use, knowledge distribution and knowledge maintaining. In Firm B, it was well understood that the quantity surveyors could hardly fulfil clients' expectations without constantly digging in the latest literature and journals to update their wealth of knowledge.

In addition, the interviewee pointed out that projects with similar attributes were the favourites of the firm. In these projects, they could take full advantage of the experience and knowledge gained in previous projects and thus could achieve pleasant result without extensive exploration. This was particularly evident in handling relationships with clients and other professional counterparts, understanding of the project nature and managing forms of contracts and methods of measurement. Apart from these, the interviewee also suggested that the accumulated experience and knowledge formed the integral part of the approach to administer some prescribed forms of contracts adopted by large clients. For instance, the quantity surveyors could often identify the loopholes in these types of contracts and proposed associated refinements by analogy to their accumulated experience and knowledge in previous projects.

Further, the interviewee reminded that the contribution of the support staff should never be overlooked. He supported his view by his observation of the following ways in which the support staff expedited the knowledge processes in the firm:

- The librarian offered comprehensive assistance to the quantity surveyors to locate their searches of knowledge materials, such as seminar materials, newsletters, product catalogues, contract document and tender reports;

- The knowledge manager, who was also a chartered quantity surveyor, designed and formulated series of training courses to both new and existing colleagues. In addition, he also produced regular knowledge updates to the quantity surveyors.

In spite of the firm's enthusiasm for knowledge, there was still no mechanism for quantity surveyors to record any time spent in knowledge processes, such as knowledge

acquisition and sharing. Hence an accurate record of time spent for managing knowledge in the firm was still pending.

At the conclusion of the interview, the interviewee expressed his scepticism towards the transferability of knowledge among different projects. He opined that not all types of knowledge gained from one project could be utilised in another project. Hence, it was hard to conclude whether knowledge was project specific.

Firm C

As a small private partnership, Firm C sustained their business by providing clients a wide variety of advisory and consultancy services in relation to financial and contractual issues in construction industry. The firm basically operated in teams, each of which was led by a partner. The interviewee from Firm C was a senior quantity surveyor working in one of the teams. In most projects taken by the team, he was assigned as the project quantity surveyor and catered for all project coordination and contract administration work.

The interviewee acknowledged that a great tension always existed between time constraints and demand for quality. Should opportunities for revisions be contemplated, the quantity surveyors would endeavour to complete the task within the time limits and allowed further refinements in later versions. Undoubtedly, knowledge and experience of the quantity surveyors catalysed efficient execution of their duties and enhanced their capabilities to deliver quality output. The interviewee cited the following example in support of his view. It was not rare that clients or architects requested the quantity

surveyors to deliver instant and accurate responses on the progress of the project or implications of certain design options. In these instances, knowledge and experience of the quantity surveyors often allowed them to make proper professional judgement and consideration. The quality of responses might, nevertheless, varied with the quantity surveyors' attributes and exposures, such as cost awareness, alert for errors, etc. In cases where the quantity surveyors came across problems outside the ambit of their knowledge, they would attempt to request for more time so that they could prepare their answers by searching and learning the required information afterwards.

In addition, the interviewee also realised a general trend of an increasing emphasis on knowledge attributes of a firm in clients' assessment of bidding proposals. Therefore, in order to demonstrate the competence and the professionalism of the firm, Firm C incorporated into its bidding proposals with the following items:

- Staff training policy;
- Academic background of the staff;
- Ratio of professionally qualified quantity surveyors to those not professionally qualified;
- Resources and approaches to the maintenance of knowledge in the firm.

During the interview, the interviewee shared one of his encounters to illustrate the significance of knowledge in the professional duty of quantity surveyors. He associated with his experience in assessments of claims for extension of time. In principle,

contractors should complete the construction work on or before the Date for Completion as stated in the contract or the extended time. Further, an extension of time was defined as a period of time beyond the Date for Completion granted to a contractor to account for any delay, outside his control, to the completion of the works. Despite this, an evidenced delay beyond the control of a contractor did not always accompany a grant of extension of time. On the other hand, in assessing every claim for extension of time, quantity surveyors had to undertake a thorough investigation and research into the relevant site progress, criticality of the delayed activities, the ownership of float times, etc. This area was renowned for its contentious nature and often involved a great deal of professional judgement and discretion. As such, the decisions of quantity surveyors on the assessment often attracted rigorous debates. In the worst cases, inadequate exercise of this power by quantity surveyors could result in liability in tort. In view of this, Firm C adopted a prudent approach in managing every assessment. The quantity surveyors were highly recommended to substantiate their decisions by court decisions, precedents and technical literature. Moreover, only these experienced quantity surveyors were allowed to handle the assessment process under close supervision of the partners. Hence a professional, fair and justified assessment could hardly be made without the knowledge of the quantity surveyors.

To further enhance the knowledge flow within the firm in this respect, assessment reports of claims for extension of time, updates on court decisions and literature on construction programme analysis were circulated among the quantity surveyors within the firm. After circulation, these knowledge and expertise would be recorded in documentation and kept for future reference.

The illustration above gave a clear narration of how various knowledge processes, including knowledge acquisition, knowledge store, knowledge use and knowledge distribution, took place in the firm. The interviewee further observed that the quantity surveyors had a strong interest in acquiring and learning new techniques and the latest legal development of delay assessment. Some even established comprehensive archives of related materials as assessment tools and reference for professional qualification examinations.

Similar to Firms A and B, Firm C placed projects with similar attributes, including clients, consulting parties (other professional counterparts), nature, forms of contracts and methods of measurement, in the top places of its list of project preference. It was because knowledge and experience accumulated in the previous projects were proved to help identify any problematic and contentious areas. Rectifications and amendments could then be made accordingly to prevent future undesirable disputes and to attenuate unforeseen damages.

In respect of the support team for knowledge activities, the interviewee reported that there was a part-time librarian, the major duty of whom was to file and update the library stock. Nonetheless, there was still no formal procedure to guide the quantity surveyors to handle useful information and knowledge. Unlike the other two firms, a code was designated to record the time spent for knowledge handling and searching in the staff timesheet system.

4.3 Summary

Based on the interviews conducted the three experienced practitioners in Hong Kong quantity surveying firms, several knowledge processes are identified and discussed. These are acquisition, creation, store, distribution, use and maintaining. The following paragraphs give a detailed narrative summary of the associated correlations.

In assessments of loss and /or expense, quantity surveyors in Firm A acquired copies of the latest developments in legal interpretations, court cases and professional literature in order to decide whether a contractor was entitled to receive extra monetary compensation and the amount of compensation if a claim was found valid. Quite often, debates about the definition of financial charges in an assessment were fierce. Resolution of these matters was recorded in precious output in the form of professional reports and thus was transformed into a part of Firm A's organisational wealth. These professional reports were then stored in hard copy for future use and distributed to interested colleagues for reference.

Firm B placed heavy reliance on acquiring new procurement methods from the professional literature so as to satisfy clients' demands. By this means, the quantity surveyors in Firm B were trained to identify potential disputes should such procurement methods be adopted. For example, ambiguities in the definition of variations would be clearly clarified and defined in advance in the contract document. This certainly helped evade undesirable and unnecessary disputes in the post-contract stage. Obviously, the knowledge and expertise of the quantity surveyors were fundamental in bringing about this value added service. All new knowledge was then passed to the knowledge manager for central processing and store to maintain and preserve this invaluable product. It was

then transferred by the knowledge manager's regular issue of bulletins or via internal consultations with experienced staff. In terms of knowledge maintaining, the knowledge manager took a key role to ensure a valid and updated archive of knowledge for colleagues to cope with the rapidly changing nature of the knowledge stock, especially in the light of time factors and legal developments.

During the course of preparing assessments of extension of time, Firm C acquired regular updates on court decisions and technical literature on construction programme analysis in order to probe into the actual delay in lieu of the delay claimed by the contractor. These assessment reports were stored in hard copy for future reference and were circulated among colleagues for information.

Based on the interviews with the three experienced quantity surveyors from different sizes of professional Hong Kong quantity surveying firms, similarities and differences in the practice of managing knowledge were observed. In the process of knowledge acquisition, all the quantity surveying firms relied on acquisition of new knowledge, such as the latest legal interpretations, court cases and academic research results. However, it was found that the implementation of some knowledge processes was influenced by firm size. Unlike the process of acquisition, large firms like Firm A and Firm B would have more resources allocated to knowledge store. Both Firm A and Firm B had full time librarians to assist the quantity surveyors in searching for information and knowledge materials. In addition, Firm B had even set up a post of knowledge manager to handle all knowledge-related activities. By contrast, small firms like Firm C could only afford a part-time librarian. Regarding the process of knowledge distribution, Firm C did not provide any guidance to surveyors on how to handle information and knowledge, while

Firm A and Firm B were supported by an information unit for central processing and a knowledge manager respectively. These findings were in line with the research hypothesis relating to the impact of firm size on managing knowledge in quantity surveying firms.

Although managing knowledge is probably inattentive in the Hong Kong construction industry and the surveying discipline, knowledge processes indeed took place implicitly in quantity surveying firms. As testified by the interviewees in the previous sections, processes such as acquisition, creation, store, use, distribution and maintaining were evidenced and confirmed through the professional assignments exercised by quantity surveyors.

5. STUDY RESULTS

5.1 Introduction

This chapter consists of three sections that report the findings gathered from the questionnaires in respect to the research hypotheses. The first section illustrates the evidence for the research hypotheses concerning low awareness of managing knowledge in Hong Kong professional quantity surveying firms and the execution of underlying knowledge handling activities in the firms. The questionnaire findings continue to delineate the possibility of developing a framework of knowledge processes for the firms in the second section. The last section depicts the research hypothesis whether the perceptions of quantity surveyors of the way knowledge is managed in their workplace is influenced by firm size and their experience of professional practice.

5.2 Data Collection

5.2.1 Response Rate

Despite the absence of a rigid threshold of response rate, a questionnaire with excessively low response rate can hardly establish sufficient representation of its survey findings. Hence it is prudent to refer to some objective bases and criteria to qualify the results of questionnaires. In this respect, Alreck and Settle (2004) and Nederhof (1985) observe that response rates between 10% and 30% are generally anticipated. Similarly, Owen and Jones (1994, p.313) posit that “on average a response rate of 20% of questionnaires returned without reminders is considered satisfactory, while 40% is exceptionally good”. Alreck and Settle (2004, p.36) further discuss the response rates of questionnaires and opine that “mail surveys with response rates over 30% are rare”. Based on the views

above, the response rate of this questionnaire lies above the acceptable level. Among the 260 questionnaires dispatched, 111 questionnaires were completed and returned which constituted 42.6% of the entire sample of quantity surveyors.

5.2.2 Reliability of the Instrument

The reliability of scale refers to a statistical concept that measures "how free it is from random errors and the degree to which the items that make up the scale 'hang together' " (Pallant, 2005, p.6 & 85). Peterson (2000, p.79) explains further that reliability is "the extent to which a scale produces identical results if a particular construct is measured repeatedly". In other words, it serves as an objective numerical indicator of the scale's "consistency or dependability in measuring whatever it is designed to measure" (Peterson, 2000, p.79). This technique is adopted as a quantitative reliability assurance of the result of this questionnaire. In general, internal consistency is a tool among academic scholars in reliability assessments of survey data. To turn this concept into a comparable numerical scale, it is commonly transformed into an index - Cronbach's coefficient alpha. In his literature, Nunnally (1978) recommends that survey data should satisfy a minimum alpha, 0.70, to ensure an acceptable data consistency. Higher value of Cronbach's coefficient alpha implies greater data reliability. The Cronbach's coefficient alpha of the 83 question items is 0.9078 which lies above 0.70.

5.2.3 Demographic Make-up of Respondents

Among the 111 returned questionnaires, 51 questionnaires (46%) were completed by quantity surveyors practising in small and medium (S&M) quantity surveying firms while the remaining portion (54%) came from large quantity surveying firms. Table 10 portrays the demographic distribution of the 111 respondents in respect of firm size.

Categories of Variables	S&M Firm		Large Firm	
	Frequency	% of sample	Frequency	% of sample
Respondents with experience of less than 3 years	17	33%	21	35%
Respondents with experience of 3-6 years	17	33%	20	33%
Respondents with experience of over 6 years	17	33%	19	32%
Total	51 (46% of 111)	100%	60 (54% of 111)	100%

Table 10 Firm Size Distribution of Respondents

Apart from a glimpse at the firm sizes, the lengths of experience of the respondents were also taken as a crucial parameter in the questionnaire. The background of respondents is presented in the form of length of experience in Table 11. At the time of completing the questionnaire, it was reported that 38 respondents, i.e. 34% of the total, had been working in their quantity surveying firms for less than 3 years. In the remaining portion, 37 respondents (33% of the total) and 36 respondents (33% of the total) possessed working experience of 3-6 years and more than 6 years respectively. Furthermore, the number of questionnaires gathered from small firms was found slightly less than that from large firms in all three distinct categories of lengths of experience (see Table 11).

Categories of Variables	Experience of less than 3 years in quantity surveying discipline		Experience of 3-6 years in quantity surveying discipline		Experience of over 6 years in quantity surveying discipline	
	Frequency	% of sample	Frequency	% of sample	Frequency	% of sample
Respondents working in small firms	17	45%	17	46%	17	47%
Respondents working in large firms	21	55%	20	54%	19	53%
Total	38 (34% of 111)	100%	37 (33% of 111)	100%	36 (33% of 111)	100%

Table 11 Distribution of Length of Experience of Respondents

To summarise, this section has given a detailed narration of the respondents in respect of the sizes of their workplace and their lengths of experience. The next section then reports and discusses the findings of the questionnaires.

5.3 Study Results

An anatomy of this section is presented as follows:

- Section 5.3.1 illustrates the results for each question item that respond to the hypotheses in relation to the low awareness of managing knowledge and the underlying scope of knowledge activities in the quantity surveying firms;

- Section 5.3.2 depicts the derivation of a framework of managing knowledge for quantity surveying firms;

- Section 5.3.3 reports if the influence of firm size and the length of professional practice on the perception of quantity surveyors to the way knowledge is managed in their workplace.

One may mistake the above ways of presentation of study results as an unnecessary repetition and may even suggest to narrow down the discussion to a segmented analysis based on size of firms and length of professional practice only. Conversely, the three-section arrangement is particularly devised to set the relevant analyses and discussion in an appropriate disposition to correspond to each hypothesis. In addition, a mere segmented analysis based on those two variables also fails to cover all question items. Hence the segmented analysis approach would unnecessarily limit the scope of the discussion to question items that only indicated statistically significant difference.

5.3.1 Question Items

As described in the design of the questionnaires, responses are rationalised into Likert scales to facilitate systematic processing into meaningful result. Details of the statistical processing and the associated inference are presented in the following sections for each individual question item.

Questions: 1-3 (Time, cost and quality)

In the eyes of every business leader, better quality and less costly production are invariably two effective weapons in the vigorous market place (Chase, 1998; Drucker, 1993). In these questions, quantity surveyors were requested to rank the importance of three conflicting elements, i.e. quality of output, time constraints and resources allocation in their workplace. As shown in Table 12, nearly 80% of the respondents agreed or strongly agreed that “Quality” confirmed its priority. Simultaneously, four fifths of the returned questionnaires also indicated a similar conclusion for “Meeting Deadlines”,

Nonetheless, "Allocation of Workforce" received relatively less respondents' concurrence with its importance in their workplace. Only one out of every two respondents recognised its essential role in their workplace.

The finding that the notion of quality receives a high standing among quantity surveyors falls with the advocacy of quality by Chase (1998) and Drucker (1993). Moreover, quantity surveyors are also highly aware of the imminent need to deliver quality work to clients within stipulated time limits. However, the questionnaire responses indicated a general lack of awareness of the importance of allocation of workforce. This leads to an inference that business profitability and efficient operation rarely becomes a critical concern of most quantity surveyors. This phenomenon is well explained by the fact that organisational strategies of operation and profitability is probably steered by the top management whereas quantity surveyors at working level are only interested in when and how to get their jobs done.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Quality of output is the most crucial concern in my workplace	1 (0.9)	4 (3.6)	17 (15.3)	42 (37.8)	47 (42.3)
Meeting deadline is the most crucial concern in my workplace	1 (0.9)	1 (0.9)	14 (12.6)	44 (39.6)	51 (45.9)
Allocation of workforce (resources) is the most crucial concern in my workplace	0 (0.0)	19 (17.1)	34 (30.6)	41 (36.9)	17 (15.3)

Table 12 Attitude to Time, Cost and Quality

Questions: 4-5 (Workload and time constraints)

As expected in general working environment in Hong Kong, an overwhelming majority of the respondents hold the view that their workloads were heavy and approximately 85% of them had to work overtime as delineated in Table 13. These responses are consistent with the views of Davenport and Smith (1999) that professionals and knowledge workers often have to strain themselves beyond yield point. It can be concluded that quantity surveyors in Hong Kong quantity surveying firms have to cope with weighty workload and often extend their work period beyond normal office hours. These findings lend support to the interview finding which attributes the cause to severe time constraints and echoes the responses to question 2.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
My work load is heavy	0 (0.0)	1 (0.9)	23 (20.7)	52 (46.8)	35 (31.5)
Working overtime (OT) is common in my workplace	1 (0.9)	3 (2.7)	13 (11.7)	40 (36.0)	54 (48.6)

Table 13 Workload and Time Constraints

Question 6: (Job nature)

Yau and Yang (1998, p.143) assert that "in construction industry, knowledge and assessments of previous experience are critical to resolving problems …" and the essence of knowledge to making judgements is also raised by Gupta et al. (2004). Reponses of questions 4 and 5 reveal that quantity surveyors were facing severe challenges of lengthy working hours and harsh workload whereas Table 14 probes into the matter further to study the matters they tackle in

execution of their duties. Four fifths of the respondents got used to dedicate their time to problem resolution in office hours. This trend unequivocally reverberates with the principle in the previous sections that distinguishes knowledge workers from factory workers. Without knowledge, knowledge workers can never fulfil their duties in an efficient and effective manner. On the other hand, factory workers are trained to follow rigid rules and work procedures and are not expected to exercise brainstorming and problem solving. Based on the responses to question 6, the intermingled relation of knowledge and quantity surveying is further evidenced.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
My work involves problem solving	0 (0.0)	1 (0.9)	22 (19.8)	51 (45.9)	37 (33.3)

Table 14 Job Nature

Questions 7-8: (Demand for new knowledge and significance of knowledge)

In question 7, respondents were invited to elect their levels of demand for new knowledge. Table 15 indicates that approximately 45% of the respondents confirmed their needs for new knowledge. Nevertheless, the number of respondents, who chose a neutral stance in this question, strikes an astonished figure - only slightly below 40%. These results may originate from the traditional job allocation practice and training profiles in quantity surveying firms. “Routine jobs”, in which less experience and knowledge are required, are usually assigned to newly graduated quantity surveyors. This does not only reduce the toll of mistakes in these firms as a whole, but also allows them to learn by practising bits and pieces as “apprentices”. On the other hand, tasks demanding intensive skill and knowledge, such as assessments of claims involving

extension of time or loss and expense, are always handled by experienced surveyors with close supervision of directors / partners or even conducted by directors / partners themselves. As a result, the occasions for less experienced quantity surveyors to handle difficult tasks are extremely rare.

