The Application of Knowledge Management in Enhancing the Performance of Malaysian Universities

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Abstract: The government's aspirations of making Malaysia a leading international educational centre in the Asian Region has put a strong pressure on local universities to improve the quality of education they offer. One of the major steps that has been identified by the government to achieve this goal is to enhance the performance of local universities through the application and implementation of an excellent knowledge management (KM) system. An effective KM system requires every academician to practice appropriate management of knowledge in his or her teaching and learning activities, which includes, generating, acquiring, storing and disseminating knowledge effectively to users of knowledge, especially students. A study by the Centre for Academic Development (CADe) of Universiti Putra Malaysia in 2005 found that the level of knowledge management practices in Malaysian universities was merely moderate; and to meet the national aspirations, KM practices need to be developed further from various aspects of structure, facilities and culture among the academic players. The objective of this study is to evaluate the level of practice among the academicians and to determine factors contributing to the effectiveness of knowledge management practices at individual, faculty and university level. Eight local universities, both public and private participated in the study. Factor Analysis was used to determine factors affecting the practices of knowledge management while Multiple Regression Analysis was used to analyse and determine the importance of various variables that will add value, thus improve the performance of Malaysian universities. The results indicate that info-structure support; infrastructure capacity; info-culture; and knowledge acquisition, generation, storage and dissemination; are important factors in shaping the KM initiatives. Info-structure is found to be the most significant variable. This is consistent with other studies, which confirm that people and cultural issues are the most difficult problems to resolve, but tend to produce the greatest benefits.

Keywords: Organisational knowledge, knowledge management practices, infrastructure, info-structure, info-culture.

1. Introduction

Knowledge has become a precious property and Knowledge Management (KM) has been widely practiced by many organisations as one of the most promising ways of achieving success in the information age (Malone, 2002). Realising the importance of knowledge as an intellectual asset, the Malaysian Ministry of Higher Education has identified KM as one of the prerequisites to turn Malaysia into a centre of excellence for higher education and to achieve its mission to develop and put in place a higher education environment that encourages the growth of premier knowledge centres and individuals who are competent, innovated with high moral values in order to meet national and international needs. There are many good practices that support the important role of the university as an institution for critical thinking, where knowledge is developed and disseminated widely throughout the organisation as a source of value creation. However, a culture of creativity must be nurtured and knowledge must be shared through teaching and learning (TandL) methodologies where the goal of a university is to provide an environment in which university staffs and students develop skills, understanding, and common values to university education. The main concern of a university is to develop quality graduates, who should possess analytical and problem solving skills and interpersonal understanding as part of their learning achievements, thereby, contributing to the nation's goal of building a knowledge-based (k-based) society.

Organisational knowledge has been stored in numerous ways, including in human minds, documents, notes, manuals, and reports; and it has also been shared among individuals through several communication channels such as conferences, seminars, training programs, and forums. These have been applied for many years and although they are still being used, the emergence of new computer-based communication technologies has, not only complemented the traditional storage and delivery methods, but has also improved the efficiency and effectiveness of the overall knowledge delivery mechanisms. Based on a survey by the Centre for Academic Development (CADe), most Malaysian universities have invested heavily in information and communication technologies (ICT); however, the new technologies have not enabled the free flow and sharing of knowledge among members of the respective organisations, including the academic staffs and students (CADe, 2005). Universities are the ideal place for knowledge creation (Cronin, 2000) and

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the best place for practicing knowledge management system. Unfortunately, as knowledge service providers, many Malaysian universities were not utilising knowledge to the fullest to improve their performance and this is because the data, information and knowledge available in the universities were not properly managed such that they could be efficiently shared and reused to generate new knowledge.

According to Marwick (2001), efficient and effective knowledge management typically requires an appropriate combination of organisational, social, and managerial initiatives along with the deployment of appropriate technology. Thus, the main objective of this paper is to evaluate the application of knowledge management towards enhancing the performance of Malaysian universities in delivering their core businesses. The specific objectives are as follows:

- To identify the level of knowledge management practices (i.e. acquisition, generation, storage, and dissemination) adopted by various universities,
- To determine the various level of socio-technical components (infrastructure, info-structure, and info-culture) at each university, and
- To determine factors affecting the application of knowledge management practices in improving the performance of Malaysian universities.

