IJMS 13 (SPECIAL ISSUE), 65-82 (2006)

IDENTIFICATION AND CLASSIFICATION OF THE IMPLEMENTATION OF KNOWLEDGE MANAGEMENT FACTORS IN MALAYSIAN CONSTRUCTION CONSULTING COMPANIES: AN EXPLORATORY STUDY

AMRAN RASLI
Faculty of Management and Human Resource
Universiti Teknologi Malaysia

ADE ASMI
Department of Civil Engineering
Universitas Indonesia

M. Z. ABD. MAJID
Faculty of Civil Engineering
Universiti Teknologi Malaysia

ABSTRACT

Ever since knowledge has become an important corporate asset, Knowledge Management (KM) has become a critical concern for construction consulting companies to create and sustain their competitive advantage. Therefore, an exploratory research was conducted to identify and classify the methods of implementing key KM faktors in Malaysian construction consulting companies using a three-round Delphi technique study to identify and rank critical components of Knowledge Management (KM) principles for construction consulting companies. Subsequently, faktor analysis was used to generate variables for the KM faktors and the results are compared with the original groupings identified from the first level of the research. Finally, the classification of the implementation of KM faktors are analysed and further grouped into two categories i.e., exploitive and explorative. A one sample t-test was conducted to confirm the difference between the two types of KM and the overall the KM program.

Keywords: *Knowledge management; Delphi study and factor analysis.*

ABSTRAK

Pengurusan Ilmu (PI) telah mendapat perhatian yang khusus dalam firma perundingan pembinaan sejak ianya menyokong kemampuan berdaya saing bagi firma perunding pembinaan. Dengan itu, penyelidikan ini dijalankan untuk mengenal pasti dan mengklasifikasikan penerapan faktor-faktor PI dalam firma perunding pembinaan di Malaysia. Dalam penyelidikan ini, kaedah 'Three-Round Delphi' digunakan untuk mengenal pasti dan mengklasifikasikan komponen-komponen PI sebagai asas bagi firma perunding pembinaan. Selepas itu, analisis dengan menggunakan kaedah analisa faktor digunakan untuk menghasilkan pemboleh ubah factor-faktor PI. Hasilnya akan dibandingkan dengan klasifikasi yang asal yang diperoleh daripada penyelidikan sebelumnya. Akhirnya, analisa terhadap mengenal pasti dan mengklasifikasikan penerapan faktor-faktor PI lebih lanjut dibahagikan kepada dua kategori iaitu 'exploitive' dan 'explorative'. Pada akhir penyelidikan, pengujian perbezaan antara dua jenis PI (exploitive dan explorative). Ujian one sample t-test dijalankan untuk mengenal pasti perbezaan antara dua jenis kategori PI dan keseluruhan program PI.

Kata kunci: *Pengurusan Ilmu; kaedah Delphi dan Analisa factor.*

INTRODUCTION

In this knowledge era, Knowledge Management (KM) is recognised as a core business consideration to promote intellectual asset in order to gain competitive advantage. If properly managed, KM can be converted into strategic assets of any knowledge-intensive organisation, especially the construction consulting companies in the networked economy. It has been argued that new skills, mind-sets, models and commitment throughout the organisation, as well as new ways of interpreting the concept of effective management are needed to improve construction project performance (Rasli, Abd. Majid & Asmi, 2004). Both practitioners and researchers have addressed the important issue of applying KM to support project performance (Egbu & Botterill, 2002; Mitev & Venters, 2004; Rezgui, 2001). Many construction industries employ KM and ITI capability programs in various ways to manage and share their knowledge, particularly in storing and transferring explicit forms of knowledge and capturing and storing tacit knowledge in repositories.