Teece (1981) observes that economic prosperity relies on knowledge and its application. This citation was proved to apply in Hong Kong quantity surveying firms by the response of almost 55% of the respondents who advocated that the significance of knowledge was being promoted in their workplace (see the categories “Agree” and “Strongly Agree” in Table 15). Organisational strategy is initiated by the top management of a firm rather than those at the working level (Puccinelli et al., 2003). This bare majority in the responses to question 8 perhaps reflects that the top management in quantity surveying firms failed to fully enact their organisational knowledge strategy and even undermine the value of knowledge to their business. In some cases, they may acknowledge the essence of knowledge to the keen fee-cutting competition among firms but they are abstained from spending resources to manage knowledge. This misconception may hinder or sterilise the development of managing knowledge facilities in these firms.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Satisfactory completion of my work requires input of new knowledge	1 (0.9)	17 (15.3)	44 (39.6)	29 (26.1)	20 (18.0)
Importance of knowledge is advocated in my workplace	0 (0.0)	9 (8.1)	41 (36.9)	41 (36.9)	20 (18.0)

Table 15 Demand for New Knowledge and Significance of Knowledge

Question 9: (Awareness of managing knowledge)

The responses to questions 2, 4 and 5 affirm that most quantity surveyors in Hong Kong were fed up with exceptionally heavy workload. According to Davenport and Prusak (1998), heavy workload may discourage people to evaluate or deliberate their routine work methods in a perspective totally detached from his work. The responses to question 9 reveal that quantity surveyors were quite aware of the approaches of managing knowledge amid the influence of heavy workload. This is shown in Table 16 that around 44% of the respondents realised how knowledge was handled in their workplace. Despite this, the figures also pose an equally weighing state of response that over one third of quantity surveyors held a neutral stance and almost 20% did not show awareness. It is apparent that they exhibited diverse views on this matter. In this case, the proposition of Davenport and Prusak (1998) fairly fail to offer a sensible explanation for the divergence. In the same vein, Dent (2004)'s citation in relation to the weakening effect of time constraints on staff's knowledge awareness makes the argument far from credible in the light of the coherent inference from the responses to questions 4 and 5. As recalled from the previous section, questions 4 and 5 disclose the dramatic extent to which quantity surveyors suffered from weighty work pressure and long working hour.

In view of the failure to demonstrate a convincing consensus of the degree of awareness from the poll, the previously established research hypothesis, which comprises a presumption that the awareness of managing knowledge in quantity surveying firms is not satisfactory, reasonably stands. This is shown in Table 16 that a majority of the respondents (55.8%) cast their votes on the neutral and negative side.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
I am aware of how knowledge is managed in my workplace	1 (0.9)	20 (18.0)	41 (36.9)	37 (33.3)	12 (10.8)

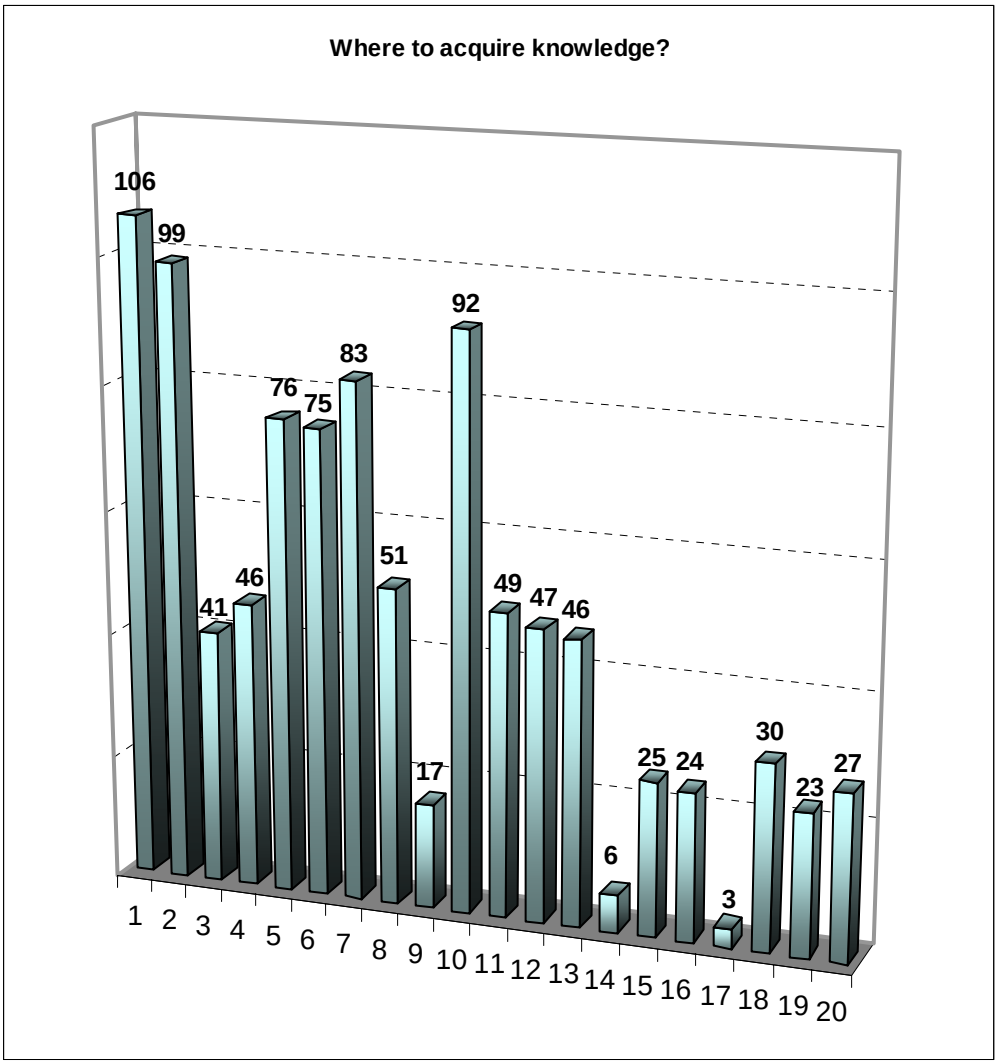
Table 16 Awareness of Managing Knowledge

Questions 10-11: (Where and what to acquire)

Denning (1998) describes that knowledge capture varies with the sources of information whereas Demarest (1997) believes that forms of knowledge requirements are never generic but unique. Questions 10 and 11 attempt to find out the favourite sources for knowledge acquisition among quantity surveyors and types of knowledge in which they are interested. As indicated in Figure 11, the three most popular sources in terms of the number of votes were personal experience, colleagues' experience and personal network. They were followed by a number of alternatives, such as interaction with external parties, office manuals / in-house standards and office good work practice / lessons learned, etc. The order of preference indicates that quantity surveyors were inclined to acquire knowledge through searches of personal archives, direct human interaction and resort to organisational memory. The direct and convenient nature of these knowledge acquisition means pose an appealing incentive for them to seek swiftly desired knowledge resources for problem resolution. For instance, they can often simply consult their colleagues, classmates and friends by instantaneous communication or check with the relevant office manuals and standards.

Government agencies, company libraries, internet searches, professional literature, external courses, seminars and conferences and internal courses and training rarely flashed in quantity surveyors' minds in their knowledge capture processes. The remaining options, including trade related magazines / business literature, newspapers / newspaper cuttings, professional institutes, universities and knowledge of competitors were even at the low end. Therefore, those sources, which are remote to quantity surveyors and only offer unilateral interaction, were generally not welcome by most of them. In other words, quantity surveyors tend to swarm with knowledge sources with easy accessibility and bilateral communications. Perhaps the most primitive, simple and direct mode, like Q and A sessions, may better serve the purposes and needs of quantity surveyors. Other alternatives, say relaying enquiries, searching and scanning of articles, travelling to remote locations for courses and seminars, certainly cannot compete with the scarcity of time. This inherent preference is best attributed to Gamble's (2001) observation that most people prefer posting queries to searching for answers in knowledge bases.

Among all these options, R & D department in workplace, capture through merger and acquisition together with purchases of licences or patents received the least number of votes in the poll. It is understandable that the provision of R & D departments in quantity surveying firms is largely deterred by the constant need of substantial monetary investment and time consuming research processes. In addition, merger & acquisition and purchasing licenses or patents are not better off. They are both strangers in the quantity surveying discipline and thus received merely 10 votes.



Legend

1	Personal experience	6	Good work practice / Lesson learned	11	Company library	16	Universities
2	Colleagues' experience	7	Interaction with external parties including clients, consultants, contractors, sub-contractors or suppliers	12	Internet searches	17	Purchasing license or patents
3	Internal courses and training	8	Government agencies such as Architectural Services Department, Housing Department, etc.	13	Professional literature, e.g. HKIS Journal, etc.,	18	Trade related magazines / business literature
4	External courses, seminars and conferences	9	Research & development department in workplace	14	Through merger and acquisition	19	Knowledge of competitors
5	Office manual / In-house standard	10	Personal network (ex-classmates, ex-colleagues, friends, professional society members, etc.)	15	Professional institutes	20	Newspapers / newspaper cuttings

Figure 11 Distribution of Choices of Knowledge Sources

Among a variety of knowledge sought, cost data dominates the knowledge searches of quantity surveyors as shown in Figure 12. Its popularity is closely followed by information in relation to forms of contract and standard methods of measurement. This was largely ascribed to a logical inference from the basic nature of the services delivered by quantity surveying firms, i.e. provision of cost advice and quantitative measurement of building materials. Accurate and reliable cost advice can never go without appropriate reference to updated cost data while the principles and accuracy of quantities measurement are strictly prescribed in the standard methods of measurement and standard forms of contract. Apart from this primary information, other subsidiary aids, namely procurement methods, construction methods / techniques, construction materials / equipments and codes of practice, were also visited by approximately half of the respondents. This relatively less demand for technical information lies in the fact that they are located outside the knowledge domain of quantity surveyors and are usually catered for by professional engineers in conventional practices. Relative to standard methods of measurement and standard forms of contracts, procurement methods unexpectedly gained less counts of reference, approximately 70%, by quantity surveyors in spite of its prerequisite role in presenting procurement appraisals to clients. This phenomenon is partly attributed to the practice in quantity surveying firms as discussed early in this section. These tasks with large demand for professional judgement and discretion are largely confined to the duties of experienced quantity surveyors at senior level. In addition, large client corporations often possess a series of established procurement methods for different projects and thus seldom require quantity surveyors' input in this respect. Consequently, these factors react to return a relatively low level of votes. The last two categories, legal cases and government ordinances were at the low end. This is well contemplated in view of the knowledge and experience requirements of

quantity surveyors. In their point of view, legal cases usually serve as substantiation and clarification of arguments for dispute resolution while government ordinances are often put forward as implied conditions of contract for contractor's attention and compliance. But in most cases, they are always tackled by a small group of specialist quantity surveyors the portion of which in the firms are not sufficient to reflect the importance of these types of information.

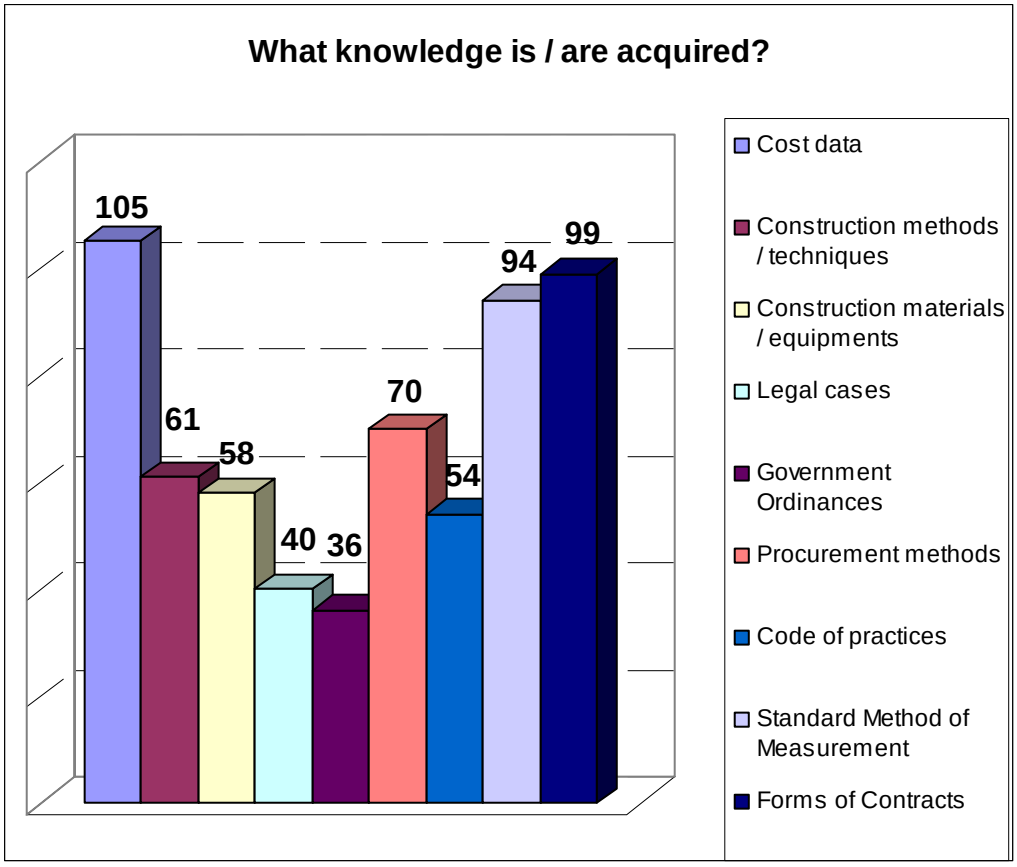


Figure 12 What Knowledge is / are Acquired

Questions: 12-14 (External knowledge acquisition)

As delineated in Table 17, almost one quarter of the respondents conceded that knowledge was acquired by specific staff in their workplace. However, the statement

received an indication of neutral stance from over one third of the respondents and even disapproval pegs from 42% of them. From these responses, it can be deduced that only some quantity surveying firms in Hong Kong allocate sufficient resources to offer such provision while the majority still lags a long way behind. There is an interesting point to note in the statistic that a vast portion of the respondents chose to return a neutral stance and thus implied a failure to acknowledge the existence of such provisions. This uncertainty or perhaps frustration may arise from the absence of a clear demarcation of the duties of the responsible staff in respect of knowledge matters.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Specific staff in my workplace is responsible for obtaining knowledge from external sources	16 (14.4)	31 (27.9)	38 (34.2)	20 (18.0)	6 (5.4)
My work output relies on knowledge input externally	7 (6.3)	31 (27.9)	56 (50.5)	13 (11.7)	4 (3.6)
Experienced staff is recruited externally	13 (11.7)	37 (33.3)	33 (29.7)	25 (22.5)	3 (2.7)

Table 17 External Knowledge Acquisition

The degree of reliance on external knowledge import in Hong Kong quantity surveying firms deserves particular attention. In question 13, a half of the respondents neither agreed nor disagreed with the statement while negative responses amounted to approximately 34% of the total. Affirmative responses constituted the remaining 15% and thus the least minority of the respondents in all five categories of responses. These findings imply that external knowledge import does not seem to be a vital element in the operation of quantity surveying firms. Perhaps, existing stocks of knowledge possessed by quantity surveyors are broad enough to cover applications in most occasions

encountered in the course of their duties. New external knowledge may only be called for in a few cases and even rare to be involved in daily output of the firms.

Organisations tend to hire people who possess relevant knowledge. In contrast to this belief, 45% of the respondents stated that this phenomenon was not identified in their workplace. Approximately 30% of them took a neutral stance while the remaining 25% chose to affirm this assertion. These findings reflect an active measure generally adopted by quantity surveying firms to preserve their own unique work practice. Some large quantity surveying firms exhibit reluctance to intake candidates with past working experience in other firms. This attitude is understandable in view of the perceived difficulties to these people to assimilate their long established mental models and working styles into the firms' work practice. This explains the reason why most experienced staff of large quantity surveying firms is brought up from fresh graduates in lieu of external recruitment.

Questions: 15-17 (Internal knowledge acquisition)

As an alternative to external knowledge acquisition, internal knowledge acquisition is believed to be undertaken in quantity surveying firms to a certain extent. Job rotation, reduction of valuable knowledge into writings at staff departures and experience evaluations at project conclusion are common methods of internal knowledge acquisition. As depicted in Table 18, a quarter of the respondents admitted that they acquired new knowledge by job rotation while 18% of them identified that measures were taken to encourage experienced staff to transform their knowledge into writings or the like. The remaining 60% affirmed their experience of knowledge capture in experience evaluations

conducted at the conclusion of a project. From the statistics, it is evident that job rotation and positive encouragement to departing staff to reduce their knowledge into writings were rarely observed in quantity surveying firms. In terms of cost effectiveness, job rotation is undesirable in these firms due to its tendency to incur unnecessary learning cycles for newcomers and vindicate the benefit of staff continuity from project inception to completion. In addition, effort may have been taken to encourage departing staff to record their knowledge but in most cases the concerned staff is deterred from doing so by a number of factors, such as preparation of handover arrangements, reduced loyalty to the firms, managing to conclude his duties within deadlines, etc.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Job rotation is encouraged in my workplace	23 (20.7)	33 (29.7)	27 (24.3)	23 (20.7)	5 (4.5)
Experienced staff and staff approaching departure are invited to record their knowledge and experience	9 (8.1)	47 (42.3)	35 (31.5)	16 (14.4)	4 (3.6)
I learn lessons after project closure	2 (1.8)	18 (16.2)	24 (21.6)	47 (42.3)	20 (18.0)

Table 18 Internal Knowledge Acquisition

Questions: 18-23 Knowledge creation

Lu and Tsai (2004, p.284) remind that “organisations have to focus on the creation of knowledge to prevent existing knowledge from becoming obsolete quickly”. Therefore the respondents were requested to describe the atmosphere and attitudes towards new

knowledge in both individual and organisational levels. The responses to these questions are tabulated in Table 19. It indicates a number of observations as stated below:

- Approximately 40% of the respondents had experience of being encouraged to explore alternative solutions for their current assignments in their workplace;

- Almost 50% of them conceded that they were motivated to spell out work-related suggestions for their firms as a whole;

- Over half of them had experience of developing new knowledge from existing knowledge;

- Over half of them admitted that they were encouraged to identify best practice for future use.

The responses demonstrate that there is a general awareness in Hong Kong quantity surveying firms on the value of new ideas and best practice. In their working environment, quantity surveyors were welcomed to suggest alternatives methods of performing same / similar task(s) and encouraged to identify best practice for sharing.

To be consistent with the notion of Gupta et al. (2004, p.5) that "organisation gains knowledge from its own experience and from the experience of others", it is interesting to note that knowledge could be more satisfactorily enriched by evaluating mistakes in lieu of successes. This is well illustrated in Table 19 that 63% of the respondents elected mistakes as more advantageous cases for evaluation as opposed to the other 47% respondents who voted for its counterpart – successes. Perhaps, quantity surveyors are

highly alerted that any mistakes and negligence on their part would severely ruin the firm's reputation and attract unnecessary liabilities. This may explain why more knowledge is gained in experience of failure.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
I am encouraged to find alternative solutions for existing assignments in my workplace	2 (1.8)	21 (18.9)	44 (39.6)	31 (27.9)	13 (11.7)
Work related suggestions are encouraged in my workplace	1 (0.9)	12 (10.8)	44 (39.6)	36 (32.4)	18 (16.2)
Existing knowledge is used to develop new knowledge in my workplace	1 (0.9)	6 (5.4)	43 (38.7)	45 (40.5)	16 (14.4)
I am encouraged to identify best practice for future use	1 (0.9)	11 (9.9)	36 (32.4)	45 (40.5)	18 (16.2)
I am encouraged to analyse success factors to enrich my knowledge	1 (0.9)	10 (9.0)	48 (43.2)	34 (30.6)	18 (16.2)
I am encouraged to analyse mistakes to enrich my knowledge	0 (0.0)	7 (6.3)	34 (30.6)	47 (42.3)	23 (20.7)

Table 19 Knowledge Creation

Questions: 24-34 (Knowledge store)

Notwithstanding the overwhelming academic support of the need of knowledge being processed and integrated prior to store (Lee and Yang, 2000; Fischer and Ostwald, 2001; Holsapple and Joshi, 2002; Rollett, 2003), the findings of the questionnaires reveal something slightly different. Table 20 shows that only approximately 50% of the respondents identified the existence of such processes in their workplace and almost one

third of them were suspicious of the presence of such arrangement. This may be attributed to the fact that quantity surveyors devote their attention and effort to their duties unmindful of any non-work related aspects.

