Organizational Culture and Knowledge Management Success at Project and Organizational Levels in Contracting Firms

Patrick S.W. Fong[1] and Cecilia W.C. Kwok[2]

ABSTRACT

This research focuses on contracting firms within the construction sector. It characterizes and evaluates the composition of organizational culture using four culture types (Clan, Adhocracy, Market, and Hierarchy), the strategic approach for knowledge flow, and the success of KM systems at different hierarchical levels of contracting organizations (project and parent organization level). Responses from managers of local or overseas contracting firms operating in Hong Kong were collected using a carefully constructed questionnaire survey that was distributed through electronic mail.

The organizational value is analyzed in terms of the four cultural models. Clan culture is found to be the most popular at both project and organization levels, which means that the culture of contracting firms very much depends on honest communication, respect for people, trust, and cohesive relationships. On the other hand, Hierarchy

[1] Associate Professor, Department of Building & Real Estate, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong (corresponding author). T: +(852) 2766 5801 F: +(852) 2764 5131 E-mail: bspafong@polyu.edu.hk

[2] Department of Building & Real Estate, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong.

culture, which focuses on stability and continuity, and analysis and control, seems to be the least favored at both levels.

Another significant finding was that the two main KM strategies for knowledge flow, Codification and Personalization, were employed at both project and organization levels in equal proportion. This indicates that successful knowledge management efforts at both enterprise levels utilize a hybrid and balanced approach for their knowledge flow, and that they complement each other. The findings also revealed that KMS success factors emphasize the support of the management level. The results show that KM is critical and beneficial as indicated by 64% at the project and 74% at the organization level. The expectation is higher for organizations as they are the organizational memories in which experiences of past projects are archived and connected. Understanding these factors and the relationships among them has been demonstrated to be critical in order to increase the chances of success or to help with making decisions when applying knowledge management.

Keywords: Construction companies, contractors, organizations, construction management

Introduction

In today's competitive and dynamic business environment, knowledge becomes an important asset of organizations. Effective knowledge management (KM) provides the capacity to engineer an organization's formal and informal structure, functions and processes to formalize and leverage its intellectual assets. There is an emerging need in the construction sector to effectively implement KM systems with the aim of

transcending boundaries for the purpose of disseminating essential knowledge throughout projects, teams and organizations (Carrillo et al. 2004; Love et al. 2005). However, for KM to be truly effective and successful requires more than new technologies alone; it requires understanding and the integration of its human aspects, as well as the right culture to operate (Davenport et al. 1998; Shand 1998).

Knowledge is an important asset for all companies. With the rapidly changing environment and the increase in competition, it is important to manage knowledge properly in the construction industry. As in other countries, Hong Kong's construction industry is labor-intensive and relies heavily on practice and experience. For this reason, the construction industry contains large amounts of knowledge. On top of this, the dynamic environment and the implementation of advanced technologies result in a vast pool of knowledge. Therefore, good knowledge management would probably benefit the exchange and re-use of knowledge in the short term and innovation in the long run (Prusak 1998).

Knowledge management is not something entirely new, as knowledge has existed throughout time. Organizations have always used different knowledge practices to produce goods and services; people do share knowledge but the extent of sharing is informal and not systematic. It very much depends on individuals and their personal networks. However, sometimes employees lack motivation or have no channels through which to share. As a result, their knowledge disappears once they leave a company. With the application of knowledge management, knowledge would hopefully be more securely managed.

The construction industry is a project-based industry. People from different departments, professions or companies gather as a team to complete a project. The duration of a project may be from several months to years. Upon the completion of the project, this temporary group is disbanded and may never work together on other projects (Love et al. 2005). Knowledge is created during a project, but the pool of knowledge is lost if there are no effective ways of managing it. By the same token, knowledge cannot be re-used if there is no proper channel for transferring it from one project to another.

Knowledge sharing across projects is equally important because knowledge transfers from a current to a concurrent or future project allow people to use existing proven knowledge to solve problems instead of generating knowledge anew, which can consume time (Fernie et al. 2003; Love et al. 2005). Overall efficiency is thereby increased, and project expenditures can be lowered. Critical factors for the success or failure of a project can also be shared as lessons learned or post-project reviews. This is especially crucial to contractors, as they are now operating in a highly competitive environment. Effective knowledge management would definitely improve the competitiveness of an organization.

The composition of a contractor firm includes the organization itself and projects. There is no doubt that they are both equally important to an organization. Therefore, the implementation of knowledge management at these two levels is investigated. This research aims to: (1) identify the organizational values and cultural composition of contracting organizations, (2) recognize the strategic approach of knowledge flow, and (3) evaluate the degree of knowledge management success at the project and

organization levels.

Concept of Knowledge Management

Knowledge management emerged from the world of academia in the 90s and has become a hot issue, especially for business and technology leaders (Frappaolo 2002). The motivation for actively engaging in knowledge management is to improve employees' decision-making and productivity (Koenig 2002). The concept of knowledge management is nothing new, but the terminology is new. The exact definition of knowledge management is difficult to clarify and is still the subject of an ongoing debate. There are a number of definitions of knowledge management. For example, Frappaolo (2002) identifies knowledge management as the leveraging of collective wisdom to increase responsiveness and innovation, also emphasizing the re-use of experience and practices. Cong and Pandya (2003) mention knowledge management has three basic elements: people, process and technology. Among these three elements, the percentage of effort put in is around 70%, 20% and 10%. According to Palmer and Platt (2005), there are five stages of knowledge management: horizon scanning, awareness, understanding, implementation and monitoring. Though knowledge has to be managed, this does not imply that the objective of knowledge management is to manage all knowledge. Instead, it is to manage knowledge that is the most essential to an organization, whether it be tacit or explicit.