2. Knowledge management

2.1 Knowledge management practices

Knowledge Management practices consist of the generation, acquisition, storage and dissemination of knowledge. Knowledge generation involves the creation of new knowledge in the organisation. This comprises of activities associated with the entry of new knowledge into the system, and includes knowledge development, discovery and capture (Newman and Conrad, 1999). Individuals obtain knowledge by grafting on new sources including other individuals or other organisations (Huber, 1991). Knowledge acquisition, the second variable, is the process of acquiring and capturing information about knowledge in the explicit forms. There are some difficulties involved regarding knowledge acquisition as most of the knowledge resides in the heads of experts and this implicit knowledge is not easily documented into its explicit form. These experts usually have vast amounts of knowledge useful to the organisation as a whole. Knowledge storage, the third variable in the knowledge practice domain, includes all activities that preserve knowledge and allow it to remain in the system once acquired. Also, it includes those activities that maintain the viability of knowledge within the system (Newman and Conrad, 1999). The fourth variable in the knowledge practice dimension is knowledge dissemination. It refers to activities associated with the flow of knowledge from one party to another (Newman and Conrad, 1999).

2.2 Knowledge management in higher learning institutions

By its nature, university environment is suitable for the application of knowledge management principles and methods (Mikulecky and Mikulecka, 1999). The reasons include the followings: (i) universities usually possess modern information infrastructure, (ii) knowledge sharing with others is natural for lecturers, and (iii) the desire of students is to acquire knowledge from accessible sources as fast as possible. Universities have to live up to expectation of the global society. They must adopt and adapt good practices that emanate from ICT and globalisation. Traditionally, the main functions of universities are to create and disseminate knowledge and these are done through their research and teaching activities as well as their outreach programs. Metaxiotis and Psarras, (2003) outline three major missions of universities:

- Teaching – to prepare students to become successful lifelong learners,
- Research – to expand the frontiers of human knowledge and to promote creativity, and
- Service – to serve on communities and in leadership positions within the university and in professional organisations, and to participate in outreach activities that serve the local, national, and international communities.

With rapid changing economic environment, the role of universities or higher education institutions as knowledge providers has been scrutinised and challenged by the various stakeholders, including the public. To answer this challenge, knowledge management ideas and principles have been proposed to be employed by universities for the purpose of doing fundamental and applied research, teaching suitable curricular program, utilisation of knowledge for management decision support to improve internal document management and exploitation to increase the level of knowledge dissemination, and utilisation of knowledge for a qualitative change in the educational process. The introduction of KM methods and tools would enable the universities to share their knowledge, to improve the level of teaching and research

collaboration, and to improve the working relationships among the staff and students (Mikulecky and Mikulecka, 1999) and other stakeholders.

To successfully manage KM initiatives in universities, the management need to consciously and explicitly manage the processes associated with the creation of their knowledge assets, and to recognise the value of their intellectual capital to their continuing role in society (Rowley, 2000). However, focussing on the technical side alone, such as increasing the level of computer literacy and providing adequate information and communication infrastructure will not ensure the success of the KM initiatives. The management needs to also overcome the more difficult problems related to social and cultural issues in organisational knowledge management.

2.3 The social-technical perspectives of knowledge management

The socio-technical perspective of knowledge management adopts a holistic approach, which highlights the interweaving of social and technical factors in the way people work. According to Pan and Scarbrough, (1999), an important function of the socio-technical analysis is "to understand the organisation of social relationships in which knowledge, especially in its tacit form is embedded." They suggest that knowledge needs to be seen as intrinsic in social interaction, rather than as a resource disseminated from one person to another. They believed that organisational knowledge is socially constructed and shaped by the reciprocal interaction between technological and organisational elements. Further, Pan and Scarborough claimed that the implementation of socio-technical elements on knowledge management could unfold the interaction between technological, informational and organisational components. The socio-technical components, as shown in Figure 1, comprised of three major layers of knowledge management system (Pan and Scarbrough, 1998). The three layers are:

- Infrastructure – comprises of technical components such as hardware and software that enables the physical and communicational contact between people using network,
- Info-structure – incorporates the formal rules governing exchanges and sense making between people; and
- Info-culture – the background knowledge embedded in social relations and work group process.

These three layers or factors which influence the level of success or failure of any knowledge management initiative may eventually determine the university's overall performance in fulfilling its functions as knowledge providers.

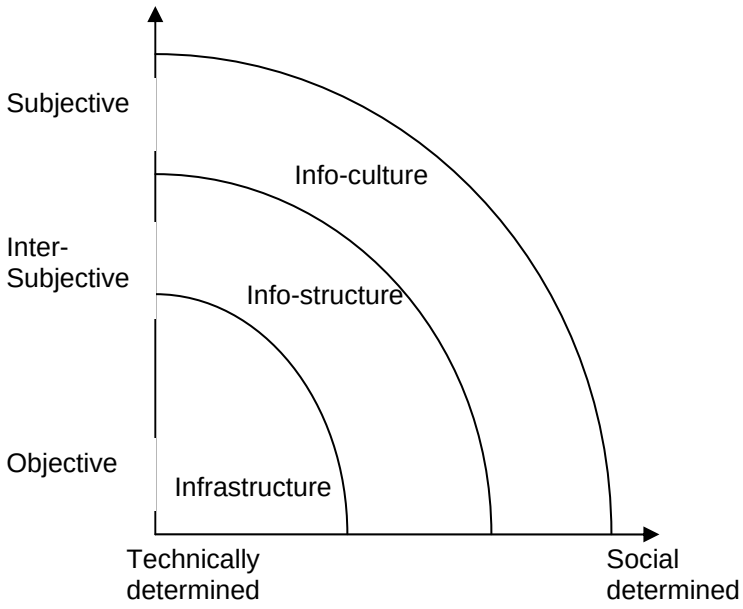

Figure 1: Socio-technical perspective of knowledge management
Source: Pan and Scarbrough, 1998