Even so, knowledge exists in a wide variety of formats in quantity surveying firms. As delineated in Table 20, paper medium and electronic means had gained the concurrence of 60% of the respondents as the most common store modes of knowledge. Following them, organisation's routines / procedures and human brain also proved their existence with considerable support from 39.6% and 36.9% of the respondents respectively. The response to the questions in this section reveals at the same time that firms' documentation and personal reference files were considered the destiny of knowledge by 60.3% and 45.9% of the respondents respectively. These findings reflect that knowledge stored in quantity surveying firms largely existed in the form of explicit knowledge and is codified in a wide variety of media. On the other hand, implicit knowledge which resides in human memory constitutes a relatively small majority. The above categorisation follows the assertion that Tan et al. (1999) and Davenport and Prusak (1998) that explicit knowledge was stored by electronic databases and written documentation while tacit knowledge resided in individuals. It is observed that quantity surveying firms preferred to store a large portion of their knowledge in a form highly accessible by quantity surveyors as an explicit knowledge and an organisation memory in lieu of a private individual asset. Their effort to compile own office manuals or work standards to retain organisational knowledge and ensure knowledge accessibility is a testament of this phenomenon.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Data and information are selected and organized before being stored in my workplace.	1 (0.9)	20 (18.0)	36 (32.4)	36 (32.4)	18 (16.2)
Knowledge is recorded by electronic means (soft copy) in my workplace.	5 (4.5)	11 (9.9)	27 (24.3)	52 (46.8)	16 (14.4)
Knowledge is recorded in paper medium (hard copy) in my workplace.	2 (1.8)	8 (7.2)	34 (30.6)	51 (45.9)	16 (14.4)
Knowledge is resided in human memory (brain) in my workplace.	8 (7.2)	17 (15.3)	45 (40.5)	29 (26.1)	12 (10.8)
Knowledge is kept in personal reference file(s).	7 (6.3)	19 (17.1)	34 (30.6)	35 (31.5)	16 (14.4)
Knowledge is resided in my organisation's routines / procedures.	4 (3.6)	16 (14.4)	47 (42.3)	32 (28.8)	12 (10.8)
Knowledge is recorded in the form of documentation such as office manuals, work practice, in-house standard, lessons learned, etc.	7 (6.3)	14 (12.6)	23 (20.7)	41 (36.9)	26 (23.4)
Confidential / sensitive information has restricted access in my workplace.	1 (0.9)	14 (12.6)	23 (20.7)	34 (30.6)	39 (35.1)
Access to some knowledge is recorded.	9 (8.1)	20 (18.0)	47 (42.3)	29 (26.1)	6 (5.4)
I know where to find knowledge when I need it.	0 (0.0)	16 (14.4)	28 (25.2)	47 (42.3)	20 (18.0)
I know who to ask for knowledge when I need it.	0 (0.0)	6 (5.4)	28 (25.2)	54 (48.6)	23 (20.7)

Table 20 Knowledge Store

Approximately, two thirds of the respondents made similar observations as Dent (2004) and Bergeron (2003) that curbs were put in place against unauthorised access to confidential information in quantity surveying firms and near 32% of them even reported that measures were taken to record staff retrievals of some knowledge (refer to Table 20).

However, portion of the respondents with a neutral stance on the record of knowledge access also stroke a comparable figure – over 40% of the total. This may be attributed to the quantity surveyors' ignorance of matters unrelated to their duties and their reduced awareness of the knowledge provision in their workplace.

The ease of search for required knowledge often determines the ultimate success of a knowledge store system. Result from the questionnaires indicated that 60% and 69% of the respondents agreed or strongly agreed that they knew where and whom to approach for knowledge respectively. Despite this, there is ample room for quantity surveying firms to enhance their provisions for locating knowledge in view of the limited absolute concurrence (20%) and considerable bewilderment and uncertainty (25%) of the statements of the respondents.

Questions: 35-45 (Knowledge distribution)

As revealed in Table 21, the methods of knowledge transfer mostly adopted by quantity surveyors embraced a wide spectrum. Mentoring topped the popularity list with the support of 63% of the respondents. Expertise input into specific projects (62.1%), daily interaction (58.5%), electronic means (42.3%) and documentation (38.7%) followed closely behind. This trend is probably related to the unique capability of mentoring as advocated by Srikantaiah (2004, p.372) that "facilitates the transfer of tacit knowledge from seasoned employee to new recruits". These findings lead to an indirect inference that the type of knowledge broadly disseminated in quantity surveying firms lies predominantly in the ambit of tacit knowledge. As opposed to other mechanic means, knowledge transfers involving human interactions, namely mentoring, expertise input

into specific projects and daily interaction, serve best to articulate tacit knowledge. Tacit knowledge is largely experience-based and includes insights and intuition gained through experience. Its transfer can hardly be conducted by written instructions. According to Nonaka and Takeuchi (1995), sharing of tacit knowledge through oral conversation and dialogues are most effective. On the other hand, knowledge distribution by electronic means and documentation observed less counts in the response. This may be attributed to the relatively less dominance of explicit knowledge sharing with reference to that of tacit knowledge. Although face-to-face sharing is highly promoted by Standards Australia (2001), only approximately 23% of the respondent observed that it was the sole channel of knowledge sharing in their workplace. This may infer that other methods of transfer, such as printouts and electronic means, are found equally helpful by the respondents. On the whole, tacit knowledge seems to play a more crucial role in these firms. Notwithstanding the large demand for sharing by daily interaction, a sole reliance on face-to-face transfer is a rare instance in quantity surveying firms.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Experienced staff in my workplace is encouraged to mentor new or less experienced staff.	2 (1.8)	8 (7.2)	31 (27.9)	49 (44.1)	21 (18.9)
Knowledge gained from different projects is made accessible to all in my workplace.	4 (3.6)	21 (18.9)	45 (40.5)	33 (29.7)	8 (7.2)
Knowledge is transferred by electronic means throughout the office.	13 (11.7)	17 (15.3)	34 (30.6)	38 (34.2)	9 (8.1)
Knowledge is distributed through documentation in my workplace.	5 (4.5)	19 (17.1)	44 (39.6)	36 (32.4)	7 (6.3)

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Knowledge is shared by daily interaction with colleagues in workplace, e.g. in the corridor, during lunch, in the pantry, social functions	2 (1.8)	6 (5.4)	38 (34.2)	43 (38.7)	22 (19.8)
Knowledge is transferred by face-to-face means only.	16 (14.4)	28 (25.2)	42 (37.8)	21 (18.9)	4 (3.6)
Staff who share knowledge receive reward / recognition in my workplace.	23 (20.7)	38 (34.2)	39 (35.1)	10 (9.0)	1 (0.9)
Office layout in my workplace encourages staff to share knowledge.	11 (9.9)	27 (24.3)	41 (36.9)	22 (19.8)	10 (9.0)
Knowledge sharing is a measure of employee's performance in my workplace.	24 (21.6)	40 (36.0)	35 (31.5)	9 (8.1)	3 (2.7)
Remote access for workplace's database is provided.	17 (15.3)	36 (32.4)	29 (26.1)	20 (18.0)	9 (8.1)
Staff with specific expertise is assigned to specific project(s).	2 (1.8)	7 (6.3)	33 (29.7)	49 (44.1)	20 (18.0)

Table 21 Knowledge Distribution

In respect of the facilities and provisions for knowledge sharing, the responses of the respondents generally were not on the positive side. Office layout, which favours low-height partitions, doors, meeting rooms and café, catalyses knowledge sharing among the staff. However, one third of the respondents rejected the existence of such office layout and 37% of them were even suspicious of its influence. Table 21 indicates that only 29% of them cast their votes for its benefit. Apart from this, remote access provision is another alternative that helps break the geographical impediment of knowledge transfer. However, it is evident that this technology has not been fully utilised in quantity

surveying firms. Approximately half of the respondents were deprived of access to their organisation repositories from remote sites while only 26% of them could enter their organisational repositories irrespective of their locations and time as delineated in Table 21. In view of the above, seating arrangement design may become an agony to resolve the tension between the need of maximised use of spaces and aesthetics and the demand for spatial and functional provisions for knowledge sharing. By the same token, more resource is required in term of extra expenses on installation and security should remote access be provided. Hence this initial investment and commitment often deter quantity surveying firms from providing these two facilities for their staff.

In Table 21, serial transfer and near transfer (Dixon, 2000) denote two distinct processes with focus on knowledge transfer within the same team and to another team respectively. The response to the questionnaires reveals that they were not satisfactorily executed in quantity surveying firms. It is evident from the response that about 41% of the respondents remained uncertain about whether they were authorised to access knowledge from other projects. This is only opposed to a 37% indication from the response that they could get whatever they demanded without difficulties. Further, in the interviews, the interviewees also testified that not all types of knowledge gained from different projects were completely accessible by all quantity surveyors. For example, grants by directors / partners were necessary for retrieval for information or knowledge of a project in the electronic database.

The obstacle of knowledge sharing lies in absence of trust. There is always a traditional belief that knowledge sharing will weaken their personal competitive advantage. To break through this psychological barrier, different forms of motivation may help to

certain extent. Table 21 outlines the views of the respondents on this aspect. Offers of reward and incorporation of knowledge sharing into staff appraisals received similar response. Approximately 55% of the respondents reported the absence of such arrangements and only 10% of them acknowledged their implementation in their workplace. Perhaps pressure of heavy workload drives quantity surveyors effort away from promoting knowledge sharing as revealed in the response to questions 2, 4 and 5. The top management of these firms are fully engaged with exploring new business opportunities while the staff at working level is busy with their duties. Hence motivation by these means rarely found themselves in the firms' agenda and knowledge strategy.

Questions: 46-48 (Knowledge use)

In line with Prokesch (1997)'s proposition that powerful use of knowledge is a business tactic to defeat rivals, over three quarters of the respondents were encouraged to refer to the knowledge / experience learned from previous projects and 71% of them utilised knowledge to solve problems as indicated in Table 22. The negative responses "Disagree" and "Strongly Disagree" attracted no vote from the respondents on the statement in relation to recourse to knowledge / experience gained from previous projects. This statement serves as a solid piece of evidence that knowledge is indispensable to problem resolution and most quantity surveyors accumulate their individual knowledge stock by assimilating the knowledge gained from previous projects. Another incentive that arouses quantity surveyors' enthusiasm about knowledge in previous projects is its contribution to the evidential proof of their skills, experience and knowledge in their career development and internal promotion.

Despite the vital role of knowledge for creation of knowledge and innovation (Hauschild et al., 2001), only 41% of the respondents made use of knowledge to develop new products and services and 44% of them failed to indicate their stance as outlined in Table 22. Perhaps innovation of new services often requires the input of expertise and research techniques from the R & D sector or top management in the organisations so that most quantity surveyors may seldom or even never come across.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
I utilise knowledge to solve most problems that I encounter in my job.	0 (0.0)	3 (2.7)	29 (26.1)	58 (52.3)	21 (18.9)
I am encouraged to refer to knowledge / experience learned from previous project(s) to subsequent project(s).	0 (0.0)	0 (0.0)	22 (19.8)	64 (57.7)	25 (22.5)
I apply knowledge in developing new products / services.	2 (1.8)	15 (13.5)	49 (44.1)	30 (27.0)	15 (13.5)

Table 22 Knowledge Use

Questions: 49-53 (Knowledge maintaining)

Knowledge is dynamics in nature and keeps evolving from time to time (Skyrme, 2001). Table 23 summarises that approximately half of the respondents confirmed specific staff in workplace was assigned to update and maintain the validity of the knowledge in the databases / libraries. Probably stemming from the above provision, 46% of the respondents were able to obtain the necessary knowledge when they needed. It is deduced that knowledge processing in quantity surveying firms generally fulfils the knowledge demand without hindering daily work of quantity surveyors.

The interview results of Pavos (2002) reveals that quantity surveying personnel in South Australia admitted that they lacked sufficient time and tended to put added effort on running on-going projects and seeking future business chance. In light of this working environment, they encountered severe difficulties in dealing with managing knowledge. In line with this observation, about 40% of the respondents failed to observe a clear policy / strategy of managing knowledge in their workplace and 27% of them even could not ascertain its existence. However, 36% of the respondents still realised that their knowledge needs were properly dealt with by manager / senior staff. This is opposed to 41% of them who could not figure out if such need was specifically coped with. On the whole, Hong Kong quantity surveying firms appeared to realise knowledge needs in workplace whereas formulation of an overall policy in relation to knowledge managing still required a positive stride by them.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Specific staff in my workplace is responsible for regular updating of knowledge in database / library.	8 (7.2)	17 (15.3)	23 (20.7)	41 (36.9)	22 (19.8)
Specific staff in my workplace is responsible for maintaining the applicability of the knowledge in database / library.	9 (8.1)	17 (15.3)	31 (27.9)	36 (32.4)	18 (16.2)
I am able to obtain the necessary knowledge when I need.	0 (0.0)	19 (17.1)	41 (36.9)	33 (29.7)	18 (16.2)

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Manager / senior staff is assigned to deal with knowledge need.	3 (2.7)	23 (20.7)	45 (40.5)	31 (27.9)	9 (8.1)
There is a clear policy / strategy in my workplace of how to handle knowledge.	10 (9.0)	34 (30.6)	30 (27.0)	29 (26.1)	8 (7.2)

Table 23 Knowledge Maintaining

In the above discussion, the research hypothesis that affirms the underlying scope of knowledge managing activities in quantity surveying firms is justified. It is apparent that knowledge processes - knowledge acquisition, knowledge creation, knowledge store, knowledge distribution, knowledge use and knowledge maintaining, operate in the quantity surveying firms. They work to benefit these firms in a discreet manner and are seldom given explicit flags or labels. With such an intermingled relationship with the daily processes in these firms, the scope of managing knowledge may sometimes be overlooked by its closet counterpart - quantity surveyors.

5.3.2 The Proposed Framework of Knowledge Processes in Hong Kong Quantity Surveying Firms

In the previous sections, statistical findings of the responses to each question items and their derivatives in each knowledge process have been thoroughly discussed. In this section, a direct inference of the validity of proposed framework of knowledge processes in Hong Kong quantity surveying firms from the questionnaire findings is put forward. Table 24 outlines the mean values and standard deviations of the responses for question items from the 111 respondents. The mean value of each process is taken as the sum of the mean values of question items of the knowledge process divided by the total number

of question items of that process. For instance, the mean value of Knowledge Acquisition strikes 2.83, which is the quotient of the following arithmetic formula (2.72+2.78+2.71+2.59+2.63+3.59)/6. This applies to other knowledge processes - Knowledge Creation, Knowledge Store, Knowledge Distribution, Knowledge Use and Knowledge Maintaining.

		Mean (Question Items)	Standard Deviation (Question Items)	Mean (Process)
Knowledge Acquisition				
1	Specific staff in my workplace is responsible for obtaining knowledge from external sources.	2.72	1.089	2.837
2	My work output relies on knowledge input externally.	2.78	0.868	
3	Experienced staff is recruited externally.	2.71	1.030	
4	Job rotation is encouraged in my workplace.	2.59	1.164	
5	Experienced staff and staff approaching departure are invited to record their knowledge and experience.	2.63	0.953	
6	I learn lessons after project closure.	3.59	1.022	
Knowledge Creation				
1	I am encouraged to find alternative solutions for existing assignments in my workplace.	3.29	0.967	3.555
2	Work related suggestions are encouraged in my workplace.	3.52	0.923	
3	Existing knowledge is used to develop new knowledge in my workplace.	3.62	0.832	
4	I am encouraged to identify best practice for future use.	3.61	0.906	
5	I am encouraged to analyse success factors to enrich my knowledge.	3.52	0.903	
6	I am encouraged to analyse mistakes to enrich my knowledge.	3.77	0.849	

		Mean (Question Items)	Standard Deviation (Question Items)	Mean (Process)
Knowledge Store				
1	Data and information are selected and organized before being stored in my workplace.	3.45	0.998	3.492
2	Knowledge is recorded by electronic means (soft copy) in my workplace.	3.57	1.006	
3	Knowledge is recorded in paper medium (hard copy) in my workplace.	3.64	0.882	
4	Knowledge is resided in human memory (brain) in my workplace.	3.18	1.055	
5	Knowledge is kept in personal reference file(s).	3.31	1.110	
6	Knowledge is resided in my organisation's routines / procedures.	3.29	0.967	
7	Knowledge is recorded in the form of documentation such as office manuals, work practice, in-house standard, lessons learned, etc.	3.59	1.164	
8	Confidential / sensitive information has restricted access in my workplace.	3.86	1.066	
9	Access to some knowledge is recorded.	3.03	0.995	
10	I know where to find knowledge when I need it.	3.64	0.942	
11	I know who to ask for knowledge when I need it.	3.85	0.811	
Knowledge Distribution				
1	Experienced staff in my workplace is encouraged to mentor new or less experienced staff.	3.71	0.918	3.059
2	Knowledge gained from different projects is made accessible to all in my workplace.	3.18	0.946	
3	Knowledge is transferred by electronic means throughout the office.	3.12	1.134	
4	Knowledge is distributed through documentation in my workplace.	3.19	0.949	
5	Knowledge is shared by daily interaction with colleagues in workplace, e.g. in the corridor, during lunch, in the pantry, social functions	3.69	0.912	

		Mean (Question Items)	Standard Deviation (Question Items)	Mean (Process)
6	Knowledge is transferred by face-to-face means only.	2.72	1.046	
7	Staff who share knowledge receive reward / recognition in my workplace.	2.35	0.940	
8	Office layout in my workplace encourages staff to share knowledge.	2.94	1.098	
9	Knowledge sharing is a measure of employee's performance in my workplace.	2.34	0.995	
10	Remote access for workplace's database is provided.	2.71	1.171	
11	Staff with specific expertise is assigned to specific project(s).	3.70	0.900	
Knowledge Use				
1	I utilise knowledge to solve most problems that I encounter in my job.	3.87	0.740	3.757
2	I am encouraged to refer to knowledge / experience learned from previous project(s) to subsequent project(s).	4.03	0.653	
3	I apply knowledge in developing new products / services.	3.37	0.943	
Knowledge Maintaining				
1	Specific staff in my workplace is responsible for regular updating of knowledge in database / library.	3.47	1.182	3.270
2	Specific staff in my workplace is responsible for maintaining the applicability of the knowledge in database / library.	3.33	1.163	
3	I am able to obtain the necessary knowledge when I need.	3.45	0.960	
4	Manager / senior staff is assigned to deal with knowledge need.	3.18	0.946	
5	There is a clear policy / strategy in my workplace of how to handle knowledge.	2.92	1.105	

Table 24 Mean Values of Question Items and Processes

As depicted in the questionnaire design section, the questionnaire was specifically framed with an aim to affirm the scope of the six proposed framework of knowledge processes in Hong Kong quantity surveying firms. The wordings in the questions were normalised to account for the relatively immature recognition of managing knowledge processes in these firms. Technical terms, such as knowledge acquisition, etc., frequently adopted in academic literature were deliberately avoided and replaced by easily comprehensible and lay descriptions of scenes and examples in their working environment. For example, broad questions, like “Do you find knowledge acquisition in your workplace?”, clearly dropped out of the list. This was then transformed into discrete question items 10 – 17, including “What do you seek?”, “Where can you find them”, “How can you get them?”, in a literally simple and direct format. Following this particular approach, a circle by a respondent on the affirmative responses for a question item would draw two inferences. This would not only represent his agreement with the statement, but also indicated that the relevant knowledge process, in the form of the behaviour, examples and scenes as posed in the question item, would be proved to exist in his workplace. Under this questionnaire setting, it is reasonably envisaged that as a derivative of the associated question items, the overall mean values of the knowledge processes, bear a larger representation than those of the individual question items. As opposed to the overall mean values of the knowledge processes, those of the individual question items merely give an indication of their validity.