KNOWLEDGE MANAGEMENT

KM is concerned with the entire process of creating, organising, locating, distributing and sharing knowledge. Researchers found that

there are two major approaches while managing organisation knowledge to KM, i.e., "exploitive" and "explorative" (Hansen, Nohria & Tierrney, 1999; Jordan & Jones, 1997; March, 1991; Sarvary, 1999; Skyrme, 1999; Zack, 1999). The exploitive approach focuses on reusing existing knowledge, while the explorative approach centres on the creation of new knowledge. Hansen *et al.*, (1999) found that emphasising a wrong strategy or trying to pursue both KM approaches at the same time could quickly undermine a business. They suggested that effective management needed to focus on one of the KM approaches and use the other in a supporting role. The research framework for KM in this study is presented in Figure 1.

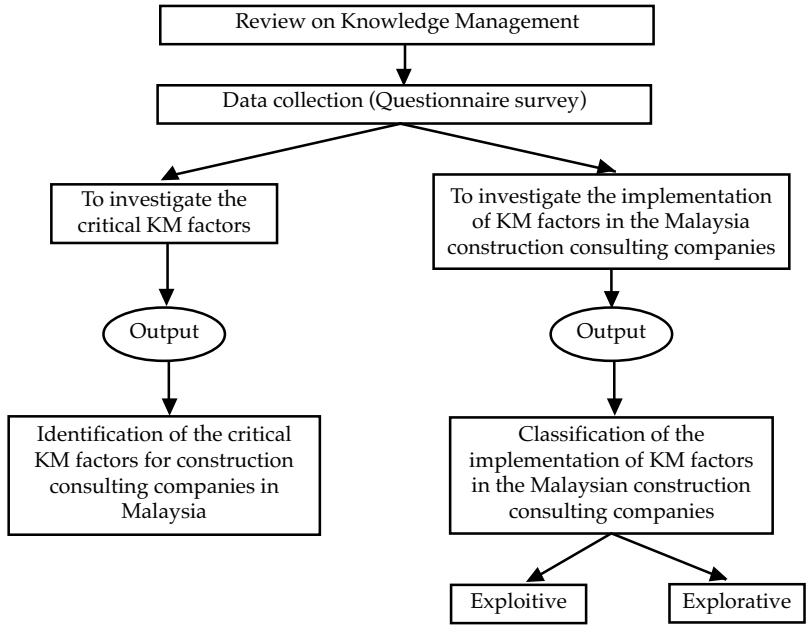

Figure 1
KM research framework

METHODS OF THE RESEARCH

As shown in Figure 1, this exploratory research on KM consists of two parts. The first part is to investigate the critical KM factors, while the second part is to determine the implementation of the KM factors in the construction consulting companies. The first part commenced with a Delphi assessment to identify the KM factors which are relevant to

the implementation of the KM principles. The second part of the study used a questionnaire with a five-point Likert scale from "Very Effective" to "Very Ineffective" that was based on the Delphi assessment output. Components generated from the factor analysis were compared with the original groupings identified from the first part of the study.

Jordan and Jones (1997) describe the two dominant KM types within an organisation. Even though they did not term the KM types, the two KM types represent the exploitative approach and the explorative approach. In this study, to assess the knowledge type in the second part of the study, the overall mean score of the items of the KM questionnaire is used. Respondents who scored less than the mean total score were classified as "exploitive" while those whose scores were equal or greater than the total mean score were classified as "explorative" (Kim, 2001).

The First Level of the Research

The first level of the research commenced with a three-round Delphi assessment. In the first round of the Delphi assessment, identification of the thirteen factors that would be critical components of the KM principles was adopted from the Construction Industry Institute (CII), United States of America (2004). These thirteen are shown in Table 1 and are considered as pertinent to the implementation of the KM principles in Malaysia. For this research, the list of KM components from the thirteen factors is presented in Table 1.