Pan and Scarborough defined knowledge system and organisational knowledge repository as part of the infrastructure in their case study. Knowledge Management System (KMS) refers to the information systems adopted and designed which efficiently leverage the collective experience and knowledge of employees to support information processing needs as well as enabling and facilitating sense making activities of knowledge workers (Wickramasinghe, 2002).

3. Conceptual framework

Nonaka and Takeuchi (1995) defined knowledge as a product that results from the interaction of explicit and tacit knowledge. The process of creating knowledge results in a twirling of knowledge acquisition. It starts with people sharing their internal tacit knowledge by socialising with others or by capturing it in digital and analogue form. Then, other people internalise the shared knowledge, and that process creates new knowledge. These people, with the newly created knowledge, then share this knowledge with others, and the process begins again. Figure 2 illustrates the theoretical framework of knowledge management in universities. Since the core business of a university is on teaching and learning (TandL), the framework is used as a conceptual model showing relationships among several factors that have been identified as important to the university's functions. The framework illustrates the relationships among the variables (dependent and independent variables) that are deemed to be integral to the dynamics of the situation being studied. From this, testable hypotheses were developed to examine the validity of the theory formulated through appropriate statistical analysis, i.e. Multiple Regression Analysis. In this study, the dependent variable is Value Added Change in Teaching and Learning. This variable reflects the improvement in the area of teaching and learning of a university, which is of primary interest of this paper, whereas the variance is attempted to be explained by the two categories of independent variables, namely: personal knowledge management practices (KMP) and socio-technical components of knowledge management.

The closely related attributes for personal KM practice (components) are knowledge generation, knowledge acquisition, knowledge storage, and knowledge dissemination; where each component is represented by several items. Exploratory research was undertaken to identify the level of KM practices at individual level and to identify the programs that the universities have in place to manage the flow of knowledge. This leads to the hypothesis: the greater the perceived knowledge management practices at individual level (academics), the more likely that there will be improvement in teaching and learning.

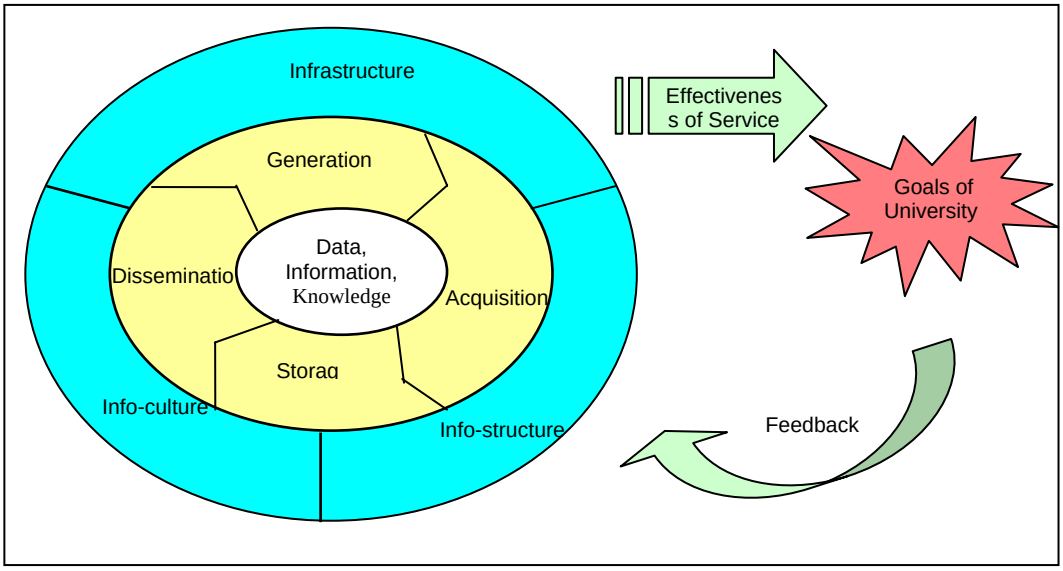

Figure 2: Conceptual framework on knowledge management model for university implementation

Socio-technical factors (the three major layers of KM systems) are the components that will influence the KM process at university's level. Pan and Scarbrough (1999) have considered knowledge enterprising culture, knowledge entrepreneurship and the role of top management, and communities of practice, as part of the info-culture components. Infrastructure consists of technical components such as hardware and software that enable communication between people via network. According to Arthur Andersen (1996), 80% of cultural changes influence the KM process. This includes change management program, behaviour of the leaders, sharing of information, and reward and punishment system. The remaining 20% is on the right tool and technology, which enables the practices and application of knowledge management in the organisation.

