KNOWLEDGE MANAGEMENT FRAMEWORK FOR FACULTY OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY UNIVERSITY OF MALAYA

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DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS
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ABSTRACT

Knowledge management is not one single discipline. Rather, it is integration of numerous endeavors and fields of study. This research proposes a conceptual framework for knowledge management implementation at Faculty of Computer Science & Information Technology. The framework focuses on the importance of aligning the knowledge management strategy with the objectives or goals of the faculty. Basically, the framework consists of three main interlinked components: Organization (Faculty), People, and Infrastructure and Processes. The culture for implementing knowledge management is also dealt with. Furthermore, the framework recommends a holistic approach to managing knowledge. The proposed framework can be useful for this faculty to improve their ability to learn and adapt to changing environments. This research also emphases the computer-based systems can bring benefit in knowledge-based activities by using it to support the development and communication of human meaning. Finally, it is hoped that this research can contribute for the successful of future knowledge management implementation at this faculty.

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1.0 Introduction

Over the past decades, the world has been experiencing significant changes in which the need to acquire, utilize and share knowledge has become increasingly essential. While products and services continue to be the principal sources of wealth and remain the leading sectors in global markets, a new source of wealth creation is emerging, namely, the knowledge sector. Knowledge is rapidly becoming a major factor in the creation of wealth, on a global scale.

Garvin (1993) maintains that new ideas are essential for learning. Sometimes these ideas are created by insights or creativity within the organization, but sometimes they arrive from outside the organization or are communicated by knowledgeable insiders. Having the new ideas alone cannot improve the organization. These new ideas have to be adopted and the organizational procedures must be changed accordingly. According to Garvin, many organizations fail to do this and he specifically mentions universities.

Higher education institutions have "significant opportunities to apply knowledge management practices to support every part of their mission," explains Kidwell et al. (2001). He also added that "knowledge management should not strike higher education institutions as a radically new idea; rather it is a new spin". The problem is that it is such a "wide open area of study that it is difficult to understand the implications of knowledge management for an educational setting" (Thorn, 2001). This research offers a basic introduction to the potential of knowledge management for higher education through the creation of a knowledge management framework for Faculty of Computer Science & Information Technology (FCSIT) University of Malaya.

1. 1 Problem Statement

Too often when someone leaves the institution, his/her experience leaves too. This knowledge skills, competencies, understanding, and insight then often go to work for a competitor. How to save the institution from losing critical capabilities when that happens? The ability to survive and compete comes only from an institution's ability to create, acquire, process, maintain, and retain old and new knowledge in the face of complexity, uncertainty, and rapid change. How can this be done? What are the guidelines available? Just IT alone cannot ensure that an institution can get all the benefits. So, how can IT be utilized together with knowledge management to reach the goals of an institution?

Relying on the institutional knowledge of unique individuals can hamper the flexibility and responsiveness of any organization. The challenge is to convert the information that currently resides in those individuals and make it widely and easily available to any faculty member, staff person, or other constituent. Knowledge management certainly can solve all the problems stated above and other problems that are not described in this report. A knowledge management framework can provide answers to the questions that arose.

1.2 Importance of Study

In this new Millennium, knowledge is power and more knowledge is within individuals more than in records. Consequently, knowledge management is mandatory of higher education. There are many KM frameworks available for an organization, which is discussed in chapter 2. However, the frameworks focused more into business needs

rather than educational needs. Based on this reason, a framework dedicated to academic is necessary and essential for better management in this field. At present environment, FCSIT has no KM framework and this proposal will bring benefits to this faculty if successfully implemented in future. In addition, the proposed framework can play an important role in providing better quality of education.

1.3 Introduction to Knowledge Management

Knowledge Management (KM), also referred to as corporate memory, is an emerging discipline that comprises activities focused on a formalized, integrated approach to managing an enterprise's tangible and intangible information assets, or enterprise knowledge. Organizations have just recently started to consider the strategic value of their intellectual assets. These assets, which include knowledge experience and expertise, are highly volatile component of the enterprise's intangible assets.

There is no general agreement at present on the meaning of knowledge management. This term originates from the business organization context. It aims at providing instruments for employees of professional organizations who need to optimize the control and management of their most critical production factors. Knowledge management focuses on problem solving and therefore is strongly a problem oriented (Liebowitz & Wilcox, 1997). From the business point of view, knowledge management is concerned with the improvement of the performance of individuals and organizations by maintaining and leveraging the value of knowledge assets (Newman & Conrad, 2000). In terms of process, knowledge management is a discipline that promotes an integrated approach to identifying, managing, sharing, and reusing all of an enterprise's information assets by using advanced technology (Fenn, 1996; O'Leary, 1998). In this

study, knowledge management is referred to the entire process of acquisition, management, and utilization of information and knowledge to achieve the objectives for FCSIT.

In the era of new economy, knowledge management through systematic sharing is playing a significant role in global organizations. For example, Denning (1998) reported that knowledge management in the World Bank, initiated in 1996, is changing the way in which it operates internally and transforming the organization's relationships with external clients, partners and stakeholders to become in effect a key strategic thrust for the 21st century. The involved knowledge management activities include developing an on-line knowledge base, providing access to transaction or engagement information, and establishing advisory services, etc. Today, more and more information technologies have been adopted in support of knowledge management (O'Leary, 1998; Abecker et al., 1999). A better definition and more information will be given during the literature review in the next chapter.

1.4 KM in Higher Education

Information practices and learning strategies known as knowledge management are gaining acceptance in the field of education .At the most basic level, knowledge management can be described as a set of practices that helps to improve the use and sharing of data and information in decision-making. All institutions inherently store, access, and deliver knowledge in a manner that they could not exist without it in the marketplace. The question is what value is added to the products and services they deliver by the effective use of that knowledge capital. Almost any institution in this country will make reference to the capturing of knowledge, the sharing of knowledge and the delivery of knowledge from faculty to students.

Corrall (1998) commented on the application of Knowledge Management in higher education asserts that there are few formal Knowledge Management initiatives at present, but many institutions are already using intranets to manage some types of explicit knowledge, such as minutes of meetings, lecture notes, etc. She broadly classifies application of Knowledge Management into three groups:

- Knowledge databases and repositories (explicit knowledge)
- Knowledge route maps and directories (tacit and explicit knowledge)
- Knowledge networks and discussions (tacit knowledge).

1.5 Faculty of Computer Science & Information Technology: An Introduction

The provision of computer facilities and services at the University of Malaya (UM) began in mid-1967, soon after the Computer Centre was officially formed in 1965. This also made the university one of the pioneers in computer usage in Malaysia. In December 1969, the Computer Centre took on an additional role of teaching and research of computer science and information technology. The Computer Centre Board was formed, comprising the Vice Chancellor (as Chairman), the Director of Computer Centre (as Secretary), and a representative from each Faculty, Institute, Centre of the university, and from the University Senate.

In 1974, the Diploma in Computer Science postgraduate programme was introduced. From its inception in the 1974/75 sessions to the 1999/2001 sessions, a total of 304 students had been awarded the Diploma.

The Master of Computer Science (M.Comp.Sc.) and Doctor of Philosophy (Ph.D.) programmes were two higher degree research programmes approved by the Senate and had been administered by the Computer Centre since 1985. In addition, the Computer Centre offered a 4-year Bachelor of Computer Science programme. The first undergraduate enrollment for 1990/91 sessions was 50 students.

In April 1993, the University Senate agreed to the formation of the Computer Centre Study Board. The Board proposed the establishment of a faculty to be called the Faculty of Computer Science and Information Technology (FCSIT). The existing Computer Centre was to be annulled and replaced by a Computer Services Division, which was placed under the Chancellery. On September 22 1994, the University of Malaya Council agreed to the formation of the Faculty of Computer Science and Information Technology (FCSIT), and the Computer Services Division.

The Bachelor of Information Technology programme started in the 1996/97 academic sessions, with an initial intake of 50 students. In 1997, the Faculty established four Departments, Artificial Intelligence, Software Engineering, Information and Library Science, and Computer Systems and Technology.

(Source: Faculty of Computer Science & Information Technology, University Malaya)

1.6 Objectives of Dissertation

Institutions with a focus on knowledge management pay close attention to issues of collaboration, organizational learning, best practices, workflow, intellectual property management, document management; customer-centric focus, and using data effectively. Knowledge management initiatives include portals that use the web to span

communication across an entire enterprise and to promote business-to-business relationships. The Internet is also used intensely for team collaboration and groupware; natural language queries of data; sharing information on best practices; and anytime/anywhere online learning. The objectives of this research are:

i) To provide guidelines for sharing knowledge and best practices for FCSIT.

ii) To improve communications and the uses of knowledge at FCSIT.

iii) Use appropriate methods and frameworks to leverage organizational knowledge to produce the learning organization.

1.7 Scope of Dissertation

Faculty of Computer Science & Information Technology, University of Malaya, located in Kuala Lumpur. This project involved the participant of the management staffs, lecturers, and students of this faculty. These people were required to answer questionnaires that distributed to them, which contribute to useful information gathering. Duration for the completion of this project was 7 months time period.

1.8 Research Methodology

The methodology for this research can be summarized as the following four-step process:

- Study existing research and frameworks to understand prevalent problems (discussed in the next chapter).

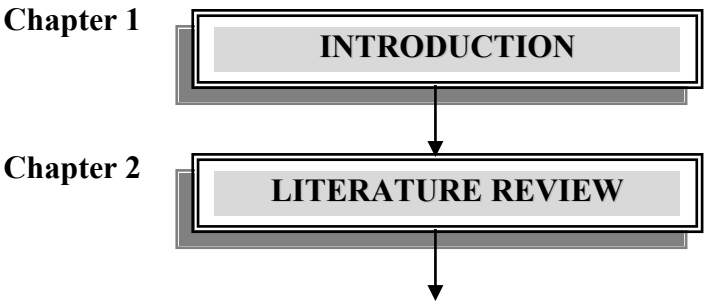
- Choose methodologies for framework design and develop discussion board (chapter 3).
- Form hypotheses about features to aid practical knowledge management and propose a framework (these are discussed in chapters 4 and 5).
- Develop discussion board to support these hypotheses and perform evaluation (chapter 6).

Chapter 7 discusses the main contributions of this thesis and proposes directions for future research.

The Internet has been a valuable resource for obtaining information about this topic. Much of the material referenced in this paper is available on the Internet. In the reference section, URLs (Uniform Resource Locators) have been included that are current at the time of publication. Due to the changing nature of the Internet and especially the World Wide Web, there is no guarantee that this information will continue to be available at these locations. Besides that, some of the information has been collected from books and journals.

1.9 Dissertation Organization

This dissertation consists of seven chapters and arranged as following:



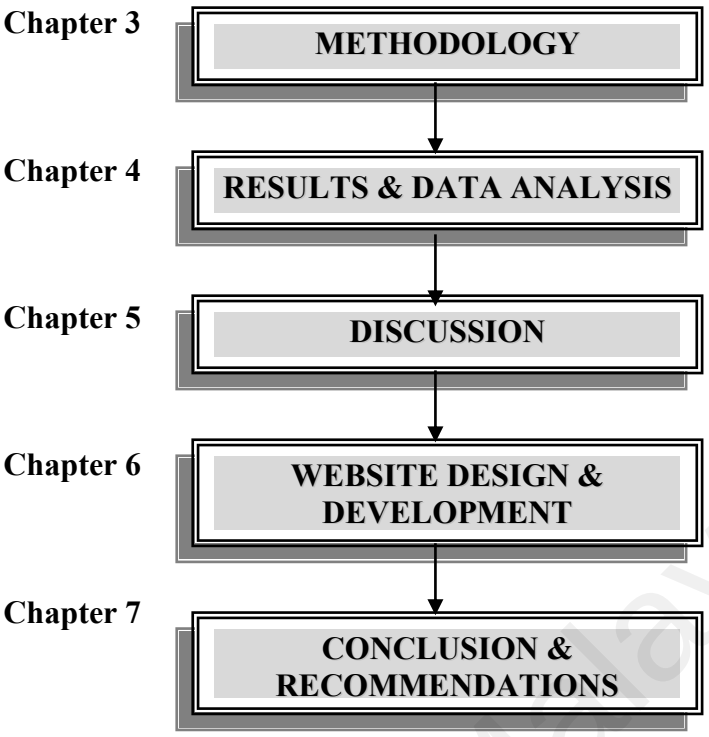


Figure 1.1: Dissertation Organization

Chapter 1: Introduction

Introduction to the title of this dissertation, the scope of research, expected output, and introduction to FCSIT.

Chapter 2: Literature Review

A literature review is an account of what has been published on a topic by accredited scholars and researchers. In this chapter, it justifies the reason of this research and establishment of theoretical framework and methodological focus.

Chapter 3: Methodology

Explains the method used to reach the purpose of this research, which includes a step-by-step process. Basically, the methodology used is based on the currently available methodology that suits this type of research.

Chapter 4: Results and Data Analysis

This chapter is based on the surveys and data collected and analysis is done to make use this information in order to get accurate output. The results and data analysis are presented in the form of text, figures, tables, etc.

Chapter 5: Discussions

Using the results from Chapter 4, further elaborations and discussions are done in this chapter. It contains the interpretation of the results and the analysis of data. This chapter is important because the findings of the research are presented here.

Chapter 6: Website Design and Development

Explanations about the website developed for this project, which intended for the staff of FCSIT to share their knowledge. The functions and appearance of the website are described in this chapter.

Chapter 7: Conclusion and Recommendations

A conclusion for this report comprises the whole work (input and output) of the research. The findings are summarized and suggestions for future improvements are given in this chapter.

1.10 Summary

Using knowledge management techniques and technologies in higher education is as vital as it is in the corporate sector. If done effectively, it can lead to better decision-making capabilities, reduced time (for example: curriculum development and research), improved academic and administrative services, and reduced costs. Based on the

introduction given, the aim of this research will focus more on the creation of a conceptual knowledge management framework. Besides that, a website is created in order to support the theory of knowledge management framework for Faculty of Computer Science and Information Technology, University of Malaya.

2.0 Introduction

In this chapter, the researcher investigated some of the existing works/research related to knowledge management (KM) and its framework. However, the scope of this research will be on higher education such as universities and colleges, which have already implemented knowledge management. The researcher also analyzed some of the knowledge management frameworks proposed by knowledge management researchers and used by organizations. Based on these existing knowledge management processes, basic ideas on how to create a new framework could be discovered. Most of the information about knowledge management in higher education institutions was collected from the Internet (using search engines: www.google.com, www.hotbot.com, www.infoseek.com, etc), books, and journals.

2.1 Scenario: A College Example

As example of knowledge management approach, the researcher considered a scenario given by Lisa and Thad (2003). Two college teachers (Biology and English teachers) found out that each has begun developing and implementing a community-involvement component to a course. The two begin meeting to share knowledge about their experiences. Within, a month, two other faculty members heard about their efforts and joined in the meetings. The administration looks favorably on these kinds of cross-departmental groups, and provides technical support to enable the team to create a website and a user's group dedicated to their work. Through the website, direct emails, announcements at faculty meetings, and other means, the faculty members publicize the meetings, and over the next six months they are joined by at least one faculty member in almost every department. Several faculty members attend the meetings because they

would like ideas on how to include a component in their courses. Teaching plans and syllabus are posted on the web site.

Through their discussion during the year, the teachers agree that these courses are popular among students, but enrolment had remained only moderate because of the additional time required of students to complete the community-involvement elements of the course. Yet the payoffs have been significant: the teachers have seen their students develop deeper understanding of the issues. The teachers would like to add credit hours to their courses, but there are procedural difficulties in doing so. In preparing their case for additional credit hours, they decide to collect information about the number of students hours required and the relationship between student's enrollment in these courses and various elements of persistence and completion. They found that students who take these courses spend almost twice as many hours as they do in similar courses without the community requirement. They also found that students who take these courses are more likely than other students to complete their major.

2.1.1 Analysis of Scenario

Based on the scenario given above, knowledge management efforts started only through sharing of knowledge between two individuals. Later on, more people get involved and the knowledge sharing process expended. So, it is clear that knowledge sharing among a small group in the beginning will create a much bigger group and finally influence the whole organization. Besides that, if knowledge sharing culture is already happening in an organization, then support of ICT (e.g. website, internet) is required to assist the bigger group of people to share their knowledge in an effective way and reduced time. In the case of the scenario mentioned above, a website was created for direct emails, announcements of meetings, other for other purposes. Basically, we are able to

understand the processes and activities involved in knowledge management approach. These activities are happening in our everyday life but we might not realize that it is a part of knowledge management process. In order to bring realization of knowledge management approach, a framework is necessary as guidelines for the people involved. In addition, a KM framework will provide direction for them in sharing their knowledge in the organization. Educational institutions are knowledge-based organizations in nature. In such an organization, constituencies acquire the knowledge and skills they need from many different sources, within and without the institutions. They openly share their own knowledge and skills with others; for they realize that they are all working in a non-profit academic community for the advancement of the society.

2.2 What is Knowledge?

The world is experiencing an era, which has been termed the "knowledge age" or the "knowledge economy". In this new context, knowledge is the primary commodity, and knowledge flows are regarded as the most important factors in the economy. But, what is *knowledge*? Knowledge starts as *data* (raw facts and number) for example, the market value of an institution's profits. *Information* is data put into context—in the same example, the profits per student at a particular institution. Information is readily captured in documents or in databases; even large amounts are fairly easy to retrieve with modern information technology systems. Before acting on information, however, people need to take one more step. Only when information is combined with experience and judgment does it becomes *knowledge*. Knowledge can be highly subjective and hard to codify. It includes the insight and wisdom of employees. It may be shared through emailed "best practices" memos or even sticky notes on a cubicle wall. And once people have knowledge, they can put it to work and apply it to decision making.

A popular framework for thinking about knowledge proposes two main types of knowledge: *explicit* and *tacit*. Explicit knowledge is documented information that can facilitate action. It can be expressed in formal, shared language. Examples include formulas, equations, rules, and best practices. Explicit knowledge is:

- Packaged
- Easily codified
- Communicable
- Transferable

Tacit knowledge is know-how and learning embedded within the minds of the people in an organization. It involves perceptions, insights, experiences, and craftsmanship. Tacit knowledge is:

- Personal
- Context-specific
- Difficult to formalize
- Difficult to communicate
- More difficult to transfer

Most business actions require the guidance of both explicit and tacit knowledge. How does knowledge work in organizations? Knowledge originates in individuals, but it is embodied in teams and organizations. In an organization, examples of explicit knowledge are strategies, methodologies, processes, patents, products, and services. Examples of tacit knowledge in an organizational context are skills and competencies, experiences, relationships within and outside the organization, individual beliefs and

values, and ideas. Knowledge also is embedded in work processes, and it exists in all core functions of an organization as well as in its systems and infrastructure. Effective knowledge management programs identify and leverage the know-how embedded in work, with a focus on how it will be applied. The challenge in knowledge management is to make the *right* knowledge available to the *right* people at the *right* time.

2.3 What is Knowledge Management?

Knowledge has limited value if it is not shared. The ability to integrate and apply the specialized knowledge by organization members is fundamental to a firm to create and sustain a competitive advantage (Grant, 1996). This is where knowledge management comes in. Knowledge management is managing the corporation's knowledge by means of a systemic and organizational specified process for acquiring, organizing, sustaining, applying, sharing and renewing both tacit and explicit knowledge by employees to enhance the organizational performance and create value (Allee, 1997). It is quite often that companies, particularly those that compete on the basis of services and expertise, facilitate the codification, collection, integration, and dissemination of organizational knowledge using computer systems because they can facilitate communication and knowledge sharing (Alavi & Leidner, 1999). Based on all these information, the researcher can conclude that knowledge management is the process of transforming information and intellectual assets into enduring value.

According to Davenport et al. (1998), there are four kinds of knowledge management projects. They are:

(1) Creating knowledge repositories in which knowledge can be retrieved easily

(2) Improving knowledge access to facilitate its transfer between individuals

(3) Enhancing a knowledge environment to conduct more effective knowledge creation, transfer and use

(4) Managing knowledge as an asset and concern about how to increase the effective use of knowledge assets over time.

2.4 A Framework for Knowledge Management Support

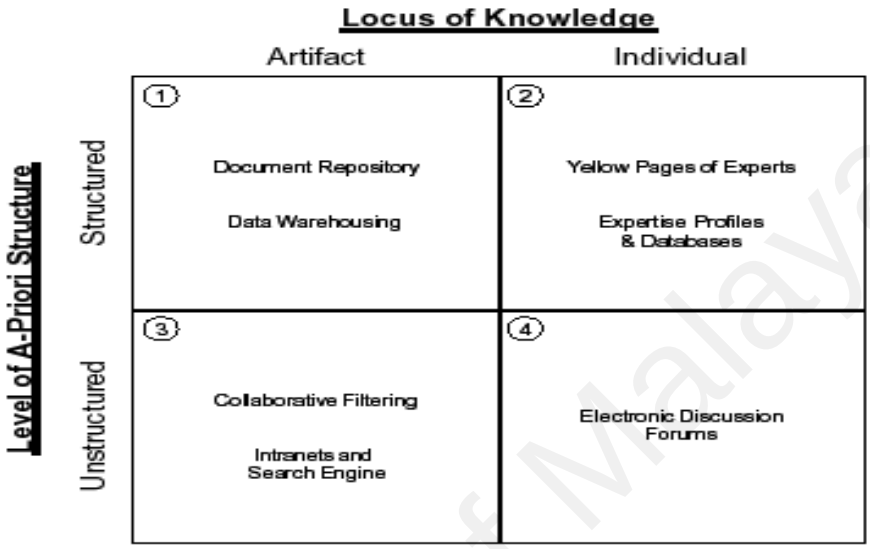
The practices of knowledge management can provide a framework for understanding how and where to focus energy to improve educational outcomes, given the goals and mission of the organization. The foregoing discussions suggest that two important considerations in managing knowledge are:

a) Where the knowledge resides and
b) The extent to which the knowledge is structured

The locus of the knowledge determines whether the KMS connects a user who has a problem or question to an artifact (e.g. a document) or directs her to a person. The researcher used these dimensions as the basis to categorize the different types of knowledge management systems currently used for knowledge management support. The framework by Hahn and Subramani (2000) is presented in **Figure 2.1** with examples of currently used knowledge management systems represented in each category.

The horizontal dimension of the framework focuses on the location of the organizational knowledge resources managed by the KMS– whether the knowledge is embodied within individuals or whether it exists as externalized knowledge artifacts. The vertical dimension deals with the extent to which the KMS imposes or requires a

structure. The locations of commonly used IT based solutions for knowledge management (Davenport et al., 1998), as well as the systems adopted or developed by the organizations are positioned in the framework (see **Figure 2.1**).