In view of this, Table 24 summarises the overall mean values of the knowledge process of the questionnaire responses. The figures were derived from the numerical responses of the question items under a 5-point Likert scale (5 = Strongly Agree, 4 = Agree, 3 = Neither Agree Nor Disagree, 2= Disagree, 1 = Strongly Disagree). A threshold is set at

point 3 (Neither Agree Nor Disagree) to determine the existence of a knowledge process. In other words, a knowledge process with an overall mean value above the threshold is taken to exist in their workplace and vice versa. In Table 25, five of knowledge processes - Knowledge Creation, Knowledge Store, Knowledge Distribution, Knowledge Use and Knowledge Maintaining managed themselves above the threshold value whereas Knowledge Acquisition, with an overall mean value of 2.837, fell marginally below the passing point.

Knowledge Processes in Quantity Surveying Firms	Mean Value
Knowledge acquisition occurs in my workplace	2.837
Knowledge creation occurs in my workplace	3.555
Knowledge store occurs in my workplace	3.492
Knowledge distribution occurs in my workplace	3.059
Knowledge use occurs in my workplace	3.757
Knowledge maintain occurs in my workplace	3.270

Table 25 Mean Values of the Six Proposed Knowledge Processes

The means values of the six proposed knowledge processes are also presented as Figure 13 for a clearer presentation.

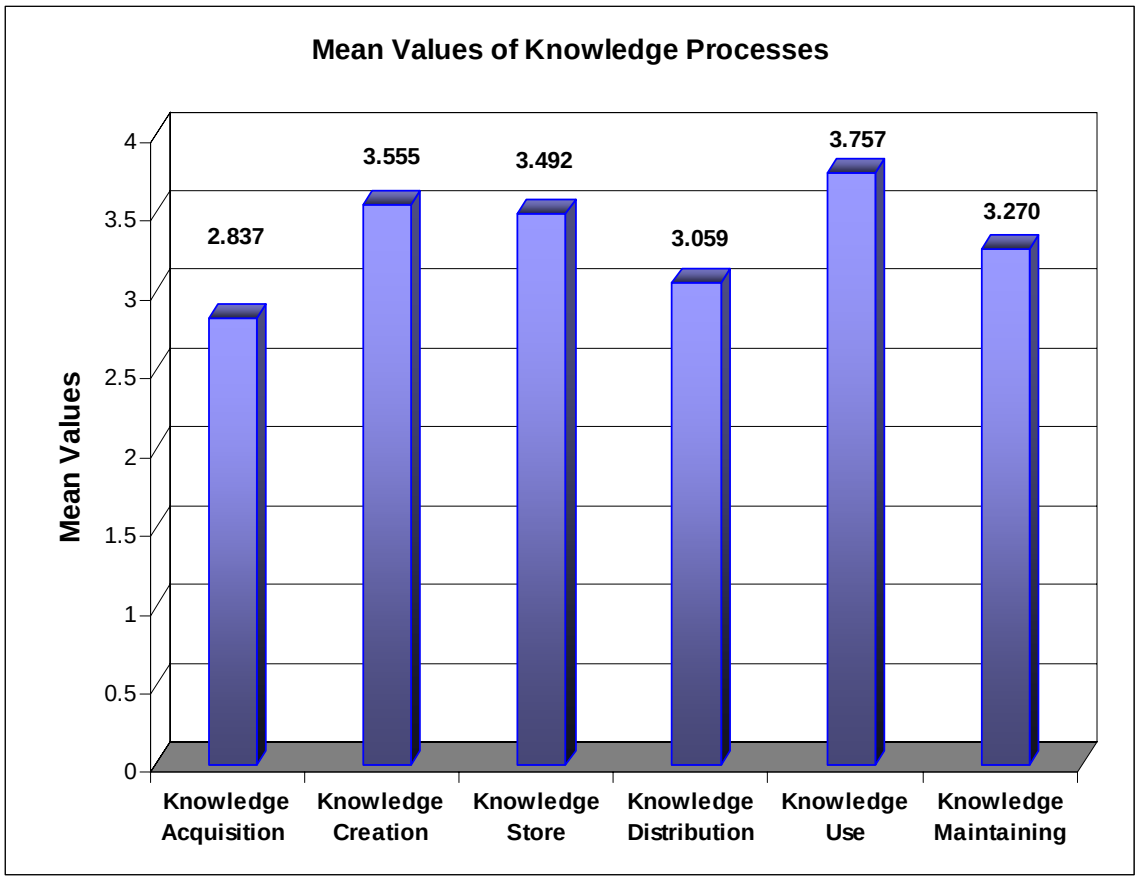


Figure 13 Mean Values of the Six Proposed Knowledge Processes

Response to question item 7, which scored a mean value of 3.45, suggests that quantity surveyors generally require import of new knowledge in the execution of their duties. It is reasonably to conclude that import of new knowledge could mainly be brought about by two knowledge processes - acquisition and creation. Therefore, it is hard to imagine how an organisation can survive without seeking or learning new knowledge from internal and external sources. Paradoxically, the degree of knowledge acquisition in quantity surveying firms lied unexpectedly below the passing point. This phenomenon may be attributed to the nature of knowledge which quantity surveying firms normally possess.

Among many distinguished knowledge practitioners, Peter Novins was a partner of Ernst & Young and specialised in enhancing the productivity of knowledge workers in his firm. Novins and Armstrong (1998) highly recommend that managers have to grab a sufficient degree of understanding of the "applicability" and the "transferability" of relevant knowledge before any attempts to manipulate it. Following a brief assessment of the above two criteria, all types of knowledge broadly fall into one of the following categories: quick access knowledge, one-off knowledge, broad-based knowledge and complex knowledge. It is observed that the types of knowledge circulating in Hong Kong quantity surveying firms are mostly broad-based knowledge and complex knowledge. Generally, the whereabouts of these types of knowledge can often be traced at different operating levels within these firms. They invariably steer their ways towards various operating levels according to the nature and pattern of predetermined work distribution. In most cases, assignments and strategic decisions, which demand careful exercise of expertise, skill and professional knowledge, are always taken by the managing level of the firms, such as senior quantity surveyors or directors / partners. On the other hand, less complicated tasks are properly dealt with by the working level of the firms. Within this framework, these two types of knowledge can easily be identified. The knowledge applied in these judgement based tasks by the managing level of these firms is a typical example of complex knowledge whereas that utilised by the working level of these firms in their rule based and mechanical assignments is largely broad based knowledge. Zack (1999) takes another approach and defines an entirely different classification of knowledge. He realises that the working level of these firms rely on "core knowledge" to perform their daily operation. The managing level of these firms, on the other hand, demonstrate the firms' competitiveness in their stock of "advanced knowledge" and sharpen the firms' edges by continuous input of "innovative knowledge". In quantity

surveying firms, the managing level, including senior quantity surveyors, directors and partners, constitutes a scarce population at the tips of pyramidal staff hierarchies. As such, the majority of the staff is confined to broad-based knowledge and core knowledge in their daily operation. This management regime may lead to quantity surveyors' ignorance of the Knowledge Acquisition process amid the dominance of broad based knowledge in the execution of their duties. As a result, response to question 13, which strikes a mean value of 2.78 only, may be construed as a consequence of keeping the firms' external knowledge input out of quantity surveyors' reach. Despite the seemingly little reliance on Knowledge Acquisition by quantity surveyors, it indeed takes place somehow in an unnoticeable manner to most quantity surveyors.

Given the established definitions of various types of knowledge, Novins and Armstrong (1998) raise the essence of the validity of knowledge to the firms. This poses a query as to who are generally responsible for reviewing and verifying the validity of newly captured knowledge and subsequently incorporating it into daily use? The answer seems straightforward. As the helmsmen/gatekeeper of the firms, directors / partners or their authorized delegates are invariably considered the ideal candidates. This assertion never surprises anyone as they are fully conversant with their firms' attributes and are best equipped to segregate valuable knowledge from irrelevance. Further, they are the only eligible ones who can tune the scope of service and the areas of specialisation of the firms to take advantage of their knowledge stock. For instance, any new practice, which have gained a pass in the scrutiny of these people, usually end up in the content of company standards or office manuals. This mechanism has already brought about a recent trend that the senior management in a number of quantity surveying firms initiated and studied the possibilities of any extension of their services to value management and

facilities management. The new knowledge which discreetly slipped into office documents are expected to disseminate among quantity surveyors through frequent reference to these documents in the execution of their duties. Though this widely adopted system ensures a highly robust quality assurance of their deliverables, it contributes to a significant extent the responses to questions 14 to 16. The respondents inclined to the assertion that means, such as staff recruitment, job rotation and reduction of senior staff experience into writings, were rarely effective modes for Knowledge Acquisition in quantity surveying firms.

As a result, in the eyes of most quantity surveyors, these Knowledge Acquisition processes often undertake in the dark and are totally immune from any personal involvement of them. Hence updates and revisions in office documents, though generally explicitly endorsed by directors/ partners, rarely attract the attention of quantity surveyors in working level. Even worse, revisions in office documents are sometimes highlighted with no more than a bare mark of the endorsement signature and date at the bottom of the relevant pages. In the lack of a commentary or an abstract of revisions, most quantity surveyors under severe work pressure seldom bother to check the source of information or the associated development of relevant knowledge. Nevertheless, quantity surveyors indeed absorb newly acquired knowledge from the continuous and timely updates and revisions in company standards and office manuals. Thus the content of these standards and manuals is the tangible product of many prior processes of Knowledge Acquisition, in which the majority of quantity surveyors are not personally involved. Consequently, this seemingly implicit nature may lead to low rating of the response to question 12 (mean value 2.72) and reveals that assignment to specific staff to obtain external knowledge is not fully appreciated by quantity surveyors in the working

level of these firms. As illustrated in the above paragraphs, senior staff, such as directors/ partners, probably conduct their 'secret' mission - knowledge acquisition in their board rooms. Although the fruit of this process is well codified and utilised by the staff every day, the process itself is rarely put under the spotlight. Nevertheless, it is commonly accepted that this practice serves well to maintain the standard and validity of knowledge circulating in the firms.

Apart from the above observation in relation to the nature of knowledge and practice in quantity surveying firms, the intermingled relations and interactions among individual knowledge process also contribute to the low scores for the knowledge acquisition process. Mendes et al. (2004, p.165) reverberates with this view and describes the knowledge process as "a set of continuous interdependent sub-processes or multiple inter-reliant knowledge cycles". He comes up with a conclusion that each stage of the knowledge process cycle is unlikely mutually exclusive but in fact intermingled and interdependent. In addition, Gamble (2001) also quotes an example that the activity of knowledge transfer is not confined to the mere transmission of a piece of information but includes the activity of application. This phenomenon is also featured in quantity surveying firms. In construction industry, there is a procurement method named Guaranteed Maximum Price (GMP) contract, the details of which has been discussed in previous sections and is not repeated here. This type of procurement often gives rise to rigorous arguments in relation to the definition of variations. It is particularly crucial in situations where the definition is adopted to determine the legitimate right of a contractor to claim extra time and / or money in addition to the original contract period and contract sum respectively. As such, clauses / terms regarding the definition of variations have to be carefully drafted by experienced and senior staff to avoid unnecessary disputes. The

process of knowledge creation is always put into play whenever these drafting processes take place. Moreover, in these drafting processes, these experienced and senior staff never keep themselves away from external sources and merely rely on their personal wealth of knowledge. Research in relevant professional articles and legal cases is often found inevitable. For instance, an article in the March 2004 issue of Surveyor Times gave useful reference to the application of Guaranteed Maximum Price (GMP) contracts. Two legal cases from the Technology and Construction Court in the United Kingdom were quoted to illustrate the essence of the precise definition of variations. Besides, seminars on project procurement are regularly held to share the experience on project procurement among practitioners on both local and global bases. Further, codes of professional ethnics urge quantity surveyors to always seek for new reference, such as new knowledge on recent legal cases, during the drafting process. On the whole, knowledge acquisition and knowledge creation are indeed simultaneous, complementary and intermingled. However, people tend to realise the outcome of a process rather than the process itself. Even worse, some quantity surveyors may undermine the importance of knowledge acquisition and generally mistake it as a constituent of knowledge creation.

With the above detailed exploration of implicit nature and existence of knowledge acquisition in quantity surveying firms, this process is well justified to be one of the processes in the framework amid the relatively low scores of the process. Hence the framework of knowledge processes in Hong Kong quantity surveying firms is thereby confirmed as Figure 14. The six knowledge processes radiate from the nucleus of the processes for managing knowledge. The processes are iterative and intermingled but not in a linear relationship.

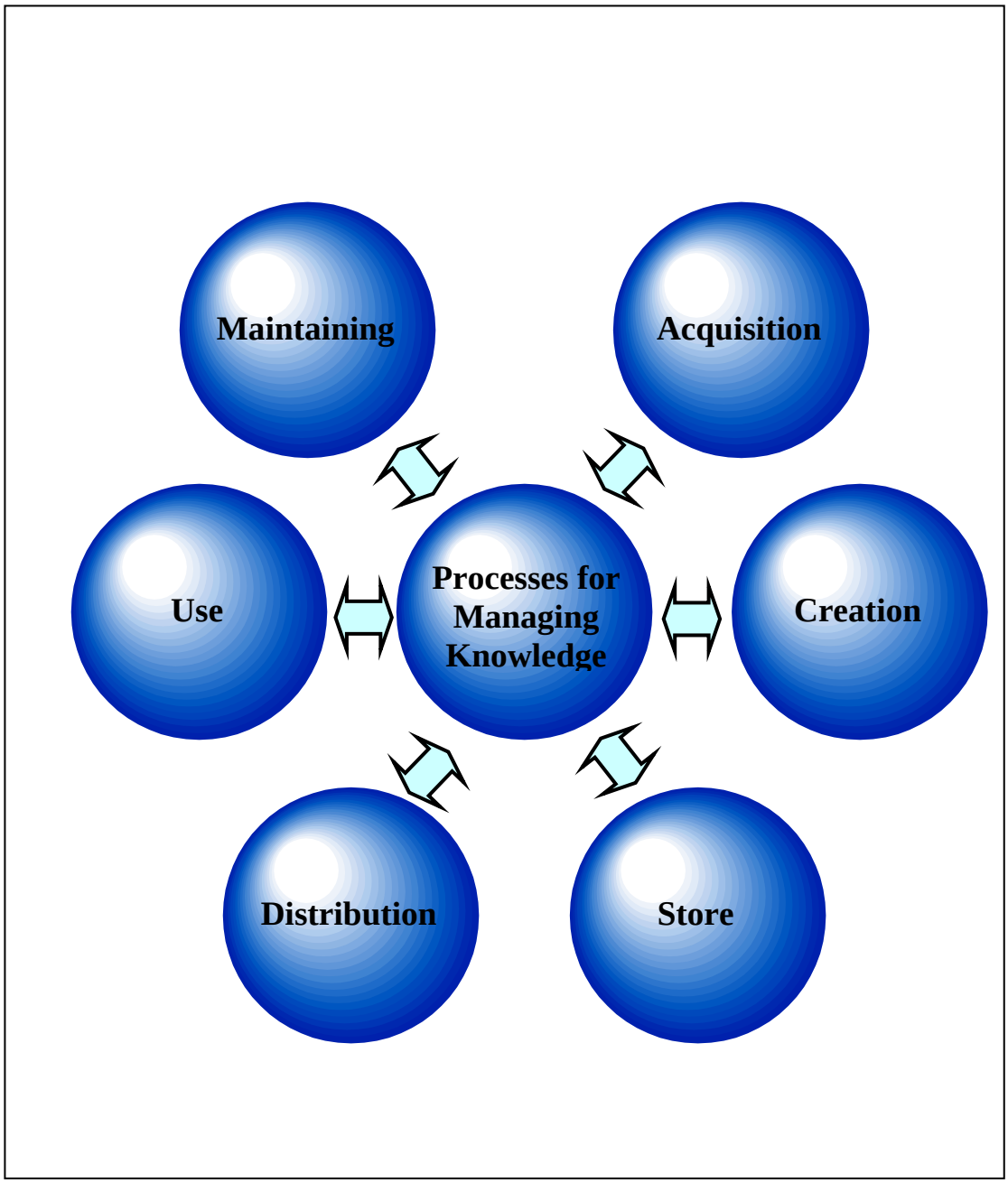


Figure 14 The Framework of Knowledge Processes in Hong Kong Quantity Surveying Firms

At this point, the research hypothesis that presumes the existence of a possibility of deriving a framework of managing knowledge for professional quantity surveying firms has been proved to stand. The findings also affirm the essence of Knowledge Use to

Hong Kong quantity surveying firms. This is consistent with the proposition of Hussein and Wahba (2003, p.246) that "value is only created when the knowledge is used".

5.3.3 The Influence of Size of Quantity Surveying Firms and Length of Experience of Quantity Surveyors

The influence of firm size on the operation of organisations is identified in a number of academic literature (Evans, 2003; Davenport and Prusak, 1998). However the extent of the influence exhibited in different industries may differ and may sometimes be exaggerated. Before a conclusive assertion can be reached, it is prudent to explore specifically in quantity surveying discipline how the effect of firm size influences the knowledge managing processes in these firms. In addition, length of experience is known to exert some bearing on one's behaviour and perceptions (Williams and Noyes, 2004). Therefore the extent to which experience of professional practice affects quantity surveyors' perceptions of the way their firms manage knowledge is also investigated. In order to pick the most appropriate statistical analysis program for the research, normality test is adopted to help the decision making.

5.3.3.1 Normality

Statistical normality test is a power tool to determine the most appropriate statistical test for data analysis. In this research, tests of normality were performed to verify if the data were normally distributed. For this purpose, Kolmogorov-Smirnov test of normality for 51 dependent variables (questions 1 – 53, except questions 10-11) was conducted. The result is tabulated in Table 26.

Table 26 Tests of Normality

	Kolmogorov-Smirnov(a)		
	Statistic	**df**	**Sig.**
Quality is the most crucial concern	.249	111	.000
Meeting deadline is the most crucial concern	.275	111	.000
Workforce is the most crucial concern	.221	111	.000
Work load	.236	111	.000
Overtime	.286	111	.000
Problem solving	.231	111	.000
Input of new knowledge	.234	111	.000
Importance of knowledge	.222	111	.000
Awareness of managing knowledge	.206	111	.000
Staff obtain external knowledge	.178	111	.000
Rely on external knowledge	.256	111	.000
Recruit experienced staff externally	.206	111	.000
Job rotation is encouraged	.197	111	.000
Staffs are invited to record their knowledge	.250	111	.000
Lesson learnt after project closure	.261	111	.000
Alternative solutions are encouraged	.221	111	.000
Work related suggestions are encouraged	.228	111	.000
Existing knowledge is used to develop new knowledge	.225	111	.000
Identification of best practice is encouraged	.233	111	.000
Success factors are analysed	.250	111	.000
Mistakes are analysed	.235	111	.000
Selection and organisation before storage	.196	111	.000
Knowledge is recorded by electronic means	.279	111	.000
Knowledge is recorded in paper medium	.262	111	.000
Knowledge is resided in human memory	.207	111	.000
Knowledge is kept in personal reference files	.193	111	.000
Knowledge is resided in organisations' routines/procedures	.221	111	.000
Knowledge is recorded in form of documentation	.243	111	.000
Restricted access to confidential information	.208	111	.000
Access to some knowledge is recorded.	.228	111	.000
I know where do find knowledge	.253	111	.000
I know who to ask for knowledge	.269	111	.000
Mentoring to new or less experienced staff	.254	111	.000
Knowledge gained from different projects is made accessible	.206	111	.000
Knowledge is transferred by electronic means	.205	111	.000

	Kolmogorov-Smirnov(a)		
	Statistic	**df**	**Sig.**
Knowledge is distributed through documentation	.205	111	.000
Knowledge is shared by daily interaction	.214	111	.000
Knowledge is transferred by fact-to-face means only	.209	111	.000
Reward / recognition to knowledge sharing	.205	111	.000
Office layout encourages knowledge sharing	.189	111	.000
Knowledge sharing is a measure of employee's performance	.211	111	.000
Remote access for database	.206	111	.000
Staff with specific expertise is assigned to specific project(s)	.251	111	.000
Knowledge is utilised to solve most problems encountered	.307	111	.000
Referring knowledge / experience learned from previous	.291	111	.000
Knowledge is used to develop new products /services	.247	111	.000
Staff update knowledge in database / library	.241	111	.000
Staff maintain the applicability of knowledge in database / library	.203	111	.000
Knowledge is founded when needed	.221	111	.000
Manager / senior staff is assigned to deal with knowledge need	.215	111	.000
A clear policy / strategy of how to handle knowledge	.194	111	.000

A Lilliefors Significance Correction

A non-significant result, i.e. a Sig value above 0.05, indicates the presence of a collection of normally distributed data and vice versa (Pallant, 2001). As shown in Table 26, the significance values of the 51 items in the Kolmogorov-Smirnov test all lied below the 0.05 alpha level. This leads to a conclusion that none of the dependent variables passed the test of normality. In other words, all the items failed to satisfy the assumption of normality.

