A Self-Assessment Tool for Knowledge Management Implementation in the Construction Industry

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Abstract
Knowledge management (KM) provides a structured process to establish the link between knowledge-based assets within an organisation and its desired business objectives. Although KM issues are becoming increasingly important to the construction industry, there is currently no measurement tool for assessing the implementation of KM programmes. This paper reports on the development of such a tool which can be used as both a means of self-assessment and also for benchmarking purposes. Important practices needed for successful KM implementation were identified from the literature and via a self-administered survey targeting large and medium construction organisations in Hong Kong. Survey findings demonstrate the potential of the proposed self-assessment tool to measure the individual's perception of the relative importance of KM antecedents and practices, also providing early insight of KM implementation by highlighting the negative gaps between what "is" and "should be" happening, thus identifying areas that need re-alignment of KM strategies and tactics. The paper also suggests this tool could be further developed to help organisations to formulate and modify their KM programmes according to their own specific internal business environment, and the nature of their projects.

Key words
Knowledge management, construction industry, self-assessment tool, benchmarking

1. Introduction

Knowledge management (KM) issues are becoming increasingly important to the construction industry due to its theoretical proposition in providing structured processes and technologies to establish links between the knowledge-based assets within an organisation and its desired objectives (Cavaleri, 2004). It is widely perceived that KM has the potential to facilitate the integration approaches being promoted within this highly fragmented and competitive industry (Chan et al, 2001; Price and Newson, 2003). Given KM is a relatively new concept for the construction industry and its implementation is at the early stage (Egbu et al, 2003; Ng, 2003), it is understandable that most construction organisations do not adopt a structured approach to the selection of KM technologies and techniques. Additionally, the adopted KM approaches are mainly 'reactive' in response to the organisations' business needs (Egbu et al, 2003). With KM issues becoming increasingly important, there is a need to develop a measurement tool that can be used to assess KM programme implementation, with the ultimate aim of helping systematic KM strategy formulation. The

study reported by this paper endeavours to shed some light on this issue through: 1) identifying important practices needed for a successful KM implementation, and 2) demonstrating the potential of a proposed self-assessment tool.

2. Knowledge Management Practices

KM is a process with the ultimate aim of leveraging organisations' intellectual capital to achieve organisational objectives (Cavaleri, 2004), and is primarily centred on the formalisation, storage, sharing and distribution, as well as co-ordination of existing knowledge assets throughout the organisation, and the building and exploiting of core competence that yield superior performance (Pemberton and Stonehouse, 2000). Darroch (2003) suggests KM activities can be classified into three (3) dimensions, i.e. responsiveness to knowledge within the business environment, knowledge acquisition and dissemination. *Responsiveness to knowledge* refers to the knowledge-related activities in responding to the various types of knowledge accessed by an organisation, e.g. knowledge related to the market and/or technology. *Knowledge acquisition* focuses on creating and extending organisational knowledge, and is driven by organisational intention, which is defined as an organisation's aspiration to its goals (Nonaka and Takeuchi, 2004). *Knowledge dissemination* is the prerequisite for effective and efficient implementation of the other knowledge activities (Gold et al, 2001). This activity also creates and maintains structures, systems, and processes for sharing knowledge across various organisational levels, and also for retaining knowledge within the organisation (McCann and Buckner, 2004).

3. Research Objectives and Methodology

The purpose of this study is to develop a self-assessment tool to facilitate KM implementation, self-assessment and bench-marking. This tool is designed as a vehicle for achieving continuous improvement of KM within construction organisations. It enables the managerial and professional practitioners within the industry to decide which KM practices are important to their organisations according to their own specific internal business environment and nature of projects, to assess the level of implementation of these practices, and accordingly to identify the areas needing re-alignment.

The descriptive approach used in developing a self-assessment tool for total quality management (TQM) implementation (Baidoun, 2003; Thiagarajan and Zairi, 1998) is adopted in this study, due to its suitability for assessing both the implementation and the understanding of certain management strategies within organisations. Thus, this study follows the research method pertaining to this approach, which involves the following steps: 1) developing measures for KM practices based on a literature review; 2) designing a questionnaire according to the measures; 3) undertaking questionnaire survey with a sample of construction organisations; 4) stratifying KM practices based on their perceived importance, and creating the desired level of implementation for benchmarking.

In this study the KM activity measurement scales empirically developed by Darroch (2003) are adopted to provide measures for KM practices. The findings of the exploratory studies on the knowledge-related activities in the context of the construction industry (Egbu et al, 2003; Kululanga et al, 2002) are also taken as reference to modify these measures pertaining to the situation of the construction industry. Based on the measures a questionnaire is designed to enable respondents to indicate both the level of importance of each practice in terms of its positive contribution to the business operation of the organisation, and the level of implementation of the practice. A 5-point ordinal scale usually used to measure variables with an order to their categories is applied in the survey. As illustrated in Table 1, the ordinal variables are scored by an integer scoring system ranging from 1 to 5.