[Source: Hahn & Subramani, 2000]

Figure 2.1: Framework for Knowledge Management System

Cell 1 comprises KMS managing knowledge artifacts that have an inherent structure (e.g., enterprise wide data) or those where the KMS imposes a structure on the contents (e.g. consulting reports tagged with keywords). Essentially, the domain of these systems is restricted to the organizational knowledge that is or can be effectively codified. Document repositories and data warehousing systems fall into this category. These systems typically use database management systems (DBMS) designed to capture and store documents with predefined keywords and meta-data so that the contents can be accessed using the document categorization scheme.

Cell 2 comprises systems where the knowledge resides in individuals but the contents managed by the KMS are catalogued and structured employing categorizing schemes. A

database of experts is an instance of such a system. The contents of the KMS are created by employees filling out a questionnaire to describe their level of expertise in a predefined list of skill categories (e.g. Java programming, project management, vibration dampening etc.). The expert's database is intended to be useful for users to locate people with specific skills in domains where the user has a problem to contact them for help.

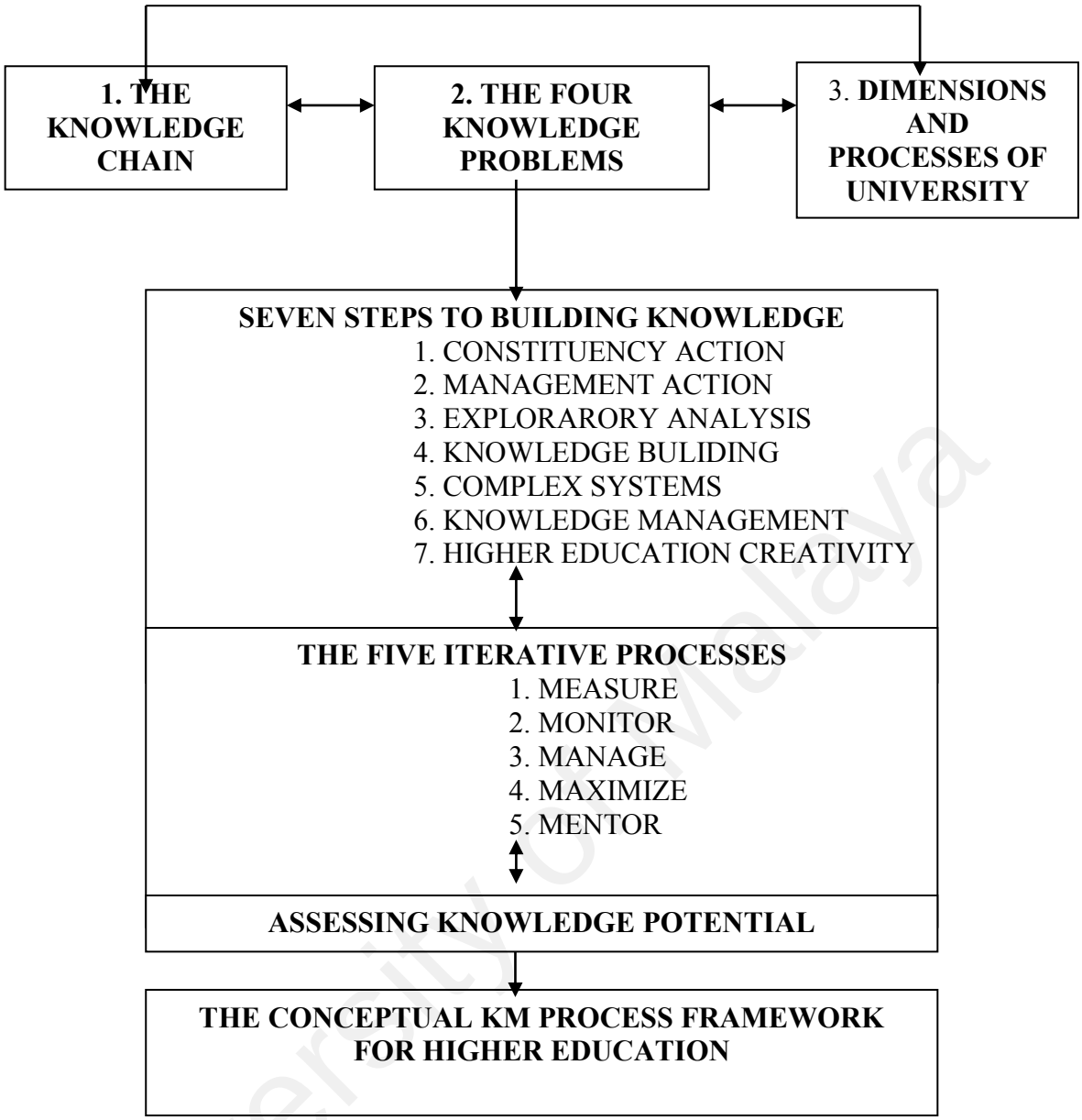
Cell 3 comprises systems where the knowledge is captured in artifacts but where the contents do not have structures imposed on them. Instances include KMS systems incorporating document repositories that are fully indexed on the words they contain and KMS with document recommendation capabilities using *collaborative filtering* technology. The organization of the contents in such systems is dynamic and the systems aim to provide employees with relevant documents on the fly. For example, many organizations currently deploy corporate intranets so that important documents can be posted and accessed by other users browsing or searching though the site. The documents do not follow a predefined structure: search and retrieval is achieved via search engines that locate documents using full-text search.

Cell 4 comprises systems that provide means for users to access others who may be able to help and where the system imposes no a-priori structure on the knowledge. In such systems, interpersonal contacts enabled by the system results in knowledge sharing and transfer. Instances of such systems include electronic discussion forums where employees may post questions to which other employees with answers or suggestions can post replies. Threaded discussions and email distribution lists (Listservs) are typical technologies used in systems in this class.

2.5 Previous Research: Knowledge Management Model

Pornchulee (2001) presented a paper at "*The First SEAMEO Education Congress"*, where he proposed a knowledge management model for higher education. The main purpose of this paper is to propose a model for KM in higher education in 7 parts (see the paradigm). (1) The Knowledge Chain; (2) The four Knowledge Problem and Hierarchy; (3) Dimensions and Processes of University Memory, (4) Seven Steps to Building Knowledge, (5) The Five M's of the Iterative Knowledge Management Process, (6) Assessment of knowledge Potential and (7) The Conceptual KM Process Framework for Higher Education.

To be assuring of common understanding, a definition is given here. According to Davenport (1998), knowledge is information combined with experience, context, interpretation and reflection. It is a high value form of information that is ready to apply to decisions and actions. Knowledge management involves setting an environment that allows college and university constituencies to create, capture, share and leverage knowledge to improve their performance in fulfilling institutional missions. In order to install a knowledge management system appropriate for the missions of higher education, a model is proposed as follows:



[Source: Pornchulee, 2001]

Figure 2.2: Knowledge Management Model

2.6 Knowledge Management Implementation Strategies

A business strategy can be defined as a high-level, flexible plan that oversees the birth and development of a business initiative. To ensure the success of the business objectives, any subsequent business development within the organization must be aimed

at furthering the goals of the organization. A Knowledge Management implementation strategy must be a function of the business strategy, or else the knowledge management initiative will fail to accomplish goals that are tangible to the organization. A knowledge management strategy can thus be defined as a high-level plan that aims at supplying the organization with the knowledge resources that it needs to carry out its vision and goals. As a result, the knowledge management strategy must be closely aligned to the overall business strategy, and must produce a tangible result to the organization as a whole. For example, Zack (1999) states that a knowledge management strategy expresses the overall approach a company intends to take to align its knowledge resources and capabilities to the intellectual requirements of its strategy. Chatzkel (2000) states that a knowledge management strategy provides the framework within which his organization manages new initiatives aimed at leveraging the intangible assets of the organization. Furthermore, the strategy outlines the processes, the tools and infrastructure required for knowledge to flow effectively. The author regards this definition to be that of a Knowledge Management implementation strategy, in that it goes in more detail than a high-level plan.

In the next section, we will describe 4 examples of knowledge management implementation from three aspects: purpose, participants, and steps involved in implementation. The institutions are:

i. University of Kentucky
ii. University Teknology Mara (UiTM)
iii. University Putra Malaysia (UPM)
iv. Center for Information Technology (CIT), National Institutes of Health, US

These four higher education institutions were selected because they have already implemented knowledge management and continuously doing research in this field. Besides that, these institutions knowledge management approach is proven to be effective and successfully implemented. For more information about these institutions, please visit their respective website stated in the references.

Example 1: Kentucky Initiative Knowledge Management (KIKM), University of Kentucky

For this university, knowledge is a vital organization resource. KIKM was established in 1998 within the University of Kentucky's College of Business and Economics. The purpose is:

i) To foster cutting-edge research that stimulates, discovers, and explores new computer-based possibilities for knowledge management, making notable contributions to the advance of the field;

ii) Facilitate effective, up-to-date instruction about the rapidly growing and changing field of knowledge management, including computer-based possibilities for supporting the decision making, communication, and coordination of individuals, groups, and organizations;

iii) Establish a reputation for innovation and expertise in knowledge management, bringing a degree of visibility that can help attract, spawn, and enhance business in the state, as well as adding to the prestige of the College of Business and Economics and the University of Kentucky.

The KIKM activities that aim to enable the College of Business & Economics to reach the following objectives:

i) Attracting promising students and faculty by building an academic/research program recognized on a national basis.

ii) Maintenance of advanced computer lab facilities for conducting research on knowledge management issues.

iii) Timely dissemination of research results through the KIKM series of research papers and occasional KIKM monographs.

iv) Covering research expenses of doctoral students and faculty in the area of decision science and information systems (DSIS).

v) Funding summer research assistantships for DSIS doctoral students.

vi) Working on knowledge management issues with faculty at affiliated Kentucky institutions to raise the caliber of higher education and research in state-assisted universities across the state.

vii) Participation in the sponsorship and organization of conferences concerned with knowledge management.

viii) Providing complementary support for research funded by external agencies.

ix) Sponsoring guest speakers, seminars, and the professional development of students and faculty.

x) Cooperating with other initiatives, centers, and institutes concerned with bridging the realms of management and technology.

The participants of KIKM are:

i) The KIKM Director who oversees the foregoing activities.

ii) A teaching assistant whose duties are dedicated to operating and maintaining the lab facilities in support of graduate education.

iii) Part-time staff assistance for the Director.

iv) The KIKM Faculty Associates who contribute to the KIKM research paper series and teach in the area of decision science and information systems at the University of Kentucky.

v) The KIKM Affiliates composed of departments at other state-assisted universities whose faculty members conduct research and teaching related to knowledge management.

vi) The KIKM Liaisons consists of one representative from each KIKM Affiliate.

However, no information was provided on the steps involved in KIKM implementation.

Example 2: Knowledge Management Implementation, University Teknologi MARA (UiTM)

The purpose of KM at UiTM is to:

i) Boost research and development among academicians

ii) Improve the quality of teaching

The participants for KM at UiTM were 31 academic faculties, departments, centers, and units. No further elaboration about the participants was given.

The development of change movement in UiTM can be divided into 2 crucial phases:

i) The first phase involved the transferring and dissemination of knowledge from the Technology Provider to the Technology Recipient.

ii) The second phase will witness the monitoring and measuring of the change movement in UiTM. The development of knowledge management, learning organization and intellectual capital will be dedicated in this phase.

Phase 1: Change Movement

1. Transfer of technology (TOT).

The first phase involved the transferring and dissemination of knowledge on change management and process improvement to a group of people with diverse academic backgrounds called the Core Technology Recipient (CTR). A Project Office was set up to house all the CTR first, to receive knowledge from the Technology Provider (TP) and later to conduct a workshop together with the TP. A year schedule was formulated for the main purpose of receiving knowledge and at the same time to allow the CTR to conduct workshops for their satellite team.

2. 31 workshops and 10 dialogue sessions and encounters were conducted successfully.

Through the work of the consultant and the core team, learning encounters in the form of workshops, lectures and dialogue sessions were held. Realizing the need to get the involvement of the management, separate learning sessions were held.

3. Participating teams.

To date, 31 academic faculties, departments, centers, and units have participated in this massive project in that the outcome is to determine and identify the areas of change in their organizations.

4. Quarterly Report and Consolidation Exercises

A consolidation exercise was conducted and over 280 change items were presented and later categorized under the headings of people, process and technology. It was a learning moment for both entities: the leadership of UiTM and the Change Team. It was the first forum ever conducted by the university where both parties witnessed the idea that changes are required which were brought about by the critical mass and on the part of the leadership to know that the changes are urgent required.

5. Change Forum

The finale of the Project will be the Change Forum to be held sometime in August 2001. The real objective of the forum is to invite the stakeholders of the university to come and witness the change agendas of various faculties, departments and units.

6. Self Enrichment Program

The team has also invited people from the industries to present a talk or discussion where they can learn from the experience of the organizations.

Phase 2: Monitoring and Measuring

1. Reporting and Monitoring Procedures

The team has also developed a mechanism for monitoring the change activities at the departmental level so that they are on the track and that the momentum for change will continue.

2. Establish an Institute

The completion of the first phase will also witness the establishment of an institute mainly to act an organization to monitor and measure the activities of the change items in the university.

3. Creating an environment for Learning Organization in UiTM

As an organization the university needs to create a learning organization.

4. Knowledge Management

The other core function of the institute is to develop the knowledge management of the university. A scheme was develop where the institute will operate with an industry to provide professorial chair where out of this the person main task is to develop knowledge management in the university. The following items have been identified as the necessary elements to ensure that UiTM can management knowledge:

i. Knowledge server.

ii. Create fellowship at the institute.

iii. Collect data.

iv. Upgrading system.

5. Developing Intellectual Capital in UiTM.

Another important function of the university is to develop its intellectual capital.

Example 3: Knowledge Management Center, University Putra Malaysia (UPM)

UPM Knowledge Management Center was established on 1st January 2002 to optimize the utilization of knowledge and expertise within UPM so as to increase its

responsiveness, innovation, competency, and efficiency in carrying out its duty. The knowledge management initiative at UPM intentions were:

i) To create and provide relevant intelligence/knowledge among the university community and a range of university partners and customers

ii) To deliver university-wide intelligence knowledge service, and

iii) To manage the obligations of UPM community with regards to Intellectual Property Rights (IPR).

The participants were the members of the UPM community, which included lecturers and other staff.

Based on the vision, mission and the goals of UPM and **KMC**, five critical management areas have been identified for KM implementation:

- Infrastructure and System

  This management area deals with determining, developing, and evaluating both knowledge-based and technology-based infrastructure and system requirements, constantly keeping up with new technological development and vigilantly ensuring the security of knowledge posed over the Intra and Internet.

- Repository

  Managing knowledge repositories is an important component of the overall knowledge management system. This includes knowledge mapping, tagging knowledge with attributes, information indexing and classification, information clustering and lumping, and knowledge auditing.

- Community Interface

  Satisfying the needs of the knowledge communities is essential in determining the success of knowledge management initiatives. The Customer Service Unit deals with both the internal and external customers in promoting the culture of knowledge sharing. KMC provides services through multi-channels to support its client's needs for better and efficient services.

- Intellectual Property Rights (IPR)

  In order to sustain its competitiveness, UPM must protect its intellectual assets and properties. Using IPR, which is the principle rights governing the ownership, distribution and commercial development of knowledge, UPM will be able to protect its IA and IP through legislation by granting patents, copyright, trademark, and etc

- Research and Education

  Knowledge management must develop the capacity to develop and assess the appropriateness of new technologies that could be used to accomplish its mission. It should also learn new ways of coping with the needs of staff and clientele in the context of the changing work culture. Research in knowledge management environment covers topics dealing with information-based and technology-based infrastructure and systems, repository systems as well as community interface and culture. Training programs need to be developed and offered to the knowledge community in order to increase their effective involvement.

However, the detailed information on the implementation was not given.

Example 4: Knowledge Management Implementation at Center for Information Technology (CIT), National Institutes of Health, US.

Based on the paper by Marsh (2000), it describes a capsulation of the main lessons learned by the division of Customer Support at the Center for Information Technology (CIT), a component of the National Institutes of Health (NIH). The main purpose of KM implementation was to improve the health services within US. The people involved were all the staff of National Institutes of Health, US. The steps, which is called "recipe" in this article, are described as follows:

Step One: Project Identification

In the first step, identification of the area, process or application is done. At this step, people must look into the current situation of the organization. According to the author, a small initiative is the best place to begin. Once its successful, then we can move on to expand. However, if it fails, then there will be a minimal impact. In general, we can say that the first step requires us to look at the organization and locate one or more area where technology, process, or both can be improved.

Step Two: Leader and Expert Identification

The second step involves identifying the leaders and expert to facilitate the knowledge management project. To avoid pitfall, a beginning knowledge manager must work to identify the though leaders in her or his organization. In this paper, the term" thought leader" is used to indicate the staff members who always seem to have answer to every question, or who know where to find the answer. They are the ones who other staffers look to as a resource and reference point.

Step Three: Solution Identification

At stage three, it described about using tools to find a solution. Basically, using the existing technology is better because it can minimize the initial impact of changes. According to the author, a knowledge manager must create a win-win situation by utilizing the tools already in place for the proposed solution because we must ensure minimal changes.

Step Four: Knowledge Capture

To capture knowledge, the author proposed to give priority to the explicit knowledge and move on to tacit knowledge later on. This is because tacit knowledge will arise spontaneously if we focus on explicit information as knowledge management project grows. To capture knowledge, it is to focus on "Frequently Asked Questions" because it enables experts to focus on more interesting and challenging problems. Besides that, it can also increase the likelihood that users of the system to find out what they are looking for.

Step Five: Information Entry

For information entry, there must be standards that have been set initially. At this stage the best information managers are the people with the subject matter expertise.

Step Six: Deployment

In step six; it involves improvement and keeping up-to-date the systems. The author proposed incentive for staffs that keep new and latest information in the system because if a user cannot get useful knowledge, then they will not go back to the system again.

Step Seven: Feedback

In this last step, communication plays an important role. The first way to get feedback is to allow users who find an error in the system to submit some kind of a problem report. The second way is to record and review all the queries and hits by users. Based on this, system administrators must take action to address it.

2.6.1 Analysis of KM Implementation

Based on the examples mentioned above, the researcher fount that knowledge management implementation at a faculty or center involves the following participants:

i) Academicians
ii) Staff
iii) Students

Meanwhile, the objectives of knowledge management implementation at these organizations are:

i) Improve Research and Development (R&D) programs
ii) Facilitate the organization to reach their goals
iii) Improve services to customers/students
iv) Improve quality of knowledge and education

As for the steps involved in implementation, it starts by analysis of present situation at faculty or center and followed by programs to motivate knowledge sharing and transfer among members of this organization. Next, knowledge management infrastructure is

provided in order to assist knowledge sharing. Finally, the whole knowledge management implementation is monitored and deployment was done if necessary.

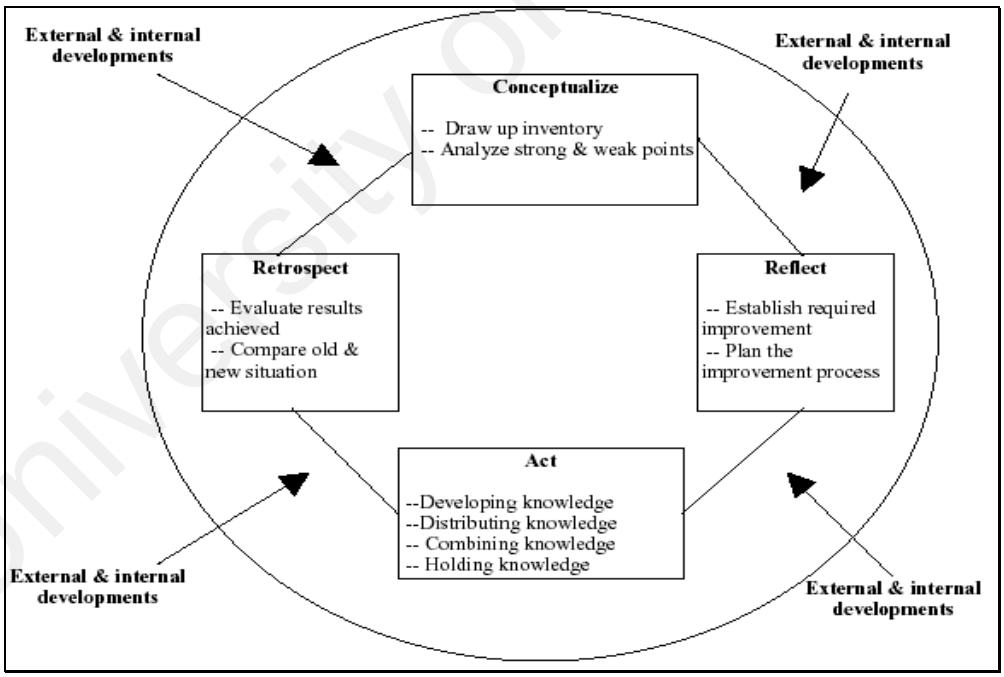
2.7 Existing Knowledge Management Frameworks

In this section, some of existing frameworks for knowledge management were identified. These frameworks differ not only in their focus, but also in their breath and depth in characterizing the nature of knowledge management phenomena. Knowledge management remains a young, developing field, and existing frameworks include some but not all of the key attributes identified in this paper. However, academics, the business community, and governmental institutions have reached a common understanding with regard to the constitution of knowledge and the basic approach for its management, although in every case a specific analysis must be conducted in order to implement a knowledge system properly. So, these frameworks can be used as guidelines for creating KM framework in academic environment because it is inter-related and reflects management of any organization.

2.7.1 Framework of Knowledge Management

The framework created by Van der Spek and Spijkervet (1997) identifies a cycle of four knowledge management stages: conceptualize, reflect, act, and retrospect. As shown in **Figure 2.3**, these stages control the basic operations on knowledge. The conceptualize stage focuses on gaining insights into knowledge resources. This is achieved through researching, classifying, and modeling existing knowledge. During the reflection stage, the conceptualized knowledge is evaluated using a variety of criteria, required improvements are established, and an improvement process is planned. During the act stage, actions to improve the knowledge are taken. This involves developing new

knowledge, plus distributing, combining, and holding this developed knowledge. The last stage, retrospect, recognizes the effects of the act stage, evaluates the results achieved in that stage, and compares old and new situations. The configuration of knowledge management stages is oriented toward a problem-solving cycle. Therefore, this configuration can be viewed as one way of coordinating knowledge manipulation activities within a problem-solving period. The stages in the cycle are influenced by internal and external developments. Internal factors that impact the organization of the management of knowledge are culture, motivation of employees, organization, management, and information technology. External factors are recognized as influences, but examples of this factor are not identified in the framework.