This lead to the following hypothesis: the higher the socio-technical components supported by the university's management, the more likely that there will be improvement in teaching and learning.

4. Methodology

The study was carried out using an investigative questionnaire to review the scope of KM practices; the level of KM systems used; and the status of info-structure, infrastructure and info-culture available at each university. The questionnaire was based on key areas of interest in KM including:

- KM systems in universities,
- KM practices at individual and organisational level,
- Infrastructure, info-structure and info-culture development, and
- The added value that KM brings into the organisation to improve existing performance.

4.1 Sampling design

The study adopted a three-stage sampling strategy, as shown in Figure 3, to ensure adequate representatives from both the hard science and social science disciplines. All the major public and private universities in Peninsular Malaysia which offer both hard and social science academic programmes and have conducted significant amount of research and consultancy in their respective areas, were selected. In the first stage, seven public universities and three private universities in Peninsular Malaysia were selected and invited to participate in the study. In the second stage, from each university, four faculties were chosen, two from hard science and two representing the social science discipline. In the final stage, a simple random sampling technique was adopted to select the academic staff, who served as respondents to the study.

1st Stage	**Public University** - Universiti Islam Antarabangsa Malaysia (UIAM) - Universiti Kebangsaan Malaysia (UKM) - Universiti Malaya (UM) - Universiti Putra Malaysia (UPM) - Universiti Sains Malaysia (USM) - Universiti Teknologi Malaysia (UTM) - Universiti Utara Malaysia (UUM) **Private University** - Universiti Multimedia (MMU) - Universiti Teknologi Petronas (UTP) - Universiti Tenaga Nasional (UNITEN)
2nd Stage	Faculty (Representing Hard and Social Sciences)
3rd Stage	**Unit of Analysis** Academicians (Random)

Figure 3: Three-stage sampling strategy

4.2 Questionnaire design

The questionnaire, which was used to record the responses of each respondent, contained mainly close-ended questions using a five-point Likert and ratio scales. It was divided into four sections:

- The first section consisted of questions regarding respondent's profile, including demographic variables such as gender, age, years of working experience; highest academic level achieved, as well as his/her professional and administrative positions at the faculty and in the university.
- The second section included questions about the respondent's personal knowledge practices in generating, acquiring, storing and disseminating knowledge.
- The third section was designed to get information regarding respondents' perception towards KM socio-technical perspectives at the university level.
- The fourth section was designed to get information regarding the respondents' perception on the added value that KM brings into the organisation to improve existing performance.

5. Analysis of data

The starting point in data analysis was to convert the primary or raw data, recorded in the questionnaire, into numbers and to arrange them into a tabular form. Several statistical techniques were utilised to analyse the data and they are as follows:

Descriptive Analysis: Descriptive analysis is the transformation of raw data into a form that will make them easy to understand and interpret. The analysis usually includes a statistical summary that succinctly characterise the observations and variables. In this study the analysis was used to describe the demographic profile of the respondents in terms of distributions and percentages. Also, it was used to determine the respondent's KM practices and his/her perception of KM socio-technical components.

Factor Analysis: Factor analysis can be used to analyse interrelationships among a large number of variables and to explain all these variables in terms of their common underlying characteristics or dimensions, which are called factors. Three basic steps were undertaken to conduct factor analysis: computing the correlation matrix of all variables, extracting the factors, and rotating the factors to create a more understandable factor structure for interpretation (George and Mallery, 2001).

Multiple Regressions Analysis (MRA): The MRA is a statistical technique for finding the best relationship between a dependent variable and selected independent variables. In this study, the regression model was specified as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_nX_n$$

where,

Z = value added change in the performance,
a = constant value,
X = variables to be specified from results of Factor Analysis, and
b_1, b_2, $b_3 \ldots b_n$ = coefficients.

6. Findings and discussion

The data were analysed using SPSS software version 14, and the findings of the study are discussed below.

6.1 Sample size

Out of the 10 public and private universities, only eight (seven public and one private) agreed to participate in the study (Table 1). A total of 2430 questionnaires were distributed. The usable response rate for this survey, after completion of the follow-up mailings in the central, northern, and southern region of Peninsular Malaysia, was 28.19% of the population, where the population comprises of all academic staff in the selected faculties.