The negative result in the normality test and the use of Likert scale in the questionnaire design culminated in a necessity to have recourse to some non-parametric statistical techniques for the data. The rationale and justification of this assertion have two limbs and are stated below:

- The Assumption of Normality*:* De Vaus (2002) recommends the use of non-parametric statistical techniques for those data which fail to meet the normality criteria.

- Ordinal Scale of Measurement*:* Likert scale, which is adopted in the questionnaire for all questions except questions 10-11, is indeed an ordinal scale (Fellows and Liu, 2003) and is considered fit for non-parametric study.

De Vaus (2002) also provides different techniques for data which fail to fit the normal distribution. They are outlined in Table 27.

Purpose of analysis	Normal distribution (parametric statistics)	Non-normal distribution (nonparametric statistics)
Difference between two independent groups	*t* test	Mann-Whitney test
Differences between more than two independent groups	Analysis of variance and *F* test	Kruskal-Wallis analysis

Table 27 Non-parametric Statistical Tests (Extracted from De Vaus (2002) p.77)

5.3.3.2 Size of Quantity Surveying Firms and Mann-Whitney Test

Firm size in this research is measured by a rule as established by Trade and Industry Department of the Hong Kong Special Administrative Region which states that "non-manufacturing enterprises with fewer than 50 employees are regarded as small and medium enterprises". This dividing line thus allows all quantity surveying firms to fall into either of the two categories, i.e. large or small and medium (S&M) firms. To capture this information, respondents were requested to provide the number of quantity surveyors in their firms.

In this section, Mann-Whitney test is devised to ascertain whether two independent sample groups originate from the same population (Siegel, 1988). In addition, Noruisis (1990, p.227) asserts that "when the data are ordinal but from a markedly abnormal distribution - the Mann-Whitney test is the procedure of choice". With such clear advantages, Mann-Whitney test is therefore adopted to identify the influence of firm size on the way quantity surveying firms mange their knowledge. The criterion of the test is at a significance level (Asymp. Sig.) (p) of 0.05 below which the data would be classified statistically significant (Pallant, 2005). Table 28 presents statistically significant level of the responses to the questions in the two comparison groups, namely S&M and large firms. The result of Mann-Whitney test reveals that the significance levels of 18 question items were below 0.05, i.e., significant differences are observed in the responses from large and S&M quantity surveying firms to 18 question items.

Questions No		Mann-Whitney U	Asymp.Sig.
Q.12	Staff obtain external knowledge	1079.000	.006
Q.13	Rely on external knowledge	1200.000	.034
Q.14	Recruit experienced staff externally	750.000	.000
Q.18	Alternative solutions are encouraged	1173.000	.027
Q.25	Knowledge is recorded by electronic means	996.500	.001
Q.27	Knowledge is resided in human memory	1181.500	.031
Q.28	Knowledge is kept in personal reference files	917.000	.000
Q.29	Knowledge is resided in organisations' routines/procedures	985.000	.001
Q.30	Knowledge is recorded in form of documentation	840.500	.000
Q.32	Access to some knowledge is recorded.	1095.000	.007
Q.35	Mentoring to new or less experienced staff	1214.500	.047
Q.36	Knowledge gained from different projects is made accessible	1215.000	.049
Q.37	Knowledge is transferred by electronic means	1055.500	.004

Questions No		Mann-Whitney U	Asymp.Sig.
Q.40	Knowledge is transferred by fact-to-face means only	1041.000	.003
Q.47	Referring knowledge / experience learned from previous project(s) to subsequent project(s)	1151.000	.012
Q.49	Staff update knowledge in database / library	867.000	.000
Q.50	Staff maintain the applicability of knowledge in database / library	815.500	.000
Q.53	A clear policy / strategy of how to handle knowledge	1027.500	.002

Table 28 Mann-Whitney Test Result

The following section gives an overview of the result of Mann-Whitney test and seeks to dissect reasons why S&M and large quantity surveying firms performed differently in managing knowledge. The discussion will follow a multi-faceted approach towards the phenomenon with particular attention to resources, type of knowledge, project nature and staff number.

Resources

Earl and Gault (2003), in "Knowledge management: size matters", state that large firms are likely to exhibit higher capability of formulating strategies and policies by deploying sufficient resources and benefiting from economy of scale. Hong Kong quantity surveying firms are of no exception. Inadequate financing is a common hardship encountered in small business (Megginson, 1991; Jones and Tilley, 2003). Hence large quantity surveying firms usually possess relatively greater flexibility in allocating their resources for this purpose. This phenomenon is reflected in the result of Mann-Whitney test and evidences a difference in the states of managing knowledge in S&M and large quantity surveying firms.

Acquisition of external knowledge by specific staff (Question: 12)

Merely from the low mean value of response to question 12 (see Table 29), it is, at first sight, believed that knowledge acquisition by specific staff gained low popularity in quantity surveying firms. However, findings as presented in Table 30 illustrate that firm size does effect to influence the firms' decision in this respect. Large quantity surveying firms were more inclined to deploy specific staff to organise knowledge acquisition from external sources when compared with their small and medium counterparts. The reward, in terms of salary and benefit, offered to staff with solid experience and expertise for this task are generally costly. Perhaps the higher cost per head in S&E firms may raise an inherent deterrence to the use of this provision.

		Mean		
		Overall	**S & M Firms**	**Large Firms**
Q. 12	Specific staff in my workplace is responsible for obtaining knowledge from external sources	2.72	2.39	3.00

Table 29 Mean Value of Question 12

Q. 12	**Firm size**	
Specific staff in my workplace is responsible for obtaining knowledge from external sources	**S & M firms**	**Large firms**
1 - Strongly disagree	25.5%	5.0%
2 - Disagree	25.5%	30.0%
3 - Neither agree nor disagree	35.3%	33.3%
4 - Agree	11.8%	23.3%
5 - Strongly agree	2.0%	8.3%
Total	100%	100%

Table 30 Cross-Tabulation on Firm Size & Question 12

Knowledge acquisition by recruitment (Question: 14)

Table 31 shows that large quantity surveying firms in Hong Kong was less reliant on recruitment of experienced staff from external sources as knowledge import whereas S&M firms took the opposite approach. These findings are consistent with the observations of O'Farrell (1989) and Ogawa (1994) that small business tends to recruit competent staff to harness the developed knowledge asset from the market and to supplement their internal knowledge deficiencies. In contrast, large quantity surveying firms preferred bright and fresh university graduates in their recruitment process and were often well equipped with comprehensive training programs to bring up their new recruits. Intake of experienced candidates was very rare in these firms. This may explain the reason why S&M quantity surveying firms, often being under-resourced for staff training, had large demand for quantity surveyors at all experience levels.

Q.14	**Firm size**	
Experienced staff is recruited externally	**S & M firms**	**Large firms**
1 - Strongly disagree	3.9%	18.3%
2 - Disagree	21.6%	43.3%
3 - Neither agree nor disagree	27.5%	31.7%
4 - Agree	43.1%	5.0%
5 - Strongly agree	3.9%	1.7%
Total	100%	100%

Table 31 Cross-Tabulation on Firm Size & Question 14

Knowledge store (Questions: 25, 27 & 29)

Tables 32 to 34 outline the ways how knowledge is stored in quantity surveying firms of different sizes. Knowledge was largely deposited by electronic means and organisational

routines / procedures in large firms whereas S&M firms usually lacked a systematic regime for knowledge store and relied on human brains as a storage medium. Among these methods, routine / procedures is the accumulation of experience and reflection of an organisation's standardisation of behaviour (Kim, 1993). However, in an exchange for a more reliable knowledge store, electronic means and organisational routines invariably place large demand on technology support and man hours. Despite this, new / existing explicit knowledge in quantity surveying firms is traditionally accumulated and transformed into office manuals and standards in large quantity surveying firms. With regular revisions, these documents are distributed among the staff for their reference and study. Nowadays, as information technology continues to develop, quantity surveying firms start migrating their knowledge to electronic storage systems for less time requirement, less spatial demand for paper documents, higher efficiency of knowledge retrieval and better intellectual protection. Notwithstanding these advantages, electronic knowledge storage may not justify itself in the S&M firms in the light of the relatively high cost per head in terms of time and investment and the long period of return for the investment.

Tacit knowledge, which is the root of explicit knowledge (Polanyi, 1966), can be articulated into explicit concepts by a process called "externalisation" (Nonaka and Takeuchi, 1995). These explicit concepts can further be assimilated in working rules, processes and procedures of daily operation. This conversion process is likely associated with some human factors which originate from the top managerial level possessing adequate authorisation and competence to oversee and conduct the whole process. S&M quantity surveying firms may even not be capable of affording the investment in both technology and manpower to store their knowledge in organisational routines /

procedures as well. As advocated by Polanyi (1966) and Nonaka and Takeuchi (1995) that tacit knowledge is precious but hard to be articulated in writing, 'externalisation' of tacit knowledge may probably require disproportionate resources to overcome this inherent difficulty when compared other alternatives. Hence this may also contribute to the phenomenon that "externalisation" becomes a rare creature in S&M quantity surveying firms. Therefore, S&M quantity surveying firms preferred to keep their knowledge in individual's mind (see Table 33).

Q. 25 **Knowledge is recorded by electronic means (soft copy) in my workplace**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	7.8%	1.7%
2 - Disagree	13.7%	6.7%
3 - Neither agree nor disagree	37.3%	13.3%
4 - Agree	29.4%	61.7%
5 - Strongly agree	11.8%	16.7%
Total	100%	100%

Table 32 Cross-Tabulation on Firm Size & Question 25

Q. 27 **Knowledge is resided in human memory (brain) in my workplace**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	3.9%	10.0%
2 – Disagree	9.8%	20.0%
3 - Neither agree nor disagree	43.1%	38.3%
4 – Agree	25.5%	26.7%
5 - Strongly agree	17.6%	5.0%
Total	100%	100%

Table 33 Cross-Tabulation on Firm Size & Question 27

Q. 29 Knowledge is resided in my organisation's routines / procedures	Firm size	
	S & M firms	Large firms
1 - Strongly disagree	7.8%	0.0%
2 – Disagree	21.6%	8.3%
3 - Neither agree nor disagree	45.1%	40.0%
4 – Agree	19.6%	36.7%
5 - Strongly agree	5.9%	15.0%
Total	100%	100%

Table 34 Cross-Tabulation on Firm Size & Question 29

Organisational and personal knowledge store (Questions 28 & 30)

Hansen et al. (1999) develop two distinct strategies for handling knowledge, one of which is codification. As delineated in Table 36, codification was evidenced in large quantity surveying firms in which knowledge was codified and accumulated in a repository accessible by all staff. On the other hand, knowledge in S&M quantity firms was inclined to be kept in personal files (see Table 35). This mode of handling clearly reduces knowledge accessibility but promotes direct face-to-face contact. The findings draw an inference that the repository systems in quantity surveying firms of different sizes differ in nature. S&M firms placed reliance on personal storage whereas organisational storage dominated in large firms. In these circumstances, the success of knowledge repository systems in S&M firms depends very much on one's self discipline and initiative in maintaining his personal knowledge asset. However, it is quite inevitable that even within a firm, the approaches, intuitions, and effort adopted and dedicated by the staff may vary greatly from one to another. This inconsistency probably makes a unifying knowledge standard in S&M firms difficult. These firms may be alert of this potential risk in personal knowledge storage. However, the necessity of huge investment

devoted to the establishment and operation of organisational repositories often impede S&M firms from taking a step further.

Q. 28	Firm size	
Knowledge is kept in personal reference file(s)	**S & M firms**	**Large firms**
1 – Strongly disagree	3.9%	8.3%
2 - Disagree	7.8%	25.0%
3 - Neither agree nor disagree	25.5%	35.0%
4 - Agree	37.3%	26.7%
5 - Strongly agree	25.5%	5.0%
Total	100%	100%

Table 35 Cross-Tabulation on Firm Size & Question 28

Q. 30	Firm size	
Knowledge is recorded in the form of documentation such as office manuals, work practice, in-house standard, lessons learned, etc	**S & M firms**	Large firms
1 - Strongly disagree	11.8%	1.7%
2 - Disagree	19.6%	6.7%
3 - Neither agree nor disagree	31.4%	11.7%
4 - Agree	23.5%	48.3%
5 - Strongly agree	13.7%	31.7%
Total	100%	100%

Table 36 Cross-Tabulation on Firm Size & Question 30

Knowledge distribution and associated protection (Questions 32 & 37)

Certain level of security has to be deployed to curb competitors from stealing and imitating one's knowledge asset. In this respect, the responses to questions 32 and 37 are found reciprocal. Response to question 37 reveals that electronic means were likely to be deployed in large quantity surveying firms to disseminate knowledge among their staff (Table 39). Effective security protection against malicious intrusion and pirating of their knowledge asset could easily be imposed by the use of information technology. Some

examples, like personal ID and password, are commonly adopted in large corporations to ensure that only authorized identities can access organisational knowledge (Buckman, 2004). Equipped with the above protective measures, knowledge asset in large quantity surveying firms could safely be confined to authorised access (Table 38). On the other hand, knowledge dissemination in S&M firm was less likely to be conducted by electronic medium and the corresponding protective measures might hardly be leak-proof. They tended to distribute knowledge by traditional means, such as paper documentation and staff daily interaction (see Table 37). As such, access to these tangible documents is hard to be controlled without a 24-hour surveillance and register system. Personal interaction by verbal conversation and informal correspondence is by itself too difficult to be defined and thus control of access by this means is almost an impossibility. Therefore, responses to questions 32 and 37 suggest the methods of knowledge transfer adopted in an organisation could significantly influence the feasibility of imposing control on access to their knowledge assets. Unless equipped with sufficient resources for a major migration of their knowledge assets from paper documentation to electronic means, S&M firms may still have to face difficulties ahead to improve their control on the access to their knowledge assets.

		Mean	
		S & M Firms	**Large Firms**
Q. 37	Knowledge is transferred by electronic means throughout the office.	2.76	3.42
Q. 38	Knowledge is distributed through documentation in my workplace.	3.22	3.17
Q. 39	Knowledge is shared by daily interaction with colleagues in workplace, e.g. in the corridor, during lunch, in the pantry, social functions	3.78	3.25
Q. 40	Knowledge is transferred by face-to-face means only.	3.04	2.45

Table 37 Mean Value of Questions 37 – 40

Q.32 Access to some knowledge is recorded	Firm size	
	S & M firms	Large firms
1 - Strongly disagree	13.7%	3.3%
2 - Disagree	23.5%	13.3%
3 - Neither agree nor disagree	39.2%	45.0%
4 - Agree	23.5%	28.3%
5 - Strongly agree	0.0%	10.0%
Total	100%	100%

Table 38 Cross-tabulation on Firm Size & Question 32

Q.37 Knowledge is transferred by electronic means throughout the office	Firm size	
	S & M firms	Large firms
1 - Strongly disagree	21.6%	3.3%
2 - Disagree	17.6%	13.3%
3 - Neither agree nor disagree	31.4%	30.0%
4 - Agree	21.6%	45.0%
5 - Strongly agree	7.8%	8.3%
Total	100%	100%

Table 39 Cross-tabulation on Firm Size & Question 37

Knowledge maintaining and knowledge policy (Questions 49, 50 & 53)

Drucker (1999, p 54) emphasises that "the nature of knowledge makes itself obsolete". As shown in Tables 40 and 41, large quantity surveying firms seemed to reverberate this assertion and constantly allocated sufficient resources on updating and reviewing the validity of their knowledge asset. Under their established regimes, obsolete knowledge would be expelled and those remained in their repositories would be kept refreshing. A clear strategy / policy directing the way how knowledge in quantity surveying firms is managed certainly helps maintain the accuracy and validity of organisational knowledge.

Sometimes, it is a common practice in these firms that these polices seldom receive much attention and often left those no longer sensible intact and unchallenged (Gamble, 2001). Even worse, S&M quantity surveying firms rather undermined the contribution of knowledge flow to firms' performance and were quite reluctant to formulate policies / strategies on knowledge aspects as indicated in Table 42. To the contrary, large quantity surveying firms held opposite attitude and kept exploring ways to enhance knowledge flow in their workplace. Investment on these types of updating and reviewing systems undoubtedly constitutes a continuous consumption of resources. S&M firms with limited financial capability are understandably unable to finance these provisions. At most, staff is perhaps requested to check the validity of knowledge prior to utilisation but the effectiveness varies very much with their initiatives and self discipline. In the same vein, formulation and implementation of new policy / strategy involves corporations' commitment, training of all staff and installation of new equipment or new operation system. Therefore, the enormous manpower and monetary investment involved further exemplify the difficulties S&M firms currently encounter.

Q.49 **Specific staff in my workplace is responsible for regular updating of knowledge in database / library**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	15.7%	0.0%
2 - Disagree	19.6%	11.7%
3 - Neither agree nor disagree	25.5%	16.7%
4 - Agree	31.4%	41.7%
5 - Strongly agree	7.8%	30.0%
Total	100%	100%

Table 40 Cross-tabulation on Firm Size & Question 49

Q.50 **Specific staff in my workplace is responsible for maintaining the applicability of the knowledge in database / library**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	15.7%	1.7%
2 - Disagree	23.5%	8.3%
3 - Neither agree nor disagree	31.4%	25.0%
4 - Agree	23.5%	40.0%
5 - Strongly agree	5.9%	25.0%
Total	100%	100%

Table 41 Cross-tabulation on Firm Size & Question 50

Q.53 **There is a clear policy / strategy in my workplace of how to handle knowledge**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	13.7%	5.0%
2 - Disagree	35.3%	26.7%
3 - Neither agree nor disagree	35.3%	20.0%
4 - Agree	11.8%	38.3%
5 - Strongly agree	3.9%	10.0%
Total	100%	100%

Table 42 Cross-tabulation on Firm Size & Question 53

Knowledge type

Tacit knowledge and knowledge transfer (Questions 35 & 40)

Tacit knowledge is precious but rather incommunicable, hence dissemination of it is generally not conducted by writing but personal interaction. Tables 43 and 44 depicts that personal interaction were in fact more favourable in S&M firms. Gamble's assertion

(2001, p.40) best explains this preference and states that "knowledge is most effectively transferred through interaction - preferably face-to-face interaction". He further stresses that acquiring new knowledge by personal interaction would enhance the process. As illustrated in tables, mentoring and face-to-face sharing were ranked high as media of knowledge dissemination in S&M firms. In spite of its inherent weaknesses in other aspects, these modes of transfer facilitate transfer of tacit knowledge in these firms.