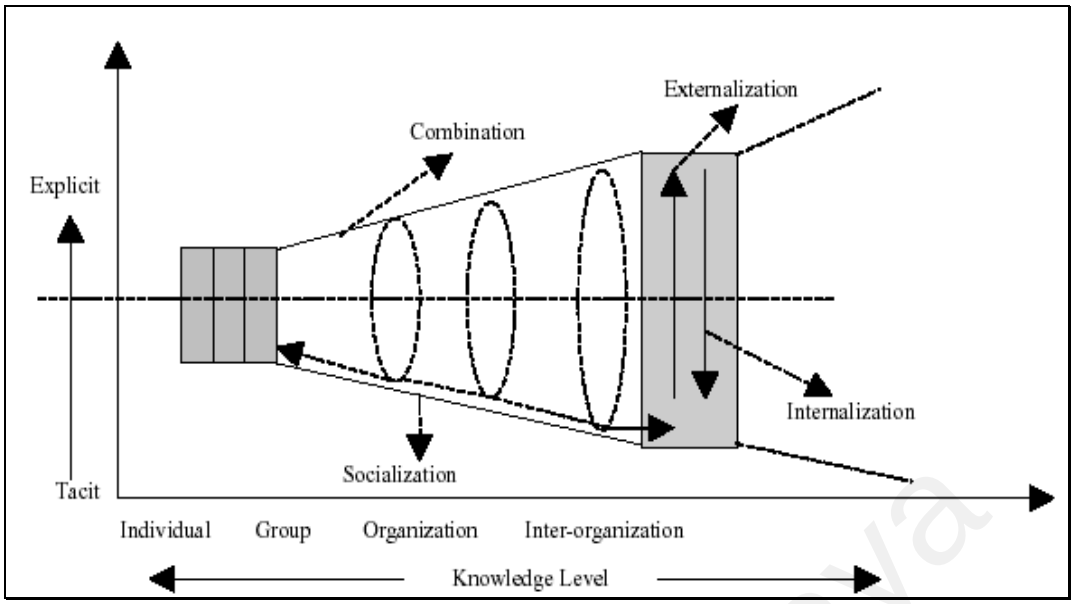


[Source: Van der Spek & Spijkervet, 1997]

Figure 2.3: Framework of Knowledge Management

2.7.2 Framework of Knowledge Conversion

The model by Nonaka (1994) identifies four kinds of "knowledge conversion" that drive knowledge creation: socialization, externalization, internalization, and combination. These conversions are based on a correlation between the tacit versus explicit modes of knowledge. Tacit knowledge refers to knowledge that cannot be easily verbalized and articulated, whereas explicit knowledge refers to knowledge that can be readily verbalized in a formal, systematic language. The conversion is also based on recognition of distinctions between individual knowledge and collective knowledge. Socialization is a process of creating knowledge by converting tacit knowledge from one entity (individual, group, or organization) to another entity. Combination is a process of creating new explicit knowledge from existing explicit knowledge. The conversion of tacit knowledge into explicit knowledge is called externalization. The conversion of explicit knowledge into tacit knowledge is called internalization. Organizational knowledge is created by the interactions among these four conversion processes, and through transferal of tacit/explicit knowledge from individual to group to organizational levels. Knowledge creation starts with socialization. This interaction facilitates the sharing of member's experiences and perspectives. Then, successive rounds of meaningful "dialogue" trigger externalization. Through this dialogue, entities articulate their formerly tacit knowledge to each other. The knowledge that is created through externalization can be combined with existing knowledge to further refine and extend the knowledge base. This process iterates, with knowledge increasingly taking concrete form. Through this experimentation of learning by doing, internalization takes place. This process of knowledge conversion is shown in **Figure 2.4**.



[Source: Nonaka, 1994]

Figure 2.4: Spiral of Organizational Knowledge Creation

2.7.3 Framework of Knowledge Management Pillars

Wiig's (1993) knowledge management framework involves three knowledge management pillars, which represent the major functions needed to manage knowledge. As shown in **Figure 2.5**, the pillars are based on a broad understanding of knowledge creation, manifestation, use, and transfer. Pillar I is concerned with exploring knowledge and its competency. The framework identifies several components of this function, which are:

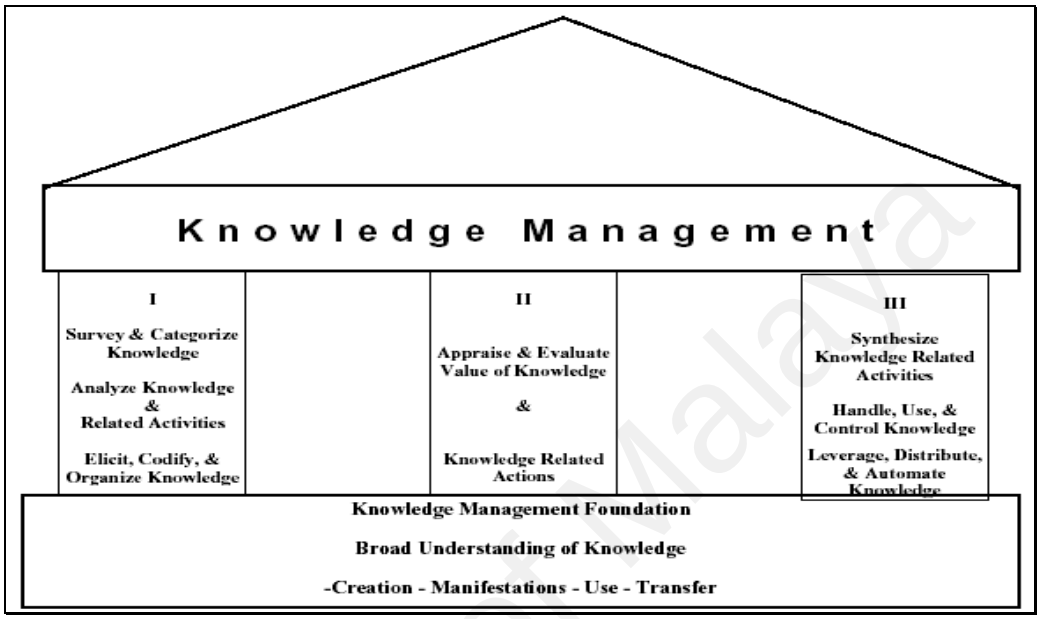
i.) Survey and categorizes knowledge;

ii) Analyze knowledge and knowledge-related activities;

iii) Elicit, codify, and organize knowledge

Pillar II involves appraising and evaluating the value of knowledge and knowledge-related activities. The third pillar focuses on governing knowledge management

activity. This function has three components: synthesize knowledge-generated activities; handle, use, and control knowledge; and leverage, distribute, and automate knowledge.



[Source: Wiig, 1993]

Figure 2.5: Pillars of Knowledge Management

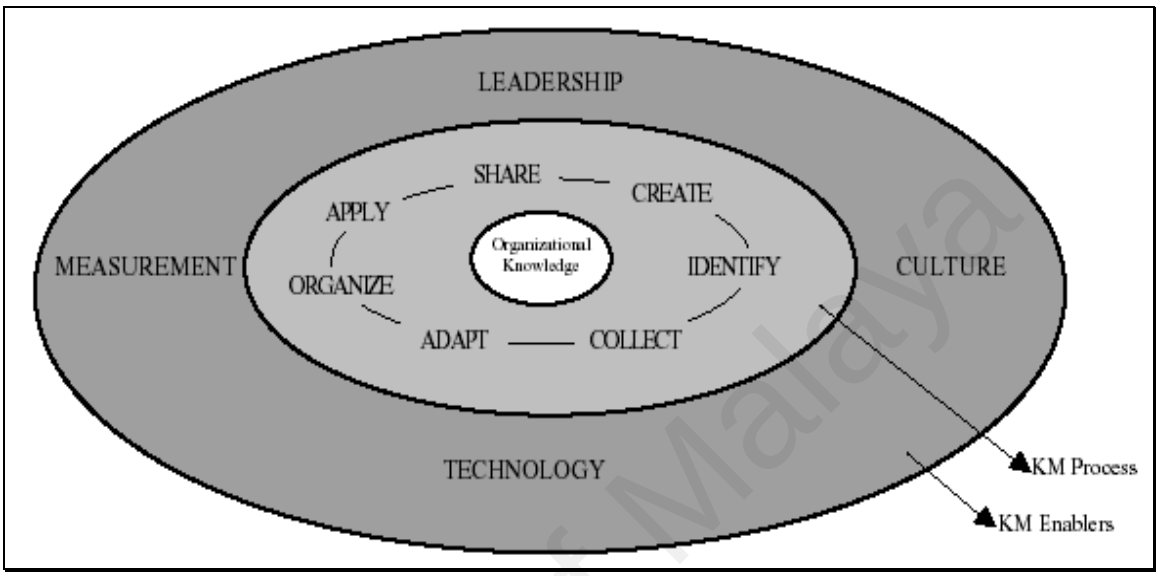
2.7.4 Model of Organizational Knowledge Management

Arthur Andersen and APQC's (1996) model comprised of seven processes that can operate on an organization's knowledge. As illustrated in **Figure 2.6**, these processes are create, identify, collect, adapt, organize, apply, and share. The nature of organizational knowledge that they process is not characterized in this model. Moreover, it does characterize the nature of the processes themselves. The model identifies four organizational enablers that facilitate the workings of the knowledge management processes:

- Leadership
- Measurement

- Culture
- Technology

However, the model does not detail the nature of the enablers.



[Source: Arthur Andersen & APQC, 1996]

Figure 2.6: Organizational Knowledge Management Model

2.7.5 Other Related Works

Distinguished from frameworks; the knowledge management literature also contains a variety of ideas and concepts that help to clarify the nature of knowledge management practices. Even though, these are not referred to as frameworks by their authors, such works may help shape the development of more comprehensive frameworks in the future. Here, the researcher stated a couple of examples of this related work. Demarest (1997) identifies four knowledge management processes that operate in an organization for the purposes of knowledge production. These four knowledge management processes (he also calls them knowledge economies) are construction, dissemination, embodiment, and use. Construction refers to "the process of discovering and structuring a kind of knowledge." Dissemination refers to the human processes and technical

infrastructure that make embodied knowledge available to the people within the firm. Use refers to the production of commercial values of the customer. He also suggests that knowledge management is the systematic underpinning, observation, instrumentation, and optimization of a firm's knowledge management knowledge economies. Taylor (1996) describes a knowledge cycle comprised of knowledge development and knowledge use. In knowledge development, knowledge is created at individual, group, and/or community levels through the activities of conceptualization, review, internalization, and sharing. Knowledge use refers to storing, distributing, applying, and reviewing the knowledge as a basis for continuing development of knowledge. Some of the existing frameworks and their description are shown in **Table 2.1**.

Table 2.1: Summary Existing KM Frameworks

Framework	Description
Alavi, 1997	(1) Acquisition (knowledge creation and content development), (2) Indexing, (3) Filtering, (4) Linking (activities 2, 3, and 4 involve screening, classification, cataloging, integrating, and interconnecting internal and external sources), (5) Distributing (packaging and delivery of knowledge in form of Web pages), (6) Application (using knowledge)
Leonard-Barton, 1995	(1) Shared and creative problem solving, (2) Importing and absorbing technological knowledge from the outside of the firm, (3) Experimenting and prototyping, (4) Implementing and integrating new methodologies and tools
Liebowitz, 1997	(1) Transform Information into Knowledge, (2) Identify and Verify Knowledge, (3) Capture and Secure Knowledge, (4) Organize Knowledge, (5) Retrieve and Apply Knowledge, (6) Combine Knowledge, (7) Learn Knowledge, (8) Create Knowledge loop back to (3) and (9) Distributor/Sell Knowledge
Van der Spek and Spijkervet, 1997	(1) Developing New Knowledge, (2) Securing New and Existing Knowledge, (3) Distributing Knowledge and (4) Combining Available Knowledge
Wiig, 1993	(1) Creation and Sourcing (2) Compilation and Transformation, (3) Dissemination Application and (4) Value Realization

2.8 Comparison and Analysis of frameworks

The analysis of some current knowledge management frameworks above reveals that several key points have been identified:

1. The frameworks are prescriptive in nature and thus center on knowledge management tasks
2. The frameworks do not address the notion of double-loop learning
3. There is no single definition of what constitutes a knowledge management framework; and
4. There are many concepts that are common to multiple frameworks, but the ordering or structure of the frameworks varies.

Based on these key points, the researcher compared the frameworks mentioned above on four aspects. These four basic aspects are:

1) Framework Basis
2) Knowledge Exploitation
3) Focus & Influences
4) Knowledge Resources

The framework basis indicates the methodology used for framework development. The aspect of knowledge exploitation activity identifies operations on these knowledge resources that can be executed in the organization's conduct of knowledge management. The knowledge exploitation activities generally do not function on the knowledge resources in a random manner. The focus and influence aspects identify the primary

intent of a framework. The knowledge resources aspect deals with the characterization of an organization's resources (e.g., "where" it is embedded, stored, manifested, and/or represented in an organization).

2.8.1 Framework Basis

The frameworks are based from both academic and practitioner sources. They have their basis in various development methodologies. For example, the framework of Arthur Andersen and APQC (1996) has the basis from consulting experiences. Some have grown out of academic study of organizations, ranging from field research into knowledge management phenomena across multiple organizations to a case study examination of an individual organization. Other frameworks have evolved out of first-hand experiences of practitioners, some in a consulting capacity and others in a management capacity. Yet other frameworks are the result of synthesizing concepts from previously published works. In one case, this synthesis was followed by an empirical evaluation of the consequential framework.

2.8.2 Knowledge Exploitation

Most of the frameworks explicit identify knowledge exploitation activities. Some frameworks treat these activities at a relatively element level, while others deal with relatively higher-level knowledge exploitation activities. For instance, the activities identified by Arthur Anderson and APQC (1996), Wiig (1993), and Van der Spek and Spijkervet (1997) appear to be more element than those identified by Nonaka (1994). The higher-level activities seem to be comprised of some configuration of more elemental activities. For example, decision-making is an activity that may involve a subset of the more element activities identified by Arthur Anderson and APQC (1996).

2.8.3 Focus & Influences

Each framework's focus reveals which of the aspect is (or are) emphasized and the orientation of that emphasis. The goal of the Arthur Andersen and APQC (1996) framework is to provide a basis for benchmarking the conduct of knowledge management within and among organizations. As such, it identifies knowledge exploitation activities and their enablers (i.e., influences on the conduct of knowledge management). Wiig (1993) focuses on managerial issues (i.e., managerial influences) that affect the conduct of knowledge management in an organization. In so doing, this framework identifies knowledge exploitation activities that are subjected to these influences. The framework of Van der Spek and Spijkervet (1997) focuses on a cycle of stages that governs the conduct of knowledge management (i.e., the pattern of knowledge manipulation activities) in an organization. However, the analysis revealed the frameworks by Wiig and Van der Spek do not place any emphasis on the alignment of the knowledge management strategy with the organizational strategy. Identified influences on some of the knowledge management frameworks are shown in **Table 2.2**.

Table 2.2: Identified Influences on Knowledge Management

	Culture	Leader ship	Measurement	Technology	Education	Reward & Incentive systems	Values & Norms
Arthur Anderson & APQC (1999)	✓		✓	✓			
Van der Spek & Spijkervet (1997)	✓	✓	✓	✓		✓	
Leonard-Barton (1995)		✓		✓	✓	✓	✓
Holsapple & Jodhi (1999)	✓	✓	✓	✓	✓	✓	

2.8.4 Knowledge Resources

The frameworks assume that knowledge resources exist, in that knowledge manipulation activities must operate on something. However, they have little to say about resource differentiation. For instance, Nonaka's framework does incorporate knowledge modes (i.e., tacit vs. explicit) with respect to human knowledge resources, but it does not identify different classes of knowledge resources. That is, it looks at one attribute of a resource rather than a range of resources. For the framework by Wiig, there was no mention at technological and human factors. In addition, the framework by Van der Spek (1997), there was no clear alignment between these two factors. Some of the frameworks and their knowledge resources are shown in **Table 2.3**.

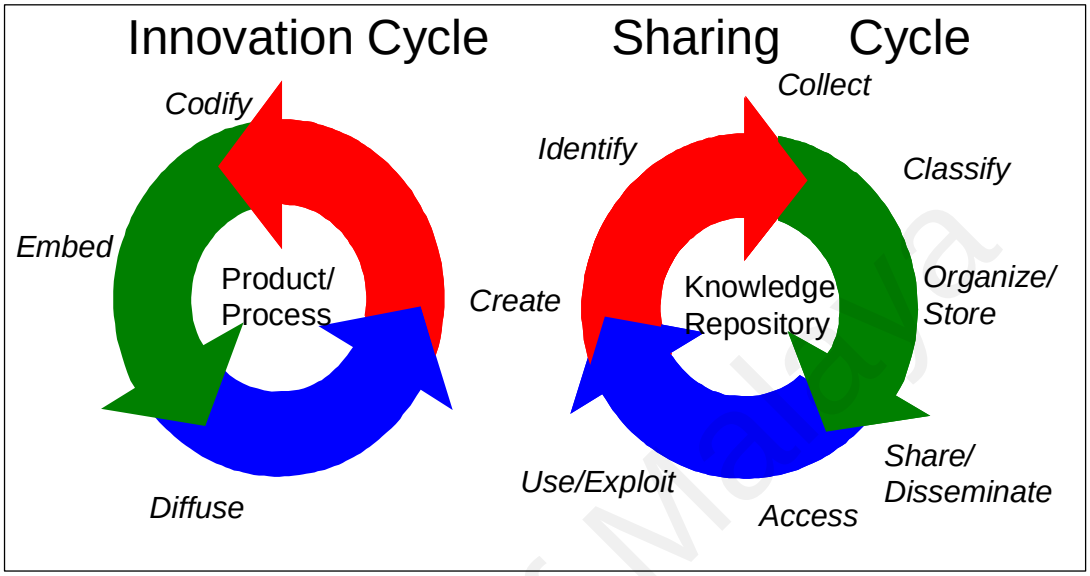
Table 2.3: Knowledge Resources

Author	Knowledge Resources
Leonard-Berton (1995)	Employee Knowledge Knowledge embedded in physical systems
Sveiby (1997)	External Structure Internal Structure Employee Competencies
Stewart (1997)	Human Capital Structure Capital Customer Capital

2.9 Techniques for Knowledge Management

In practice, knowledge management is the deployment of a set of tools and techniques that are used to help organizations manage the two knowledge cycles more effectively. Over 100 such techniques have been identified. They can be conveniently grouped according to which part of the knowledge cycle they augment (many tools can

contribute to one or more phases). An illustrative set of techniques based on Willard Model (Burk & Horton, 1988) is listed below:



[Source: Burk & Horton, 1988]

Figure 2.7: Willard Model

1) Innovation Cycle:

Create

- Creativity techniques: over 80 distinct techniques are available
- Creative abrasion: where people form different perspectives discuss ideas
- Simulation: business simulations and models often provide new insights as to how things works
- Skilful dialogue: an approach in which discussion is structured to reveal assumptions and to surface new ideas
- Morphological analysis: a specific approach in which the functions of a product are described and new combinations or alternative sought.

Codify

- Design methods: many disciplines now have formal approaches for design; these represent knowledge that was once tacit or ad-hoc and has now been systematized, often into computer-based applications
- Algorithms: many such applications have some core algorithms that embody design rules based on past experience
- Methodologies: particularly relevant to process design; a methodology in the form of procures, guidelines and workbooks represents codification of good practice

Embed

- Prototyping: initial 'proof of concept' of new knowledge; although the term is most commonly refers to new products, it can also be the prototyping of computer applications or even documents.
- Packaging: knowledge is made explicit and organized into some form of package, such as a document, a software application, or a database entry.
- Software development: this is another process used to embed knowledge into routine activities; a workflow routine is another

Diffuse

- Marketing: effective marketing is a common way of promulgating new knowledge; this may take the form of articles, conference presentations, as well as the more traditional marketing approaches such as brochures and promotion
- E-marketing: the Internet has considerably extended the scale and scope available for the diffusion of new knowledge

- Networking: for less structured and intangible knowledge informal networking is one of the effective ways of disseminating; many innovations are the result of networking along the supply chain e.g. academia with industry, and producers with customers.

2) Knowledge Sharing Cycle

Identifying

- Information audit: a process of identifying core knowledge needs and how well they are met; typically duplication of effort and some key gaps are identified
- Knowledge mapping: visual presentation of the location and structure of knowledge
- Expertise profiling: identifying the knowledge and experience of individuals, either through defined keywords for skills or free text descriptions
- Text mining: procedures for identifying core concepts within a body of textual material
- Conceptual mapping: visual mapping of knowledge, showing relationships between different entities.

Gathering

- Interviewing: semi-structured interviews are an effective way of gathering and making explicit core knowledge
- Intelligent agents: software that searches the Internet and alerts the user when new items of interest have been downloaded

- Search/retrieval: a core feature of knowledge-based software; the prevalent way of finding information on the Internet.

Organizing

- Thesaurus: a defined vocabulary of terms, used to aid retrieval from large databases; it helps users identify similar information, even when the terminology may differ
- Knowledge trees: a visual representation of categories of information
- Meta-data tools: facilities to simplify the addition of metadata (such as author name, keywords, audience etc.) to a block of information, such as a document or Web page.

Sharing

- Best practices: a best practices database is a common first project within a knowledge management programme; such entries not only describe in outline a recommended practice, but also give pointers to additional material and experts
- Office design: Scandinavian architects, in particular, have shown the important of good office design that takes account of people flows, and provides informal areas for wedge exchange
- Share fairs: an event whose purpose is to connect knowledge providers (e.g. R&D teams) with knowledge users or exploiters (e.g. business units or venture capitalists)
- Communities of Practice: an informal network or community that cuts across normal departmental boundaries to develop and share knowledge around a common interest or organizational problem

- Document management: documents are a key way of formalizing and sharing explicit knowledge; their value is enhanced is a community is built up around a key corpus of documents
- Portal: a single point of access to information and knowledge held in many different forms
- Cross-functional teams: teams with people from different disciplines and organizational units; such teams are a good way of sharing knowledge – especially informal knowledge - across normal discipline or organizational boundaries.
- Knowledge centres – an evolution of the corporate library; a knowledge centre will typically staffed by information scientists (librarians) who act as a conduit between the requester and suppliers of knowledge.