Many people may consider information technology (IT) as knowledge management (KM). However, the equal sign should not put between IT and KM. IT is an enabler of KM, and has undoubtedly engendered a revolution in knowledge management (Marwick 2001). KM is something more than IT: a good database system for

knowledge storage is not enough, rather the critical point is the high accessibility to acquire knowledge (Chait 2000). IT is effective in the transfer of articles, documents or data, but in certain circumstances the effectiveness increases if the transfer of knowledge is undertaken verbally, because interaction speeds up the rate of knowledge delivery and receiving.

From the beginning, it is stressed that contracting firms have a pool of knowledge that needed to be managed: knowledge in advanced machinery and technologies, the experiences of personnel involved in a project, the properties of different construction materials, or products and lessons learned as a result of managing a project.

Models of Organizational Culture

Cameron and Quinn (1999) developed a widely adopted organizational cultural framework. Organizational culture is an organization's values, assumptions and expectations (Hooijberg & Petrock 1993). It serves as a filter through which strategies are decided and performance results (Saint-Onge 2002). Four models of culture are determined through an organizational culture assessment instrument (OCAI) (O'Neill & Quinn 1993). The OCAI approach uses two sets of questionnaires to assess current and ideal organizational values in six essential dimensions of culture respectively. The International Council for Research and Innovation in Building and Construction (CIB) has conducted the "OCAI-questionnaire" worldwide, including in Hong Kong, to evaluate cultures in construction processes (Tijhuis 2005). The four models of culture are Hierarchy, Market, Clan and Adhocracy.

Hierarchy culture is considered as the earliest approach, recognized by a formalized

and structured working place (Cameron & Quinn 1999). This culture emphasizes internal issues and intends to provide a stable environment to increase productivity, or to generate efficient and reliable products by setting up rules, policy or specialization. **Market** culture focuses on management of external affairs. This is regarded as a results-oriented and customer-based culture. It contributes to organizational effectiveness and operates as a market. **Clan** culture is about people and sharing between individuals. This organizational culture concentrates on teamwork, loyalty, commitment and participation of employees. It ultimately helps human resources development. **Adhocracy** culture is dynamic and creative. This culture has a higher ability to assume risk and encourages employees' initiative and innovation. The organization likes to have unique products and aims at seeking new resources.

Knowledge Management Strategies

The purpose of having KM strategies is to improve an organization's competitiveness (Bellaver & Lusa 2002). Implementation of knowledge management has to be delivered through a number of tools, for example, research collaboration, conferences, seminars, personal interaction, job rotation, the Internet, etc. The final strategy should reflect a company's competitive strategy and is usually decided by the top management. The two kinds of KM strategy are *codification* and *personalization* (Koenig 2001). Codification strategy represents knowledge that is stored in database systems. It connects people with information (Palmer & Platt 2005). Codification formalizes an organization's knowledge for a broad scale of utilization and requires abundant implementation of technology. As a result, anyone in the company is able to access and use the knowledge easily. It is especially suitable for managing explicit knowledge. Personalization strategy characterizes the situation where the knowledge of an

organization is mainly stored in people's brains, and the sharing channel relies heavily on human interaction. Unlike codification, personalization focuses on person to person transfer; technology becomes an instrument for communicating, not gathering knowledge. Transfer of tacit knowledge is more often done using this strategy. The organization is therefore required to invest greatly in its people network (Foray & Gault 2003). Both strategies can co-exist and the proportion of the two approaches depends on the nature and function of different units under the parent organizations. Hansen et al. (1999) suggested that an 80-20 split should be followed in deciding strategy, that is one approach should account for 80% of the KM strategy, with the other one occupying 20% as a support for the major one. They claimed that most organizations follow the 80-20 split, and the attempt to excel in both strategies will fail. Koenig (2001) questioned the 80-20 distinction. He argued that a 50-50 mix does not necessarily cause failure. His research found that a successful company places equal emphasis on both codification and personalization. Instead, the best balance point should be within the 20-80 or 80-20 range.

Critical Success Factors for KM practice

Hariharan and Cellular (2005) suggest the "4 pillars" of KM critical success factors. The first type is leadership, people and culture; the second is KM processes and technology; the third is relevance to business and objectives; and the last is measurement of KM.

Koenig (2002) pointed out that the effect of KM should be justified by differences in people's behavior after applying KM, therefore measuring performance is an indicator of success. Cong and Pandya (2003) point out that successful KM practice not only

contributes to the awareness and support from managers, but should also raise the awareness and support of staff. The effectiveness of KM can be evaluated through staff involvement and motivation in projects. The greater the staff involvement, the greater the potential for knowledge transfer. Secondly, the ability to consolidate learning from a previous project is crucial. The problem in the construction industry is that employees usually have no time to share and evaluate before going on to the next project (Palmer & Platt 2005). If more time were spared between projects, individuals would have more time to combine, collaborate and reflect on knowledge obtained from the last project, resulting in a higher quality of knowledge sharing (Fernie et al. 2003; Love et al. 2005).