Table 1: Number of respondents

UNIVERSITY	NO. OF RESPONDENTS	% of TOTAL RESPONSE
Universiti Islam Antarabangsa Malaysia (UIAM)	60	8.8
Universiti Kebangsaan Malaysia (UKM)	93	13.6
Universiti Malaya (UM)	85	12.4
Universiti Multimedia (MMU)	101	14.7
Universiti Putra Malaysia (UPM)	119	17.4
Universiti Sains Malaysia (USM)	41	6.0
Universiti Utara Malaysia (UUM)	94	13.7
Universiti Teknologi Malaysia (UTM)	92	13.4
Total	685	100

6.2 Reliability test

Reliability tests were carried out before doing further analysis. Table 2 portrays values of Cronbach's Alpha for the personal knowledge management practices and perceptions of the respondents. The results suggest that the instrument used in the study was highly reliable as the reliability statistics of the KM components category fell well above 0.7 (Hair et al 1998).

Table 2: Reliability tests

Knowledge Management Components (KMP+KMS)	Items in Scale	Cronbach's Alpha
Knowledge management practices	22	0.864
Info-culture	9	0.881
Infrastructure	10	0.888
Info-structure	7	0.919

6.3 Descriptive analysis

6.3.1 Knowledge management practices

Four components were grouped as knowledge management practices, namely; knowledge generation, acquisition, storage and dissemination. The score of responses from respondents were calculated based on relevant items in the questionnaire. The items were measured in a 5-point Likert scale, ranging from 1 = Not at all, 2 = Rarely, 3 = Seldom, 4 = Often, and 5 = Always.

The respondents often developed new ideas or generated new knowledge through discussions with peers and experts, observation, by experimentation, etc. with mean ratings of 3.32 to 4.18. The findings are consistent with other literatures on knowledge management process that members of an organisation develop knowledge through learning, problem solving, innovation, creativity, and importation from outside sources and generation of new knowledge through tacit and explicit knowledge (Nonaka and Takeuchi, 1991). Six items were used to measure personal knowledge acquisition practice. From the responses, most of the respondents generally acquired information through research, the Internet and Intranet, seminars and workshops, periodicals, bulletins, and notices, where the mean ratings ranged from 3.32 to 4.32. Four items were used to measure the practice of storing knowledge by academicians and administrators. The responses on the four items of knowledge storage showed the mean distribution ranged from 3.21 to 4.26. A majority of the respondents always keep their information in hard and soft copy. Also, they declared that they often have a proper filing system and update their information regularly. Overall, the respondents often contribute or disseminate their knowledge through publications, seminar, conferences, workshops, dialogues, forums, informal discussions, teaching and training, and consultancy. The means ratings ranged from 3.30 to 4.31.

Table 3 shows the mean scores for the practices of knowledge management by university. From the table, it can be seen that Multimedia University (private university) has the lowest mean scores as compared to the seven public universities for the practices of knowledge generation, acquisition and dissemination. By using "industry" average as a benchmark for the level of KM practice, Universiti Kebangsaan Malaysia, Universiti Malaya, Universiti Putra Malaysia, and Universiti Teknologi Malaysia were found to have above average scores.

Table 3: Level of involvement in knowledge management practice (individual) by universities

KM PRACTICES	UIAM	UKM	UM	MMU	UPM	USM	UTM	UUM	Average
Generation of knowledge	3.89	3.90	3.95	3.83	3.95	3.97	4.03	3.87	3.92
Acquisition of knowledge	3.88	3.91	3.72	3.60	3.89	3.94	3.82	3.88	3.83
Storing of knowledge	4.05	3.98	4.04	3.94	4.00	3.99	4.07	3.85	3.99
Dissemination of knowledge	3.66	3.87	3.91	3.55	3.90	3.97	3.91	3.64	3.80

Legend**:** 1 – 1.49 = Not at all, 1.50 – 2.49 = Rarely, 2.50 – 3.49 = Moderately, 3.50 – 4.49 = Regularly, 4.50 – 5.00 = Always

6.3.2 Socio-technical components

Info-culture: Organisational culture can be thought of as a relatively rigid tacit infrastructure of ideas that shape not only a person's thinking but also his/her behaviour and perception of his/her business environment. It effectively establishes a set of guidelines by which members of an organisation work and how those organisations are structured. Most of the respondents agreed that the faculty encouraged staff members to combine ideas from cross-functional and cross-discipline teams, experimentation with new ideas and encouraged staff members to collaborate with others including students to generate new knowledge, with mean ratings of 3.53 to 3.82. Also, the respondents agreed that the faculty top management did show support through encouraging teamwork among staff members and encouraging open communication.