Learning

- AAR (After Action Review): a procedure developed by the US Army, but now widely used in large organizations; it is a systematic process carried out at the end of an assignment that asks: what should have happened? What actually did happen? What can we learn from what went right and what went wrong?
- Project reviews: a formal session at the end of a project to distil the lessons learned.
- Decision diaries: diaries kept by decision makers that explicitly state the assumptions and the rationale behind a particular decision
- External forums: events and networking with external peers, such as at a meeting of a professional society, to learn from the experience of others in similar situations

- Storytelling: the use of 'stories' as a way of transferring knowledge and making it memorable.

Applying

- Packaging: putting knowledge in a form that makes it more widely accessible
- Decision support: using knowledge to inform decision making
- Process/ workflow: embedding knowledge into a process to improve quality and consistency
- Case based reasoning (CBR): interpreting a situation based on analogues from the past or related situations. CBR is a particular type of artificial intelligence software.

Evaluating

- KM assessment: an assessment of activities within a knowledge management programme, gauged against generally accepted good practice
- IC measurement and accounting: a formal approach for classifying intellectual capital into its components (typically human capital, customer capital, structural capital and intellectual property) and developing metrics to assess how it is changing over time
- Benchmarking: comparison of a specific process with other organizations or units carrying out the same process; the comparison is done via a set of metrics that may reflect input parameters (e.g. level of skill used), processes and outputs / outcomes.

The above list is used to indicate the many ways in which knowledge management manifests itself within an organization. As the discipline of knowledge management becomes more established, each technique becomes better understood, documented and diffused. Many techniques have associated computer tools that make them easier to implement and diffuse through an organization.

2.10 Summary

There has been resurgence in recent literature on the most effective way of managing organizational knowledge for competitive advantage. Based on the literature review conducted, the comparative examination of descriptive knowledge management frameworks reveals that such frameworks are being approached from variety of perspective and with a variety of methodologies. Each, in its own way, contributes to an understanding of knowledge management practices. Generally, information gathered in this chapter can be used as guidelines to create a conceptual knowledge management framework for Faculty of Computer Science & Information Technology, University of Malaya.

3.0 Introduction

Research methodology is essential for any kind of research or study that is conducted because it can give us an effective research or study results. To investigate the relation between formal university education and knowledge management, a survey instrument was developed to reach as many students, staffs, and lecturer as possible. The questionnaire consisted of 14 multiple-choice questions and the survey was conducted in January 2004. Criteria chosen for framework development were comprehensiveness, correctness, conciseness, and clarity. Each criterion played a role in guiding the development of framework and assessing the degree of its success. For this project, the methodology was divided to two parts:

i) Framework Design Methodology

ii) Website Development Methodology

3.1 Framework Design Methodology

For the development of the conceptual knowledge management framework, four phases of methodology were employed, which is newly created based on the literature reviews done earlier. This new methodology can ensure the effectiveness of creating a conceptual knowledge management framework. The phases in this methodology are:

1) Environment Analysis
2) Knowledge Management Requirements Specification
3) Knowledge Management Strategy Establishment
4) Knowledge Management Framework Design

The knowledge management framework design is the most important outcome of the proposed methodology (see **Figure 3.1** and **Table 3.1**). The four phases are not independent, but interrelated to each other. Hence, knowledge management cannot be implemented by any of the four phases, but requires integrated approach.

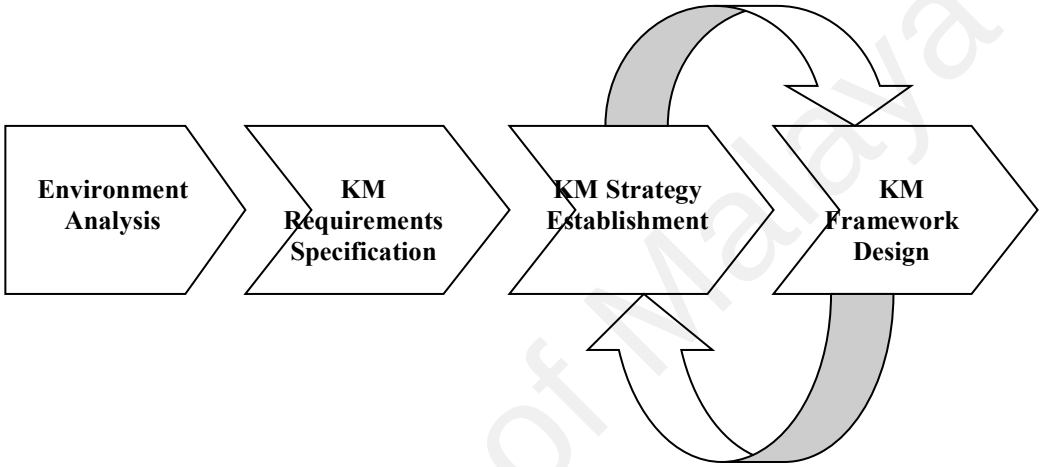


Figure 3.1: Framework Creation Methodology

3.1.1 Environment Analysis

The environment analysis is the first phase and starting point for this research. This phase is very important to understand the present situation of an organization and to collect precise data or information before moving to the next phases. During this phase, the strength, weakness, or opportunities of an organization can be identified from internal and external points of view. Based on these results, the researcher can determine the organization current status and where it should go in future. For this purpose, a survey through questionnaires was conducted.

3.1.2 Knowledge Management Requirements Specification

The knowledge requirement specification is the next phase after environment analysis and the most basic task in a knowledge strategy planning process because its results enable to recognize the directions and details of an organization's knowledge management. In this phase various types of knowledge, whose strategic potential seems to be maximized when managed appropriately, are identified. After identifying knowledge requirements, it is important to investigate how well they are actually being managed. The idea of knowledge management competence evaluation is to investigate the current state of knowledge management and potential of leveraging knowledge assets. Analysis of survey results was done at this phase to identify the requirements of knowledge management implementation for this faculty.

3.1.3 Knowledge Management Strategy Establishment

In the third phase, long-term knowledge management goals and strategies are set up based on the output of preceding two phases. The long-term objective of knowledge management is consequential through the vital form knowledge management initiatives seek. Knowledge management strategies state what should be implemented in knowledge management by which approaches. Each strategy represents what is the most important or imperative when starting a knowledge management initiative. It defines the short-term goal to be achieved firstly and searched for enablers (e.g. people, technology) available to accomplish its own goal.

3.1.4 Knowledge Management Framework Design

The knowledge management framework is the most important and substantial outcome of knowledge strategy planning. The framework plays the critical role of a blueprint for implementing knowledge management. The knowledge management framework shows

knowledge management process, which defines knowledge management activities and their relationships. In other words, the process defines a variety of processes involved in a life cycle of knowledge, from its creation to termination. Basically, knowledge management processes can be largely summarized into: creation/acquisition, registration/storage, sharing/utilization, and updating/termination. After establishing a framework for knowledge management processes, detailed activities and their relationships within each process are defined. Those works are same as building a process model of knowledge management.

Table 3.1: Summary of Methodology

Phase	Description of aspects
Environment Analysis	• Used to understand which knowledge assets play a role in which business processes • Explores and describes activities, tasks, artifacts • Analysis is based on questionnaire (survey) and observations
Knowledge Management Requirements Specification	• Identifies how knowledge is required to perform knowledge work and how it is (not) used by knowledge workers • Based on requirements gathering at different levels in the organization • May support valuation efforts, identification of bottlenecks
Knowledge Management Strategy Establishment	• Used to develop concept maps as hierarchies or nets • Provide highly developed procedure to elicit and document concept maps from knowledge workers
Knowledge Management Framework Design	• Based on knowledge surveys and results of process modeling

3.2 Questionnaire Development

Questionnaire items were developed in an iteration manner by conducting review of literature dealing with the dimensions of knowledge management framework. The questions were created for better understanding of the current state of knowledge sharing and expectations among members of FCSIT. As mentioned earlier, the questionnaire consisted of 14 multiple-choice questions, which was reviewed among 20 students before distributed for real survey. Some changes were done on the initial version of the questionnaire after considering the opinion given by the respondents. Four of the questions featured a 5 points scale, with response options ranging from "not important" to "very important". The respondents estimated that it took approximately 15 minutes to complete the questionnaire. Along with the questionnaire, the respondents will receive an introduction letter that explains the objective of survey and explained several concepts of the survey. Following the code of ethics, respondents were assured anonymity and confidentiality. The definition of knowledge management in the questionnaire is shown in **Figure 3.2**. In addition, the questionnaires are attached in **Appendix A** (Staff's Questionnaire) and **Appendix B** (Student's Questionnaire). Data collected through this questionnaire were subjected to quantitative analysis using Statistical Package for Social Sciences (SPSS, version 11.5) software.

Introduction

Knowledge Management is the *explicit* and *systematic* management of *vital knowledge* and its associated *process* of creating, gathering, organizing, diffusion, use and exploitation. It requires turning professional knowledge into corporate knowledge that can be widely shared throughout an organization and appropriately applied. (Skyrme, 1997). In simplest term, it means managing the knowledge that a person has in his/her mind and also share it with others.

Knowledge Management Framework is a complete guideline on how the process of creating, gathering, organizing, diffusion, use, and exploitation can be used in order to share and manage knowledge. People can make use the knowledge management framework to share their knowledge with others in order to benefit their organization.

Figure 3.2: Definition of knowledge management and knowledge management framework

3.3 Website Development Methodology

In order to support the theory of this research, a website for sharing of knowledge between FCSIT's staff was developed and named "FCSIT's Knowledge Management". The methodology that the researcher decided to apply in this project is based on **Linear Sequential Model** (Pressman, 2001). Sometimes called the *classic life cycle* or the *waterfall model*, the linear sequential model suggests a systematic, sequential approach to any project development. That's begins at the system level and progresses through analysis, design, coding and testing (**Figure 3.3** illustrates the linear sequential model).

Why did the researcher choose this model? It is because of the following reasons:

- It is a series of steps (like a production line)
- Each step is well defined
- Each step creates a definite product (this is often a piece of paper)
- Each product forms the basis for the next step.
- The correctness of each step can be checked. (Verification or validation)
- It divides a complex task into smaller, more manageable tasks
- Each task produces a well defined deliverable.

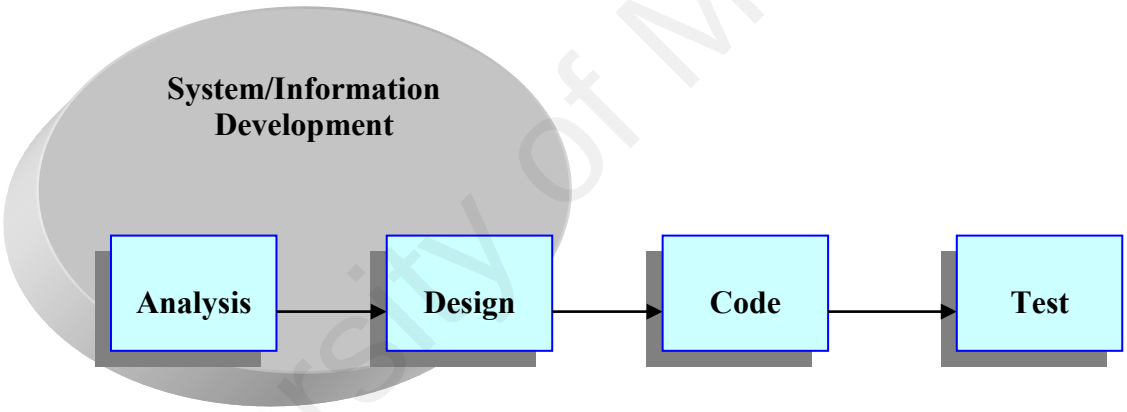


Figure 3.3 Linear Sequential Model

3.3.1 Systems/Information Development

The work to create this website begins by establishing requirements for all system elements and then allocating some subset of these requirements to larger system. This system view is essential when it must interact with others elements such as hardware and human. System development and analysis encompass requirements gathering at the system level with a small amount of top-level design and analysis.

3.3.2 Requirements Analysis

The requirements gathering process is intensified and focused specifically on system. From the literature review and survey, the researcher can identify the requirements for this system, as well as required function, behavior, performance and interface. Then, requirements for the system are documented and reviewed. In this project, requirements divided to three important parts, which are software, hardware and programming language.

3.3.3 Design

To design this website, the researcher used multi-step process that focuses on three distinct attributes of a program; data structure, interface representation and procedural (algorithmic) detail. At this phase, the researcher translates requirements into a representation of the system before coding begins. Like requirements, the design is documented.

3.3.4 Code Generation

The design must be translated into a machine-readable form. The code generation step performs this task. For this purpose, the website was created using Microsoft FrontPage 2000, Active Server Page (ASP), and JavaScript. The reason for choosing these languages is due to their easy usage and flexibility. The main reason for developing a web-based knowledge sharing is because it enables users to access the website anywhere and anytime as they wish.

3.3.5 Testing

Once code has been generated, program testing begins. For this purpose, the web pages were previewed through Personal Web Server and later uploaded on the Internet. The

testing process focuses on logical internals of the website, ensuring that all statements have been tested and on the functional externals, that is, conducting tests to uncover errors and ensure that defined input will produce actual results that agree with required results. Besides that, an evaluation form was distributed to get feedback from users about the website (see **Appendix D**). The number of users participated for this evaluation was 50 participants (students and staff).

3.4 Summary

As the basis of value creation increasingly depends on leveraging firm's intangible assets, knowledge management is emerging as powerful sources of competitive advantage. For this project, two different methodologies were applied for framework creation and website development. The participants of this survey are members of FCSIT and the conceptual framework is dedicated in the context of this faculty.

4.0 Introduction

In previous chapters, the researcher have discussed about knowledge management and methodology of this research. After a deep understanding about this topic based on the data and information collected, a questionnaire was developed. In order to support this research, responds from the questionnaire must be studied for in-depth understanding of the current status and expectations in FCSIT. As mentioned in the previous chapter, data collected throughout the questionnaire were analyzed using SPSS (version 11.5) software. To represent results and feedback, bar chart and pie chart were used to illustrate them graphically. Up to November 2004, there are 110 staff and 3200 students (Source: FCSIT, University of Malaya).

4.1 Background of Respondents

Generally, the respondents for this survey were the members of FCSIT, which can be categorized to two types:

a) Staff – Lecturers and Administration Staff
b) Students – Postgraduates and Undergraduates

It can be said that the majority of the respondents were those with IT knowledge and familiar with the term knowledge management. Their knowledge in IT and knowledge management are very important because it will help them to answer and give constructive responds to this research. However, there were a small number of respondents (administration staff) without IT knowledge but contributed their best for this survey.

4.2 Survey Response Rate

As mentioned earlier, the respondents for this questionnaire were lecturers, administration staff, postgraduates, and undergraduates. Total of the respondents are 960 people. **Table 4.1** shows the segregation of respondents and their percentages.

Table 4.1: Segregation of Respondents

Respondents	Frequency	Percentage %
Lecturer	30	3.1%
Administration Staff	30	3.1%
Postgraduate	100	10.5%
Undergraduate	800	83.3%
Total	**960**	**100%**

Based on the table above, majority of the respondents were undergraduates, which contributed 83.3% for this questionnaire. This is because the number of undergraduates at FCSIT is higher compare to other members of this faculty. Second highest contributor for this questionnaire would be postgraduate students with 10.5% of participants for this survey. Besides students, lecturers and administration staff too played an important role by being third highest participants with the percentage of 3.1% respondents. Most of the lecturers and administration staff co-operated to student's project survey as they understand and realize the necessity of such activities. In addition, they might have the experience of conducting survey for their own projects as well. This data breakdown is also represented in a pie chart, **Figure 4.1**.

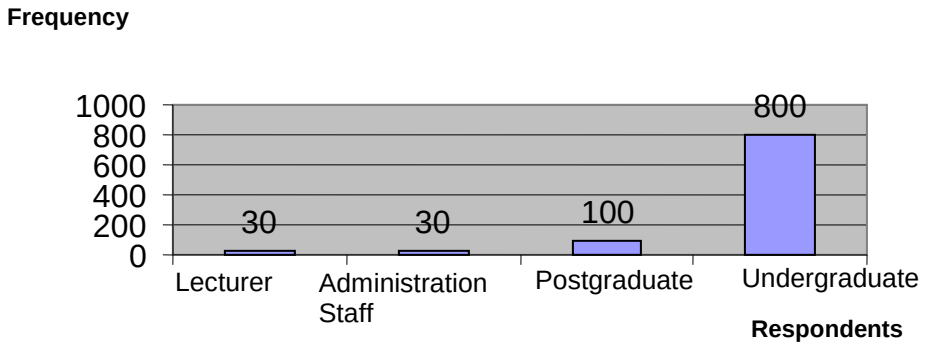


Figure 4.1: Segregation of Respondents

4.3 Data and Survey Findings

In this section, the researcher will look into results for each of the question based on the respond given by participants of this survey. As mentioned previously, the questionnaire consists of 14 questions including four scale-based questions. This section was divided to two parts:

a) Staff Questionnaire Results

b) Students Questionnaire Results

In first question **(Q1)**, the researcher asked whether staff share their knowledge with colleagues related to their work. Respondents must choose either "yes" or "no" for this question. After going through the questionnaire feedback, result for this question is shown in **Table 4.2**. It is very clear that majority of FCSIT staff do share knowledge with their colleagues in the current environment and this finding would be constructive in proposing a knowledge management framework. As shown in **Table 4.3**, 846 students chose "yes" and 54 students chose "no" for this first question. Many of the students share their knowledge because of their group assignments and also group

discussions related to the course they take each semester. As most of the courses require them to interact among each other, it is necessary for them to exchange whatever knowledge that they have.

Table 4.2: Sharing of knowledge (staff)

	Frequency	Percent	Cumulative Percent
Yes	56	93.3	93.3
No	4	6.7	100.0
Total	**60**	**100.0**	

Table 4.3: Sharing of knowledge (students)

	Frequency	Percent	Cumulative Percent
Yes	846	94.0	94.0
No	54	6.0	100.0
Total	**900**	**100.0**	

The second question **(Q2)** asked the respondents about their level of willingness to share knowledge with others if they choose "yes" for question 1. As 56 staff ticked yes for question 1, outcome of this question is shown in **Table 4.4**. Question 2 is a scale-based question, so mean and standard deviation are included in the table. The outcome of this question shows that majority of FCSIT staffs are willing to share their knowledge with others in order to achieve goals set for this faculty. Majority of students chose scale 4 and only 18 students chose scale 1 (not important). The result for this question is shown in **Table 4.5**. Generally, many of the students indicated their willingness to share their knowledge with others and only a minority of them was not keen to share their knowledge. The reason this minority of students do not share their knowledge might be because of their character, which prefer to study alone and do not

like to participate group discussions. The outcome of question 2 is also represented in bar chart, **Figure 4.2**.

Table 4.4: Willingness to share knowledge (staff)

Scale	Frequency	Percent	Cumulative Percent
2	6	10.7	10.7
3	16	28.6	39.3
4	18	32.1	71.4
5	16	28.6	100.0
Total	**56**	**100.0**	
Mean	**3.79**		
Std. Deviation	**.995**		

Table 4.5: Willingness to share knowledge (students)

Scale	Frequency	Percent	Cumulative Percent
1	18	2.1	2.1
2	27	3.2	5.3
3	234	27.7	33.0
4	378	44.7	77.7
5	189	22.3	100.0
Total	**846**	**100.0**	
Mean	**3.82**		
Std. Deviation	**.892**		

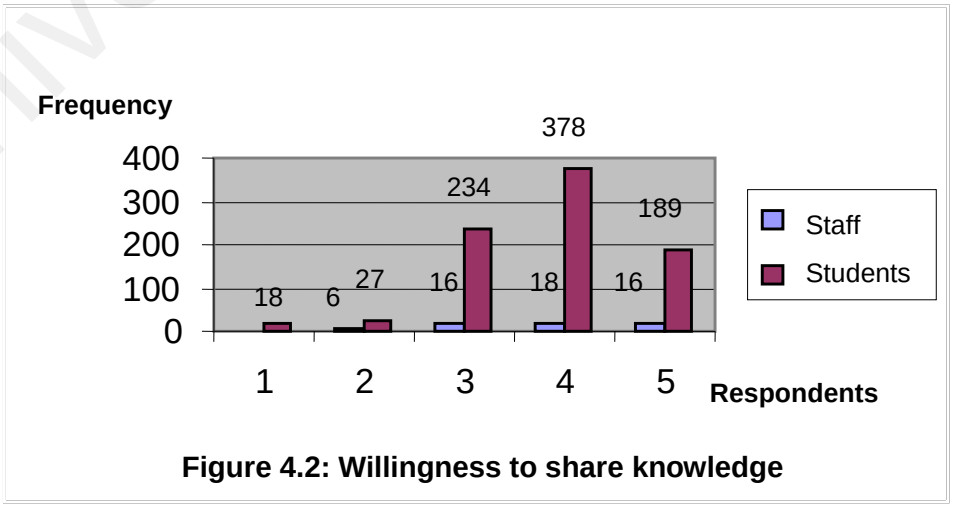


Figure 4.2: Willingness to share knowledge

Now the researcher continues with question 3 **(Q3)**, which investigated if staff uses IT to share his/her knowledge. For this question, 56 respondents use IT to share their knowledge and 4 respondents do not use IT. Result for this question is shown in **Table 4.6**, which shows that IT (computer, email, etc.) is crucial in sharing their knowledge. In addition, 872 students chose "yes" and 28 students chose "no". The breakdown is shown in **Table 4.7**. It is very clear that IT is an important tool for sharing knowledge among these students. Besides that, these students have higher chances using IT in their everyday life because their study field is strongly related with IT. In addition, facilities (e.g. computer lab, internet, etc.) available at this faculty boost the students to take advantage of technology.

Table 4.6: Using IT for knowledge sharing (staff)

	Frequency	Percent	Cumulative Percent
Yes	56	93.3	93.3
No	4	6.7	100.0
Total	**60**	**100.0**	

Table 4.7: Using IT for knowledge sharing (students)

	Frequency	Percent	Cumulative Percent
Yes	872	96.9	96.9
No	28	3.1	100.0
Total	**900**	**100.0**	

Question 4 **(Q4)** investigated the level of importance in using IT to share their knowledge with others. This is a scale-based question and the result for staff is shown in **Table 4.8**, together with its mean and standard deviation. Generally, majority of the respondents feel that IT plays an important role in sharing their knowledge with others. This might be because most of the people at this faculty use computer and Internet in

their everyday life. As shown in **Table 4.9**, the highest score for student questionnaire will be on scale 5 (very important) with 41 frequencies. Only 18 students chose scale 1 (not important), which means majority of the students felt that IT is important. This result shows that most of the FCSIT students realize the essential of IT, which is required for a better life in present and future.