Knowledge transfer between projects and the parent organization

The nature of knowledge keeps changing. Tacit and explicit knowledge are transferred constantly between projects and parent organizations (Love et al. 2005). Figure 1 presents the relationships between a parent organization and several projects, showing the cyclical transfer and reuse of knowledge between the parent organization and projects, as well as the transfer between projects through the organizational memory.

There are three main types of knowledge that result from project-based working: (a) knowledge in projects, (b) knowledge about projects, and (3) knowledge from projects (Love et al. 2005). “Knowledge in projects” is that knowledge which resides in a project in the form of documentations, meeting repository, discussions and project management system. “Knowledge about projects” is knowledge that is required for executing a project. This knowledge includes project organization design, designing, planning and controlling, project marketing and skills management. Knowledge about

end products or materials that satisfies competing requirements and constraints is under this category as well. “Knowledge from projects” is the experiences archived from executing a project. This is in the form of best practices, lessons learned, post-project reviews or after-action reviews. Unfortunately not a great deal of time is spent on the latter, as people are pulled out from a project before it is actually completed, resulting in valuable lessons from the project not being recorded and therefore being lost (Koenig & Srikantaiah 2004). In some cases, the lessons are collected too late or are forgotten when the review is only carried out at the end of a project.

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KM in the construction industry should include the reuse of knowledge within (intra-project) and across (inter-project) projects, and conserving it (Love et al. 2005). According to Kamara et al. (2005), the sharing of knowledge in a project takes place at three levels: (a) the transfer/sharing of knowledge between different professionals involved in each phase of a project, (2) the transfer/sharing of knowledge between different professionals involved in different stages of a project, and (3) the mutual transfer of knowledge from a project to the organizational knowledge base of each firm involved in a project.

Kamara et al. (2005) suggest that cross-project KM is not explicitly undertaken, even if companies identify this problem. In order to manage cross-project KM, companies need to identify the high-grade or core knowledge and make it as explicit as possible. In addition, they mention that successful transfer of knowledge between different

projects depends on the way knowledge is captured and codified. Since people are always treated as the key resources of any organization, they play an important role in knowledge transfer. It is assumed that the acquired knowledge of one project can be transferred through individuals when they are re-assigned to other projects (Love et al. 2005). This approach can also be reflected in job rotation, as well as mentoring for junior staff.

Research Methodology

The research was conducted by questionnaire survey. The questionnaire was the most appropriate data source for this research. The reason for using a questionnaire was to investigate the general situations and applications of knowledge management in contracting firms. A generalized picture of the situations was planned from the survey instead of in-depth purposeful studies. From the responses and background information given, we are able to evaluate knowledge management practices at both project and organizational levels in contracting firms. The questionnaire included four sections. The distribution method used was email, as it is an environmentally-friendly and cost-effective approach as well as a speedy way of delivering and reminding respondents about the survey.

The questionnaire was finally sent to managers at different local contracting firms. Project managers and other management levels were invited to participate in this research study, as the implementation of knowledge management ultimately requires support from top or senior managers, and they are considered as the group with the best knowledge about their organizations and projects.

The first step of the survey method was compiling a contact list of project managers from among graduates of the department, current part-time students or students who had previously worked or were currently working in construction firms. An invitation was then sent via email, with an invitation letter and questionnaire as attachments. Once the target respondents had completed the questionnaire, they were asked to send the attachment back via email. There were 205 emails sent in total, but 11 of them bounced back because the individuals were on leave or the organization's security system screened out the invitation.

The design of the questionnaire was based on a review of the existing literature, as well as making reference to some KM questionnaires available on the Internet. The questionnaire was organized in 6 pages. Although it was rather long, the questions were straightforward and it took about 20 minutes to complete. The research questions were investigated from two perspectives: that of the project and that of the organization. Projects meant construction projects that the respondents were working on at that moment, while organizations indicated the parent organizations employing the respondents. The purpose of such direction was to determine the differences and similarities in KM applications at these two levels. The questionnaire was divided into four sections as described below.

Section A: Organizational Value

Eleven items were included in Section A: honest communication, goal achievement, getting the job done, innovation, respect for people, trying new concepts, trust, outcome excellence, analysis and control, stability and continuity, and cohesive relationship. Participants were required to answer questions on a 5-point scale, with 1

being strongly disagree and 5 as strongly agree.

Section B: Knowledge Flow

Section B requested respondents to provide information regarding their usual practice in knowledge flow at the project and organization levels. The definition of the term knowledge flow was adopted from a knowledge management and information technology encyclopedia and Palmer & Platt (2005). Responses were measured on a 5-point scale where 5 equaled to a minimal extent and 1 to a very great extent. An additional option of "0" signified that the respondent did not know the answer. This was included because it was preferable to have respondents opt for "don't know" than blind guessing.

Section C: Knowledge Management

Section C identified respondents' perceptions on knowledge management (KM) and knowledge management systems (KMS), i.e. to what extent the respondent believed that KM is important and how far their project and organization have implemented KMS. The definitions of KM and KMS were stated in the questionnaire for the purpose of giving a more precise instruction to participants. Questions evaluated the success of KMS in several directions by scoring different statements. The 5-point scale applied for KMS success was the same as that for knowledge flow in the previous section.