Table 1
List of KM Factors and Components

No	KM factor	Component
1	Front-end Planning	Pre-project planning Early estimating Modularization/Pre-assembly
2	Design	Design standard Design effectiveness Cost effective engineering Computer-aided
3	Procurement	Supplier relationships Material management
4	Construction	Cost and schedule control Risk management
5	Start-up and Operation	Managing worker compensation Design for maintainability Planning for start-up

(*continued Table 1*)

No	KM factor	Component
6	People	Management of education and training Productivity measurement Multi-skilling
7	Organisation	Project teams Leader selection Partnering Organisation work culture
8	Project Processes	Quality management Implementation of products Benchmarking
9	Project Controls	Change management Work packaging
10	Contracts	Project delivery and contract strategies Use of project incentive
11	Safety, Health and Environment	Zero-accident techniques Design for safety
12	Information Management	Automatic identification Electronic commerce Fully integrated and automated project process Wireless technology Automation and robotics
13	Globalisation Issues	International standards Globalisation industry

Source: Construction Industry Institute (2004)

In the second round, seventeen experts comprising academicians who are knowledgeable on the subject matter were invited to become the panel of experts for this stage. The experts were asked to "agree" or "disagree" to each of the KM factor component. Table 2 shows the results of the second round.

Table 2
Results of the Second Round Delphi Assessment

KM factor	Agree	Disagree	No Answer
Front-end Planning			
Pre-project planning	17	-	-
Early estimating	16	1	-
Modularization/Pre-assembly	14	3	-

(*continued Table 2*)

KM factor	Agree	Disagree	No Answer
Design			
Design standard	13	4	-
Design effectiveness	15	2	-
Cost-effective engineering	16	1	-
Computer-aided	16	1	-
Procurement			
Supplier relationships	13	4	-
Material management	17	-	-
Construction			
Cost and schedule control	17	-	-
Risk management	14	3	-
Managing worker compensation	14	3	-
Start-up and Operation			
Design for maintainability	15	2	-
Planning for start-up	16	1	-
People			
Management of education and training	13	4	-
Productivity measurement	13	4	-
Multiskilling	11	6	-
Organisation			
Project teams	16	1	-
Leader selection	14	2	1
Partnering	13	3	1
Organization work culture	16	1	-
Project Processes			
Quality management	17	-	-
Implementation of products	15	1	1
Benchmarking	12	5	-
Project Controls			
Change management	10	7	-
Work packaging	12	4	1
Contracts			
Project delivery and contract strategies	16	1	-
Use of project incentive	14	3	-
Safety, Health and Environment			
Zero-accident techniques	12	5	-
Design for safety	15	2	-
Automatic identification	11	5	1
Electronic commerce	10	6	1
Fully integrated and automated project process	10	6	1
Wireless technology	9	7	-
Automation and robotics	7	9*	1
Globalization Issues			
International standards	10	6	1
Globalization industry	10	6	1

As shown in Table 2, the automation and the robotics components of the information management factor were recommended to be excluded, as nine experts chose to disagree on the importance of these two items, while only seven experts considered these items to be included and one expert gave no answer.

Due to attrition leading towards the third round, only fifteen academicians participated in the ranking of each factor based on their importance whereby "1" was rated as the most important and "13" was rated as the least important. Following the completion of the third round of the study, Kendall's coefficients of concordance (W) were calculated to assess the level of consensus among the participants. Kendall's W is a measure designed to determine the level of agreement for a set of ranked scores (Siegel, 1956). A significant W indicates that the participants are applying essentially the same standard in judging the importance of the factors and they are in consensus which is reflected by a high W and a low p-value (less than 0.05), so that the null hypothesis that "there is no consistency in response from the experts" can be rejected. The results for the third round are presented in Table 3.