Table 4.8: Level of importance using IT (staff)

Scale	Frequency	Percent	Cumulative Percent
2	4	6.7	6.7
3	14	23.3	30.0
4	22	36.7	66.7
5	20	33.3	100.0
Total	**60**	**100.0**	
Mean	**3.97**		
Std. Deviation	**.928**		

Table 4.9: Level of importance using IT (students)

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
1	18	2.0	2.0	2.0
2	45	5.0	5.0	7.0
3	216	24.0	24.0	31.0
4	252	28.0	28.0	59.0
5	369	41.0	41.0	100.0
Total	**900**	**100.0**	**100.0**	
Mean	**4.01**			
Std. Deviation	**1.020**			

Question 5 **(Q5)** dealt with the way the staff uses to share their knowledge among themselves. The choices given to them were email, MSN/Yahoo Messenger, face to face, and telephone. Besides these choices, they were allowed to give their own answer and for this question and their answer can be more than one. **Table 4.10** below shows

breakdown based on the feedback given by respondents. As for students, the score for e-mail is 900 students, MSN/Yahoo Messenger is 858 students, face to face is 885 students, telephone is 895 students and only 10 students gave other then these 4 choices. The result for student's response is shown in **Table 4.11**. This outcome was expected because students like to spend time using real-time chatting tools to communicate with their friends and family. Besides that, majority of students these days own mobile phone and use it as alternative communication tool, especially via SMS.

Table 4.10: Way of sharing knowledge (staff)

	Frequency	Percent	Cumulative Percent
Email	60	29.1	29.1
MSN/Yahoo Messenger	26	12.6	41.7
Face to Face	60	29.1	70.9
Telephone	60	29.1	100.0
Total	**206**	**100.0**	

Table 4.11: Way of sharing knowledge (students)

	Frequency	Percent	Cumulative Percent
Email	900	25.4	25.4
MSN/Yahoo Messenger	858	24.2	49.6
Face to face	885	24.9	74.5
Telephone	895	25.2	99.7
Other	10	0.3	100.0
Total	**3548**	**100.0**	
Mean	**2.50**		
Std. Deviation	**1.183**		

Based on the table above, many of the respondents chose e-mail, face to face, and telephone because it is more convenient and suitable to working environment. MSN and

yahoo messenger are not suitable to be used in office for most companies. This result is also represented in bar chart, **Figure 4.3**.

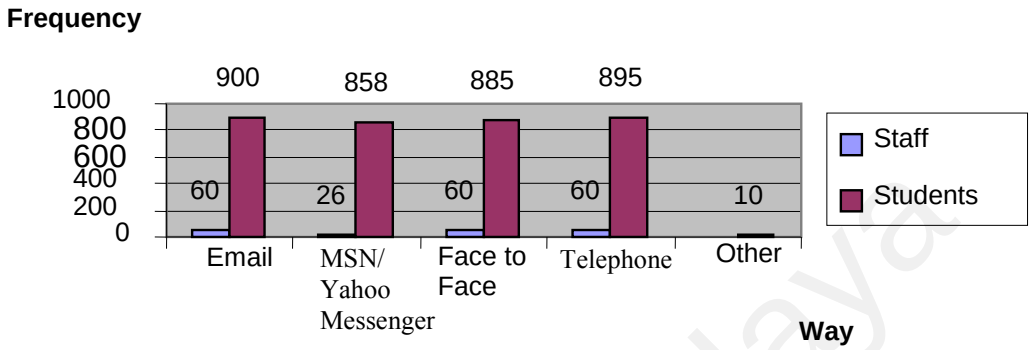


Figure 4.3: Way of sharing knowledge

Next, question number 6 **(Q6)**, the researcher asked respondents the level of importance in sharing knowledge, where they must indicate between 1 and 5. The staff's result for question 6 is shown in **Table 4.12**. None of the respondents ticked level 1 and 2, so it is not included in the table. Based on this result, it is very clear that majority of the respondents felt that sharing of knowledge is very important and crucial to achieve organizational goals and successfully complete any given task. For this same question, majority of students ticked scale 5 because they felt that knowledge sharing is very important. However, only two students ticked scale 1. The outcome for question 6 is shown in **Table 4.13**. This result is an important input for this project because their participation in knowledge sharing will ensure the success of knowledge management implementation.

Table 4.12: Level of importance in sharing knowledge (staff)

Scale	Frequency	Percent	Cumulative Percent
3	12	20.0	20.0
4	22	36.7	56.7
5	26	43.3	100.0
Total	**60**	**100.0**	
Mean	**4.23**		
Std. Deviation	**.774**		

Table 4.13: Level of importance in sharing knowledge (students)

Scale	Frequency	Percent	Cumulative Percent
1	18	2.0	2.0
2	18	2.0	4.0
3	243	27.0	31.0
4	261	29.0	60.0
5	360	40.0	100.0
Total	**900**	**100.0**	
Mean	**4.03**		
Std. Deviation	**.969**		

Question number 7 **(Q7)** was to find out whether respondents are familiar with the term 'knowledge management'. They were required to choose either "yes" or "no" to answer this question. The breakdown of respondents that chose "yes" and "no" is shown in **Table 4.14**. As shown in the table, majority of the staff are familiar with the term 'knowledge management', where 54 respondents chose "yes". 6 out of 60 respondents chose "no" because they never heard of this term before. Majority of the staff are familiar with this term because knowledge management is one of the course offered for both undergraduate and postgraduate studies. Now the researcher moves on to student's response on this question, where 855 students chose "yes" and only 45 students chose "no". This result is shown in **Table 4.15**. As majority of the students are familiar with knowledge management, then it is easier to get their support in implementing this approach.

Table 4.14: Familiarity of the term 'knowledge management' (staff)

	Frequency	Percent	Cumulative Percent
Yes	54	90.0	90.0
No	6	10.0	100.0
Total	**60**	**100.0**	

Table 4.15: Familiarity of the term 'knowledge management' (students)

	Frequency	Percent	Cumulative Percent
Yes	855	95.0	95.0
No	45	5.0	100.0
Total	**900**	**100.0**	

In addition, question 8 **(Q8)** was intended for those respondents who chose "yes" for question 7. This question was asked to find out how they get to know the term 'knowledge management'. They were given five choices and allowed to choose more than 1 answer. Besides that, respondents can also provide they own answer for this question. **Table 4.16** shows the findings for question 8 given by staff. As shown in the table, most of the respondents got to know about knowledge management through world wide web, magazine, course, and journal. Only 28 respondents chose face to face for question 7. None of the respondents gave other than the answers stated in the questionnaire. Besides that, **Table 4.17** gives the breakdown of feedback given by students, where 855 students chose World Wide Web, 774 students chose magazine, 630 students chose newspaper, 792 students chose course, 630 students chose journal, and only 45 students gave other answer. The result is also represented in a pie chart, **Figure 4.4**.

Table 4.16: How respondents know the term 'knowledge management' (staff)

	Frequency	Percent	Cumulative Percent
World Wide Web	56	24.6	24.6
Magazine	52	22.8	47.4
Face to face	28	12.3	59.6
Course	42	18.4	78.1
Journal	50	21.9	100.0
Total	**228**	**100.0**	
Mean	**2.90**		
Std. Deviation	**1.511**		

Table 4.17: How respondents know the term 'knowledge management' (students)

	Frequency	Percent	Cumulative Percent
World Wide Web	855	22.9	22.9
Magazine	774	20.8	43.7
Newspaper	630	16.9	60.6
Course	792	21.3	81.9
Journal	630	16.9	98.8
Other	45	1.2	100.0
Total	**3726**	**100.0**	
Mean	**2.92**		
Std. Deviation	**1.457**		

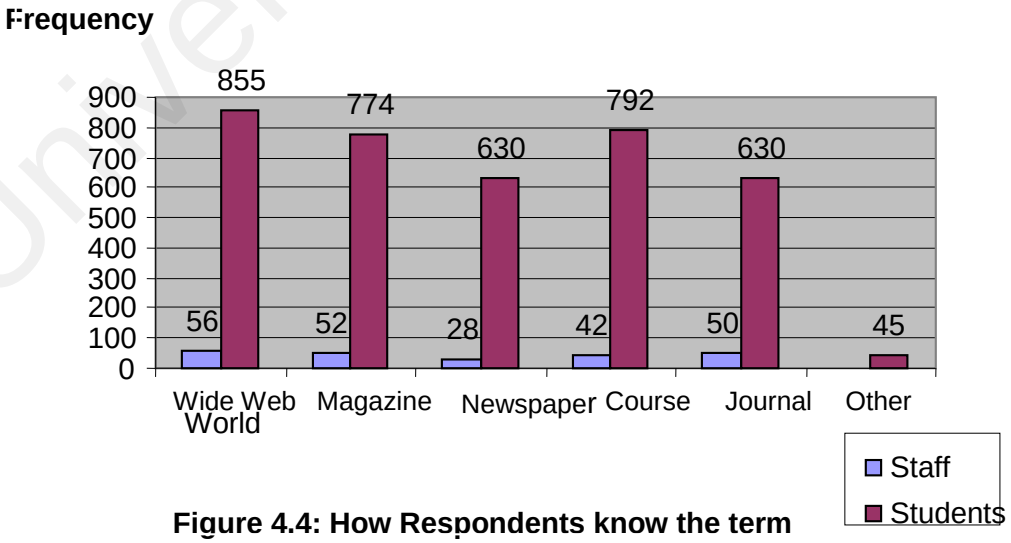


Figure 4.4: How Respondents know the term

Meanwhile, if respondent chose "no" for question 7, then they are required to move to question 9 **(Q9)** (not required answering question 8). This question asked the

respondents if they are interested to know more about knowledge management, as there are not familiar with this term. In question 7 earlier, only six of staff ticked "no" and out of these respondents, four of them chose "yes" and two chose "no". The breakdown of feedback for this question is shown in **Table 4.18**. Meanwhile, for students, out of 45 students who chose "no", all of them chose "yes" to know more about knowledge management with the percentage of 100% as shown in **Table 4.19**. This is a good sign to implement knowledge management culture in this faculty.

Table 4.18: Interested to know about knowledge management (staff)

	Frequency	Percent	Cumulative Percent
Yes	4	66.7	66.7
No	2	33.3	100.0
Total	**6**	**100.0**	

Table 4.19: Interested to know about knowledge management (staff)

	Frequency	Percent	Cumulative Percent
Yes	45	100%	100%
No	0	0	100.0
Total	**45**	**100.0**	

With accordance to question 10 **(Q10)**, the researcher investigated the necessity to have guidelines on how to manage knowledge. Out of 60 staff, 58 of them chose "yes" and only 2 respondents chose "no". The result for this question is shown in **Table 4.20**. Based on this outcome, it is clear that respondents indicated that it is necessary to have guidelines on how to manage their knowledge for better utilization of knowledge and experience available within this faculty. For question 10, majority of students felt that it

is necessary to have guidelines on how to manage knowledge with 848 students chose "yes". However, 52 students felt that it is not necessary. The outcome is represented in **Table 4.21**. Even though minority students felt that it is not necessary, there is a possibility that they might change their mind upon implementation of knowledge management.

Table 4.20: Necessity to have guidelines (staff)

	Frequency	Percent	Cumulative Percent
Yes	58	96.7	96.7
No	2	3.3	100.0
Total	**60**	**100.0**	

Table 4.21: Necessity to have guidelines (students)

	Frequency	Percent	Cumulative Percent
Yes	848	94.2	94.2
No	52	5.8	100.0
Total	**900**	**100.0**	

Now we move on to question 11 **(Q11)**, which was asked to find out if it is necessary to implement knowledge-sharing culture among people in FCSIT. For this question, the score is similar to question 10, where 58 staff chose "yes" and only 2 staff chose "no". **Table 4.22** gives the breakdown of feedback for this question, which shows that majority staff agreed that knowledge sharing culture is necessary in providing better service and quality of education. For the same question, out of 900 students, 865 of them chose "yes" and 35 respondents chose "no". The outcome of this question is

shown in **Table 4.23**. Those students, who chose "no", might not understand well on the importance of knowledge sharing culture for an organization.

Table 4.22: Knowledge Sharing Culture Implementation (staff)

	Frequency	Percent	Cumulative Percent
Yes	58	96.7	96.7
No	2	3.3	100.0
Total	**60**	**100.0**	

Table 4.23: Knowledge sharing culture implementation (students)

	Frequency	Percent	Cumulative Percent
Yes	865	96.1	87.0
No	35	3.9	100.0
Total	**900**	**100.0**	

Question 12 **(Q12)** asked respondents on their willingness to share knowledge based on a knowledge management framework. The feedback given by staff for this question is shown in **Table 4.24**. The outcome of this question shows that majority of the respondents are supportive and willing to share their knowledge based on a framework. For this question, majority of the students indicated that they are willing to share their knowledge based on a framework and the figures are shown in **Table 4.25**. This result is a big boost for this project because it's a proof that knowledge management framework is necessary for this faculty.

Table 4.24: Willingness to share knowledge based on framework (staff)

Scale	Frequency	Percent	Cumulative Percent
2	2	3.3	3.3
3	14	23.3	26.7
4	14	23.3	50.0
5	30	50.0	100.0
Total	**60**	**100.0**	
Mean	**4.20**		
Std. Deviation	**.925**		

Table 4.25: Willingness to share knowledge based on framework (students)

Scale	Frequency	Percent	Cumulative Percent
1	45	5.0	5.0
2	36	4.0	9.0
3	189	21.0	30.0
4	351	39.0	69.0
5	279	31.0	100.0
Total	**900**	**100.0**	
Mean	**3.87**		
Std. Deviation	**1.060**		

This outcome is crucial for this research because it will decide whether a knowledge management framework is really necessary to be created or not.

Next, question number 13 **(Q13)**, dealt with respondent's opinion on which will be the best way to share their knowledge. The choices given to them were web-based, face-to-face, and telephone. Besides that, the respondents could also give other than the choices listed and allowed to choose more then 1 answer for this question. **Table 4.26** shows the outcome of this question given by staff. The result shows that web-based knowledge sharing is important as well as telephone and face-to-face approach. The same question indicated that 873 students chose web-based and only 36 students gave other answers.

The number of score for each choice given in this question is shown in **Table 4.27**. Most of the students chose web-based because it is suitable for those majoring in computer field, as they are 'fanatical' to computers and Internet. The outcome of this question is also illustrated in **Figure 4.5**.

Table 4.26: Best way of sharing knowledge (staff)

	Frequency	Percent	Cumulative Percent
Web	60	32.6	32.6
Face to face	60	32.6	65.2
Telephone	60	32.6	97.8
Other	4	2.2	100.0
Total	**184**	**100.0**	
Mean	**2.04**		
Std. Deviation	**.863**		

Table 4.27: Best way of sharing knowledge (students)

	Frequency	Percent	Cumulative Percent
Web Based	873	36.9	36.9
Face to Face	720	30.4	67.3
Telephone	738	31.2	98.5
Other	36	1.5	100.0
Total	**2367**	**100.0**	
Mean	**1.97**		
Std. Deviation	**.862**		

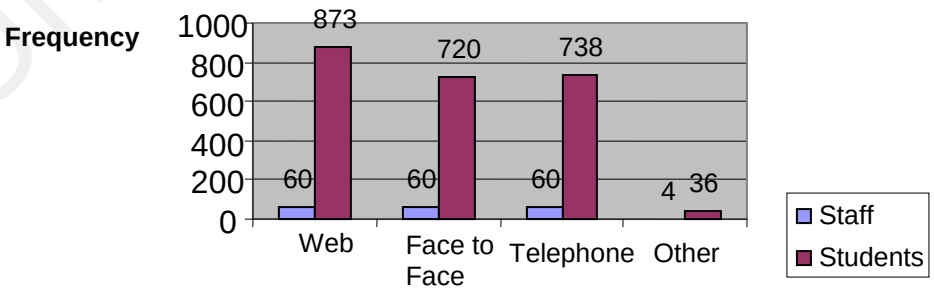


Figure 4.5: Best way of sharing knowledge

Last question, number 14 **(Q14)**, asked for respondent's opinion on what are the necessary characteristics for KM framework. They were given three choices; user friendly, simple, and/or effective. If they have any other characteristic, then they may specify it. Respondents might choose more than 1 answer for this question. The outcome of this question given by staff is shown in **Table 4.15**. All the participants chose user friendly and effective as their priority, which means 100% of score. Meanwhile, 58 respondents chose simple and 4 respondents gave extra characteristic. Generally, they prefer the framework to be easily assisting them in knowledge sharing approach. All students chose the three characteristics given in the question and 18 students gave an additional characteristic. The result for this question is shown in **Table 4.29**. All the students felt that the knowledge management framework should fulfill all three characteristics stated in the questionnaire form. The response given by both staff and students is illustrated in **Figure 4.6**.

Table 4.28: Characteristics of framework (staff)

	Frequency	**Percent**	**Cumulative Percent**
User friendly	60	33.0	33.0
Simple	58	31.9	64.8
Effective	60	33.0	97.8
Other	4	2.2	100.0
Total	**182**	**100.0**	
Mean	**2.04**		
Std. Deviation	**.868**		

Table 4.29: Characteristics of framework (students)

	Frequency	Percent	Cumulative Percent
User Friendly	900	33.1	33.1
Simple	900	33.1	66.2
Effective	900	33.1	99.3
Other	18	.7	100.0
Total	**2718**	**100.0**	
Mean	**2.01**		
Std. Deviation	**.831**		

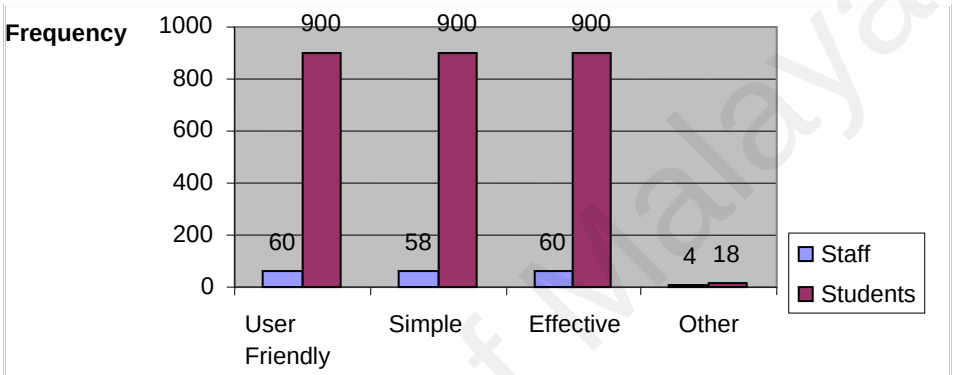


Figure 4.6: Characteristics of Framework

4.4 Similar Research: Australian Telecom Company and Arthur Anderson

Koennecker et al. (1999) reports on the introduction of an Experience Factory in an Australian telecommunications company. The study was done by the company in co-operation with the Center for Advanced Empirical Software Research at the University of New South Wales, Australia. The goal was to find out knowledge sharing between staff. This was sought to be done by collecting information that was already documented in the company, and to make it available and searchable, a kind of a "bottom up" way to start a knowledge management program. The article then reports the usage of this experience base over time, and classifies the searches that were made. A survey amongst the staff was conducted, and the acceptance and judgment of knowledge management was good. The experience database is also reported to break

down barriers between project environments, but this is not supported by quantitative data. Although no information is given on the research method used, it seems that the researchers involved defined the metrics to collect and we can then say that this is a case study. In a later paper, this introduction is described as a "failure" and the project was abandoned by management. Some reasons for this are discussed in the paper:

- The researchers felt that there was a lack of ongoing management support for this initiative.
- The goals and payback-criteria for the project were not clearly defined.
- The researchers think that a more formal approach should have been used to construct an experience-repository, because the users were physically co-located, and the number of people relatively small. The scientific method here is assertion.

In addition, the survey conducted by Arthur Anderson (1996) in their organization showed that a knowledge management infrastructure must provide the following physical benefits:

- No boundaries between departments as to what documents they can access via databases and editing of them via whiteboards and the like;
- Total mobility in that all of these resources can be accessed at all times from each PC;
- Easy access to documents because they are all accessible through each PC and can be modified by each individual for their particular need and use;
- One password can be set up for each individual for use at his or her PC that allows them access to information as the company deems necessary.

Based on these surveys outcomes, the researcher able to get a clear picture by combining and comparing them with the survey conducted at FCSIT.

4.5 Summary

Based on the results of this questionnaire, the response given by participants provides a constructive input for creating knowledge management framework. These entire outcomes will be used and considered in creating the framework, which is presented in the next chapter.

5.0 Introduction

For this chapter, the researcher will discuss about the inputs collected in the previous chapters in order to get a positive output (conceptual framework) for this research. Before that, the researcher will go through a glimpse of contents from the previous chapters.

In the first chapter, some of the problems related to this field of study were discussed and a brief introduction on this research was presented. Next, in the second chapter, literature review was done to get some knowledge and information of the existing works related to knowledge management and its framework. The researcher has gone through some of the knowledge management implementation in higher education institutions and other knowledge management frameworks. Moreover, the researcher also discussed about the methodology that will be used for this research in Chapter 3. The researcher described the steps and the guidelines that need be followed in order to develop this research. Then, in Chapter 4, the researcher discussed the results of the survey done earlier and analyzed it to get an insight of the data collected.

In addition, the contents of Chapter 5 are related with results of the questionnaire that can be used as a proof to support this discussion. This chapter contains an important part of the research where the researcher will proposed a conceptual knowledge management framework for Faculty of Computer Science and Information Technology, University of Malaya.

5.1 Information Technology

Many IT system vendors have already recognised the market potential of labelling their products and services "knowledge management" solution. Similar to how a filing system, an e-mail system or other systems, does not automatically structure your document files or facilitates retrieving them, improves efficiency or solves whatever expectations we might have, this kind of "knowledge management systems" does never solve the real problems that you have.

Knowledge management is ***not*** about implementing an information technology (IT) solution. "The assumption that technology can replace human knowledge or create its equivalent has proven false time and again" (Davenport, 1997).

But the other side of the story is that knowledge management does have a very strong technology component attached to it. To create effective working organizations today totally without incorporating IT, is like turning your back to the future. Knowledge management is strategic management. Strategic management requires that the top management fully exploit the opportunities given by IT for effective management purposes.