Section D: Participant Profile

Participant profile was included at the end of the questionnaire. Basic information like job title, size of organization, and years of work experience was collected. Filling in

the name of the organization was optional out of respect for participants and in order to safeguard their privacy.

In this research, basic descriptive statistics are used, e.g. frequencies and means. SPSS 12.0 also helps to process data by selecting cases, for example, to interpret results in terms of different respondents' experience.

Research Results and Analysis

205 emails were sent to the target population, i.e. managers at different contracting firms. 11 emails were immediately returned because (1) the target respondent was on leave, (2) there was an automatic delivery failure, or (3) the email address was invalid. A total of 194 emails were successfully sent to target respondents. 139 completed questionnaires were received. The response rate was calculated as 71.6%, which is a very satisfactory result.

Participants' profile

Of the completed questionnaires received, 90% of the respondents were at managerial level (e.g. director or manager grades). The remainder held positions such as project coordinators, engineers or foremen. Some did not specify the names of their organizations, therefore the distribution of companies' participation could not be counted. In terms of total work experience in the construction industry, 23% had less than 10 years' experience, 38% had between 10 to 20 years' experience and the remaining 39% had over 20 years of experience. As for length of service in their current organizations, 72% had less than 10 years, 18% had been with the same firm for between 10 and 20 years, and the remaining 10% had over 20 years' experience in

their current organizations. The respondents were generally experienced practitioners in the construction industry.

Organizational value

From Table 1, the mean scores of organizational value at project level ranged from 3.33 to 4.38 on a 5-point scale (3 being neutral). These scores show that the general project value is relatively high. The top four project values in ascending order are *getting the job done*, *honest communication*, *trust* and *goal achievement*. These four values obtained scores over 3.90. Conversely, the top five organizational values in ascending order are *honest communication* (mean = 4.33)*, getting the job done*, *goal achievement*, *trust* and *cohesive relationship*, which are very similar to the project values. Two of the top three organizational values are the same as the project values, indicating that the core values in projects and organizations are connected and are very similar. However, the mean scores of organizational value ranged from 3.26 to 4.33. This was comparatively lower than for project values.

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The three core values, *honest communication*, *getting the job done* and *trust* can be assumed as the cultural strength in both projects and organizations. KM does not work without trust (Koenig 2002). As the research results reveal, trust is an important value; with trust, KM is made possible in the construction industry. As described before, the average mean values are higher in projects. This can be explained by the nature of the construction industry, where, in a project, members of different professions work closely together. The relationships between members are closer in projects than in

organizations because they have clear goals behind them; the goals of the team are to coordinate well and get the job done. Only honest communication between members and trust in each other's professionalism will allow them to achieve these goals.

The great difference between project and organizational values is in *trying new concepts*, which ranks 9 for project value (mean = 3.56) but 7 for organization value (mean = 3.64). This is understandable, because the principle value in a project is getting the job done on a tight schedule and in spite of the multiple problems faced on site each day. There is relatively little extra effort required to try a new concept or innovation. *Innovation* and *trying new concepts* is not something that can be executed instantaneously; these approaches require support from the organization because ultimately the project is only a sub-layer within the organization. The resources and decision to be innovative, organizational value and strategies are strong elements that determine the value of a project. From the perspective of organizational value, *innovation* and *trying new concepts* are more popular than in projects, ranking middle, 6 and 7 out of the total 11 values. Innovation is now regarded as a key success factor for an organization, and creative ideas are seen as a strong parameter for an organization's competitiveness.

Cultural Composition Analysis

The OCAI tool was employed to determine the four culture constructs. This tool has been successfully used in several large organizational culture research studies, including those of Yeung et al. (1991) and Quinn and Spreitzer (1991). In both of these studies, the reliability of the OCAI tool created confidence that the results produced exceed the reliability of the most commonly used instruments in the social and

organizational sciences (Cameron & Quinn 1999). However, to further assess the internal consistency for this current study, the coefficient alpha reliability estimates of the four culture type constructs were calculated and are reported in Tables 2 and 3.

Table 4 shows which core values contribute to which culture type. Tables 2 and 3 demonstrate the results after taking the average means of each culture type. The comparison of mean score by the four culture types reveals an interesting phenomenon. The total received score is very close between the two enterprise levels, which suggests that the values to either project or organization are similar, and the difference is only in the composition of culture. Clan culture is the dominant value applied in both projects and organizations, while hierarchy culture is the least often applied. The market culture is more popular in projects than in organizations, whereas the adhocracy culture is more common in organizations than projects.

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The mean difference between the Clan and Market cultures in projects is 0.01. This implies that both Clan and Market cultures are dominant values. Clan culture concerns teamwork and people relationships, and Market culture focuses on goal achievement. This again proves that Hong Kong's construction industry is a people-based industry, in which interaction among project stakeholders is highly appreciated and encouraged.

It is quite surprising that *Respect for people* has a rather low ranking. Although it is a value considered typical of Clan culture, it only ranks 8 for both project and organization values, despite the fact that other items of Clan culture have a higher score. The result obtained does not signify that respect is not necessary; it simply reflects the fact that even if a relationship is close in a project or organization, there might be different personal values and beliefs, or different personal or organizational objectives have affected respect among people. However, senior management should be aware of this phenomenon because it will be difficult to manage people if employees lack respect for one another, a situation which can occur at any time and does not only apply to KM.