Table 3
Results of the Third Round Delphi Assessment

Knowledge Management Factor	Mean Rank	Rank
Front-End Planning	3.73	1
Organisation	4.00	2
Design	4.80	3
Construction	4.93	4
Contracts	5.53	5
Startup and Operation	6.53	6
Procurement	6.93	7
People	7.07	8
Project Processes	7.20	9
Project Controls	8.33	10
Safety Health and Environment	9.40	11
Information Management and Technology System	10.27	12
Globalisation Issues	12.27	13
Kendall's W =0.424, p-value = 0.000		

As shown in Table 3, the third round of the Delphi assessment produced mean and group for all the factors. The output of the third round was found to be statistically significant (p-value < 0.05) and consistent. The order of ranked importance for these factors for the components of KM principles is as shown in Table 3. These thirteen factors and its

components are considered as important inputs to the development of a questionnaire which was used in the second level of research.

The Second Level of the Research

After completing the first level of the research, a questionnaire was developed taking into consideration all of the 13 factors identified. For each factor, a few items were identified and converted into questions after the pilot test. Finally, 52 items with a five-point Likert scale were selected and their distribution is as shown in Table 4.

Table 4
Number of Items According to Factors

Knowledge Management Factor	Number of Items
Front-end Planning	3
Design	4
Procurement	7
Construction	5
Start up and Operation	2
People	3
Organisation	4
Project Processes	3
Project Controls	4
Contracts	2
Safety, Health and Environment	2
Information Management and Technology System	4
Globalisation Issues	3
Total KM questionnaire items	47
Demographic information	5
Total	52

RESULTS AND DISCUSSION FOR THE SECOND LEVEL RESEARCH

Eightyeight practitioners from construction consulting companies were randomly selected to form the sampling frame. As shown in Table 5, the high value of 0.847 for the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and the low p-value of 0.00 in Bartlett's test for sphericity indicate that the analysis is significant for subsequent factor analysis. The factor analysis using Varimax with the Kaiser Normalisation method, was able to generate nine factors as shown in Table 6. These

nine factors were compared with the original groupings identified from the first level of the research (refer to Table 1). Further to this, in order to ensure that the data was statistically reliable and valid, the internal consistency method was employed using the reliability coefficient known as Cronbach alpha. Based on Table 6, the Cronbach alpha values for the components ranged from 0.707 to 0.900 and implied that the data was very statistically significant (Nunally, 1978).

Table 5
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		847
Bartlett's Test of Sphericity	Approx. Chi-Square	3256.991
	df	1081
	Sig.	.000

Table 6
KM Factors, Its Components and Reliability Coefficients

No	KM Factor	Component	Coefficient Reliability
1	Project Control and Construction	a. Use of modularization and pre-assembly as a tool at project level. b. Implementation of risk management at the project level. c. Management of workers' compensation based on regional standard. d. Availability of design for maintainability to measure project performances. e. Management of planning for start up to ease collaboration work of projects or teams that are physically separated (i.e., different work sites). f. Availability of appropriate tools to measure productivity measurement. g. Implementation of systems for change management. h. Resources are sufficient to implement change management (e.g. time, computers & people). i. There is a written process for work packaging implementation within the project.	0.900

(*continued Table 6)*

No	KM Factor	Component	Coefficient Reliability
2	Operation Management	a. Implementation of cost-effective engineering for every aspect in project design. b. Implementation of material management at project level. c. Comprehensive material management training program. d. Regular updating of database of good work practices for risk management, lessons learned and listing of experts. e. Availability of formal and informal training to keep employees' skills current. f. Sufficiency of resources to ensure multiskilling of employees at the project level.	0.860
3	Front-end Planning	a. Implementation of pre-project planning at the corporate and project level. b. Implementation of early estimating in project planning and risk management. c. Implementation of design effectiveness at the project level. d. Control of cost and schedule based on the master plan. e. Appropriate actions taken based on the cost and schedule control for every project. f. Usage of project incentive is implemented at the project level.	0.865
4	Organisation	a. Identification of barriers for implementation of project team. b. Implementation of appropriate strategies for leader selection for every project. c. Implementation of comprehensive partnership training program. d. Management of the organisational work structure at the project level. e. Implementation of quality management at the project level. f. Identification of barriers to the implementation of products and services based on planning and design.	0.898
5	Information Management and Technology System	a. Availability of written process for project delivery and contract strategies within the project. b. Utilisation of electronic commerce to increase number of markets (e.g., website, e-mail). c. Management of fully-integrated and automated project using information technology (i.e., database, filing system, sharing data, etc). d. Utilisation of wireless technology for project processes. Wireless technology is implemented for project processes.	0.809