Large and medium sized contractors in Hong Kong represented the study's theoretical population, because they provide a relatively better environment for KM comparing with small sized contractors, and are much more arduous in enabling KM practices, in comparison with other construction organisations (Ng, 2003). The sample was randomly drawn from Group C contractors (i.e. contractors qualified for public works of contract value exceeding HK$50 million), as appeared in the database of "Contractor List" in the Contractors' Guide published in 2003.

3. Data Analysis

The questionnaires, with a covering letter addressed to professional and managerial staff members explaining the objectives of the survey, were hand-delivered or distributed by facsimile or e-mail. A total of 43 useful responses were received by the due day, representing a 33.7% response rate. Questionnaire responses were processed using the Statistical Package for Social Sciences (SPSS 12.0) and Microsoft Excel spreadsheet. Analysis reveals that 70% of respondents have more than ten (10) years relevant construction work experience.

3.1 Categorization of KM Practices

The frequency analysis of the data measured by the 5-point ordinal scale shows very low frequency at the two (2) extreme ends of the scale spectrum, i.e. '1 = not important' and '5 = very important'; '1 = not implemented' and '5 = fully implemented'. Hence, a simpler 3-point ordinal scale and a corresponding integer scoring system ranging from 1 to 3 were applied to reveal the broader categories of opinions. For example, under the new measuring system, number 1 is assigned to categories of both '1 = not important', and '2 = of little importance' measured by 5-point scale to indicate the 'less important' items. Table 1 presents the creation of the 3-point ordinal scale adopted in the data analysis.

Table 1 Scale Conversion

Variables	Itemised scale and 1-5 integer scoring system used in the questionnaire survey	Scale conversion	Ordinal scale and 1-3 integer scoring system used in the data analysis
"Level of importance": The level of importance of KM practices in terms of their positive contribution to the business operation of the organisation	1 = not important	Convert to	1= less important
	2 = of little importance		
	3 = moderately important	Convert to	2 = moderately important
	4 = important	Convert to	3 = important
	5 = very important		
"Level of implementation": The level of implementation of the practices	1 = not implemented	Convert to	1= not implemented
	2 = plan to implement		
	3 = just being implemented	Convert to	2 = just being implemented
	4 = partially implemented	Convert to	3 = implemented
	5 = fully implemented		

3.2 Central Tendency and Range

Analysis of central tendency was undertaken to gauge respondents' typical opinions on the 'level of importance' of KM practices. Median and mode calculation for the ordinal data reveals that 50 of the 52 practices have both median and mode of three (3). This indicates three (3) is not only the typical value for

most (96%) of the practices, but also occurs with greatest frequency. Whilst analysis of spread is used to reveal how typical these typical values are (Weisberg, 1992). The simplest order-based measure of spread is the range of values, which is the difference between the largest and the smallest data values (Weisberg, 1992). The calculation shows that 48 of 52 practices have range values of two (2), which ranges between the maximum value of three (3) and minimum value of one (1), indicating dispersion of the responses around all three (3) categories. In summary, more than 90% of the practices have typical values indicating 'important'; while the opinions are spread over the three categories ('not important', 'moderately important' and 'important'). In view of this, further analysis is necessary to stratify the practices by identifying the extent of consensus in opinions.

3.3 Variation Ratio and Index of Diversity

Variation ratio (VR) is the proportion of responses that do not fall within the modal category, and is calculated by the formula: $VR = 1-$ Proportion of the modal cases (p_{mode}). As a useful measure of spread showing how descriptive of the data the mode is (Weisberg, 1992), VR is considered as an objective measure that illustrates the extent of consensus (Baidoun, 2003; Thiagarajan and Zairi, 1998). If all cases fell into the same category, the VR would be zero, whilst a VR value of 0.5 or less means majority consensus. VR is based only on the proportion of cases within the modal category, which is considered a disadvantage of this measure (Weisberg, 1992). The other measure of spread – Index of Diversity (ID) – overcomes this disadvantage by taking the full distribution of cases into account (Weisberg, 1992). In mathematical terms, $ID = 1- (p_1^2+p_2^2+ ...+p_k^2)$, where p_k is the proportion of responses in category k, and k is the number of categories. According to the formula, when the proportion of cases that fell into the same categories approaches 100%, the ID value will be close to zero, which indicates a high extent of consensus. An ID value of 0.5 represents equal clustering around two (2) large categories. A near-uniform distribution in the three (3) categories will give a maximum value close to 0.667 (3-1/3), which in this case will mean a high level of disagreement.

50 KM practices seem to have VR valued less than 0.50, and 38 practices' ID value are less than 0.50, showing that respondents reach majority consensus on the 'level of importance' of most of the practices. Table 2 presents 18 practices of a high level of consensus, with the proportion of modal cases of more than 75%; these are ordered according to their level of consensus as measured by both their ID and VR values. Both median and mode value of these 18 practices is three (3). To sum up, these short-listed KM practices are perceived by more than 75% of the respondents as 'important' in terms of positive contribution to the business operation of their organisations. These practices are stratified into three (3) tiers based on the extent of consensus measured by VR. To illustrate, practices in Tier One are perceived by more than 85% of respondents as 'important' with corresponding VR values of less than 0.15; those in Tier Two have more than 80% consensus, and a VR of less than 0.20; similarly, a consensus of 75% and VR of 0.25 are evident for Tier Three.