Our view even is that IT solely as a support tool for the organizational activities and processes, in fact is a weak strategic angel. It is the new opportunities given by IT that need to be extensively exploited. This requires that IT is totally integrated as a central component into the organization's processes. More and more managers do see that IT gives strategic advantages through implementing a knowledge management perspective in their organization.

5.2 Survey Findings

Based on the results of questionnaire, the researcher has identified four major findings for this research as listed below:

i) Knowledge sharing is happening

ii) IT plays an important role

iii) Support to knowledge management

iv) Willingness to follow a framework

Basically, the researcher can conclude that members of this faculty are supportive of knowledge management and its framework, which they preferred it to be related with IT, rather than traditional one. These main inputs are mentioned in-depth in the next section and related to certain questions (from the questionnaire) as a proof.

5.2.1 Knowledge sharing is happening

The questionnaire started by first asking the respondents whether they do share their knowledge or not. The outcome of this question (Q1) provides us a conclusion that knowledge sharing is already happening in the present environment at this faculty because about 94% of the respondents chose "yes". This means that members of this faculty are familiar with knowledge sharing and realized that it is very important in their everyday life.

5.2.2 IT plays an important role

The survey also included questions, which relate the knowledge sharing with IT. While the researcher gone through the outcome of such as questions (question Q3 and Q4), it

showed that about 89% of the respondents agreed that they use IT to share knowledge and it plays an important role to facilitate knowledge sharing. The researcher can make a conclusion that IT is a must element in knowledge management implementation. Knowledge is at the heart of IT infrastructures, which are designed to transfer information and make knowledge available. Lack of knowledge is principally caused by inadequacies in the IT infrastructure

5.2.3 Support to knowledge management

In the second page of the questionnaire, the researcher has attached a paper that gave a brief description of knowledge management and framework. As most of the respondents understand about knowledge management, they realized the importance of knowledge sharing and supportive to this effort. Question number 11 (Q11) is a proof where almost 89% from 960 respondents felt that it is necessary to practice knowledge management.

5.2.4 Willingness to follow a framework

Based on the questionnaire's outcome, the researcher can also conclude that majority members of this faculty are willing to follow the guidelines and framework if exists for this faculty. This is because the result for question 6 (Q6) showed that about 35% of the respondents chose scale 5 and another 35% chose scale 4. Besides that, the preferred way of sharing their knowledge would be web-based where almost 98% of the respondents chose it.

5.3 Proposed Knowledge Management Framework

The main purpose of this paper is to propose a conceptual knowledge management framework for Faculty of Computer Science & Information Technology, University of Malaya. However, this conceptual framework can also be used for any other faculties or

higher education institutions because their 'business' deals with *knowledge*. The proposed framework for FCSIT is shown in **Figure 5.1**. This framework is created based on the information of existing knowledge management frameworks and also the responds given in the survey, which was done earlier.

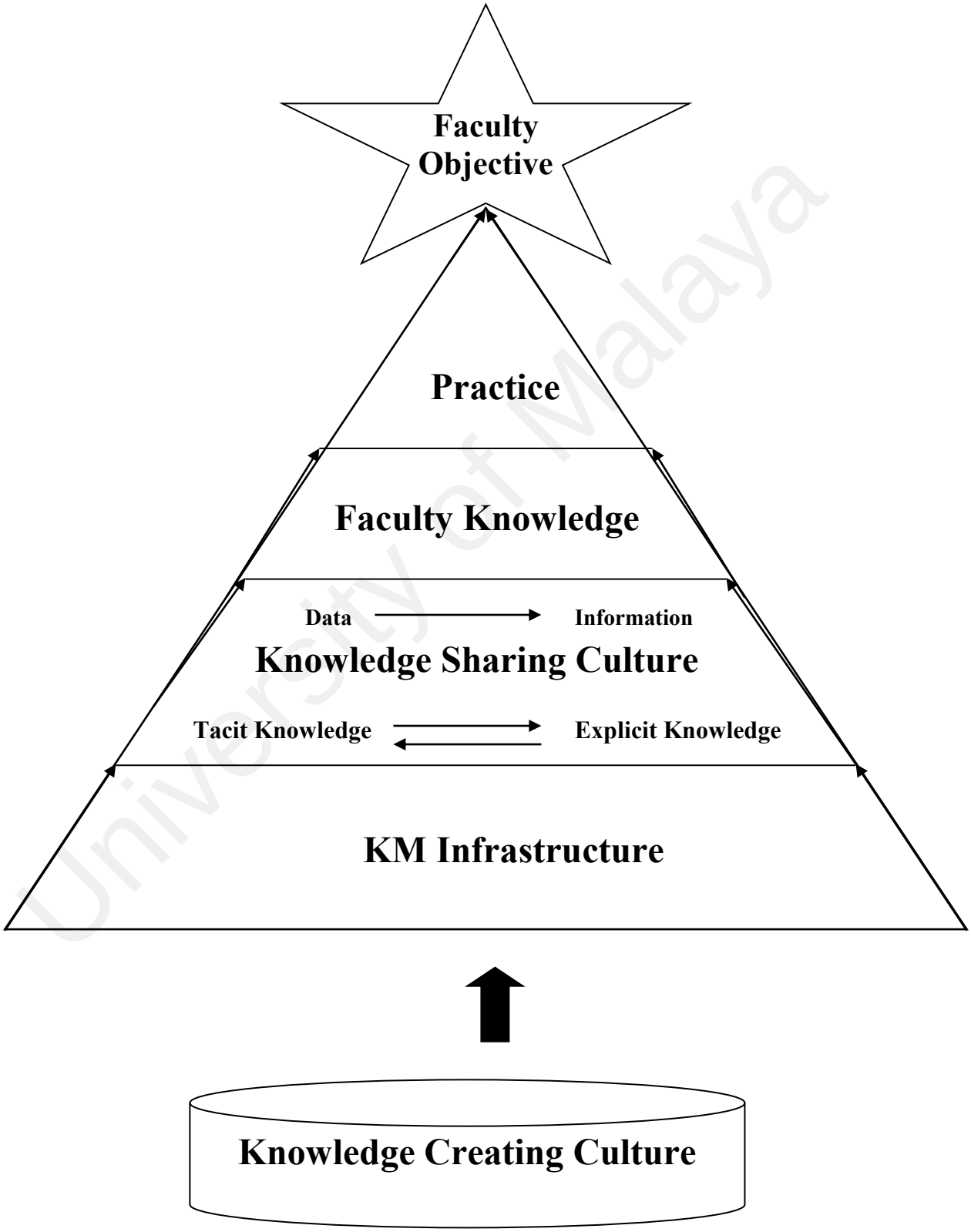


Figure 5.1: Proposed Knowledge Management Framework

5.3.1 Knowledge Creating Culture

The first step is acquisition of knowledge that is new to the organization, and perhaps represents newly created knowledge. Knowledge-centric organizations need to have appropriate knowledge available when it is needed. They may buy this knowledge, potentially through acquisition of another organization, or they may generate it themselves. This is the starting-point for knowledge management in any organization because without knowledge as an asset, it is impossible to implement knowledge management. For this faculty, they may encourage their staffs to pursue higher education or attend many seminars to get more knowledge. This is sometimes referred to as knowledge innovation (Amidon, 1997) and involves human capital. Basically this knowledge can be group into two categories:

1) Individual Knowledge

Since knowledge is an asset enhanced with use, not consumed when applied, nor lost when transferred, a critical challenge is to attract and retain knowledgeable and motivated staff. These sentiments are often echoed in service based organizations yet when the state of the processes which are supposed to deliver these is examined we usually find fragmented inconsistent practices at best. One way to start to deal with the challenge is to improve the processes which hire staff, align incentives with the business outcomes of value, recognize and reward, train, develop human potential, provide varied experience, and encourage staff to share experience. The same is generally true for acquiring knowledge from the outside through partnerships, hiring of consultants, research consortia etc. If these supposed enabling processes do not deliver appropriate enablers then knowledge will not translate to action. The objective is to enhance our ability to perform. Performing is a subsequent act.

2) Organizational Knowledge

Organizational size is a major factor in KM. Size matters since the larger the organization, the more potential knowledge exists but at the same time the harder it is to identify its source and get access to it with a trust relationship among the potential collaborators.

In larger organizations, especially, process becomes critical and advanced process renewal aims to optimize knowledge flow. For example time to market of new product ideas is a significant factor in fast moving industries such as electronics, telecommunications and banking. This process must exploit knowledge effectively and efficiently and it must not drag or breakdown. Processes which embed knowledge in other processes or enablers are paramount. They must generate, collect, structure, store, and distribute and share or stagnation will set in. Collaborative workflow processes which require a well defined flow of activity from knowledge worker to knowledge worker must have well designed connective tissue. Collaborative workgroup processes which require shared research, design and development must have the mechanisms for ongoing sharing of interim and unproven results without professional fear or jealousy. Official and unofficial teams must have shared measures and incentives

5.3.2 KM Infrastructure

Infrastructure plays an important role in any knowledge management implementation and it can be referred to as backbone of any knowledge management. So, once knowledge is acquired, there must be an infrastructure to facilitate management of knowledge using technology. Most of the organizations used intranet and Internet when it comes to knowledge management infrastructure. As for this faculty, it involves only the Internet because it is user-friendly and cost effective, and also to enable members of

this faculty to access easily. This website was developed using Microsoft FrontPage 2000, which enables the staff to share their knowledge among each other. Descriptions of the website were given in the next chapter (Chapter 6). The successful of knowledge management infrastructure is crucial before moving to the next step.

There is no one technology which is 'the' KM technology despite what the vendors say. KM requires all of our technology to work together as a whole in support of business aims in order to optimize our results.

The type of knowledge will determine the best IT support:

- Specific, repeatable consistent knowledge can be embedded in workflows, expert guidance systems and other 'push' process automation tools.
- Common reference materials can be published from databases and repositories into shareable multimedia reference documents through intranets.
- Complex, fast changing knowledge can be accessed through groupware solutions which identify and connect the right knowledgeable people rather than trying to just code the knowledge into reference able documentation.
- General individual knowledge currency can be maintained with the help of active or passive environment scanning tools either focusing internally and/or externally to find, store and advise of new structured knowledge.
- Knowledge workers searching for patterns in large amounts of stored data or information can be aided by data warehousing suites and related analysis tools

5.3.3 Knowledge Sharing Culture

Once the knowledge management infrastructure is available, it can facilitate the sharing on knowledge among members of this faculty. At this stage, the tacit knowledge is transferred to explicit knowledge and the other way round. In addition, data is changed to useful information so others can use it when required in a situation. The reason for providing knowledge management infrastructure earlier is to encourage the members to use the facility provided and this can boost the knowledge sharing culture. Besides that, the other reason is to ensure that there is no barrier in knowledge sharing. Knowledge sharing is mandatory for any knowledge management implementation and it involves human capital. In this phase, it involves 3 conversions:

i. Data to Information
ii. Tacit to Explicit
iii. Explicit to Tacit

5.3.3.1 Data to Information

Data is a raw numbers and facts, while information is a flow of messages or processed data. So, it is crucial to collect and identify useful information (i.e. knowledge acquisition) and this information will be knowledge when it is processed in the mind of an individual. If data becomes information when they add value in some way, then information becomes knowledge when it adds insight, abstractive value, better understanding.

5.3.3.2 Tacit to Explicit

The transition of tacit knowledge to explicit knowledge is an important part of a knowledge management project. Expressing the knowledge in written language (i.e.

documentation.) can do this transition and it is depending on how well an individual can express it. Basically, conversion of tacit knowledge to explicit knowledge means the articulation of knowledge into tangible form, usually through communication. On-line discussion databases are potential tool to capture tacit knowledge and to apply it to immediate problems.

5.3.3.3 Explicit to Tacit

Creating own experience such as learning by doing, where individuals internalize knowledge from documents into their own body of experience. Basically, it is the conversion of knowledge from tangible form (i.e. document) into intangible form (i.e. experience). For example, putting a document in the context of a subject category or of a step in a teaching process, by using document categorization, can help a user to understand the applicability or potential value of its information. Discovery of relationships between and among documents and concepts helps users to learn by exploring an information space. **Table 5.1** shows some examples of technologies that may be applied to facilitate the knowledge conversion processes.

Table 5.1: Examples of technologies that can enhance knowledge conversion

Explicit to Tacit	Tacit to Explicit
• Visualization • Browsable video/audio of presentations	• Answering questions • Annotation

5.3.4 Faculty Knowledge

Once knowledge sharing is already happening, there will be a huge knowledge available in this faculty. This collection of knowledge is referred to as faculty knowledge and

stored in a database, which referred as knowledge repository. What is kept in repository? Basically, repository holds much diverse information. This database allows the storage and retrieval of information in text format. In addition, it will make the lessons learned available to other members of this faculty. The faculty knowledge is precious because it is also the intellectual capital for this faculty. The critical success factors for optimum exploitation of faculty knowledge are:

1) Awareness

It is critical that all individuals understand what they know and do not know. They must also realize when they should collaborate and when they know enough to simply act. They must be aware of what knowledge exists and who has it or access to getting it. They must also understand why they are doing what they are and what makes an appropriate result.

2) Access

All individuals must have the ability to identify and get connected to the sources of better knowledge when they need to collaborate or get help They will require access to those who know in either personal and/or electronic forms. They will require the time availability and organizational permission from all parties in the collaboration as well as their management. They will also require access to appropriate repositories of best practices and guides through effective tools.

3) Appetite

Those involved with knowledge sharing or transfer must first have the personal commitment to improve their own knowledge. This may be through personal education and training, learning on the job or exploiting opportunities provided through faculty's programs. Whether lecturers, administration staff or students, they must sense openness to sharing with others. They must also truly believe that a trust culture is in place which

will encourage communication and sharing rather than punish those who expose themselves. There must also be incentives and rewards to use or share knowledge which are in synch with the incentives and time availability of others. There must be a win-win perception of support for all. They must want to share.

4) Alignment

The development and application of knowledge must be relevant and in context to the faculty's direction and the members needs. Optimum knowledge application, sharing, and flow are only delivered as part of the business processes of the organization. The objectives and measures of each must be common. Most importantly, knowledge growth and use must be specifically tied to the individual and team objective setting, incentive and reward mechanisms of the enterprise.

5.3.5 Practice

The final stage involves practice of the knowledge gained through knowledge sharing. Basically, at this stage, a person manipulates whatever knowledge he/she gets to complete the given task. If this is successful, then whatever objectives set by this faculty can be achieved using the knowledge management approach. Community of Practice (CoP) plays an important role in this stage to take advantage of benefits available through knowledge management. It is good human networking that makes knowledge management effective, not technology alone. The overall knowledge sharing and practice is summarized in **Table 5.2**.

Table 5.2: Knowledge Transfer Commitment Cycle

Stage	Knowledge Buyer	Knowledge Seller
Prepare	• Identifies own need and determines whether and how to request help based on previous history of success and support within knowledge transactions. • Makes request	• Identifies or perceives a customer need or an opportunity and determines whether and how to offer help based on previous history of success and support within knowledge transactions. • Makes offer.
Negotiate	• Buyer rejects offer or Seller rejects request OR each accepts initial proposal subject to negotiation. Both negotiate of terms and conditions AND agree to share OR withdraw.	
Perform	• Monitors activities, deliverables and progress of Seller according to negotiated terms and conditions.	• Develops and/or gathers knowledge and packages it. • Communicates knowledge to Buyer. • Proposes that knowledge selling is complete.
Assess	• Assesses usefulness of the communicated knowledge.	• Monitors buyer's assessment process.
Evaluate	• Evaluates the knowledge seller's performance. • Evaluates trust with regard to the relationship with the seller for consideration in future knowledge transactions. • Examines degree of enterprise support for knowledge buying for consideration in future knowledge transactions.	• Evaluates the knowledge buyer's performance. • Evaluates trust with regard to the relationship with the buyer for consideration in future knowledge transactions. • Examines degree of enterprise support for knowledge selling for consideration in future knowledge transactions.

5.4 KM Framework influence Factors

For the successful of this proposed knowledge management framework, there are three factors that need to be considered:

i) KM Committee

- A committee that handles knowledge management must first be created.
- There must be a Chief Knowledge Officer (CKO) in-charge with dedicated members of knowledge management community.

ii) Community involved

- People affected with knowledge management must be trained and motivated to take part and practice according to guidelines provided.
- There must be a training session to deliver the requirements and expectations through knowledge management approach.

iii) Technology

- There must be an effective and reliable technology available to assist the knowledge management approach.
- For example, the system must be always available, and there is no problem to access and use the services provided.
- As for this research, a website (message board) was developed to support the theory of proposed knowledge management framework. This will be discussed in the next chapter (Chapter 6).

5.5 Proposed Knowledge Management Implementation

In this section, researcher will explore the 5 basic steps that are shared by every successful knowledge management initiative. Many knowledge management initiatives have failed to deliver their expected returns because of the failure of management. We do not take into account the necessary process changes that have to occur to ensure success. We do not change incentive plans to fit with the new processes. We do not put in place new metrics to measure and manage performance. We do not systematically introduce the changes into our organization. The proposed guidelines for knowledge management implementation at this faculty are as following:

Step 1: KM Begins With Me

The best way to find out what knowledge management is all about and how other people in the rest of the world is practicing knowledge management is to pick up a knowledge magazine magazine. This can be done at www.kmworld.com or www.kmmagazine.com. For those who have discovered the power of knowledge management, these two websites have what we need to stay on top of new developments, select among knowledge management options and find answers to our questions.

Step 2: KM Needs a Strategy

Determine why a company needs knowledge management. What business issues are we trying to resolve? Knowledge management is only a means to an end. It is important to make significant and compelling connections between knowledge management and business strategy. There are 5 organizational challenges that need a knowledge management response:

- To Develop a Relevant Business Strategy
- To Achieve Operational Improvements
- To Improve Relationship
- To Leverage on Technology Investments
- To Demonstrate Stakeholder Value from Intellectual Capital

Once we have determined the compelling reason for organization to use knowledge management as a tool to achieve an objective, and then build a business case for knowledge management that aligns the strategy to the key organizational challenge. Without this, it is very doubtful that an organization can ever end up with a successful knowledge management initiative that is on time, on target and within budget.

Step 3: KM Requires Tools

The sheer volume and importance of electronic information has made it necessary for organizations to provide better tools to manage knowledge. Individuals must access a variety of repositories – intranets, portals, news feeds, search, collaborative tools, document repositories, and applications – to author, store, sort, personalize, categorize, cut, coy, paste, tag, send, and retrieve content. New technology for better management of electronic information will allow companies to improve their top and bottom lines.

Step 4: KM Must be Marketed

Knowledge management is one of today's hottest initiatives in any company. Many companies are putting together knowledge management initiatives. Someone in the organization is chartered to develop a unique knowledge management initiative that must help the organization gain attention of the employees, other faculties and students.

There is a need to develop a comprehensive strategy to market the knowledge management initiative.

Step 5: KM is for the Whole Company

In order to sustain the knowledge management initiative, eventually the entire company has to be involved. Keep this in mind as we develop the strategic steps to get there eventually. Buckman Laboratories Inc., who is in the specialty chemicals, has one of the most innovative knowledge management programs in the manufacturing business. Although Buckman Laboratories does not provide knowledge management services to other companies, this company is worth noting as one of the original pioneers of knowledge management and one of the most cited in literature. The company has even set up a website (www.knowledge-nuture.com) as a resource to help people learn about knowledge management.

5.5.1 Benefits of this approach

The approach to developing a knowledge management strategy outlined above provides a number of major benefits:

Solution-independent

The approach used to develop the knowledge management strategy makes no assumptions about the solutions that might be implemented. As such, the approach is independent of any technologies implemented, or knowledge management techniques applied. Instead, the approach is to identify the need, and then determine the solution.

Simple

The use of well-tested needs analysis techniques gives confidence that the true issues in the organization will be identified. In practice, these simply 'fall out' of the research activities, with the key strategic and tactical recommendations becoming obvious in most cases. This simplicity makes the process easy to implement, and ensures that the findings and recommendations are well-understood throughout the organization.

Efficient

A modest amount of initial research will be sufficient to identify the most crucial problems within the organization. These can then be tackled with suitable activities and initiatives. Once this first round of projects have delivered tangible business benefits, additional targeted research can be used to identify further issues to be addressed. This 'iterative' approach can then be repeated, ensuring that business improvements are seen even as the next round of research is initiated.

Targets resources

There are many 'good ideas' that can be drawn from the field of knowledge management. The challenge is to identify those approaches that will have the greatest impact upon the organization. By starting with the needs analysis, approaches can be targeted to address the most critical issues, or to deliver the greatest business benefits. Target the critical issues with the knowledge management strategy.

5.5.2 KM Implementation Methodology: A Phased Approach

Based on the approach mentioned above, a phased methodology is developed for knowledge management implementation at FCSIT. These phases are:

Phase 0 - Identify and Select Pilot Projects

The purpose of this phase is to create awareness of the possibilities of knowldge-based performance improvement among business leaders and stakeholders, identify potential pilots, and then assess and select a pilot for delivery. A set of standard knowledge management project selection criteria is customized for the business and used to rank pilots based on their potential knowledge-based business benefits, local business leader advocacy, transferability of learning and results, and overall project feasibility.

Phase 1 - Customize Pilot Process and Create Stakeholder Alignment

The focus of this phase is to engage key pilot stakeholders, including the local leadership team, staff and other contributors to customize the knowledge management methodology to fit the specific business improvement needs of the pilot. Local business buy-in is created and a plan is developed and agreed that fits both the operational tempo and needs of the business participants.

Phase 2 - Capture Key Learning and Good Practices

The focus of this phase is to elicit and harvest operational know-how to fill the knowledge gaps needed to meet the pilot performance improvement targets. The majority of knowledge generation and capture will be performed through a series of individual interviews and the facilitation of on-the-job team learning processes before, during, and after major work activities.

Phase 3 - Establish and Leverage Communities of Practice

The focus of this phase is to engage and enable relevant practitioners inside and outside the local pilot business area to share and transfer know-how and good practices to the

work teams involved in the pilot. At least one Community of Practice (CoP) will be established for subject area practitioners contributing knowledge to the Pilot.

Phase 4 - Adapt and Apply Best Practices in Pilot Operations

The focus of this phase is to enable and ensure the know-how gained from the pilot work teams, CoP interactions, and other sources are applied on the job to improve existing processes and deliver the agreed performance targets.