Q.35 **Experienced staff in my workplace is encouraged to mentor new or less experienced staff**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	0.0%	3.3%
2 - Disagree	2.0%	11.7%
3 - Neither agree nor disagree	25.5%	30.0%
4 - Agree	51.0%	38.3%
5 - Strongly agree	21.6%	16.7%
Total	100%	100%

Table 43 Cross-tabulation on Firm Size & Question 35

Q.40 **Knowledge is transferred by face-to-face means only**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	13.7%	15.0%
2 - Disagree	13.7%	35.0%
3 - Neither agree nor disagree	35.3%	40.0%
4 - Agree	29.4%	10.0%
5 - Strongly agree	7.8%	0.0%
Total	100%	100%

Table 44 Cross-tabulation on Firm Size & Question 40

Project nature

External knowledge input (Question: 13)

Large quantity surveying firms, equipped with substantial experience and wide variety of knowledge, are generally more prepared to win hob opportunities from clients who contemplate landmark buildings and demand exceptional cost and contractual services. That is the reason why appointment as project quantity surveyors of most prominent projects, like Hong Kong International Airport, railway infrastructure, were almost devoted to large quantity surveying firms. The chance of winning such types of projects by S&M quantity surveying firms is admittedly slim owing to their relatively less competitive capability and experience. Therefore, the demand for new external knowledge and expertise in large quantity surveying firms was expected to be larger than that of their S&M counterparts (refer to Table 45). Hodgetts (2002, p.12) holds the same view and states that "new demand is being satisfied by large competitors". It is further evidenced by the general trend that the core business of S&M quantity surveying firms concentrates on projects of simple and routine nature, such as those involving single tower residential buildings only. Consequently, it is unlikely that S&M quantity firms would have pressing demand for new knowledge input.

Q.13 **My work output relies on knowledge input externally**	**Firm size**	
	S & M firms	**Large firms**
1 – Strongly disagree	13.7%	0.0%
2 – Disagree	27.5%	28.3%
3 - Neither agree nor disagree	49.0%	51.7%
4 - Agree	7.8%	15.0%
5 - Strongly agree	2.0%	5.0%
Total	100%	100%

Table 45 Cross-tabulation on Firm Size & Question 13

Staff number

Alternative solution and knowledge use (Questions 18 & 47)

Trust influence how individual interacts with others and plays a crucial role in knowledge sharing (Wang and Rubenstein-Montano, 2003). It is also highly associated with interactions (Huortari and Iivonen, 2004). Hence trust among quantity surveyors in S&M firms is possibly established amid regular close contacts among a small number of staff (Ogawa, 1994). Consequently, initiatives to express and share different views and opinions on various issues are more likely to be motivated (refer to Table 46).

Huseman and Goodman (1999) raise a concern that people may be reluctant to share knowledge with others so as to avoid moral liability from a possibility that the prospect of their knowledge ends up in undesirable consequences or applications. Discussion and sharing of past experience and encounters under a mutual trust relationship would evade this unfavourable anxiety to refer to knowledge / experience learned from previous projects. During the course of knowledge sharing, knowledge resided in one's brain is not only transferred but also repeatedly expressed, re-organised and verified. Therefore, quantity surveyors in S&M firms were more inclined to refer to knowledge / experience gathered from past projects (refer to Table 47) and took advantage of the constantly reinforced reliability and validity of the knowledge through sharing and discussion.

Q.18 I am encouraged to find alternative solutions for existing assignments in my workplace	Firm size	
	S & M firms	Large firms
1 - Strongly disagree	0.0%	3.3%
2 - Disagree	13.7%	23.3%
3 - Neither agree nor disagree	39.2%	40.0%
4 - Agree	27.5%	28.3%
5 - Strongly agree	19.6%	5.0%
Total	100%	100%

Table 46 Cross-tabulation on Firm Size & Question 18

Q.47 I am encouraged to refer to knowledge / experience learned from previous project(s) to subsequent project(s)	Firm size	
	S & M firms	Large firms
1 - Strongly disagree	0.0%	0.0%
2 - Disagree	0.0%	0.0%
3 - Neither agree nor disagree	13.7%	25.0%
4 - Agree	52.9%	61.7%
5 - Strongly agree	33.3%	13.3%
Total	100%	100%

Table 47 Cross-tabulation on Firm Size & Question 47

Accessibility (Question 36)

People prefer asking for colleagues' advice to searching for the answers in booklets and databases (Gamble, 2001). This is particularly so if smooth contacts exist among staff. This mode of knowledge sharing is very effective in S&M firms where knowledge remains predominantly tacit and staff relationship is close and well established. Thus it

casts little doubt on the opinion of quantity surveyors in S&M firms in Table 48 that knowledge from various projects is easily accessible. On the other hand, quantity surveyors in large firms may not be able to enjoy these close contacts among them which are generally situated in great distances or even on different floors or buildings. Notwithstanding the availability of some proper project search systems for the right persons, the advice or information obtained may only be partial or sometimes even trivial due to a lack of mutual trust among staff probably unknown to each other. Quite often, some may provide limited answers with great caution to avoid undesirable reference to him. Moreover, large firms tend to distribute knowledge through electronic means as observed in the result of Mann-Whitney test of question 37 regarding the extent of electronic knowledge transfer in offices. Further, the interviewees also reported that access to knowledge of specific projects their electronic databases was only released upon prior consent from the responsible partners / directors. In other words, some project directories would remain shut for those unauthorised or unregistered login identities. Therefore, project knowledge seems less accessible in large quantity surveying firms.

Q.36 **Knowledge gained from different projects is made accessible to all in my workplace**	**Firm size**	
	S & M firms	**Large firms**
1 - Strongly disagree	0.0%	6.7%
2 - Disagree	17.6%	20.0%
3 - Neither agree nor disagree	37.3%	43.3%
4 - Agree	33.3%	26.7%
5 - Strongly agree	11.8%	3.3%
Total	100%	100%

Table 48 Cross-tabulation on Firm Size & Question 36

5.3.3.3 Length of Experience of Quantity Surveyor and Kruskal-Wallis Test

Three comparison groups were selected in the research to study the influence of the length of experience on quantity surveyors' perceptions of the way their firms manage knowledge. These three comparison groups are stated below:

- Those with less than 3 years of experience;
- Those with 3-6 years of experience;
- Those with over 6 years of experience.

Assessment of Professional Competence (APC) Scheme is a professional assessment regulated by The Hong Kong Institute of Surveyors with an aim to establish objective assessment to qualify competent candidates as Professionally Qualified Surveyors and corporate members of the Institute. According to the Rules and Guide to the Assessment of Professional Competence September 2002 - Quantity Surveying Division, there is a pre-qualification criterion for those who intend to sit for the assessment. It states that a minimum period of 600 working days of approved professional training and experience undertaken in a minimum period of 33 calendar months from date of registration. Therefore a dividing line of 3-year (36 months) was set to differentiate novice quantity surveyors from experienced ones. This setting was intended to cover the lacuna in an alternative classification that seeks to differentiate qualified surveyors and non-qualified surveyors. Taking a bare look on professional qualification, it may produce confused outcomes that some qualified candidates may have less experience than others unqualified. This is the case where some may manage to pass the assessment in their first

attempts while others with more experience may still remain unqualified. As a result, a classification by professional qualification of quantity surveyors fails to account for the actual length of experience of the respondents, especially those unqualified but possessing substantial experience. The second dividing line was set at 3 years above the 33-month minimum training period as stipulated by the Institute. By the above rationale, three distinct comparison groups were then figured out and the respondents were invited to indicate their lengths of experience at the end of the questionnaire.

The Kruskal-Wallis test was adopted to identify any differences among the three groups of quantity surveyors with various lengths of experience. As an extension of the Mann-Whitney test, it seeks to work out if several independent samples originate from the same population. Hinkle (2003) suggests that it is devised to indicate the degrees of variance among two or more independent samples. Question items with the significance levels (Asymp. Sig.) below 0.05 should be considered statistically significant in the three comparison groups of lengths of experience. Table 49 provides a list of those question items which were statistically significant. The result of the Kruskal-Wallis test reveals that the significance levels of 13 question items were below 0.05, i.e., significant differences are observed in the responses from three tiers of quantity surveyors with various lengths of experience to 13 question items.

		Chi-Square	df	Asymp.Sig.
Q.1	Quality is the most crucial concern	13.728	2	.001
Q.3	Workforce is the most crucial concern	8.557	2	.014
Q.4	Work load	19.138	2	.000
Q.6	Problem solving	17.989	2	.000

		Chi-Square	df	Asymp.Sig.
Q.7	Input of new knowledge	9.347	2	.009
Q.18	Alternative solutions are encouraged	9.282	2	.010
Q.19	Work related suggestions are encouraged	9.056	2	.011
Q.25	Knowledge is recorded by electronic means	7.034	2	.030
Q.26	Knowledge is recorded in paper medium	11.258	2	.004
Q.33	I know where do find knowledge	10.682	2	.005
Q.35	Mentoring to new or less experienced staff	16.148	2	.000
Q.38	Knowledge is distributed through documentation	7.801	2	.020
Q.48	Knowledge is used to develop new products /services	9.773	2	.008

Table 49 The Kruskal-Wallis Test Result

Quality, allocation of workforce, workload, involvement of problem solving, input of new knowledge, developing new products (Questions1, 3, 4, 6, 7 & 48)

Tables 50 to 55 depict the extent of concurrence with the statements in questions 1, 3, 4, 6, 7 & 48 increased with length of experience. It is revealed that experienced quantity surveyors generally demonstrated higher awareness of quality of output and allocation of workforce in spite of heavier work burden and larger accountability. Due to the management nature of their work, they often attached great importance to problem solving techniques and new knowledge input. From their point of view, function of knowledge was no longer limited to completion of tasks but associated with development of new services. The above findings illustrated how the roles and responsibilities of quantity surveyors varied with their experience.

Q.1 **Quality of output is the most crucial concern in my workplace**	**Length of Experience in quantity surveying discipline**		
	Less than 3 years	**3-6 years**	**Over 6 years**
1 – Strongly disagree	2.6%	0.0%	0.0%
2 – Disagree	5.3%	5.4%	0.0%
3 - Neither agree nor disagree	10.5%	24.3%	11.1%
4 - Agree	52.6%	40.5%	19.4%
5 - Strongly agree	28.9%	29.7%	69.4%
Total	100%	100%	100%
Mean Value	4.00	3.95	4.58

Table 50 Cross-tabulation on Years of Experience & Question 1

Q.3 **Allocation of workforce (resources) is the most crucial concern in my workplace**	**Length of Experience in quantity surveying discipline**		
	Less than 3 years	**3-6 years**	**Over 6 years**
1 - Strongly disagree	0.0%	0.0%	0.0%
2 – Disagree	18.4%	27.0%	5.6%
3 - Neither agree nor disagree	42.1%	24.3%	25.0%
4 - Agree	26.3%	40.5%	44.4%
5 - Strongly agree	13.2.%	8.1%	25.0%
Total	100%	100%	100%
Mean Value	3.34	3.30	3.89

Table 51 Cross-tabulation on Years of Experience & Question 3

Q.4 My workload is heavy	Length of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	0.0%	0.0%	0.0%
2 – Disagree	2.6%	0.0%	0.0%
3 - Neither agree nor disagree	39.5%	13.5%	8.3%
4 - Agree	47.4%	45.9%	47.2%
5 - Strongly agree	10.5%	40.5%	44.4%
Total	100%	100%	100%
Mean Value	3.66	4.27	4.36

Table 52 Cross-tabulation on Years of Experience & Question 4

Q.6 My work involves problem solving	Length of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	0.0%	0.0%	0.0%
2 – Disagree	2.6%	0.0%	0.0%
3 - Neither agree nor disagree	28.9%	18.9%	11.1%
4 - Agree	50.0%	62.2%	25.0%
5 - Strongly agree	18.4%	18.9%	63.9%
Total	100%	100%	100%
Mean Value	3.84	4.00	4.53

Table 53 Cross-tabulation on Years of Experience & Question 6

Q.7 Satisfactory completion of my work requires input of new knowledge	Length of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	0.0%	0.0%	2.8%
2 – Disagree	23.7%	18.9%	2.8%
3 - Neither agree nor disagree	42.1%	40.5%	36.1%
4 - Agree	31.6%	21.6%	25.0%
5 - Strongly agree	2.6%	18.9%	33.3%
Total	100%	100%	100%
Mean Value	3.13	3.41	3.83

Table 54 Cross-tabulation on Years of Experience & Question 7

Q.48 I apply knowledge in developing new products / services	Length of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	2.6%	0.0%	2.8%
2 – Disagree	18.4%	16.2%	5.6%
3 - Neither agree nor disagree	50.0%	51.4%	30.6%
4 - Agree	21.1%	24.3%	36.1%
5 - Strongly agree	7.9%	8.1%	25.0%
Total	100%	100%	100%
Mean Value	3.13	3.24	3.75

Table 55 Cross-tabulation on Years of Experience & Question 48

To give a clear picture of how their experience worked to influence their perceptions, an illustration of their roles in a typical task - preparation of bills of quantities - is presented below. The first tie - young quantity surveyors with less than 3 years of experience – is expected to prepare the taking off of quantities in which materials shown on the architectural and structural drawings are measured by manual methods. This process is renowned for its delicate and time-consuming nature. In most cases, each young quantity surveyor is responsible for one trade, such as plastering, plumbing and drainage. They should possess adequate ability to comprehend relevant drawings and pinpoint any cost related issues from specifications in which quality, standards and samples of materials are specified in solid terms. To be fully conversant with this task, they should possess sufficient capability to know what and how to measure. Meanwhile, project quantity surveyors, normally with 3-6 years of experience, are not only responsible for overseeing the quality of their project deliverables, but also take in charge of the coordination work with other project consultants.

In simple terms, project quantity surveyor is the person in charge of the project under limited supervision of some senior quantity surveyors, normally with over 6 years of experience. Project quantity surveyor is expected to keep all relevant parties informed of the project progress at this stage so as to ensure information from other parties is sufficient for the preparation of tender documents. Since bills of quantities constitute one of the major parts of tender documents, project quantity surveyors have to bear full responsibility and accountability for timely deliveries of the project deliverables. In order to achieve this task, their roles are expected to be wide ranging and cover the following aspects:

- Production and implementation of project resource plans and deployment of right staff for the right tasks;
- Identification of outstanding information from other project consultants and resolution of problems raised by young quantity surveyors;
- Issue of request for information to other project consultants;
- Follow up work with other project consultants;
- Bulk check of the quantities produced by young quantity surveyors;
- Compilation of the output of young quantity surveyors into comprehensible documents;
- Work progress monitoring and regular project updates to team leaders;

- Maintaining drawing registers and distribution of new drawings;

- Project coordination in consultant meetings to keep abreast of the latest tender changes;

- Compilation of the whole tender document.

After all, project quantity surveyors are often designated to cater for both external and internal project coordination with an overall aim to ensure smooth operation of all preparation processes. Experienced quantity surveyors, such as senior quantity surveyors / team leader / partners, often act as ultimate quality auditors of all project deliverables and all associated preparation processes. Besides, their effort is also devoted to seek business opportunities by being involved in various kinds of functions, such as seminars or symposiums, to demonstrate their firms' strength to potential clients.

The roles and responsibilities of the three tiers of quantity surveyors even on the same task are shown to differ under a principle of division of labour in teams. Table 56 outlines a general description of work processes for quantity surveyors with different experiences in performing the same task, e.g. preparation of bills of quantities.

		Young quantity surveyor **(Less than 3 years in quantity surveying discipline)**	**Project quantity surveyor** **(3-6 years in quantity surveying discipline)**	**Senior quantity surveyor/ team leader / partner** **(Over 6 years in quantity surveying discipline)**
Q.1	Quality of output is the most crucial concern in my workplace	Responsible for quality of particular trade(s) assigned by project surveyor	Responsible for quality of complete bills of quantities	Gate keeper of organisational reputation
Q.3	Allocation of workforce (resources) is the most crucial concern in my workplace	Just meet deadline given by project surveyor	Monitor progress of young surveyors Request for extra resources for slow progress	Review resources to meet daily work with consideration of certain manpower had been frozen for preparation of bills of quantities Review and plan resources for new projects and existing projects
Q.4	My work load is heavy	Measure quantities of materials Draft the description of what had been measured	Prepare queries and chase replies Chase drawings Co-ordinate with external consultants	Provide leading advice Seek next business opportunities
Q.6	My work involves problem solving	Repetitive exercise of taking off	Resources planning Dealing with client and consultants	Tackle all difficult problems incurred
Q.7	Satisfactory completion of my work requires input of new knowledge	Repetitive exercise of taking off	Bulk checking of the quantities Edit work description	Respond to client's new suggestion Promote and enhance organisation's competitiveness
Q.48	I apply knowledge in developing new products / services	Repetitive exercise of taking off	Prepare contractual document which is project-specific (if delegated)	Tackle new demand from client Extend service boundary

Table 56 General Description of Work for Quantity Surveyors at Different Experience in Performing an Assignment

Based on the above illustration, quality of output and allocation of workforce would not bother young quantity surveyors too much for being mostly involved in mechanical assignments. On the other hand, project quantity surveyors are obliged to review the accuracy and quality of the output of their young counterparts whereas senior quantity surveyors / team leaders / partners are presumed to oversee the overall quality of the organisational output. This apparently sets a hierarchy of quality assurance in which expected quality awareness of the staff escalates with the length of experience. Resolution of problems follows a similar trend. It is a common practice that one would seek for advice from their supervisors in case of any problems in their assignments. While project quantity surveyors would help their young counterparts in case of any troubles, senior quantity surveyors would do the same for their subordinates. Therefore, this mechanism is particularly important for complicated assignments.

With reference to the above illustrations and Table 56, the duties of quantity surveyors with different experiences probably affect the response of quantity surveyors to certain question items. That may be the reason why the extent of agreement in the questions 1, 3, 4, 6, 7 and 48 are found somehow positively related to the length of experience of the respondents as shown in Tables 50-55.

Knowledge creation (Questions 18 & 19)

Amid strong advocates of needs for improvements in business environment, Standard Australia (2001) realises that people often favour adhering to long established routine methods and sometimes even have a tendency to raise challenges to any proposals of changes. This inherent reluctance may contribute to some extent to the respondents'

claims that new ideas were not quite encouraged in their workplace as delineated in Tables 57 and 58. Besides, it is interesting to note from the responses to questions 18 and 19 that quantity surveyors with 3-6 years of experience received relatively less encouragement on creating new ideas for themselves and whole organisations. Perhaps this tier of quantity surveyors is probably very much goal oriented and so overloaded that they can spare no time to bother whatever innovations in their work processes. Furthermore, quantity surveyors with certain working experience are very likely to have developed their mind sets. Their predetermined ideas and opinions often govern the ways they dissect problems but at the same time deter them from accepting or initiating new approaches. Nevertheless, respondents with over 6 years of experience received relatively larger encouragement on exploration of new ideas and alternatives. This view may be attributed to the fact that they have large responsibility of overseeing the output quality and resource allocation of their firms (refer to the Krusal-Wallis test result of questions 1 and 3). To sustain their business in the competitive environment, it is sensible to keep these masterminds brainstorming innovations and new ideas to sharpen their firms' edges and enhance their overall productivity.