There is a distinct difference in mean score between the items in "Market" culture. *Getting the job done* ranks 1 and 2 in projects and organizations respectively. In contrast, *Outcome excellence* ranks 10 and 11, almost the lowest priority. The low score indicates that the construction industry places more emphasis on getting the job completed than on making the job outstanding.

Respondents indicated that the adoption of Hierarchy culture is the minimum (mean = 3.45) at both levels. This score is still slightly above neutral. Hierarchy culture establishes rules and provides a stable workplace. On top of that, the lowest mean value of Hierarchy culture does not suggest that hierarchy is not essential. *Analysis and control*, *stability and continuity* are basic elements for the development of an organization and project, therefore awareness of these two values maybe undermined by participants.

Knowledge Flow

Different means of knowledge flow are grouped under codification or personalization in Table 5. Table 6 shows the mean score obtained for different means of knowledge flow on a 5-point scale. The former approach emphasizes codifying knowledge, whereas the latter relates to people and networks as means of knowledge transfer. The score ranged from 1.95 to 4.31 in projects and between 2.26 and 4.46 in organizations. *Staff meeting / group meeting* received the highest score for both projects and organizations at 4.31 and 4.46 respectively. This shows that no matter how advanced the technology, the most traditional mode of interaction, i.e. face to face meeting, is always the most popular approach to communicating and sharing within projects and organizations.

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The items ranked second to fourth in ascending order for projects were *Document Management* (mean = 4.21), *Internet / Intranet* (mean = 4.13), *One-on-One Conversation* (mean = 3.82). For organizations, they were *Internet / Intranet* (mean = 3.82), *Training / E-learning* (mean = 3.62), *Seminars / Presentations* (mean = 3.62), *Working Groups / Communities of Practice* (mean = 3.62), *Document Management* and *Phone Calls / Teleconferencing* (mean = 3.59). The results reveal that apart from staff meetings, the most frequently employed means of knowledge flow are document management and the Internet / Intranet.

An obvious difference between the rankings of means of knowledge flow is that *Training / e-learning* and *Seminars / Presentations* rank third in importance for

organizations but 8th and 9th for projects. The means of knowledge flow mainly rely on resources provided by an organization to different projects. As a project is one of the units of an organization, training, seminars or presentations usually invite the participation of people from different projects or other units in an organization, and are something that should be organized by the parent organization. Such differences can therefore be accounted for.

Electronic discussion groups are becoming popular in our society. They provide a platform for people from different locations to express and exchange knowledge and ideas via the Internet on any specific topic. However, the use of this communication tool is not common in the contracting sector. It ranks 16th at both organization level (mean = 2.26) and project level (mean = 1.95). One of the characteristics of the electronic discussion group is that it is an indirect channel for people who do not know each other well or people in different geographical locations to share information. In the construction industry, cohesive relationships are established, and the nature of the long hours lends itself to meeting and discussing easily. As a result of people's preference for a more direct approach to knowledge flow, the electronic discussion group is not widely used at either project or organization level. Since participants welcome direct interaction, if employees have good communication skills and an extensive personal network, there is no doubt that the opportunity to exchange knowledge is considerably higher.

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When comparing the direction of the KM strategy, the pattern in Table 6 shows only the ways in which knowledge flow would dominate, e.g. meetings, but not the KM strategy. Codification is more formal and the use of technology is for storage of knowledge. Personalization is knowledge in people's heads, and technology is mainly used to communicate knowledge. The composition of each strategy, either codification or personalization, is heavily reliant on a certain approach, and this is reflected in the extreme mean values received.

Figures 2 and 3 present the aggregated score of knowledge flow in two divisions: codification and personalization. The score of projects in terms of codification is 26.03, as compared to 25.65 for organizations. The difference in the aggregated scores is 0.38, which is a very small difference over eight items. The aggregated score in terms of personalization is lower in projects (25.41) than in organizations (26.13), although the difference is only 0.72.

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The overall values obtained for codification and personalization strategies at the project and organization levels are very similar, with each strategy including some more popular and less popular approaches. At the project level, the difference in the aggregated score is 0.62, and at the organization level it is 0.48. The contrasts in the two strategies between both enterprise levels are very small.

In this research, the distribution of codification to personalization is 50.6% and 49.4% at the project level and 49.5% and 50.5% at the organization level. The proportion is nearly 1:1. Although the result does not match with the 80-20 split suggested by Hansen et al. (1999), the 50-50 straddle fits the balance suggested by Koenig (2001). We believe that the direction of knowledge flow can be personalization or codification because neither of them dominates, rather the mixed use of personalization and codification is more significant. They are both equally important and have contributed to knowledge sharing within both projects and organizations.

KMS Success Factor

The mean scores of KMS success indicators in projects ranged from 3.21 to 3.97 on a 5-point scale (Table 7). This shows that KMS success in projects is rather neutral. However, in comparison to the KMS success indicator in organizations, the result is slightly higher. All KMS success indicators received for projects were higher than those of organizations, except in the case of IT infrastructure and multiple ways to capture knowledge. The KMS success factors in organizations ranged from 3.44 to 3.82.