Phase 5 - Train and Coach Internal KM Practitioners

The focus of this phase is to transfer and embed knowledge management competencies and techniques in staff participating in the delivery of the pilot effort. Using a phased approach, the lead responsibility for delivery of knowledge management practices is purposefully shifted from the knowledge management consultant to local staff over the duration of the pilot.

Phase 6 - Monitor, Review and Optimize Pilot Learning and Impact

The focus of this phase is to manage efficient tracking and completion of the pilot deliverables. Results will be documented in a report and presentation that include a review of the benefits achieved versus planned, recommendations for strategy and broader implementation based on knowledge management pilot learning and practices.

Once a pilot is selected, the business teams involved will then proceed through a set of simple, specific facilitated processes for learning before, during, and after specific work activities. With knowledge management coaching, the key learning resulting from these processes will be applied by local pilot staff to improve their existing business and work processes on-the-job.

5.5.3 Guidelines for building KM Infrastructure

Build the infrastructure using appropriate technology

Technology enables connectedness to take place in ways that have never before been possible. Harnessing intellectual capital can be expedited through a network computing infrastructure. Technology has emerged that supports each different approach to knowledge management (**Table 5.3**). Document management systems expedite document storage and retrieval. Web-casts allow synchronous communication between experts while discussion groups enable asynchronous interaction. Learning management systems track an employee's progress with continuous learning. Data warehousing mines powerful SQL databases which organize and analyze highly structured information.

Table 5.3: Technology Appropriate to Knowledge Management Approach

REPOSITORY MODEL	COMMUNITIES OF PRACTICE	CONTINUOUS LEARNING	BUSINESS INTELLIGENCE
• Internet, HTML, XML • Full text search engines • Document management systems	• Web conferencing • Threaded discussion groups • Automated workflow • Expert Directories	• Learning Management systems • Electronic performance support systems (EPSS) • Performance management	• Databases • Data Mining Tools • Enterprise Databases • Decision Support Tools

Build a conceptual infrastructure with competencies as the backbone

Technology is important in harnessing intellectual assets, but integrated solutions encompass more than that. We must rethink the conceptual infrastructure of our business. For example, we may need to: ensure intellectual assets reflect our vision and values; articulate the theoretical framework for our processes; establish a taxonomy or categorization scheme to organize information; create cross references that reflect relationships between entries; or index information using attributes. The notion of competence plays a critical role in knowledge indexing and sharing. Karl Erik Sveiby (1997), noted Swedish expert on managing and measuring knowledge-based assets, observes, "The concept of competence, which embraces factual knowledge, skills, experience, value judgments and social networks, is the best way to describe knowledge in the business context". Once competencies or target proficiencies are defined, they become the backbone which connects users to useful knowledge.

Create a repository of reusable components and other resources

Before the Industrial Revolution, products were hand-crafted; each piece was unique and could not be reused. The genius of the Industrial Revolution centered on making reusable parts - components became standardized and interchangeable. The Information Revolution is similar. Instead of crafting a unique solution each time, knowledge sharing creates a warehouse of "stored parts'' - standardized and interchangeable components which can be reused and adapted: skills, best practices, models and frameworks, approaches and techniques, tools, concepts, specific experiences, presentation aids, white papers, etc. Adding to this, resources such as directories of experts indexed by their field can help gain access to knowledge outside of our core competencies.

5.6 Challenges in Implementing Knowledge Management

How to Begin?

Abstractly designing a holistic enterprise-wide knowledge management system may not be particularly difficult – putting it into practice is. The saving factor is that it does not have to be implemented all at once. An integrated knowledge system can gradually take form with proper organizational direction, facilitation, and support. One of the entry points to stimulating the formation of a holistic knowledge management system is to encourage employees to develop and participate in knowledge communities. Organizational managers and leaders must facilitate the development of these knowledge communities to the point that a knowledge landscape begins to form, knowledge gaps are identified, and priorities are established. The existence of active knowledge communities will build momentum and help to push activity on the other fronts. As noted earlier, these communities help solve the biggest obstacle: capturing and harnessing human attention. If knowledge communities are given enough support and direction, the rest should follow. However, it is important that the transformation plan be made explicit and that it be supported and sustained by all the necessary organizational leaders.

Cultural Challenges

A second issue in implementing a holistic knowledge management system is to ensure that these initial knowledge communities do not become knowledge hoarding gatekeepers. It is important for the organization to value, reward, and motivate knowledge creation, knowledge sharing, knowledge inclusion and broad-based knowledge engagement. At the enterprise level, there are real issues regarding

balancing a culture of openness and knowledge-sharing with the need to appropriate knowledge as intellectual property.

Infrastructure Challenges: IT, Artificial Intelligence, and Communication Technology Enablers

Technologies are essential to enable (1) most elements of knowledge management framework, (2) the linkages between these elements, and (3) the knowledge management system as a whole. Advanced IT and AI should facilitate:

- Articulation, mapping, and visualization of the knowledge landscape
- Measurement and assessment of knowledge states, goals, objectives, and activities
- Characterization and mapping of individual knowledge competencies
- Characterization and mapping of intra- and inter-organizational knowledge competencies
- Accessibility and utility of explicit knowledge resources
- Real-time capture, organization, and management of knowledge discourses
- Automated and faster R&D (virtual simulations, etc)

5.7 Components for Successful KM Implementation

If a knowledge management program is to be successfully implemented in FCSIT, we must ensure the following components are addressed:

Knowledge must be Available

We must have, "just in time" information availability when an employee or students requires knowledge to perform their work. We need to learn how to more effectively leverage our information services in the Faculty enhance our technology and create a pervasive knowledge-sharing environment. When information is created using an electronic platform it should be saved into a knowledge database, which can be "easily" retrieved and searched, as required.

Knowledge must be Accurate

It is critical to ensure that the retrieval of knowledge from the knowledge database is accurate. If searches are cumbersome, not successful or inaccurate, employees or students will find another method to obtain the knowledge they require. This will also result in valuable time being wasted as well as the chance of relevant information not being found. This defeats the purpose of a successful knowledge platform. Keyword searching, relevancy and metadata tools should be used to search the knowledge database.

Knowledge must be Effective

Knowledge in the database must be effective and of value or the employee will cease to use the database as a source of information. The database should produce a relevancy or rating scale of the information searched, to filter the information. This will narrow down the amount of information to search through and save valuable time and resources.

Knowledge must be Accessible

The knowledge in the knowledge management architecture must be accessible, when required, in order to make the database effective and efficient.

Knowledge must be Protected

Knowledge in the database must be secure and the use of authentication tools should be available. This will ensure knowledge in the database is protected from unauthorized disclosure.

Knowledge Usage Analysis and Tracking Tools

It is important to have a reporting system to track on what information is most relevant or irrelevant, to ensure the database complies with Retention and Disposition policies and is also kept free of information which may not be of any further management value.

5.8 Summary

Knowledge management complements and enhances the impact of total quality management, business process re-engineering, organizational learning and other initiatives, all of which combined open the way to a more sustainable competitive position. The proposed knowledge management framework can be used as guidelines for managing knowledge at Faculty of Computer Science & Information Technology. However, a knowledge management committee must first be created in order to ensure the success of any knowledge management project.

6.0 Introduction

In this chapter, researcher will discuss about the design and development of the website, which needed to support the proposed knowledge management framework. This web-based infrastructure is also to show the importance of IT in knowledge management and called FCSIT's Knowledge Management. The website is available online at: http://www.websamba.com/knowledgefsktm.

Davenport et al. (1998) report some interesting empirical work on knowledge management projects, but interpret the view of knowledge as an object, which can be transferred by highlighting the following:

To transfer tacit knowledge from individuals into a repository, organizations usually use some sort of community-based electronic discussion. (p. 45).

Based on the statement above, it is very clear that the message board developed for this project is an accurate and effective tool to enhance knowledge sharing.

6. 1 Hardware and Software

For any system or application development, hardware and software are essential elements. For this project, hardware is a complete computer device (mouse, monitor, etc) and the researcher did not use any additional device. As for software, Microsoft FrontPage 2000 and Macromedia Dreamweaver 4 were the main software used for creating web pages. Besides that, Internet Explorer 5.0 was used to preview and test the web pages created. Meanwhile, programming languages used to develop this website

were HTML, ASP, and JavaScript. In addition, Microsoft Access 2000 was used to create the database. SQL was used to store and retrieve data from the database. The database is named 'aspBoard.mdb'. In order to make these pages online, all the files were uploaded into free web hosting service provided at http://www.websamba.com. Finally, the minimum requirements to best view this website would be:

- 64MB RAM
- 800x600 pixels
- 17" monitor
- Internet Explorer 5.0

6.2 Reasons for adopting Internet and World Wide Web

The use of Internet and its related technologies has been growing exponentially for many years. The Internet has several characteristics, which give a profound impact in various knowledge management systems, are the reasons for adopting it for FCSIT's Knowledge Management. These characteristics are:

- It uses a communications standard protocol (TCP/IP) that is widely supported - this means that it is universally accessible from many locations and through many different computer platforms
- End-user software, such as electronic mail and World Wide Web browsers are universally available and are low cost (and often free) - this makes it cost effective to implement on an enterprise wide basis

- Internet access is widely available throughout the world, increasingly with international providers - this means that an user, especially those that travel a lot, can use the Internet rather like a corporate network
- The World Wide Web. This provides a quick means of publishing information that can be shared on a worldwide basis: "every user is also a publisher". This universal repository of information means that information resources can be updated and widely shared at an attractive cost.

6.3 Web Page Design

Basically, FCSIT's Knowledge Management website consists of 8 files as below:

1. Index.asp
2. Introduction.asp
3. aspBoard.asp
4. aspDetail.asp
5. aspBoardPost.asp
6. FAQ.asp
7. Kmframework.asp
8. Search.asp

The connections between these files are shown in **Figure 6.1** and discussed further in the next section. In addition, user manual for the website is attached in this report to assist a beginner (see **Appendix C**). Testing of the web pages was done each time a new function or component included into the page. If there is any error on the web page, corrections will be conducted first before moving further.

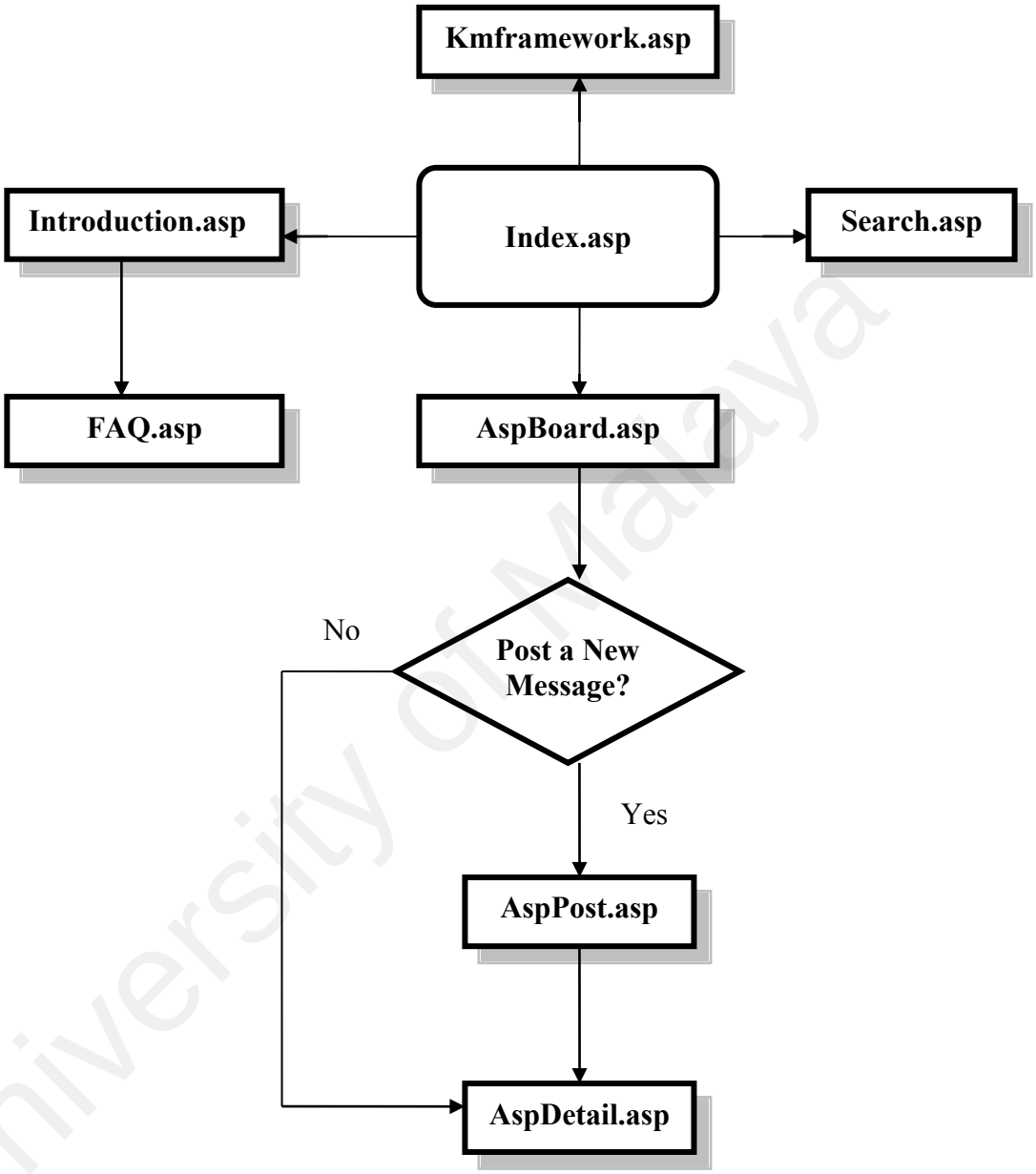


Figure 6.1: Relationship between files

6.3.1 Index.asp

The main page of this application is Index.asp and is shown in **Figure 6.2**. This page consists of eight hyperlinks, including the search and guest book. Six of the links in the table are in JPEG image format, which were created using Adobe Photoshop 5.5. These links are:

i. Introduction to FCSIT's KM

ii. List of Problems

iii. Post a New Problem

iv. Frequently Asked Questions (FAQs)

v. About FCSIT's KM Framework

vi. Contact Us

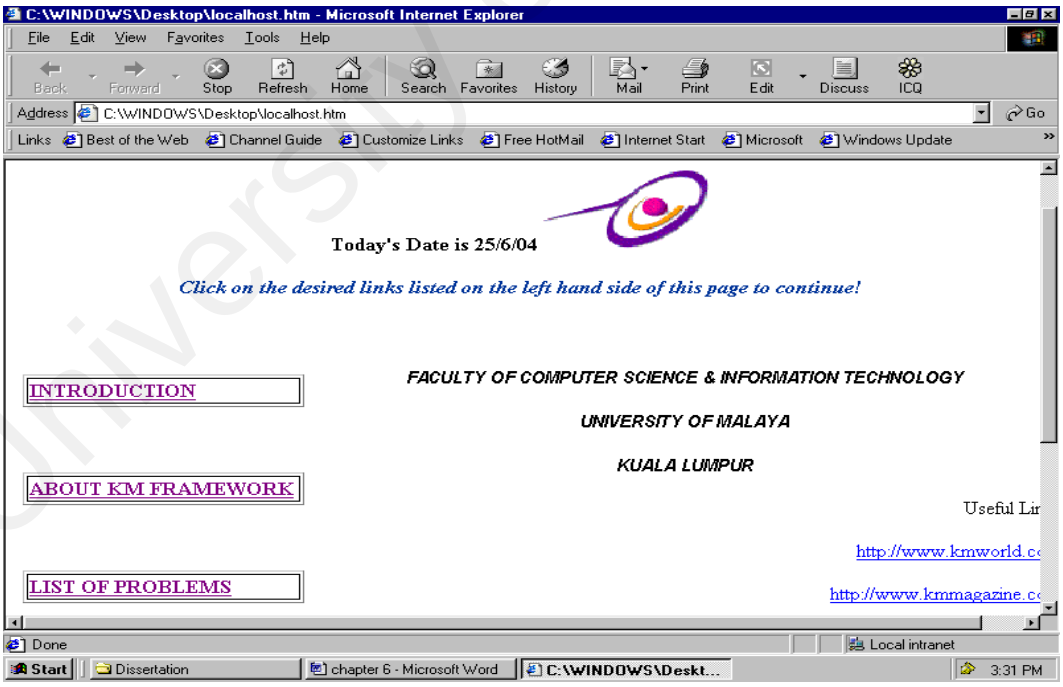


Figure 6.2: Index.asp

6.3.2 Introduction.asp

In this page, a brief description and objective of FCSIT's Knowledge Management were given. The interface is shown in **Figure 6.3**.

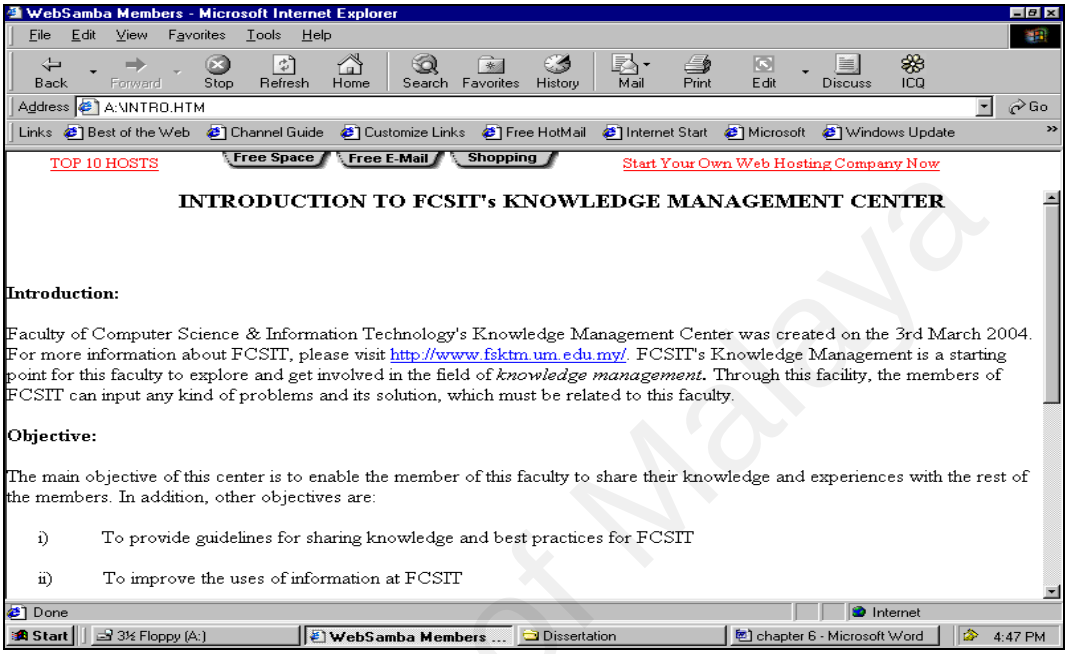


Figure 6.3: Introduction.asp

6.3.3 aspBoard.asp

List of problems and follow-ups posted to this message board will be shown in this page. User can click on the subject to view its contents and able to response to the problem stated. The appearance of this page is shown in **Figure 6.4**.

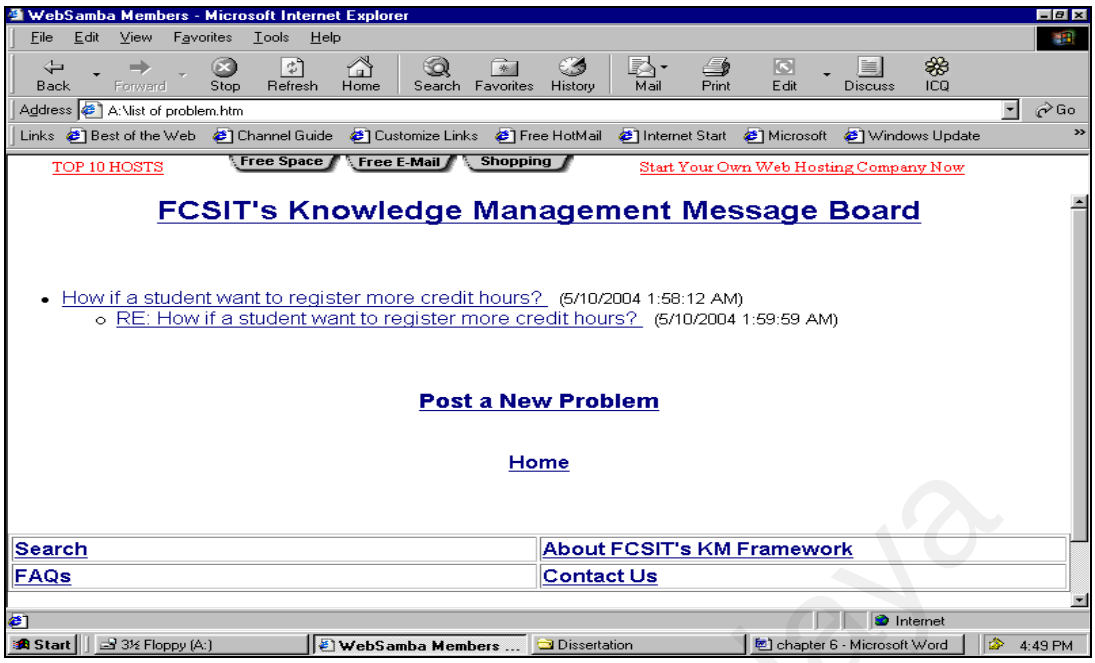


Figure 6.4: aspBoard.asp

6.3.4 aspDetail.asp

This file displays the information when a user clicks on the list of problems available on "List of Problem" page. When the user clicks on the specific subject, details of sender and their message will be shown (see **Figure 6.5**). Besides that, this page will also display the follow-ups for that particular subject. After viewing the message, they may response to that message.

Figure 6.5: aspDetail.asp

6.3.5 aspBoardPost.asp

This page is intended for users to post a new problem message. In order to post a new message, they must provide their name, email address, subject (title of the problem), and their message. The URL requirement is optional. If the user did not provide the required information, then they are not able to post the problem to the message board. This page is shown in **Figure 6.6**. For the email field, validation will be done each time a user post a new problem or respond to the existing problem. Besides that, it will be checked if the user fills in the other required fields.