(*continued Table 6)*

No	KM Factor	Component	Coefficient Reliability
6	Design	a. Availability of design standard for every project. b. Availability of computer to design every project. c. Implementation of international standards to improve the competitive advantage. d. Ability to capture employees' knowledge from other sources (i.e., other business enterprises, industrial associations, technical literature, public research institutions including universities and government laboratories). e. Ability to protect from loss of knowledge due to workers' departures.	0.812
7	Safety, Health and Environment	a. Implementation of zero accident techniques at the project level. b. Implementation of design for safety for every project. c. Automatic identification of barriers/problems for project processes (design, control, crash program, etc.) using information technology (software application: Primavera, Microsoft project, ETABS, SAP2000, etc).	0.846
8	Customer-centric	a. Management of supplier relationship. b. Sharing with and transferring knowledge to clients, customers and suppliers. c. Ability to adapt products and services to client requirements. d. Utilisation of appropriate strategies and experiences to determine benchmark. e. Measurement of cost and benefits of work packaging.	0.802
9	Material Management	a. Availability of specific documentation to support the implementation of material management (e.g. file documents, database, etc.). b. Measurement of material management cost and benefit. c. Resources are sufficient to implement material management (e.g. time, computer and people).	0.707

Subsequently, to enable the KM factors to be ranked in terms of priority, mean and group ranks for all the factors were calculated whereby each raw score was converted to a transformed score ranging from 0 to 100 using Terrell's (2000) transformation techniques as follows:

Transformed Score = [(actual raw score – lowest possible raw score)/ possible raw score range] x 100

Table 7
Mean and Group Rank for KM Factors

KM Factor	N		Mean	Rank
	Valid	Missing		
Front-end Planning	88	0	69.3	1
Design	88	0	66.0	2
Material Management	88	0	65.5	3
Customer-centric	88	0	64.8	4
Safety, Health and Environment	88	0	63.3	5
Operation Management	88	0	62.4	6
Organisation	88	0	61.8	7
Project Controls and Construction	88	0	59.1	8
Information Management and Technology System	88	0	57.1	9

The list of ranked importance for the KM factors is shown in Table 7. Based on the results from the factor analysis, these nine factors are compared with the original ranking identified from the results in the third round of Delphi assessment (refer to Table 3). The comparison for the KM factors' ranking is shown in Table 8.

Table 8
The Ranking Comparison for KM Factors

No	KM Factor	Ranking Based on Questionnaire (Practitioner)
1	Front-end Planning	Front End Planning
2	Organisation	Design
3	Design	Material Management
4	Constraction	Customer-centric
5	Contract	Safety, Health and Enveronment
6	Startup and Operation	Operation Management
7	Procurement	Organisation
8	People	Project Control and Construction
9	Project Process	Information Management and Technology System
10	Project Controls	
11	Safety, Health and Enveronment	
12	Information Management and Technology System	
13	Globalization Issues	

As shown in Table 8, there are significant changes in ranking for the KM factors. In the first study, the identification of the KM factors is based on the list from CII which originates from USA. However, in the second study, the Malaysian construction consultants tended to use nine KM factors as the tools in the construction process and operation. It can be argued that cultural and behavioral differences can influence the mechanism process and operation in the construction industry. According to Geert Hofstede (1991), there is no such thing as a universal management method or management theory across the globe. Even the word management has different origins and meanings in countries throughout the world. Management is not a phenomenon that can be isolated from the other processes taking place in the society. In this case, understanding the KM factors in Malaysia that this research carried out should make construction industry aware that Malaysian construction consulting companies may need to focus on these nine KM factors.