Q.18 **I am encouraged to find alternative solutions for existing assignments in my workplace**	**Length of Experience** **in quantity surveying discipline**		
	Less than 3 years	**3-6 years**	**Over 6 years**
1 - Strongly disagree	0.0%	5.4%	0.0%
2 – Disagree	23.7%	27.0%	5.6%
3 - Neither agree nor disagree	39.5%	37.8%	41.7%
4 - Agree	31.6%	21.6%	30.6%
5 - Strongly agree	5.3%	8.1%	22.2%
Total	100%	100%	100%
Mean Value	3.18	3.00	3.69

Table 57 Cross-tabulation on Years of Experience & Question 18

Q.19 Work related suggestions are encouraged in my workplace	Length of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	0.0%	2.7%	0.0%
2 – Disagree	7.9%	18.9%	5.6%
3 - Neither agree nor disagree	44.7%	43.2%	30.6%
4 - Agree	34.2%	27.0%	36.1%
5 - Strongly agree	13.2%	8.1%	27.8%
Total	100%	100%	100%
Mean Value	3.53	3.19	3.86

Table 58 Cross-tabulation on Years of Experience & Question 19

Where to find knowledge (Question: 33)

Young quantity surveyors usually receive briefing sessions on organisation operations in their induction periods. Locations of knowledge storage, such as filing cabinet for printed materials and electronic databases, are often in the introductory list. Moreover, they are often more conversant with the latest information technology and thus sometimes even know where to find knowledge in their firms better than other quantity surveyors. On the other hand, old citizens, who are residing in their places for a long time, are expected to know their places better than new comer. By analogy, more experienced surveyors would find locating relevant knowledge easier than their less experienced counterparts. As such, quantity surveyors with over 6 years of experience reported that they worked well to locate relevant materials in their knowledge searches (refer to Table 59). To the contrary, respondents with 3-6 years of experience seemed to overrule this logical assertion and the number of their votes cast fell below those of counterparts with less than 3 years of experience as indicated in Table 59. This phenomenon may be resulted from repetitive assignments of similar types of projects to them. This arrangement is fully

understandable in terms of business efficacy and clearly benefits the firms by taking advantage of their experience gained in previous projects of similar nature. Recognition of the merits of knowledge gained in previous projects was already established in response to question 17. Under these circumstances, their exposure would therefore be limited to certain types of projects. By then, they may get accustomed to whatever they were exposed to and become less aware of need for knowledge out of their scope of works. For instance, quantity surveyors familiar with contract procedures of Housing Authority would probably continue to apply their unique experience and knowledge in similar types of projects and rotation to other types of projects may take many years. Nevertheless, this constraint is not likely to apply to more experienced quantity surveyors since job rotations should have taken place many times in their career to widen their exposure.

Q.33 **I know where to find knowledge when I need it**	**Length of Experience** **in quantity surveying discipline**		
	Less than 3 years	**3-6 years**	**Over 6 years**
1 - Strongly disagree	0.0%	0.0%	0.0%
2 – Disagree	7.9%	27.0%	8.3%
3 - Neither agree nor disagree	34.2%	24.3%	16.7%
4 - Agree	42.1%	43.2%	41.7%
5 - Strongly agree	15.8%	5.4%	33.3%
Total	100%	100%	100%
Mean Value	3.66	3.27	4.00

Table 59 Cross-tabulation on Years of Experience & Question 33

Mentoring (Question 35)

As delineated in Table 60, experienced quantity surveyors, like team leaders, etc., realised the merits of mentoring probably because of their personal encounters of

benefiting from mentoring in their training periods. Another tier - quantity surveyors with less than 3 years of experience - certainly concurred with the functions of mentoring in their career development. But for those with 3-6 years of experience were rather indifferent to this method of knowledge transfer. This finding is not surprising as they constitute the sandwiched class of the firms and are generally regarded either too experienced to be mentored or too young to mentor others.

Q.35 **Experienced staff in my workplace are encouraged to mentor new or less experienced staff**	**Years of Experience in quantity surveying discipline**		
	Less than 3 years	**3-6 years**	**Over 6 years**
1 - Strongly disagree	0.0%	5.4%	0.0%
2 – Disagree	7.9%	8.1%	5.6%
3 - Neither agree nor disagree	26.3%	43.2%	13.9%
4 - Agree	52.6%	37.8%	41.7%
5 - Strongly agree	13.2%	5.4%	38.9%
Total	100%	100%	100%
Mean Value	3.71	3.30	4.14

Table 60 Cross-tabulation on Years of Experience & Question 35

Knowledge store and transfer (Questions 25, 26 & 38)

Tables 61 to 63 reveal that the youngest tier of quantity surveyors gave the highest number of polls for the existence of knowledge store by electronic means and paper medium, and knowledge dissemination by paper documentation. The other tier, which is composed of quantity surveyors with 3-6 years of experience, cast the least number of votes for the same issues. Explicit knowledge is readily codified and recorded in the electronic means and printed materials and thus has no difficulty of being transmitted in paper documentation. In contrast, tacit knowledge is inherently hard to be codified,

communicated and its presence can only traced in one's action (Joshi and Sarker, 2003). Based on the distinct characteristics of explicit and tacit knowledge, it is believed that young quantity surveyors are largely exposed to explicit knowledge as tacit knowledge is experience-based (Nonaka, 1999). Being consistent with Nonaka's view, quantity surveyors with 3-6 years of experience are likely to rely on tacit knowledge which is developed and accumulated with their working experience. Therefore, in view of the nature of the knowledge, they could not limit the media of knowledge store and transfer to those specifically devised for explicit knowledge as listed in questions 25, 26 and 38. However, quantity surveyors with over 6 years of experience were found to behave slightly different from those with 3-6 years of experience. Perhaps, quantity surveyors tend to attach equal importance to both tacit and explicit knowledge whenever creativity has some bearing on their work. As illustrated in the Kruskal-Wallis test of question 48, the perception of knowledge application in new product / service development in their firms was closely related to length of experience. Consequently, quantity surveyors with more than 6 years of experience, such as senior quantity surveyors / team leaders / partners, would be aware of the merits of keeping and transferring both tacit knowledge and explicit knowledge as they had to "interact and interchange with each other in the creative activities of human beings"(Nonaka, 1999, p.66).

Q.25 Knowledge is recorded by electronic means (soft copy) in my workplace	Length of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	0.0%	8.1%	5.6%
2 – Disagree	5.3%	13.5%	11.1%
3 - Neither agree nor disagree	21.1%	27.0%	25.0%
4 - Agree	50.0%	43.2%	47.2%
5 - Strongly agree	23.7%	8.1%	11.1%
Total	100%	100%	100%
Mean Value	3.92	3.30	3.47

Table 61 Cross-tabulation on Years of Experience & Question 25

Q.26 Knowledge is recorded in paper medium (hard copy) in my workplace	Years of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	0.0%	5.4%	0.0%
2 – Disagree	2.6%	8.1%	11.1%
3 - Neither agree nor disagree	18.4%	43.2%	30.6%
4 - Agree	55.3%	35.1%	47.2%
5 - Strongly agree	23.7%	8.1%	11.1%
Total	100%	100%	100%
Mean Value	4.00	3.32	3.58

Table 62 Cross-tabulation on Years of Experience & Question 26

Q.38 Knowledge is distributed through documentation in my workplace	Years of Experience in quantity surveying discipline		
	Less than 3 years	3-6 years	Over 6 years
1 - Strongly disagree	0.0%	8.1%	5.6%
2 – Disagree	13.2%	21.6%	16.7%
3 - Neither agree nor disagree	31.6%	43.2%	44.4%
4 - Agree	44.7%	24.3%	27.8%
5 - Strongly agree	10.5%	2.7%	5.6%
Total	100%	100%	100%
Mean Value	3.53	2.92	3.11

Table 63 Cross-tabulation on Years of Experience & Question 38

The results of Mann-Whitney test and Kruskal-Wallis test illustrate that respondents working in firms of different sizes and with different lengths of experience in quantity surveying discipline responded differently to the same set of questions. The former test shows that quantity surveyors in large and S&M firms expressed diverse views on 18 question items whereas the latter test reveals significant differences in 13 question items from three tiers of quantity surveyors with different lengths of experience. Hence the research hypothesis which presumes the existence of the influence of firm size and experience of professional practice on quantity surveyor's perception of how knowledge is managed in their firms is thereby proved to stand as Tables 64 & 65 below.

Knowledge Processes	S&M Quantity Surveying Firms	Large Quantity Surveying Firms
Acquisition	▪ Tendency to recruit experienced quantity surveyors externally	▪ Tendency to obtain external knowledge by specific staff ▪ More reliance on external knowledge
Creation	▪ More encouragement to find alternative solutions to existing assignments	
Store	▪ Knowledge is more likely to reside in human memory ▪ Knowledge is more likely to be kept in personal files	▪ Tendency to record knowledge by electronic means ▪ Tendency to store knowledge in organisations' routines / procedures ▪ Tendency to record knowledge in the form of documentation ▪ Access to some knowledge is more likely to be recorded
Distribution	▪ Tendency to mentor new or less experienced quantity surveyors ▪ Knowledge gained in different projects is more likely to be accessed ▪ Tendency to transfer knowledge by face–to-face means only	▪ Tendency to transfer knowledge by electronic means
Use	▪ Knowledge learned in previous projects is more likely to be applied in subsequent projects	
Maintaining		▪ Knowledge is more likely to be updated and maintained by specific staff ▪ Tendency to have a clear policy of how to handle knowledge

Table 64 Summary of Mann-Whitney Test Result

Knowledge Processes	Perceptions of Quantity Surveyors with Less than 3 Years of Experience in Quantity Surveying Discipline	Perceptions of Quantity Surveyors with 3 to 6 Years of Experience in Quantity Surveying Discipline	Perceptions of Quantity Surveyors with over 6 Years of Experience in Quantity Surveying Discipline
Acquisition	No statistically significant difference		
Creation		▪ Least affirmation of the presence of encouragement to find alternative solutions to existing assignments ▪ Least affirmation of the presence of encouragement to find work related suggestions	▪ Observe encouragement to find alternative solutions to existing assignments ▪ Observe encouragement to find work related suggestions
Store	▪ Observe that knowledge is recorded by electronic means ▪ Observe that knowledge is recorded in paper medium	▪ Least knowledgeable to find knowledge ▪ Least observation of knowledge being recorded by electronic means ▪ Least observation of knowledge being recorded in paper medium	▪ Most knowledgeable to find knowledge
Distribution	▪ Realise that knowledge is distributed through documentation	▪ Least affirmation of the presence of mentoring ▪ Least observation of knowledge being distributed through documentation	▪ Most affirmation of the presence of mentoring
Use	▪ Least concurrence with the application of knowledge for developing new products / services		▪ Observe the application of knowledge for developing new products / services
Maintaining	No statistically significant difference		

Table 65 Summary of Kruskal-Wallis Test Result

5.4 Summary

The questionnaire results have confirmed the research hypotheses. The first research hypothesis regarding the low awareness of managing knowledge in Hong Kong professional quantity surveying firms is proved valid, with over half of the respondents (55.8%) failing to affirm their awareness of this issue. Despite their low attention to managing knowledge, the second hypothesis focusing on the existence of underlying activities undertaken by the firms to manage knowledge is validated. The findings reveal that the quantity surveying firms exercised several activities, such as acquisition, creation, store, distribution, use and maintaining, to handle knowledge. In addition, the third hypothesis, aimed at developing a framework of knowledge processes for the firms is substantiated. A framework comprising six processes has been derived. The research has also confirmed the fourth hypothesis, that firm size would influence quantity surveyors' view of the approach to manage knowledge in their workplace. Variances in resources, knowledge type and project nature, and staff numbers in large and S&M firms seem to constitute the distinction in their methods of managing knowledge. On the other hand, experience of professional practice is also proved influential to the respondents' perception of the issue.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In this age of the emergence of knowledge, knowledge-based organisations and professional services firms (PSFs) are devoting considerable attention and resources to managing knowledge. Since quantity surveying firms are an example of knowledge sellers, it is reasonable to conclude that the issue of managing knowledge should have attracted much discussion in the quantity surveying firms. However, little research has been conducted that could facilitate an understanding of how quantity surveying firms manage their knowledge. Nor has any framework been devised specifically for managing knowledge in quantity surveying firms, though various frameworks for managing knowledge can be found in the literature. Therefore, this research attempts to bridge this gap by developing a proposed framework illustrating how professional quantity surveying firms in Hong Kong implicitly manage knowledge. On the other hand, this research also seeks to understand how quantity surveyors with different experience of professional practice in small & medium and large firms perceive the ways of managing knowledge in their workplace.

A review of the literature resulted in a proposed framework of knowledge processes in Hong Kong professional quantity surveying firms, and the proposed framework was validated by three semi-structured interviews with experienced quantity surveyors from three firms. The proposed framework was then further tested by questionnaires. The results of both interviews and questionnaires presented similar findings supporting the proposed framework. A framework of knowledge processes for professional quantity surveying firms in Hong Kong was developed. In addition, statistical analyses of the questionnaire data confirmed that quantity surveyors with different lengths of working experience and of different firm sizes would have diverse views on managing knowledge.

6.2 Summary of Findings

6.2.1 Awareness of Managing Knowledge in Quantity Surveying Firms

Despite the reputation of quantity surveying firms as knowledge-based organisations and professional services firms, managing knowledge is rarely placed on any discussion agenda in discussion forums, university lectures and technical meetings in this field. In line with the alarming assertion of Kretser and Wilkinson (2005) that construction consulting firms are risking their business by poorly managing knowledge, the general awareness of this area in Hong Kong quantity surveying firms remains low. Approximately 56% of the responding quantity surveyors showed little enthusiasm about or even failed to realise that they were managing knowledge in their business. The pressing workload is believed to have some causal relationship with their lack of interest. The problem is shown to be rather acute by the claim of a significant portion (almost 86%) of quantity surveyors that their efforts were entirely devoted to ensuring timely delivery of project output and maintenance of quality, leaving them no spare capacity for other issues. On the other hand, knowledge demands in their daily work are not well recognised, and the contribution of new knowledge to quantity surveyors is curtailed.

6.2.2 The Underlying Activities Adopted to Manage Knowledge

Knowledge acquisition

Reference to personal experience, colleagues' experience and personal network remains the favourite mode of knowledge searches among quantity surveyors. Regarding the types of knowledge, cost data, forms of contracts and standard methods of measurement reportedly attract the most frequent visits by quantity surveyors in their searches. In some other industries, staff recruitment is also considered capable of bringing surges of new knowledge into organisations.

By contrast, this effect is probably dampened by the reluctance of the majority of Hong Kong quantity surveying firms to introduce experienced recruits. The anomaly is further aggravated in the light of a general lack of specifically assigned staff for knowledge acquisition from external sources. The unpopularity of these alternative modes of knowledge acquisition reflects a relatively low reliance on external knowledge by these firms. Other means of knowledge acquisition, such as job rotation, or records of knowledge by experienced or departing staff, are not better off and receive a similar degree of indifference from these firms. Despite this, quantity surveyors generally agree that they gain knowledge from reviews at the conclusion of projects.

Knowledge creation

Webber (1999, p.41) points out that "a new economy is emerging built on knowledge and innovation". In line with this assertion, Hong Kong quantity surveying firms are fostering a culture that facilities the creation of new personal and organisational knowledge. For instance, quantity surveyors are constantly encouraged to put forward more efficient alternative solutions and proposals for existing assignments and other work-related issues. In this way, existing knowledge would be further developed or even sublimated in the knowledge creation. Moreover, firms also encourage staff to identify their individual working practice and procedures as recommended practice for future use. Apart from these, analysis of precedents of successes and mistakes is revealed as a means of enriching organisational knowledge.

Knowledge store

Speed of response is a distinct feature distinguishing a firm's competence from that of its competitors (Buckman, 2004). Hence a speedy and reliable knowledge retrieval system may somehow help improve an organisation's competitive strength. Knowledge in Hong

Kong quantity surveying firms is arranged in quite a systematic form so that data and information are selected and organised before being stored. It is mainly stored either in paper documentation or by electronic means. Some are transformed into organisations' routines / procedures and memories in the human brain. Furthermore, knowledge, which is reduced into paper documentation, is generally made available to all staff instead of being personal documentaries. Regarding the dominance of these means, it is suggested that knowledge in quantity surveying firms is being transformed to explicit knowledge. After all, this development in terms of on knowledge store is not perfectly free of flaws and inevitably requires some protection. Explicit knowledge, which codified the organisational wisdom, is famous for its susceptibility to malicious damage and pirating by rivals. Therefore, quantity surveying firms often impose restricted access to confidential / sensitive information. However, security protection, such as in the form of records of access, rarely works its way into these firms' protection strategy. Pleasingly, knowledge in Hong Kong quantity surveying firms is easily located by intended knowledge users.

Knowledge distribution

Mobilisation of knowledge is also observed in quantity surveying firms. Mentoring ranks highest among the various methods of knowledge transfer. Other alternatives, such as the appointment of specific expertise to specific projects, daily interaction, electronic means and paper documentation, enjoy slightly less popularity. These findings in effect acknowledge the presence of tacit knowledge transfer. However, tacit knowledge can seldom be treated as the only object of knowledge transfer in the firms since only a few

can survive by sole reliance on face-to-face knowledge transmission. Regarding knowledge sharing, financial incentives may arouse the interest of the staff in sharing. Nevertheless, the findings suggest that neither monetary rewards to staff nor the incorporation of knowledge sharing into staff appraisals is put into play in Hong Kong quantity surveying firms. Besides this omission, the physical environment, such as office layout, is not specifically designed by quantity surveying firms to enhance knowledge sharing. In addition, the provision of remote access to organisational databases is still rare in quantity surveying firms. Ultimately, although knowledge in quantity surveying firms is generally accessible, there is ample room for development.

Knowledge use

With regard to knowledge use, knowledge in quantity surveying firms is mostly used for problem solving. The purpose of product / service development is less frequently cited. Quite often, knowledge gained in previous projects is sought in order to be applied to current ones.

Knowledge maintaining

In light of the problem of obsolescent knowledge, about half of the quantity surveyors described regular updates and maintenance of validity of knowledge in their workplace. However paramount the need, a clear policy / strategy governing the ways in which knowledge should be handled is far from prevalent in the firms. The appointment of

managers for knowledge aspects is only carried out by one third of the responding quantity surveyors. Despite the absence of such an appointment and policy, nearly half of the responding quantity surveyors can seek the necessary knowledge when they need it.

6.2.3 The Framework of Knowledge Processes in Hong Kong Surveying Firms

From the questionnaire responses emerges a framework with a skeleton of six knowledge processes to represent how knowledge is implicitly managed in Hong Kong quantity surveying firms. To be more precise, the prevailing activities in the firms are broadly associated with Knowledge Acquisition, Knowledge Creation, Knowledge Store, Knowledge Distribution, Knowledge Use and Knowledge Maintaining. Although the mean value of Knowledge Acquisition was shown slightly below the criterion, there are still some compelling reasons to suggest its steadfast role in the framework of knowledge processes. They are outlined as follows:

- The majority of quantity surveyors rely on repeated application of their knowledge in the execution of their duties and thus may fail to realise the occurrence of Knowledge Acquisition in their workplace;

- Knowledge Acquisition is chiefly conducted by top management, such as directors / partners. The process may be behind the scene from the perspectives of the majority of quantity surveyor;

- Quantity surveyors get used to the outcomes of Knowledge Acquisition and fail to note their origins;

- Knowledge processes are intermingled and interdependent and thus hard to identify in distinct entities.

6.2.4 The Influence of the Size of Quantity Surveying Firms and the Length of Experience of Quantity Surveyors

The results of the Mann-Whitney test indicate S&M and large firms manage knowledge in entirely different ways in some aspects. The reasons underlying this dissimilarity can be concluded as being resources, knowledge type, project nature and staff number.