Infrastructure: Infrastructure consists of technical components such as hardware and software as well as system and organisational knowledge repository. A well designed of knowledge management system (KMS) should consider four core features to allow the system to bring expected output to the organisation (Meso, 2000). The four core features are:

- Infrastructure, Content and Portal
- Collaboration and Learning
- Social Capital and Expertise
- Communities, Business Intelligence and Integration

Some of these elements were included in the research questionnaire and the respondents rated the elements with mean ratings from 3.49 to 3.94. This shows the perception of the respondents on knowledge management initiatives were supported by top management. However, most of the respondents "moderately agreed" with some of the elements such as the faculty have an adequate IT maintenance service, sufficient data security features on IT system, and adequate technical support.

Info-structure: In this study, info-structure is regarded as one of the important perspective and initiative from organisation's top management to instil knowledge management culture and change management program. The elements included in this study were as follows: perception on comprehensive ICT infrastructure policy; top management shows support through actively demonstrating their commitment to knowledge-based activities; ensuring that information system meets the organisational needs; the ICT policy facilitates knowledge sharing among staffs, etc. These elements have mean ratings ranging from 3.24 to 3.61. Generally, the respondents perceived that info-structure is supported by top management and knowledge management is instilled through the support of info-culture.

From Table 4, Universiti Teknologi Malaysia had the lowest score for each of socio-technical components. These indicators, which act as a predictor to the current level of knowledge management application, could be used by the university to take appropriate actions to increase the level of KM application. Implementing KM process is not an easy job. An organisation's effectiveness is restricted by its present social and cognitive expertise. Even though there are "knowledge engineering methods and tools" that assist in finding knowledge assets in an organisation, these tools do not provide necessarily help the processes of managing knowledge. One can view the socio-technical component as an integral part of the organisational development, which emphasises the interrelatedness of functioning the social and technological subsystems of the organisation, and the relation of the organisation as a whole to the environment in which it operates. Therefore, the socio-technical components are very important in determining the success of KM application in the organisation.

Table 4: Mean scores for socio-technical components of each university

Socio-technical components	Uiam	Ukm	Um	Mmu	Upm	Usm	Utm	Uum	Average
Info-culture	3.91	3.92	3.73	3.76	3.91	3.83	3.60	3.85	3.81
Infrastructure	3.58	3.60	3.58	3.63	3.65	3.31	3.31	3.57	3.53
Info-structure	3.47	3.52	3.39	3.49	3.61	3.32	3.19	3.53	3.44

Legend**:** 1.00 – 1.49 = Strongly Disagree, 1.50 – 2.49 = Disagree, 2.50 – 3.49 = Moderately Agree, 3.50 – 4.49 = Agree, 4.50 – 5.00 = Strongly Agree

6.4 Factor analysis

The measure of the KMO sampling adequacy is 0.927 (92.7%) indicating that factor analysis is appropriate for these data. Table 5 also shows result of the Barlett's test of sphericity. The test shows that it is highly significant as it is less than 0.05 (p=0.000); therefore factor analysis is suitable for the study.

Table 5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin of Sampling Adequacy	0.927
Barlett's Test of Sphericity	16383.424
Significant	0.000

The total cumulative variance explained by the factor analysis, as shown in Table 6, is 67.573%. From the rotated component matrix, using Varimax with Kaiser Normalisation, the analysis extracted nine factors having eigen values of greater than one. These nine factors were identified as important determinants contributing to the successful implementation of knowledge management initiatives in Malaysian universities so as to subsequently enhance their performances. The success of the KM implementation was represented by the dependent variable Value Added Change.

Info-structure support (IS): One of the critical success factors in determining the success of KM implementation was info-structure. This factor consisted of eight sub-variables and has a total variance of 31.792%. To enable employees to continuously learn and grow, the resources and facilities for self-development as well as training must be made available to them by top management. The top management needs to bring about and sustain a knowledge-sharing environment and must demonstrate commitment via sponsorship of knowledge management and motivate knowledge sharing behaviour.

Infrastructure Capacity (INFRA): Infrastructure capacity consisted of seven sub-variables, namely; sufficient data security features, sufficient computer hardware, adequate IT maintenance service, good access to the Internet, Intranet and both, sufficient software data for analysis and reports, a comprehensive ICT infrastructure policy, and adequate technical support (system analyst, programmer, etc). This factor has a total variance of 9.325%.

Table 6 Factors affecting successful implementation of km initiatives in malaysian universities

Dimension (Factor) [Sub-Variables]	% of Variance Explained [Eigenvalues]
1. Info-structure Support **(IS)**	**31.792** [12.717]
2. Infrastructure **(INFRA)**	**9.325** [3.730]
3. Knowledge Management System **(KMS)**	**5.654** [2.262]
4. Info-culture **(IC)**	**4.050** [1.620]
5. Knowledge Acquisition **(KA)**	**3.680** [1.472]
6. Knowledge Storage **(KS)**	**3.643** [1.457]
7. Knowledge Dissemination **(KD)**	**3.336** [1.334]
8. Knowledge Generation **(KG)**	**3.140** [1.256]
9. Digital Communication **(DC)**	**2.954** [1.181]
Total of variance explained	**67.573**

Knowledge Management System (KMS): The implementation of KM initiatives depends substantially on its database and system, where it provides a means to store information, a system to update and manage the flow of knowledge, and to provide accessibility to databases where information useful for teaching and

learning, research and development, and administration are kept. There were seven sub-variables with a total variance of 5.654%.