CLASSIFICATION OF KM

As shown in Table 9, the overall mean of the 47 KM attributes is 3.52. The respondents whose scores are less than the overall mean score are classified as "exploitive" and the respondents whose scores are equal or greater than the overall mean score are classified as "explorative".

Table 9
Descriptive Statistic

No	KM component	N	Mean
1	Implementation of pre-project planning at the corporate and project level.	88	3.92
2	Implementation of early estimating in project planning and risk management.	88	3.87
3	Use of modularisation and pre-assembly as tools at project level.	88	3.30
4	Availability of design standard for every project.	88	3.99
5	Implementation of design effectiveness at the project level.	88	3.92
6	Implementation of cost-effective engineering for every aspect in project design.	88	3.77
7	Availability of computer to design every project.	88	4.09
8	Management of supplier relationship.	88	3.70
9	Sharing with and transferring knowledge to clients, customers and suppliers.	88	3.73
10	Implementation of material-management at project level.	88	3.59
11	Comprehensive material management training program.	88	3.17
12	Resources are sufficient to implement material management (e.g. time, computer and people).	88	3.47
13	Availability of specific documentation to support the implementation of material management (e.g. file documents, database, etc.)	88	3.73
14	Measurement of material-management cost and benefits.	88	3.67
15	Control of cost and schedule on the master plan.	88	3.75

(*continued Table 9*)

No	KM component	N	Mean
16	Appropriate action taken based on the cost and schedule control for every project.	88	3.75
17	Implementation of risk management at the project level.	88	3.36
18	Regular updating of database of good work practices for risk management, lessons learned and listing of experts.	88	3.42
19	Management of workers' compensation based on regional standard.	88	3.31
20	Availability of design for mantainbility to measure project performances.	88	3.39
21	Management of planning for start-up to ease collaboration work of projects or teams that are physically separated (i.e., different work sites).	88	3.38
22	Availability of formal and informal training to keep employees' skill current.	88	3.47
23	Availability of appropriate tools to measure productivity measurement.	88	3.23
24	Sufficiency of resources to ensure multiskilling of employees at the project level.	88	3.56
25	Identification of barriers for implementation of project eam.	88	3.50
26	Implementation of approprite strategies for leader selection for every project.	88	3.56
27	Implementation of comprehensive partnership training program.	88	3.06
28	Management of the organisational work structure at the project level.	88	3.60
29	Implementationof quality management at the project level.	88	3.58
30	Identication of barriers to the implementation of products and services based on planning and design.	88	3.55
31	Ability to adapt products and services to client requirements.	88	3.65
32	Utilisation of approprite strategies and experiences to determine benchmark.	88	3.47
33	Implementation of systems for change management.	88	3.40
34	Resources are sufficient to implement change management (e.g. time, computer, and people).	88	3.59
35	Measurement of cost and benefits of work packaging.	88	3.42
36	There is a written process for work-packaging implementation within the project.	88	3.33
37	Availability of written process for project delivery and contract strategies within the project.	88	3.55
38	Project incentive is implemented at the project level.	88	3.41
39	Implementation of zero accident techniques at the project level.	88	3.57
40	Implementation of design for safety for every project.	88	3.66
41	Automatic idebtification of barriers/problems for project processes (design, control, crash program, etc.) using information technology (software application: Primavera, Microsoft project, ETABS, SPA2000, ETC).	88	3.36
42	Utilisation of electronic commerce to increase number of markets (e.g., website, E-mail, etc).	88	3.13
43	Management of fully-integrated and automated project using information technology (i.e., database, filing system, sharing data, etc).	88	3.45
44	Utilisation of wireless technology for project processes. Wireless technology is implemented for project processes.	88	3.01
45	Implementation of international standards to improve the competitive advantage.	88	3.39
46	Ability to capture employees' knowledge from other sources (i.e., other business enterprises, industrial associations, technical literature, public research institutions including universities and government laboratories).	88	3.36
47	Ability to protect from loss of knowledge due to worker's departures.	88	3.36
Overall Mean			3.52

Upon further analysis, Table 10 shows the respondents' mean and the KM type for each respondent. A total of 42 respondents were classified as "Exploitive" and 46 respondents were classified as "Explorative".