The top success factor in both domains was the *support of KMS from project management* (mean = 3.97) and *organization management* (mean = 3.82). *KMS provides benefits to organization* shared the highest score with *support of KMS* at the organization level. Concerning the *multiple ways to capture knowledge*, answers from respondents were quite extreme, ranking from 7th place for projects to 3rd place for organizations. This can be explained by the nature of projects. Projects are temporary tasks, therefore if more channels are required to obtain knowledge, investment will

consequently be increased. From the profitability point of view, organizations prefer having basic channels only, resulting in the fewer resources supplied (concerning channels for capturing knowledge) at project level. Respondents may therefore sense less support there.

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The second to fourth KMS success factors at project level are KMS provides *benefit to project*, *flexible structure* and *IT infrastructure,* whereas at organization level they are *IT infrastructure*, *multiple ways to capture knowledge* and *flexible structure*. It is quite surprising that the people infrastructure is not considered to be among the top four KMS success factors, even though personalization is a top priority as a means of knowledge flow. When adding the seven items into aggregated success, the score is 25.58 for projects and 25.55 for organizations. The difference is only 0.03. This again proves that success factors and success levels are very similar between the two enterprise levels.

Participants' comments on KM

The last question on the questionnaire invited respondents to comment on the implementation of knowledge management in the construction industry. Some respondents reflected that the lack of resources is the main difficulty in implementing KM. Some suggested that people always make same mistakes but never learn from one project to another. A project manager frankly admitted that knowledge management had not yet been started in his organization; the need was realized but the development had never been carried out. He emphasized that it is always "easy to know but hard to

work out"; a clear direction, decision and action strategy are always lacking. These opinions indicate that KM has not yet been systematically introduced to employees, and that the main barrier is the lack of resources deployed by organizations, i.e. money, time, etc. The comments given are usually positive towards knowledge management. However, even if employees realize its importance, if organizations do not take the initiative to implement KM, its effect will be limited. Another interesting piece of feedback, which coincides with the findings of Cameron and Quinn (1999), is that KM requires a 'champion' to drive the implementation successfully, which again implies that a leader or other form of support from senior management is critical.

Some practitioners suggested that the application of KM reflects an organization's culture. They considered that sufficient training and information should be provided to staff, the lack of training being cited as one reason why KM is not realized (Koenig 2001). One construction manager believed that KM is an effective and useful tool but is not widely used in the construction industry, especially among local construction firms. One of the reasons may be that Hong Kong's construction industry is traditional and conservative, lacking the necessary vision to drive the industry forward.

Theoretical and practical implications

Although there exists a large body of literature about knowledge management, knowledge flow and organizational culture, there is a dearth of information regarding knowledge management specifically in a project-based industry like construction. It is hoped that this research will contribute to this body of literature in knowledge and project management.

This study has great implications in relation to the concepts of organizational culture types, strategic approach for knowledge flow, and the success of KM systems at two different hierarchical levels, i.e. the project and organization levels. It appears that different organizational culture types may call for different knowledge management strategies. Identifying the need is an important step toward developing the theory, but much research is still needed in this area.

Theoretical study is needed to explore how codification and personalization are employed at both project and organization levels in contracting firms in the construction industry. This research found that they were employed as a hybrid and balanced approach and that they generally complement each other. There is a great need for research on knowledge flows within and across projects and how to make them successful, as such literature is lacking.

Critical areas of study include how to create, capture, transfer, share, store, retrieve and understand information and knowledge in projects. Researchers need to better understand how to get from tacit to explicit knowledge and how to allow for personal experience and expertise to be shared through project networks. This growing interdisciplinary research field provides a rich library of literature from which both knowledge management and project management could benefit.

Project-based organizations can learn from this study that knowledge flow and knowledge management success are greatly impacted by organizational culture types. In order to successfully transfer and retain knowledge within and across projects and organizations, senior management should recognize and plan for this need in order to

keep from losing valuable project and organizational knowledge. In addition, cultivating the right organizational culture to encourage knowledge sharing among project networks should be greatly encouraged.

It was interesting that the use of information and communication technology was not seen as the most critical factor by most of the survey respondents. With rapidly changing information technologies and the complex knowledge required for performing project work, the dynamic of the workforce is changing as well. Delong (2004: 16) pointed out that, "knowledge-intensive work today is much more interdisciplinary, often requiring the integration of expertise across a wide range of subjects". A wealth of tools and techniques are available for project organizations to leverage for knowledge management, and additional research should be done regarding the use of these tools throughout the life cycle of projects. Good knowledge management will surely boost the image of the construction industry with the better re-use of valuable knowledge, avoiding the repetition of mistakes/defects in the short term and promoting innovation in the long run.

Conclusions

This research investigated knowledge management at project and organization levels in Hong Kong's contracting firms. Three main areas were studied: organizational value, knowledge flow and KMS success factors. The organizational value was analyzed according to mean scores, rankings and the four cultural models. The four models of culture are the Hierarchy, Market, Clan and Adhocracy cultures. The popularity of the models and the composition of each model were analyzed. Clan culture is the most popular at project and organization level, thus this finding shows that the culture of

contractor firms depends on teamwork and networks/people. This emphasizes that the construction industry, besides being a project-based industry, is also a people-based one.