Info-culture (IC):The fourth factor was info-culture, which consisted of four items; namely, combine idea from cross-functional and cross discipline teams; experimentation with new ideas; collaboration; and acquire knowledge and information from staff members. The factor has a total variance of 4.050%. Knowledge management can be easily implemented if the organisation's corporate culture of knowledge sharing and change management program is put in place.

Knowledge Acquisition (KA): The practices of acquiring knowledge consisted four sub-variables namely conferences, dialogues, and forums; publications; seminar and workshop; and research. The factor has total variance of 3.680%. The analysis identifies that academicians were actively acquiring knowledge from conferences, dialogues, forums, seminar and workshop they attended, and through their research effort.

Knowledge Storage (KS):The practice of storing knowledge, with a total variance of 3.643%, consisted of four sub-variables i.e. have a filing system; update information regularly; keep information in hard copy and keep information in soft copy. The analysis identified this practice as another important factor in KM. With proper storage system, the information can be easily and efficiently transmitted to relevant users.

Knowledge Dissemination (KD): The next factor was disseminating knowledge and it consisted of three sub-variables, namely, contribution of knowledge through informal discussion, teaching and training, and consultancy and supervisory services. The factor has a total variance of 3.336%. The result indicates that the major channel of knowledge dissemination by the academic staff was through informal discussions.

Knowledge Generation (KG): Generating knowledge consisted of two sub-variables, experimentation and observation. These two factors play an important role in generating knowledge among the academician. This factor has a total variance of 3.140%.

Digital Communication (DC): Information and knowledge can also be obtained through digital communication via online chats, forums, dialogues, and conference. This has been found to be an important contributing factor to the successful implementation of knowledge management program. The factor has a total variance of 2.954%.

6.5 Multiple regression analysis

The purpose of using Multiple Regressions Analysis was to determine important factors which influence the value added change in the performance of teaching and learning through the application of knowledge management systems in Malaysian universities. The independent variables used in the regression analysis were derived from Factor Analysis. Hence, the MRA was run using nine independent variables as listed in Table 6. About 59.9% (R^2= 0.599) of the variance in the improvement in teaching and learning was explained by nine independent variables. Table 7 reports result of the analysis.

Table 7: MRA summary results: factors affecting value added change in the performance of teaching and learning

Variables	B	T	Sig
(Constant)	3.665	165.578	0.000
Info-structure (IS)	0.295	13.339	0.000
Infrastructure (INFRA)	0.136	6.127	0.000
Knowledge Management System (KMS)	0.213	9.598	0.000
Info-culture (IC)	0.155	7.009	0.000
K-Acquisition (KA)	0.039	1.739	0.082
K-Storage (KS)	0.050	2.243	0.025
K-Dissemination (KD)	0.018	0.811	0.418
K-Generation (KG)	0.004	0.167	0.867
Digital Communication (DC)	0.079	3.568	0.000
R Square	0.599		
F Sig	42.021 0.000		

From the regression output, info-structure, infrastructure, knowledge management system, info-culture, digital communication and the practice of storing knowledge were found to be highly significant. They had a

strong positive impact on adding value to university performance through the application of knowledge management. The practices of knowledge acquisition, generation and dissemination, however, were found not be significant. Apparently, these three practices were the core functions of every individual academician; hence, these practices were not perceived as sources of additional value added. Even though these practices were perceived as not being significant, they did contribute positively to the success of teaching and learning. Regression analysis was also conducted for each university and Table 8 summarises the results. In general, the improvement in university's teaching and learning performance was highly dependent on the three socio-technical components of knowledge management as well as the availability of a proper knowledge management system. Policies and strategic management have a key role to play in ensuring the participation of people or universities' community in knowledge management program, by constant communication throughout the organisation. The result proves that the role of the university's top management to sustain a strategic commitment is vital in ensuring successful KM initiatives via the introduction of info-culture programmes especially at the initial stages of KM implementation.