Table 10
Respondent's Mean and KM Type

Respondent	Mean	KM Type	Respondent	Mean	KM Type	Respondent	Mean	KM Type
1	3.51	Exploitive	31	3.91	Explorative	61	3.96	Explorative
2	3.55	Explorative	32	3.81	Explorative	62	4.85	Explorative
3	3.04	Exploitive	33	3.57	Explorative	63	3.19	Exploitive
4	3.57	Explorative	34	3.96	Explorative	64	4.19	Explorative
5	3.68	Explorative	35	3.91	Explorative	65	4.11	Explorative
6	3.77	Explorative	36	2.91	Exploitive	66	3.43	Exploitive
7	3.02	Exploitive	37	3.60	Explorative	67	2.85	Exploitive
8	3.28	Exploitive	38	2.11	Exploitive	68	3.26	Exploitive
9	3.96	Explorative	39	3.43	Exploitive	69	4.21	Explorative
10	3.04	Exploitive	40	3.38	Exploitive	70	4.32	Explorative
11	3.38	Exploitive	41	3.94	Explorative	71	4.34	Explorative
12	2.66	Exploitive	42	3.85	Explorative	72	3.38	Exploitive
13	3.17	Exploitive	43	4.32	Explorative	73	4.21	Explorative
14	2.79	Exploitive	44	3.74	Explorative	74	3.45	Exploitive
15	3.40	Exploitive	45	3.81	Explorative	75	2.55	Exploitive
16	3.34	Exploitive	46	4.23	Explorative	76	3.26	Exploitive
17	4.21	Explorative	47	4.00	Explorative	77	3.57	Explorative
18	4.15	Explorative	48	3.60	Explorative	78	3.57	Explorative
19	3.11	Exploitive	49	3.98	Explorative	79	3.62	Explorative
20	2.96	Exploitive	50	4.28	Explorative	80	3.60	Explorative
21	3.09	Exploitive	51	3.49	Exploitive	81	3.13	Exploitive
22	3.09	Exploitive	52	2.26	Exploitive	82	3.60	Explorative
23	2.81	Exploitive	53	2.74	Exploitive	83	3.72	Explorative
24	3.21	Exploitive	54	4.26	Explorative	84	3.17	Exploitive
25	3.60	Explorative	55	3.87	Explorative	85	4.23	Explorative
26	3.49	Exploitive	56	4.34	Explorative	86	3.28	Exploitive
27	2.96	Exploitive	57	4.38	Explorative	87	3.72	Explorative
28	2.87	Exploitive	58	2.62	Exploitive	88	3.40	Exploitive
29	2.79	Exploitive	59	4.47	Explorative			
30	3.74	Explorative	60	1.64	Exploitive			

TEST BETWEEN OVERALL KM PROGRAM AND KM TYPES

A one sample t-test was used to determine whether there was difference between the overall the KM program and the KM types (i.e., Exploitive and Explorative) based on the null hypothesis that there is no difference between the KM types. The one-sample t-test results are presented in Table 11. Based on the mean differences, it is apparent that KM Exploitive has a mean below the overall mean of 3.52 due to a mean difference of -0.47441. KM explorative has a higher mean than the overall mean due to a mean difference of 0.43421. What is more

important is that both the p-values of KM exploitive and KM explorative are 0.000 implying there are significant differences between the KM exploitive and the overall mean as well as KM explorative and the overall mean. Thus, the null hypothesis that there is no difference between the KM types (i.e., Exploitive and Explorative) and the KM overall program is rejected at the 0.05 level of significance.