The investigation of knowledge flow presents the KM strategy applied in construction projects or organizations. The two main KM strategies, codification and personalization, were found to be employed in projects and organizations in a nearly 50-50 mix, which indicates that these two strategies are equally important for KM, with neither of them dominating. It was further found that face-to-face means like staff or group meetings were the most valued by industry practitioners, coinciding with previous research findings that information and communication technologies only act as enablers and do not play a dominant role.

Results from the study on KMS success indicators emphasize that support for KMS from the management level is crucial, and this may require a KM champion to drive its successful implementation. Respondents generally believed that KM is critical and beneficial, as stated by 64% at project and 74% at organization level. The data reveal that the application of KM echoes an organization's culture. It is in this respect that cultivating the right organizational culture is a prerequisite for successful KM implementation in contracting organizations. Unlike other knowledge-intensive industries, construction suffers from attitudes to completing a project according to various stakeholders' requirements; in this industry, learning and knowledge transfer seldom play a part and are not paid for as an effort in project works.

In conclusion, based on the data collected from respondents in the contracting sector of

the construction industry in Hong Kong through random sampling, the research identifies critical findings that senior management and many others should take into consideration before establishing a KMS or the implementation of a KM solution. The above areas have a significant effect on the likelihood of success and should not be ignored.

References

Bellaver, R.F. and Lusa, J.M. (eds.) (2002) *Knowledge Management Strategy and Technology*, London: Artech House.

Cameron, K.S. and Quinn, R.E. (1999) *Diagnosing and Changing Organizational Culture - Based on the Competing Values Framework*, Reading, MA: Addison-Wesley.

Carrillo, P., Robinson, H., Al-Ghassani, A. and Anumba, C. (2004) Knowledge management in UK construction: strategies, resources and barriers, *Project Management Journal*, 35(1), 46-56.

Chait, L.P. (2000) Creating a successful KM system. *IEEE Engineering Management Review*, 28(2), 92-95.

Cong, X.M. and Pandya, K.V. (2003) "Issues of Knowledge Management in the Public Sector", *Electronic Journal of Knowledge Management*, 1(2), 25-33, Academic Conferences Limited.

Davenport, T.H., DeLong, D.W. and Beers, M.C. (1998) Successful knowledge management projects, *Sloan Management Review*, 39(2), 43-57.

DeLong, D.W. (2004) *Lost Knowledge: Confronting the Threat of an Aging Workforce*, Oxford: Oxford University Press.

Fernie, S., Green, S.D., Weller, S.J. and Newcombe, R. (2003) Knowledge sharing: context, confusion and controversy, *International Journal of Project Management*, 21(3), 177-187.

Foray, D. and Gault, F. (2003) Measurement of Knowledge Management Practices, In *Measuring Knowledge Management in the Business Sector: First Step,* pp. 11-28, Canada: OECD/Minister of Industry.

Frappaolo, C. (2002) *Knowledge Management*, Oxford: Capstone.

Hansen, M.T., Nohria, N. and Tierney, T. (1999) What's Your Strategy for Managing Knowledge?, *Harvard Business Review*, 77(2), 106-115.

Hariharan, A. and Cellular, B. (2005) Implementing seven KM enablers at Bharti, *Knowledge Management Review*, 8(3), 8-9.

Hooijberg, R. and Petrock, F. (1993) On cultural change: using the competing values framework to help leaders execute a transformation strategy, *Human Resource Management*, 32(1), 29-50.

Kamara, J.M., Anumba, C.J. and Carrillo, P.M. (2005) Cross-Project Knowledge Management**,** In Anumba, C.J., Egbu, C.O. and Carrillo, P.M. (Eds.) *Knowledge Management in Construction*, pp. 103-120, Oxford: Blackwell.

Koenig, M. (2001) "Don't fall for that false dichotomy! Codification vs. personalization", *KMWorld Magazine*, 10(8), http://www.kmworld.com/Articles/Editorial/Feature/Don%E2%80%99t-fall-for-that-false-dichotomy!-Codification-vs.-personalization--9272.aspx

Koenig, M.E.D. (2001) Lessons from the study of scholarly communication for the new information era, *Scientometrics*, 51(3), 511-523.

Koenig, M.E.D. (2002) "Time saved - a misleading justification for KM", *KMWorld Magazine*, 11(5),

http://www.kmworld.com/Articles/Editorial/Feature/Time-saved—a-misleading-justification-for-KM--9347.aspx

Koenig, M.E.D. and Srikantaiah, T.K. (2004) *Knowledge Management Lessons Learned: What Works and What Doesn't*, Medford, NJ: published for the American Society for Information Science and Technology for Information Today, Inc.

Love, P.E.D., Fong, P.S.W. and Irani, Z. (eds.) (2005) *Management of Knowledge in Project Environments*, Oxford: Elsevier/Butterworth-Heinemann.

Marwick, A.D. (2001) Knowledge management technology, *IBM Systems Journal*, 40(4), 814-830.

O'Neill, R.M. and Quinn, R.E. (1993) Applications of the competing values framework, *Human Resource Management*, 32(1), 1-7.

Palmer, J. and Platt, S. (2005) *Business case for knowledge management in construction*, London: CIRIA.

Prusak, L. (1998) Where did knowledge management come from?, *IBM Systems Journal*, 40(4), 1002-1007.

Quinn, R.E. and Spreitzer, G.M. (1991) The psychometrics of the competing value culture instrument and an analysis of the impact of organizational culture on quality of life, *Research in Organizational Change and Development*, 5, 115-142.