Table 7: Factors affecting the performance of university

University	IS	INFRA	KMS	IC	KA	KS	KD	KG	DC
UIAM	√	√	√	X	X	X	X	X	X
UKM	√	√	√	√	X	X	X	X	X
UM	√	√	√	√	X	X	X	X	√
MMU	√	√	√	X	X	X	X	X	X
UPM	√	X	√	√	X	X	X	X	X
USM	√	√	X	X	√	X	X	X	X
UTM	X	X	√	√	X	X	X	X	X
UUM	√	√	X	X	X	√	X	X	X

Legend**:** √ = significant, X = not significant

7. Conclusion

Knowledge is the most important asset to a university. The ability to adeptly manage the diverse types of knowledge used by both academics and non-academics, in particular decision makers, is crucial for the sustainable improvement in the performance of the university as a whole. A variety of computer-based techniques for managing knowledge has been developed and will continue to be developed to supplement innate human knowledge management skills. Knowledge management is concerned with a range of practices used by organisations to generate, store and disseminate knowledge for reuse, especially in research, teaching and learning, decision making and others. In a university, knowledge management initiative is usually tied to its objectives and is intended to achieve specific outcomes such as improved performance through shared intelligence and higher levels of innovation. This paper focuses on several hypotheses, namely, the greater the perceived knowledge management practices at individual level (academics), the more likely that there will be improvement in teaching and learning; the higher the socio-technical components supported by the university's management, the more likely that there will be improvement in teaching and learning; and the improvement of university's teaching and learning is led by the application of KM processes and KM systems. From the findings, the perceived knowledge management practices, as would be expected, gives an indication that KM is practiced by the lecturers as work routine that will thus lead to an improvement in the performance of delivering their core duties. The findings also indicate that socio-technical components supported by the university's top management facilitate the implementation, instillation, and application of knowledge management throughout the organisation.

The socio-technical components have become the parameters in enhancing the performance of university. It can be concluded that the universities' community can be effectively performing their core businesses if they utilise and manage knowledge in a proper way when they are aware of the benefits as well as added value that knowledge management brings and also when they are provided with adequate info-structure support, thus the implementation of knowledge management throughout the organisation is instilled as an organisational corporate culture. Deployment of inputs such as infrastructure (e.g. ICT systems) or/and

Knowledge Management System enables the utilisation of human capital and organisational knowledge via best practices, rules, and procedures, which will in turn produce outcomes (enhanced performance) through effective teaching and learning.

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Appendix: MRA summary results by university

Variables	UIAM			UKM			UM			MMU			UPM			USM			UTM			UUM		
	B	t	Sig	B	t	Sig	B	T	Sig	B	t	Sig	B	t	Sig	B	t	Sig	B	t	Sig	B	t	Sig
(Cons)	3.563	41.802	.000	3.710	65.705	.000	3.717	48.403	.000	3.674	49.768	.000	3.660	73.376	.000	3.461	32.809	.000	3.587	41.685	.000	3.828	63.950	.000
IS	.429	5.672	.000	.227	4.146	.000	.395	5.988	.000	.355	6.713	.000	.225	4.023	.000	.348	3.825	.001	.115	1.631	.107	.356	5.217	.000
INFRA	.229	2.708	.009	.125	2.283	.025	.215	2.662	.010	.121	2.412	.018	.037	.775	.440	.264	2.684	.012	.046	.599	.551	.125	2.201	.030
KMS	.265	3.514	.001	.259	4.389	.000	.215	3.294	.002	.279	4.991	.000	.191	3.830	.000	.131	1.434	.162	.225	3.020	.003	.080	1.353	.180
IC	-.037	-.467	.642	.115	2.154	.034	.202	2.942	.004	.099	1.880	.063	.315	6.361	.000	.158	1.688	.102	.302	3.774	.000	.033	.556	.580
KA	.005	.071	.944	-.014	-.213	.832	-.076	-.947	.347	-.035	-.626	.533	.082	1.480	.142	.274	2.420	.022	.156	1.896	.062	.087	1.381	.171
KS	-.095	-1.055	.297	-.046	-.960	.340	.149	1.823	.072	.061	1.094	.277	.032	.669	.505	.034	.353	.726	.006	.070	.945	.116	2.273	.026
KD	.132	1.441	.156	.078	1.502	.137	-.096	-1.493	.140	.092	1.789	.077	-.008	-.159	.874	.033	.356	.724	.089	1.058	.293	.004	.061	.952
KG	-.007	-.103	.918	.021	.420	.675	-.015	-.224	.823	-.100	-1.558	.123	.048	1.014	.313	.098	1.109	.276	-.014	-.172	.864	-.043	-.589	.557
DC	.127	1.788	.080	.097	1.595	.115	.146	2.133	.036	-.006	-.093	.926	.045	.869	.387	-.050	-.455	.652	.108	1.441	.153	.076	1.194	.236
R Square	.724			.629			.713			.716			.632			.752			.562			.652		
F	6.131			6.032			8.639			10.655			8.042			4.481			4.212			6.888		
Sig	.000			.000			.000			.000			.000			.001			.000			.000		

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