3.4 Benchmarking

The benchmarking method applied in this study is based on the hypothesis that the higher the level of consensus reached by respondents in perceiving a practice as 'important', the higher the level of its implementation. Taking the 18 short-listed important KM practices as an example, more than 85% of respondents perceive the practices in Tier One as important. If resources are available, and suitable corporate culture is in place, these practices should be able to be implemented, and be perceived as 'implemented' by at least 85% respondents. Accordingly, the level of implementation of the practices is scored by the proportion of cases that fell into the category of 'implemented', which is compared against

three (3) levels of target implementation ranges set as > 85%, >80% and >75%. The benchmarking results reported in Table 2 reveal that, at this early stage of KM application, the level of implementation of all 18 important KM practices fell short of their benchmark range. Nevertheless, five (5) traditional practices of the construction sector in respect of managing financial contribution (KA2.4), cost (KA2.2), clients' requirements (KR1.1, KR1.4, KR1.2) were perceived as 'implemented' by more than 55% respondents. Comparatively larger negative gaps are identified on the practices of encouraging internal communication (KD3.1, KD2.1), with scores smaller than 40%; and on those related to market knowledge (KR3.1, KD1.1, KR4.3, KR4.4), with scores much less than or barely over 40%. In particular, only 30% or less of respondents view the practices responding to knowledge about competitors and technological development has implemented. These show that internal communication and marketing related KM practices is the area needing improvement.

Table 2 Results of Stratifying and Benchmarking KM Practices

Item Code	Description of the KM Practices	Stratification				Benchmarking	
		ID	VI	p_{mode1}	Tier	Score2 (%)	Target range3 (%)
KA2.4	Regularly analyse the financial contribution of our projects or services.	0.21	0.12	85%	1	60	> 85
KA2.2	Know exactly how much each of our projects costs us.	0.25	0.14	85%	1	57	> 85
KR1.5	Respond quickly to any concerns raised by employees.	0.25	0.14	85%	1	47	> 85
KR1.1	Act promptly if clients are unsatisfied with the quality of our service.	0.28	0.16	80%	2	67	> 80
KA3.6	Often acquire new business ideas through working with others.	0.29	0.16	80%	2	47	> 80
KR1.4	Respond quickly to any complaint raised by clients.	0.29	0.17	80%	2	70	> 80
KA3.1	Changes in market needs drive our business direction.	0.30	0.19	80%	2	51	> 80
KA3.2	Quickly detect changes in market needs (e.g. preference of clients).	0.30	0.19	80%	2	47	> 80
KD3.1	Encourage open communication within our company.	0.31	0.19	80%	2	30	> 80
KR3.1	Keep up to date with technological developments that could affect our business.	0.32	0.19	80%	2	28	> 80
KA3.4	Actively and timely collect information about our competitors.	0.34	0.21	75%	3	47	> 75
KA1.2	Encourage employees to attend training seminars and conferences.	0.35	0.21	75%	3	51	> 75
KA1.5	Attract employees qualified in complementary professional areas.	0.35	0.21	75%	3	47	> 75
KD2.1	Set up workspaces to make it easy for people to talk to each other.	0.35	0.21	75%	3	36	> 75
KR1.2	Respond positively to changes in clients' product or service needs.	0.37	0.23	75%	3	56	> 75
KD1.1	Managerial & technical staff frequently discuss market needs/trends.	0.37	0.23	75%	3	42	> 75
KR4.3	Respond quickly if a major competitor offers similar service to our clients at very competitive price.	0.38	0.23	75%	3	42	> 75
KR4.4	Respond quickly if a major competitor launches a new market campaign targeting our clients.	0.38	0.23	75%	3	30	> 75

Note:
1. p_{mode} = Proportion of mode
2. Score = Proportion of cases fell into the category of being 'implemented'

3.	Target range = target extent of implementation

4. Concluding Remarks

This paper has reported on a study that sought to identify the important practices of KM application within the construction industry, and to develop a self-assessment tool for benchmarking KM practices in order to achieve continuous improvement of KM within construction organisations. The analysis identified 18 of 52 KM practices as important based on large consensus majority (perceived by more than 75% of the respondents). The analysis shows that KM practices related to project financial contribution, cost control, and clients' needs top the list of important practices. Benchmarking also revealed the narrowest gaps between the perceived level of implementation and the target range on these practices. On the other hand, the study also presents that during the early stages of KM application, the areas that need improvement are those related to internal communication and marketing issues, particularly the practices responding to competitors' moves and technological development within the market. In the meantime, it is necessary to point out that given this study is relatively small in scope, focusing on a small sample of Hong Kong contractors, and is based merely on management perspectives, its findings may not generalise to contractors in other countries and regions. Further research will be necessary to test the suggested benchmarking approach, and to establish the generalisation of the findings of this study.

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