Saint-Onge, H. (2002) *Human Structural and Customer Capital*, working paper, http://www.knowinc.com/saint-onge.

Shand, D. (1998) Harnessing knowledge management technologies in R&D, *Knowledge Management Review*, 3, 20-26.

Tijhuis, W. (2005) *Report on the Meeting held 15 June 2005, Helsinki, Finland*, http://www.cibworld.nl/website/newsletter/0503/TG23Report.html.

Yeung, A.K.O., Brockbank, J.W. and Ulrich, D.O. (1991) Organizational culture and

human resources practices: an empirical assessment, *Research in Organizational Change and Development*, 5, 59-81.

Value	Mean (Project)	S.D.	Rank	Mean (Organization)	S.D.	Rank
Getting the job done	4.38	.747	1	3.87	.894	2
Honest communication	4.15	.779	2	4.33	.662	1
Trust	3.97	.843	3	3.82	.823	4
Goal achievement	3.95	.793	4	3.87	1.005	2
Cohesive relationship	3.87	.767	5	3.82	.854	4
Analysis and control	3.87	.615	5	3.59	.966	9
Innovation	3.64	.584	7	3.77	.842	6
Respect for people	3.62	.815	8	3.62	.782	8
Trying new concepts	3.56	.680	9	3.64	.628	7
Outcome excellence	3.46	.854	10	3.26	1.208	11
Stability and continuity	3.33	1.060	11	3.54	.913	10

Table 1. Mean scores and rankings of organizational value in projects and organizations

Culture Type Construct	Mean (Project)	SD	1	2	3	4
Clan	3.93	.80	(.92)			
Adhocracy	3.58	.63	.72	(.94)		
Market	3.92	.80	.66	.70	(.87)	
Hierarchy	3.45	.84	.53	.48	.78	(.79)

Table 2. Mean scores, standard deviations, intercorrelations and Cronbach alpha reliabilities for the project level culture constructs

Culture Type Construct	Mean (Organization)	SD	1	2	3	4
Clan	3.89	.78	(.91)			
Adhocracy	3.72	.74	.71	(.90)		
Market	3.67	1.04	.61	.68	(.83)	
Hierarchy	3.45	.94	.42	.39	.65	(.74)

Table 3. Mean scores, standard deviations, intercorrelations and Cronbach alpha reliabilities for the organization level culture constructs

Culture Type Construct	Core Values
Clan	▪ Honest communication ▪ Respect for people ▪ Trust ▪ Cohesive relationships
Adhocracy	▪ Innovation ▪ Trying new concepts
Market	▪ Goal achievement ▪ Getting the job done ▪ Outcome excellence
Hierarchy	▪ Stability and continuity ▪ Analysis and control

Table 4. Classification of organizational values into four culture types

Codification	Personalization
Search engine / Information retrieval systems	Staff meetings / Group meetings
Internet / Intranet	Peer interaction
Document management	One-on-one conversation
Training / E-learning	Phone calls / Teleconferencing
Seminars / Presentations	Video conferencing
Workflow and tracking system	Directory of expertise
Post-project review	Working group / Community of practice
Electronic discussion groups	Mentoring / Tutoring

Table 5. Classification of knowledge flow into two main KM strategies: codification or personalization

Knowledge Flow	Mean (Project)	S.D.	Rank	Mean (Organization)	S.D.	Rank
Staff meetings / Group meetings	4.31	.655	1	4.46	.756	1
Document management	4.21	.570	2	3.59	1.019	6
Intranet / Internet	4.13	.864	3	3.82	.997	2
One-on-one conversation	3.82	.756	4	3.08	1.285	10
Phone calls / Teleconferencing	3.59	1.093	5	3.59	.910	6
Peer interaction	3.49	.885	6	3.33	1.132	9
Search engine / Information retrieval system	3.41	1.186	7	3.51	1.189	8
Training / E-learning	3.38	.907	8	3.62	.907	3
Seminars / Presentations	3.26	1.069	9	3.62	1.091	3
Working groups / Communities of practice	2.97	1.328	10	3.62	1.042	3
Mentoring / Tutoring	2.90	1.071	11	2.77	1.038	12
Workflow and tracking system	2.87	1.128	12	2.49	1.315	14
Post-project review	2.82	1.233	13	2.74	1.292	13
Directory of expertise	2.33	1.221	14	2.97	1.013	11
Videoconferencing	2.00	.946	15	2.31	1.217	15
Electronic discussion groups	1.95	1.234	16	2.26	1.186	16

Table 6. Mean score of knowledge flow

* **Shaded** denotes codification; **non-shaded** represents personalization

Organization	Mean (Project)	Rank	Mean (Organization)	Rank
Management supports KMS	3.97	1	3.82	1
KMS provides benefits	3.92	2	3.82	1
Flexible structure enables sharing of knowledge	3.72	3	3.59	5
Necessary IT infrastructure is in place	3.64	4	3.67	3
Necessary people are in place	3.56	5	3.44	7
Clear purpose that is aligned with organization's mission	3.56	5	3.54	6
Multiple ways to capture knowledge	3.21	7	3.67	3
Aggregated KMS success factor score	25.58		25.55	

Table 7. Ranking of KMS success indicators in projects and organizations

List of Figures