Owing to the higher flexibility of resources allocation in large firms, they can afford more to appoint specific staff to acquire external knowledge. Moreover, their internal training programmes and fresh graduate intakes are often so well organised and structured that they seldom expect to find experience recruits from the market. In contrast, S&M firms generally lack such programmes so that experienced staff have to be recruited externally. Contrasts are also found with respect to knowledge store. Large quantity surveying firms tend to record their knowledge by electronic media and the organisation's routines / procedures, whereas S&M firms prefer to keep their knowledge in human memory. In terms of storage, knowledge is deposited in the form of paper documentation which is open to all quantity surveyors in large firms. On the other hand, knowledge remains in effect a personal asset in S&M firms. As knowledge dissemination it is largely conducted by electronic means in large firms, control can be more easily imposed on access to their knowledge. Besides, large firms often deploy specific staff to update and maintain the validity of knowledge in their databases / libraries. Finally, formulation of knowledge policy seldom takes place in S&M firms.

Personal interaction, such as mentoring and face-to-face sharing, is found to be favoured in S&M firms. These findings suggest that quantity surveyors tend to seek tacit knowledge when they are in doubt. S&M firms also place less reliance on external knowledge, as their expertise may be confined to the repetitive and simple nature of projects and thus they may have less demand for it.

The relatively small scale of S&M firms is expected to foster better communication among quantity surveyors. Hence mutual trust is established on the basis of this close social relationship and allows quantity surveyors in S&M firms to exchange ideas, views and mental models with a greater sense of confidence and security. As knowledge is passed on by this means, it will go through series of quality cross checks in the form of debates, verifications and sharing among themselves. Hence experience gained in previous projects is often successfully applied to subsequent projects by this relay process in S&M firms. On the whole, a relationship of trust in S&M firms enhances staff communication and at the same time improves the accessibility of different projects.

Apart from the influence of firm size, quantity surveyors with various lengths of experience also demonstrate different views of how knowledge is managed in their firms. The research reveals that knowledge is most frequently to be adopted by experienced surveyors with over 6 years of experience in product / service development. They also constitute the most knowledgeable group to search for knowledge when needed. Quantity surveyors with 3-6 years of experience in the field are the least encouraged to find alternative solutions for their tasks and organisational purpose. In addition, they also show the least recognition for mentoring. Young quantity surveyors with less than 3 years of experience are largely engaged in the acquisition of explicit knowledge. The

research indicates that they exhibit the highest degree of concurrence with deposits of knowledge by electronic means and paper media and the distribution of knowledge by documentation.

6.3 Recommendations for Quantity Surveying Firms

In quantity surveying firms, physical output like documents and reports is a representation of the knowledge of the firm. A single flaw in managing knowledge may adversely affect the profitability of an organisation. Thus a proper knowledge policy can act as a guide enabling an organisation to direct its staff in managing explicit knowledge, the codification and dissemination of tacit knowledge and their applications to real practice. In view of this, Hong Kong quantity surveying firms are highly recommended to consider formulating knowledge policies and raise the issue of knowledge managing in the meeting agenda. However, a knowledge policy is not a homogeneous product. Therefore the formulation and implementation of such a policy should be commensurate with their business goals. The top management of the firms can seek inspiration from some organisations such as the Hong Kong Knowledge Management Society on setting up their own unique and practical knowledge policies.

Since knowledge exists and is crucial to every quantity surveying firm, it is difficult to arrive at a consensus on the best ways to manage knowledge. Consequently Hong Kong quantity surveying firms are advised to identify the knowledge types adopted in their organisations, such as explicit and tacit knowledge, prior to any attempts to figure out ways of managing knowledge. This research may serve as a useful reference for the top management of Hong Kong quantity surveying firms, enabling them to comprehend the knowledge processes that are most widely adopted in their field.

With reference to the results of the Mann-Whitney test, it is observed that the knowledge of S&M quantity surveying firms remains tacit. Knowledge distribution by interpersonal communication, e.g. mentoring, face-to-face transfer and knowledge store in the individual's mind, are common phenomena. Since the departure of experienced quantity surveyors often leads to a brain drain problem, S&M firms may consider converting tacit knowledge to explicit knowledge which can be stored in a paper medium or by electronic means. Partners and experienced quantity surveyors are invited to transform their experiences and insights into writing for circulation or in-house seminars. Thus better accessibility of organisational knowledge can be maintained compared with when it is kept in personal files. On the other hand, owing to the relatively sufficient financial strength of large quantity surveying firms, their repositories of explicit knowledge have been well established in the form of electronic means, paper media and organisational routines / procedures. However, the accessibility of knowledge may somehow be hindered due to either a grant system of prior consents to entry of the databases from partners or a general lack of mutual trust among a large number of staff and on a large organisational scale. Hence social functions, like parties, sports games and picnics may offer opportunities for quantity surveyors to improve mutual recognition and trust. This can indirectly enhance knowledge distribution in large quantity surveying firms.

The results of the Kruskal-Wallis test reveal that quantity surveyors with over 6 years of experience have the most comprehensive recognition of knowledge processes in the firms. Due to their exposure, they express the most affirmation of the existence of knowledge processes. It is interesting to note that quantity surveyors with less than 3 years of experiences are not the group which shows the least agreement with the scope of knowledge processes in their firms. Quantity surveyors with 3-6 years of experience are

in fact the group which demonstrates the least confirmation of the scope of knowledge processes. Perhaps this tier bears the most workload compared with the other two divisions. They are responsible for bits and pieces of projects, including internal and external coordination, the accuracy and quality of young quantity surveyors, and reports to senior quantity surveyors. The efforts have already been exhausted and are seldom devoted to other subsidiary issues. However, they are actively involved in sustaining the firms' competitiveness by delivering quality and speedy services. Hence, it is recommended that they raise their awareness of the significance of knowledge and knowledge processes. Seminars promoting the value of knowledge and the recognition of firms' knowledge processes to this tier or even to all quantity surveyors would be beneficial to the firms' success.

6.4 Limitations and Suggestions for Future Studies

The classification of firm sizes in this research is in accordance with that adopted by the Trade and Industry Department of the Hong Kong Special Administrative Region: "non-manufacturing enterprises with fewer than 50 employees are regarded as small and medium enterprises". However, definitions of firm size differ in different places, e.g. the definition of a small business in the United States varies from industry to industry. Although the classification regime adopted in this research may be the most appropriate one for research in relation to Hong Kong, the selection criteria still deserve particular attention. Further study may focus on a more detailed breakdown of firm sizes, such as one with categories comprising less than 20, 20-49; 50-99; 100-149; 150-199 and more than 200.

The influence of human factors on the successes or failures of any methods of handling intangible assets should not be underestimated. Managing knowledge should become ingrained in every staff member of quantity surveying firms so as to allow them to get / to become more actively involved in knowledge processes. Further studies should be devoted to an exploration of how the involvement of human beings in managing knowledge can be improved with the aim of enhancing knowledge flow in quantity surveying firms.

Although the literature continually reminds us to keep an eye on the human factors involved in implementing knowledge management regimes, technological constraints are also an indispensable element. Based on the findings of how knowledge is handled in Hong Kong quantity surveying firms, investigations of the use of technology in managing knowledge or how technology can facilitate knowledge flow in quantity surveying firms remain to be carried out.

The research findings confirm that policies / strategies regarding how to manage knowledge are not prevalent in Hong Kong quantity surveying firms. A well established strategy should be so devised that it can identify problems hindering knowledge flow and recognise current and future knowledge needs. Since this research does not intend to analyse the rationale for the lack of popularity of such a strategy, a study for examining the impediments would be constructive for maximizing application of quantity surveying firms' intellectual assets.

6.5 Concluding Remarks

Despite the knowledge-driven nature in quantity surveying firms, little is known about how knowledge is managed in the firms. This research attempted to bridge the gap by developing a framework presenting how professional quantity surveying firms implicitly manage knowledge, especially in Hong Kong.

Results of the questionnaire survey reported that the awareness of quantity surveyors in the firms on managing knowledge remains low. The results also provided empirical evidence, which has not been substantiated in literature, that quantity surveying firms in Hong Kong somehow manage their knowledge. Further to this affirmation, six prevailing knowledge managing activities are identified, namely acquisition, creation, store, distribution, use and maintaining. The results of the Mann-Whitney test revealed S&M and large quantity surveying firms illustrate dissimilarities in some activities of managing knowledge. In addition, quantity surveyors equipped with different lengths of professional practice possess various views of how knowledge is managed in their firms.

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APPENDIX A

THE LETTER OF INVITATION TO RESEARCH INTERVIEWS

A1. THE LETTER OF INVITATION TO RESEARCH INTERVIEWS

APPENDIX A

Department of Building and Real Estate
The Hong Kong Polytechnic University
Hung Hom

Date

«Company_Name»
«Address»

Dear Sir/Madam,

RE: REQUEST FOR A RESEARCH INTERVIEW

I am a graduate student in the Department of Building and Real Estate at the Hong Kong Polytechnic University. Currently I am undertaking my Master of Philosophy on the topic of "***How Professional Quantity Surveying Firms Manage Their Knowledge***". A detailed understanding of the duties of quantity surveyors and their daily work contributes the core subject of this research.

It is recognised that your organisation is well established in the quantity surveying discipline. In order to grasp an in-depth insight of the topic, I would be grateful if you could allow me a 60-minute interview ***with your quantity surveyor(s) at senior level who have recently completed a project from design stage to final account stage and have substantial experience and thorough understanding of different quantity surveying aspects within your firm.***

Please note that any information kindly provided by your firm in the interview will be kept strictly confidential and used solely for academic purposes. Your participation will significantly contribute to the success of this research and your help would be highly appreciated.

Should you have any queries, please contact the undersigned at 9107 XXXX or sonia.choi@ . You may also contact my supervisor, Dr. Patrick S.W. Fong at 2766 XXXX or bspafong@

Thank you for your kind attention and I am looking forward to receiving your reply soon.

Yours sincerely,

Choi Kit Yung Sonia
MPhil Student
Dept. of Building and Real Estate
The Hong Kong Polytechnic University

APPENDIX B

THE INTERVIEW SCHEDULE

B1. THE INTERVIEW SCHEDULE

INTERVIEW SCHEDULE **APPENDIX B**

1. How long have you been working in the quantity surveying discipline?

2. How long have you been working for this company?

3. Position level:

4. No. of quantity surveyors in your company
   <50
   ≥50

5. How do you balance the issues of time available and quality of professional assignment?

6. Do you think knowledge and experience are significant to your company? In what way?
   (***Knowledge is the information that combines individual experience, skill, interpretation etc.)***
   - Survival
   - Reputation

7. What is your understanding on the use of knowledge?
   - Value of knowledge
   - Function of knowledge

8. When you are asked to bid for a new assignment from client/employer, would anything relevant to your organization's knowledge resources be included in the proposal?
   Such as:
   - training to staff
   - academic background of staff
   - ratio of staff who are professional qualified to non- professional qualified
   - how to encourage staff to keep abreast with new knowledge and skill
   - how to keep company's knowledge up-to-date for projects
   - how to use best practices for projects

9. Would you please describe the duties and work processes for quantity surveyors in different stages of a project by using a project you have recently completed?
   Such as:
   - Preliminary Cost Advice
   - Procurement Methods Advice
   - Contractual Advice
   - Tendering Procedure
   - Valuation of Construction Work
   - Final Account
   - Financial Claims and Dispute Resolution

   - Project Name: _____
   - Contract Sum: _____
   - Project Type: _____
   - Client: _____

10. Is there any difference (is it good or bad?) for quantity surveyors if a new project is similar to a previous/current project in the nature of
    - Project Type
    - Conditions of Contract
    - Standard Method of Measurement
    - Employer
    - Architect
    - Structural Engineer
    - Services Engineer

11. Apart from quantity surveyors, any other supporting staff (at the back of house) facilitate the work of quantity surveyors?

12. Do you think knowledge is project-specific?

13. Is there any places of time-sheet for staff to fill in for the hours allocated to handle knowledge such as searching information, sharing experience, etc

APPENDIX C

THE LETTER ACCOMPANYING QUESTIONNAIRES

C1. THE LETTER ACCOMPANYING QUESTIONNAIRES

APPENDIX C

Department of Building and Real Estate
The Hong Kong Polytechnic University
Hung Hom

Date

Dear Sir/Madam,

RE: Invitation of Participating in a Research Survey

I am a graduate student in the Department of Building and Real Estate at the Hong Kong Polytechnic University. Currently I am undertaking my Master of Philosophy on the topic of "***How Professional Quantity Surveying Firms Manage Their Knowledge***". A detailed understanding of the current situation of the way how quantity surveying firms manage knowledge contributes the core subject of this research.

As a quantity surveyor in quantity surveying discipline, you are cordially invited to express your views on how knowledge is handled in your workplace. I would be grateful if you could spend less than 20 minutes to fill in the questionnaire. Your participation will significantly contribute to the success of this research and your help would be highly appreciated

Please note that any information kindly provided by you will be kept strictly confidential and used solely for academic purposes..

Please kindly return the completed questionnaire in the prepaid and self-addressed envelope on or before 1st October 2004.

Should you have any queries, please contact the undersigned at 9107 XXXX or sonia.choi@ . You may also contact my supervisor, Dr. Patrick S.W. Fong at 2766 XXXX or bspafong@ .

Thank you in advance for taking time from your busy schedule on completing this survey.

Yours sincerely,

Choi Kit Yung Sonia
MPhil Student
Dept. of Building and Real Estate
The Hong Kong Polytechnic University

APPENDIX D

THE QUESTIONNAIRE

D1. THE QUESTIONNAIRE

APPENDIX D

How Professional Quantity Surveying Firms in Hong Kong Manage Knowledge

THE HONG KONG
POLYTECHNIC UNIVERSITY
DEPARTMENT OF BUILDING & REAL ESTATE

How Professional Quantity Surveying Firms in Hong Kong Manage Knowledge

Please assign a level from ***1 (strongly disagree)*** to ***5 (strongly agree)*** according to the extent to which you agree with the following statements.

Circle **ONE** response for each item unless otherwise specified

		Strongly Disagree				Strongly Agree
1	Quality of output is the most crucial concern in my workplace.	1	2	3	4	5
2	Meeting deadline is the most crucial concern in my workplace.	1	2	3	4	5
3	Allocation of workforce (resources) is the most crucial concern in my workplace.	1	2	3	4	5
4	My workload is heavy.	1	2	3	4	5
5	Working overtime (OT) is common in my workplace.	1	2	3	4	5
6	My work involves problem solving.	1	2	3	4	5
7	Satisfactory completion of my work requires input of new knowledge.	1	2	3	4	5
8	Importance of knowledge is advocated in my workplace.	1	2	3	4	5
9	I am aware of how knowledge is managed in my workplace.	1	2	3	4	5

10 Useful source(s) of knowledge in my workplace is (are):
(please tick box(es) that apply)

- ☐ Personal experience
- ☐ Colleagues' experience
- ☐ Internal courses and training
- ☐ External courses, seminars and conferences
- ☐ Office manual / In-house standard
- ☐ Good work practices / Lesson learned
- ☐ Interaction with external parties including clients, consultants, contractors, sub-contractors or suppliers
- ☐ Government agencies such as Architectural Services Department, Housing Department, etc.
- ☐ Research & development department in workplace

10	Useful source(s) of knowledge in my workplace is (are): (Cont'd) *(please tick box(es) that apply)*					
☐	Personal network (ex-classmates, ex-colleagues, friends, professional society members, etc.)					
☐	Company library					
☐	Internet searches					
☐	Professional literature, e.g. HKIS Journal, etc.,					
☐	Through merger and acquisition					
☐	Professional institutes					
☐	Universities					
☐	Purchasing license or patents					
☐	Trade related magazines / business literature					
☐	Knowledge of competitors					
☐	Newspapers / newspaper cuttings					
11	Types of knowledge are sought in my workplace: (*please tick box(es) that apply)*					
☐	Cost data					
☐	Construction methods / techniques					
☐	Construction materials / equipments					
☐	Legal cases					
☐	Government Ordinances					
☐	Procurement methods					
☐	Code of practices					
☐	Standard Method of Measurement					
☐	Forms of Contracts					
		Strongly Disagree				Strongly Agree
12	Specific staff in my workplace is responsible for obtaining knowledge from external sources.	1	2	3	4	5
13	My work output relies on knowledge input externally.	1	2	3	4	5
14	Experienced staff is recruited externally.	1	2	3	4	5
15	Job rotation is encouraged in my workplace.	1	2	3	4	5

		Strongly Disagree				Strongly Agree
16	Experienced staff and staff approaching departure are invited to record their knowledge and experience.	1	2	3	4	5
17	I learn lessons after project closure.	1	2	3	4	5
18	I am encouraged to find alternative solutions for existing assignments in my workplace.	1	2	3	4	5
19	Work related suggestions are encouraged in my workplace.	1	2	3	4	5
20	Existing knowledge is used to develop new knowledge in my workplace.	1	2	3	4	5
21	I am encouraged to identify best practices for future use.	1	2	3	4	5
22	I am encouraged to analyse success factors to enrich my knowledge.	1	2	3	4	5
23	I am encouraged to analyse mistakes to enrich my knowledge.	1	2	3	4	5
24	Data and information are selected and organized before being stored in my workplace.	1	2	3	4	5
25	Knowledge is recorded by electronic means (soft copy) in my workplace.	1	2	3	4	5
26	Knowledge is recorded in paper medium (hard copy) in my workplace.	1	2	3	4	5
27	Knowledge is resided in human memory (brain) in my workplace.	1	2	3	4	5
28	Knowledge is kept in personal reference file(s).	1	2	3	4	5
29	Knowledge is resided in my organization's routines / procedures.	1	2	3	4	5
30	Knowledge is recorded in the form of documentation such as office manuals, work practices, in-house standard, lessons learned, etc.	1	2	3	4	5
31	Confidential / sensitive information has restricted access in my workplace.	1	2	3	4	5
32	Access to some knowledge is recorded.	1	2	3	4	5
33	I know where to find knowledge when I need it.	1	2	3	4	5
34	I know who to ask for knowledge when I need it.	1	2	3	4	5
35	Experienced staff in my workplace are encouraged to mentor new or less experienced staff.	1	2	3	4	5
36	Knowledge gained from different projects is made accessible to all in my workplace.	1	2	3	4	5

		Strongly Disagree				Strongly Agree
37	Knowledge is transferred by electronic means throughout the office.	1	2	3	4	5
38	Knowledge is distributed through documentation in my workplace.	1	2	3	4	5
39	Knowledge is shared by daily interaction with colleagues in workplace, e.g. in the corridor, during lunch, in the pantry, social functions	1	2	3	4	5
40	Knowledge is transferred by face-to-face means only.	1	2	3	4	5
41	Staff who share knowledge receive reward / recognition in my workplace.	1	2	3	4	5
42	Office layout in my workplace encourages staff to share knowledge.	1	2	3	4	5
43	Knowledge sharing is a measure of employee's performance in my workplace.	1	2	3	4	5
44	Remote access for workplace's database is provided.	1	2	3	4	5
45	Staff with specific expertise is assigned to specific project(s).	1	2	3	4	5
46	I utilise knowledge to solve most problems that I encounter in my job.	1	2	3	4	5
47	I am encouraged to refer to knowledge / experience learned from previous project(s) to subsequent project(s).	1	2	3	4	5
48	I apply knowledge in developing new products / services.	1	2	3	4	5
49	Specific staff in my workplace is responsible for regular updating of knowledge in database / library.	1	2	3	4	5
50	Specific staff in my workplace is responsible for maintaining the applicability of the knowledge in database / library.	1	2	3	4	5
51	I am able to obtain the necessary knowledge when I need.	1	2	3	4	5
52	Manager / senior staff is assigned to deal with knowledge need.	1	2	3	4	5
53	There is a clear policy / strategy in my workplace of how to handle knowledge.	1	2	3	4	5

	PERSONAL INFORMATION (*please tick box(es) that apply)*
	How long have you been working in the quantity surveying discipline?
☐	Less than 3 years
☐	3-6 years
☐	More than 6 years
	No. of quantity surveyors in my workplace
☐	<50
☐	≥50
	End of the Questionnaire Thank you for your time and attention! Please return the questionnaire in the attached stamped & self-addressed envelope.