Table 11
One-sample T-test

KM type	Test Value = 3.52					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Exploitive	-7.735	41	.000	-.47441	-.5983	-.3505
Explorative	9.472	45	.000	.43421	.3419	.5265

CONCLUSIONS

As construction consulting companies move into the knowledge economy, KM has become an important medium for business survival. This two-level research was able to illustrate the differences in the perceptions of academicians and practitioners in the identification and ranking of critical components of the KM principles as well as identify significant differences between the two types of KM (exploitive and explorative) and the overall KM program. What is apparent is that front-end planning is perceived as very important by both the groups of academicians and practitioners. Another interesting finding is the low rating for information management and technology system by both the academicians and the practitioners. Additionally, globalisation issues, were rated the lowest by the academicians and was conspicuously missing in terms of ratings by the practitioners. Finally, careful interpretation is needed to decide whether exploitive or explorative KM is better. A company can take both approaches simultaneously but successful companies do not use them to an equal degree, i.e., they tend to employ one dominant KM approach based on the situation they face. As Ken Blanchard (2000) sums it up nicely, different strokes for different folks . . .

REFERENCES

Construction Industry Institute (2004). Knowledge areas. Retrieved March 31, 2005 from: http://construction-institute.org/services/catalog/ks-def.cfm.

Edvinsson, L. (2000). Some perspectives on intangibles and intellectual capital 2000. *Journal of Intellectual Capital, 1,* (1), 12-16.

Egbu, C. O. & Botterill, K. (2002). Information technology for knowledge management: Their usage and effectiveness. *ITcon, 7*, 125.

Hansen, M. T., Nohria, N. & Tierrney, T. (1999). What's your strategy for managing knowledge?. *Harvard Busines Review,* March-April, 106-116.

Hofstede, G. (1991). *Cultures and Organisations: Software of the Mind.* London: McGraw-Hill.

Jordan, & Jones, P. (1997). *Assessing your company's knowledge management style.* Long Range Planning, *30*,.(3), 392-398.

Kim, S. (2001). An empirical study of the relationship between knowledge management and information technology infrastructure capability in the management consulting industry (Doctoral dissertation, University of Nebraska, Lincoln Nebraska, 2001).

Mitev, N. N. & Venters, W. (2004). Knowledge management practice for sustainable construction: Political tensions in engineering ICT knowledge tools in the private and public sectors. *Workshop on information, knowledge and management: re-assessing the role of ICTs in public and private organisations.* Bologna, 3rd –5th March, Italy.

Nunally, J. C. (1978). *Psychometric* (2nd ed.). New York: McGraw-Hill.

Rasli, A., Abd. Majid, M. Z. & Asmi, A. (2004). Factors that influence the implementation of knowledge management and information technology infrastructures to support project performance. *Proceedings of UNITEN International Business Management Conference,* Pahang, 6th – 7th December, Malaysia.

Rezgui, Y. (2001). Review of information and the state of the art of knowledge management practices in the construction industry. *The Knowledge Engineering Review, 16,* (3), 241-254.

Sarvary, M. (1999). Knowledge management and competition in the consulting industry. *California Management Review, 41,*(2) 95 – 107.

Skyrme, D.U. (1999). *Knowledge networking: Creating the collaborative enterprise.* Massachusetts, Butterworth and Hainemann.

Siegel, S.(1956). *Nonparametric statistics for the behavioral sciences.* New York: McGraw-Hill Book Company.

The Blanchard Companies (2000). Situational Leadership ® II: An approach to situational leadership ® training from the Ken

Blanchard Companies. Retrieved March 30, 2005 from *http://www.blanchardlearning.com/sl_ii.htm.*
Terrell, J. (2000). Scoring the HNQOL instrument. Retrieved March 31, 2005, from http://www.med.umich.edu/oto/scoring.htm
Zack, M. H. (1999). Managing codified knowledge. *Sloan Management Review,* 45 - 58.