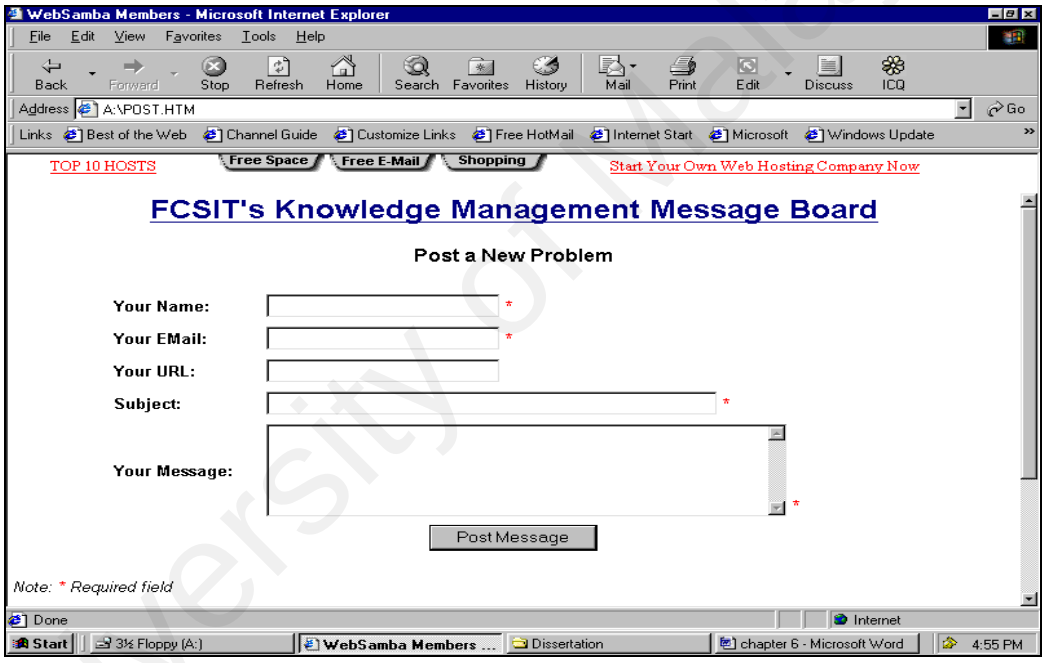


Figure 6.6: aspBoardPost.asp

Meanwhile, when a user wants to response to a message, this form will be changed as shown in **Figure 6.7**. In this page, user is given option whether to include the original message or not.

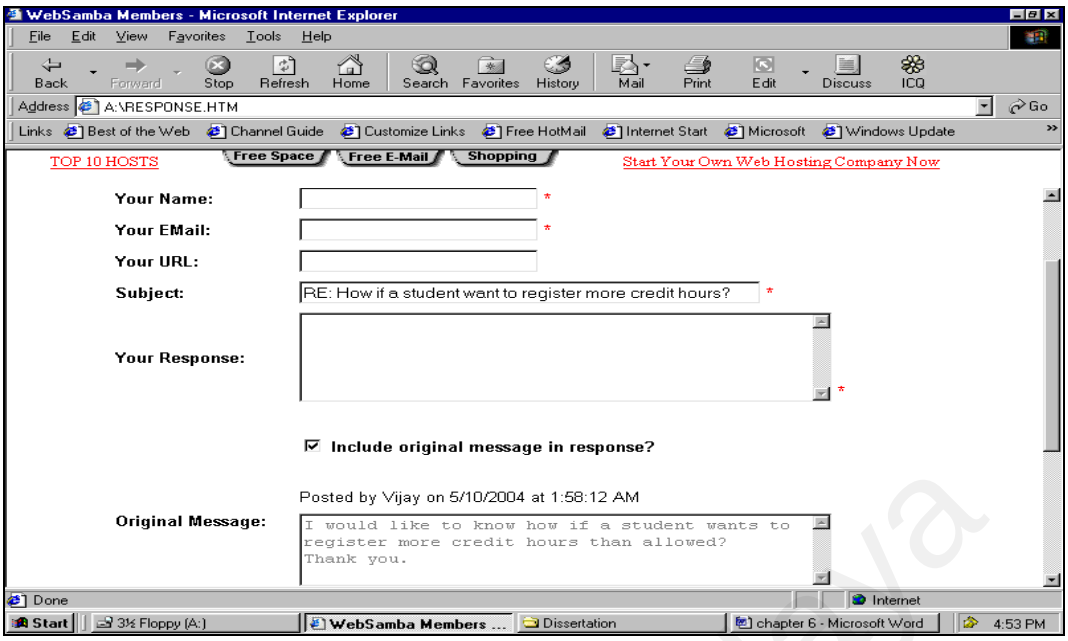


Figure 6.7: Response

6.3.6 FAQ.asp

Frequently ask questions are necessary for any homepage. As for this section, there are six questions and answers available. User can click on the question to view the answer. The page is shown in **Figure 6.8**.

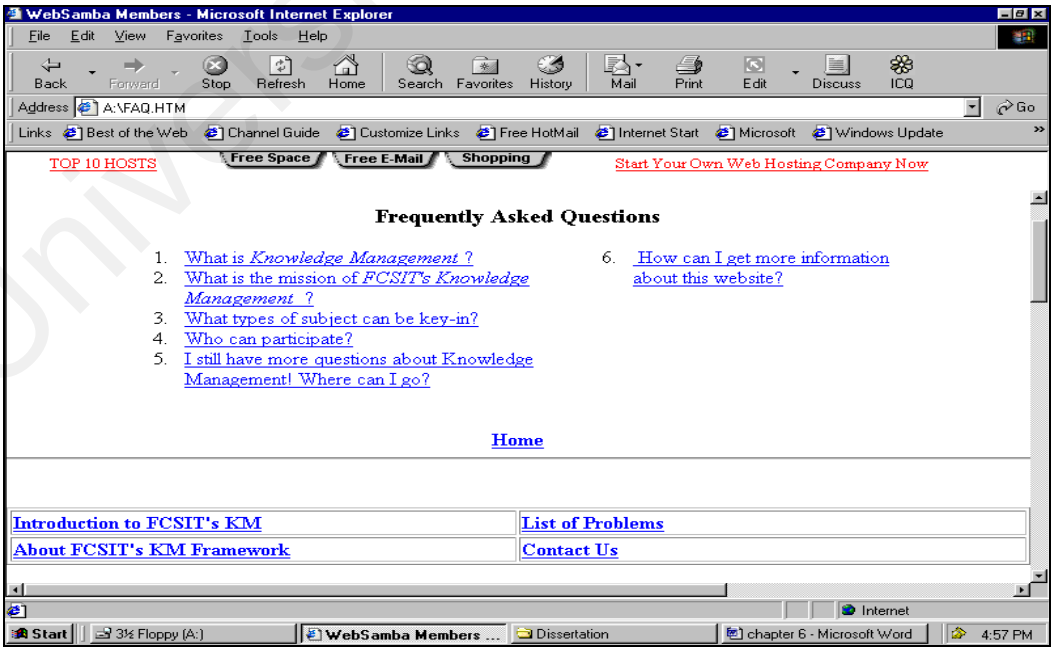


Figure 6.8: FAQ.asp

6.3.7 Kmframework.asp

This page provides information about the proposed knowledge management framework for FCSIT. Users can view the details of conceptual framework to get an idea about the approach used for knowledge management in this faculty. This page is shown in **Figure 6.9**.

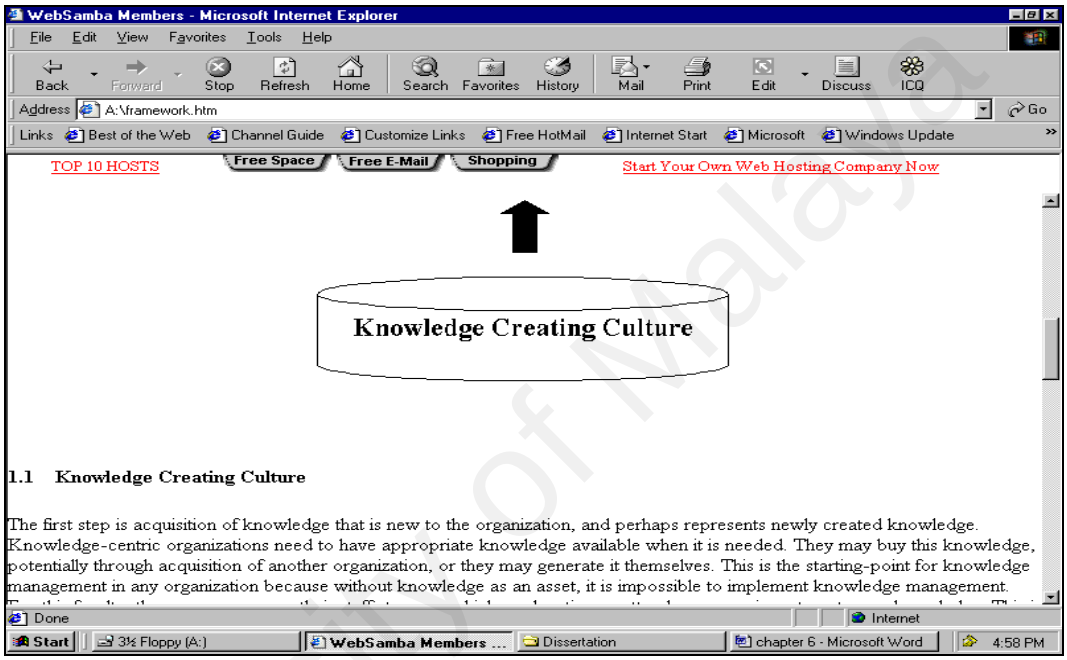


Figure 6.9: Kmframework.asp

6.3.8 Search.asp

Search is an important element in any website. When user type-in keywords, SQL statement will search the database and provide the problem's subject and details in a table. For example, if the keyword is 'register', then the search result will show all the messages that contain this word. The search page is shown in **Figure 6.10**.

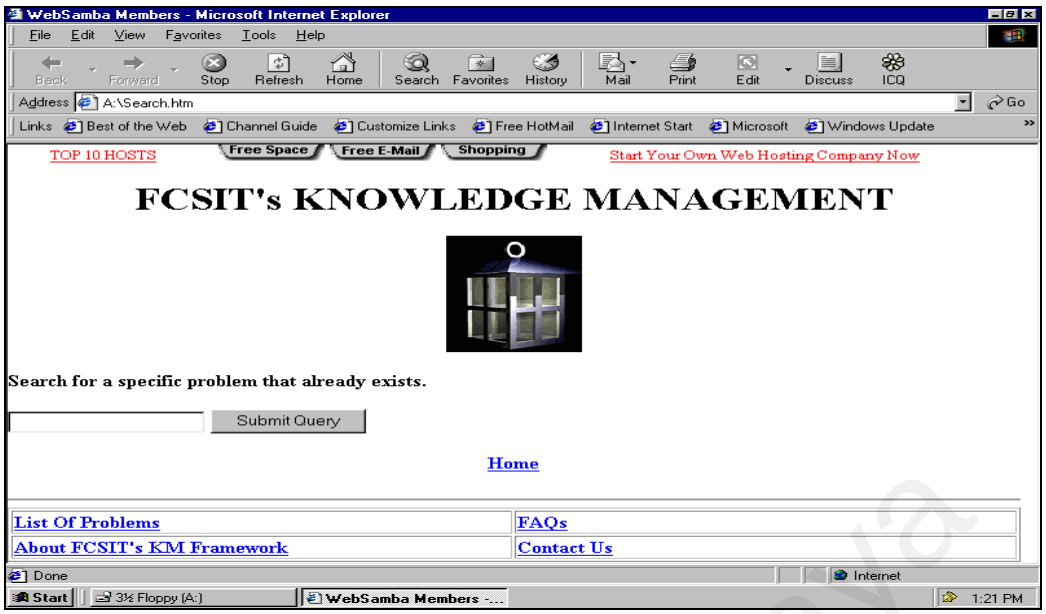


Figure 6.10: Search.asp

6.4 Database

As mentioned earlier, the database is named aspBoard.mdb and created using MS Access 2000. The table (msgDetail) consists of 8 columns, which is represented in **Table 6.1**.

Table 6.1: Database

Field Name	Data Type	Description
msgId	AutoNumber	An unique ID to message
parentId	Number	The title of a new problem
headerStr	Text	Response to a problem
detailStr	Memo	Description of problem/solution
author_nameStr	Text	Name of sender
author_emailStr	Text	Email address
author_urlStr	Text	URL address
msgTime	Date/Time	Date and Time the message sent

6.5 Response and Post New Problem

The main purpose of this website is to require solution for certain problems related to their (staff and lecturer) work. The processes involved are shown in a flowchart (see **Figure 6.11**). When users access the website, they can view the existing discussions available and then post a response to these problems or post a new problem. Besides that, they might also post a new problem without going to List of Problems page. When user posts a new problem or response to the existing one, a page that displays all the information key-in by the user will appear. This means that the information is already saved into the database.

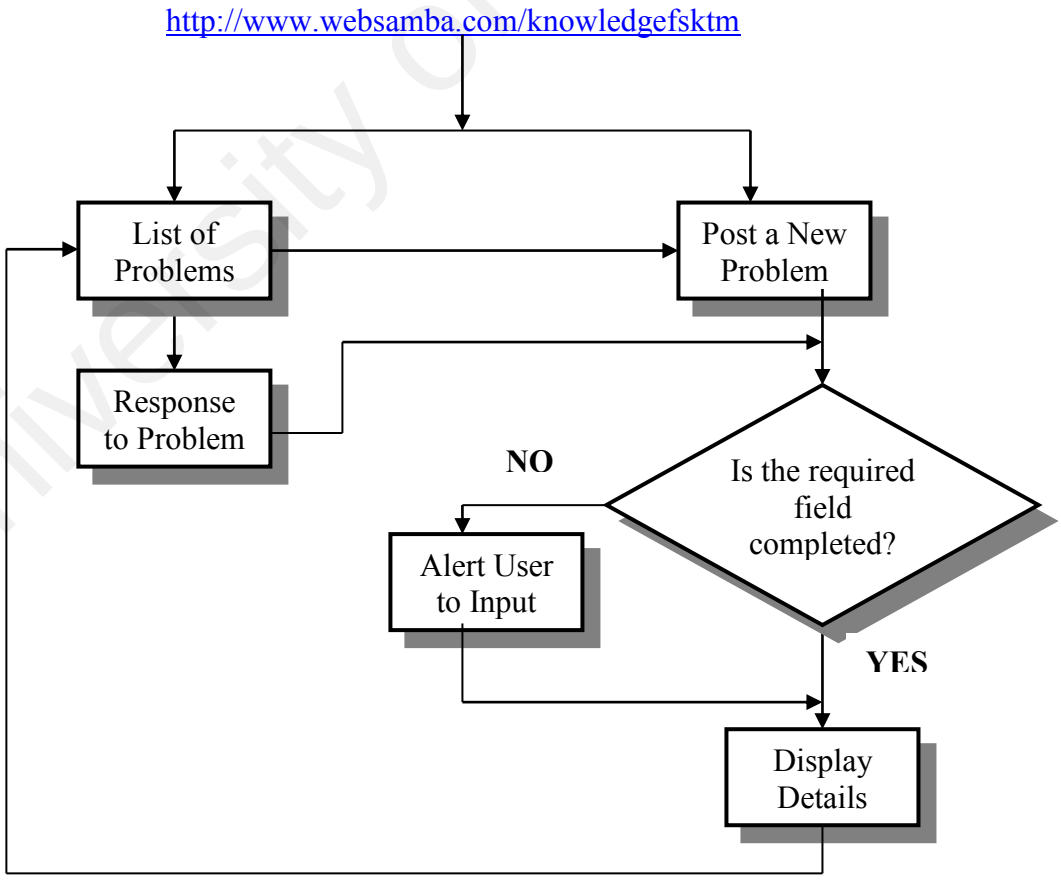


Figure 6.11: Response and Post a New Problem Flowchart

6.6 Results of User Evaluation

As mentioned earlier in Chapter 3 (Methodology), user's evaluation was conducted to get response from FCSIT's member of staff (lecturer and other staff). The number of respondents who participated was 50 people (staff and students), which required them to complete an evaluation form (see **Appendix D**) distributed after visiting the website. Majority of the users put 'good' for the arrangement of images and pictures on the website. For the loading of the web pages, they stated 'very good' because the loading time is less than 4 seconds. As for the hyperlinks, the users given "good" because all the hyperlinks work accordingly and no broke links. As for the color combinations, few users given different opinions and finally the colors were changed to satisfy all of them. They stated 'very good' for the text size and style. All the users chose 'yes' when asked if it is easy to post a new problem and they find the user manual to be useful. As a conclusion, majority of the participants were satisfied with the overall functionality and design of the website. In addition, they also admitted that this website is useful and easy to use. A small number of respondents had given suggestions and these suggestions were considered wherever appropriate.

6.7 Summary

The website developed for this project is to prove that this research can be used for knowledge management implementation at FCSIT. In other words, it shows that knowledge management can be practiced in real life with the support of IT and not just a theory alone. The researcher proposes that technology and human efforts must work together for the success of knowledge management. In fact, for knowledge

management, it is important that human make the initiative and efforts to share their knowledge by using this kind of web-based infrastructure.

7.0 Introduction

This report started by giving introduction about the field of study and followed by literature review. Then, the report continued by stating the methodology used for conducting this research. Once the methodology was determined, a survey and its analysis were done. Based on the results and analysis, discussions were produced where a knowledge management framework was proposed. In order to support the proposed knowledge management framework, a website was developed and described in chapter 6. In this last chapter, conclusions of the overall report contents will be discussed. Besides that, the researcher will consider some of the future improvements about this research in order to enhance the conceptual framework proposed. This is crucial for any research because it can help for continuous progress of this research field.

7.1 Important Phases Identified

Generally, the proposed knowledge management framework involves the following steps:

1. **Knowledge Creation**. This comprises activities associated with the entry of new knowledge into the system, and includes knowledge development, discovery and capture.
2. **Knowledge Retention**. This includes all activities that preserve knowledge and allow it to remain in the system once introduced. It also includes those activities that maintain the viability of knowledge within the system.

3. **Knowledge Transfer**. This refers to activities associated with the flow of knowledge from one party to another. This includes communication, translation, conversion, and filtering.
4. **Knowledge Utilization**. This includes the activities and events connected with the application of knowledge to business processes.

Basically, all the existing knowledge management frameworks included all these 4 crucial phases and differentiated only by the elements involved for each phase. Throughout this research study, there were few important factors that the researcher recognized and these factors were described in the next section.

7.1.1 Importance of Knowledge Management

Based on the research conducted so far, the researcher found that knowledge management plays an important role for the progress of any organization, including FCSIT. This faculty can make use the advantages that can bring benefits for the growth and reaching the objectives set for a better performance. Knowledge management can be used as a "weapon" for a competition purposes and reaching certain standard and quality. A creative approach to knowledge management will able to improve efficiency, higher productivity and increased revenues in practically any organization. In addition, it can also ensure that FCSIT's performance will not be affected when an experience staff resigns because the same knowledge is available through existing staff.

7.1.2 Importance of FCSIT's KM Framework

Based on the contents of the previous chapters, it is very clear that knowledge management can be a plus point to FCSIT. However, there must be a guide on how to

make use knowledge management. So, this is where knowledge management framework comes in. The proposed framework can be a starting point before exploring more into the world of knowledge management. This knowledge management framework can be a proof for how a knowledge management should be done in order to make it beneficial to the faculty in terms of performance and quality of services.

7.1.3 Importance of KM Infrastructure

Knowledge management concepts must be integrated with Information Technology (IT) in order to give effectiveness to the proposed FCSIT's Knowledge Management framework. Technology is not a substitute for knowledge. While knowledge is an ongoing process, technology is a pipeline, a means, more of a vehicle for delivering data and information. IT does not in itself create knowledge or guarantee knowledge generation. A system that able to assist the role of knowledge management is crucial because IT meant for making human life easier. The benefits of the knowledge management infrastructure are:

- Improved services for students
- Improved service capability of faculty and staff
- Improved effectiveness and efficiency of advising efforts (to integrate fragmented efforts currently undertaken by faculty, academic support staff, and student services staff)

As mentioned in Chapter 4 (Results and Analysis), majority of the members at this faculty would like to use a web-based system. This is the reason for developing

FCSIT's Knowledge Management website. The website is available at: http://www.websamba.com/knowledgefsktm.

7.2 Guiding Principles

Knowledge management guiding principles will provide a framework for the implementation of a knowledge management culture in the faculty. All opportunities will continually be explored to ensure our knowledge products are value added, accessible, cost efficient and user friendly. Lecturers and management staff will be accountable for knowledge management. Staff and students will be trained and have sufficient skills and competencies in knowledge management methods and practices.

7.2.1 Sharing of Knowledge

- Reward sharing and create a culture where staff and students feel free to share their information and also to solicit information from other staff or students in the faculty.
- Performance Evaluations should include a knowledge management component where an employee is assessed on how well they generate, share and convey their knowledge to others.
- Ensure that knowledge in the faculty is available to all employees and students except information, which is confidential or protected by legislation or other authority.

7.2.2 Knowledge is Accessible

- Faculty knowledge will be accessible in a user-friendly format.
- Faculty knowledge will be easy to find and of value to the users.

- Tools to access faculty knowledge will support content creation, linkages, navigation and retrieval.

7.2.3 Knowledge Value

- Faculty knowledge will be protected and secure to preserve faculty's corporate memory.
- Faculty knowledge will promote institution's identity and public image.
- Faculty knowledge will be captured and assets will be identified.

7.3 Accomplished Objectives

The following objectives were achieved at the end of this research:

i) To provide guidelines for sharing knowledge and best practices for FCSIT.

ii) To improve communications and the uses of knowledge at FCSIT.

iii) Use appropriate methods and frameworks to leverage organizational knowledge to produce the learning organization.

These objectives were reached because this project provided a conceptual knowledge management framework, which included the strategy for managing knowledge. Besides that, it also provided the methods and techniques for knowledge creation, interpretation, and practice. The discussion board created for knowledge management at FCSIT, can improve communications and sharing of knowledge among its members. Finally, the contents of this research also emphasized on boost up the responsibility to share knowledge among individuals at this faculty.

The website created for this project was a prototype to show how technology can be helpful in knowledge management. However, it is not an effective tool of technology, as there are many other technologies that can efficiently support the process of knowledge management. Besides that, the website not able to capture the best practices and users can share all kind of knowledge without any filtration of information.

7.4 Recommendations

For any kind of project, some suggestions and recommendations are necessary for the improvement of the project in future. It is also important to give some ideas on how the research could be more effective in future and to reach certain objectives that could not be done at this stage. For this research study, the recommendations are described in the next section. However, there are few issues that need to be addressed first for the future work of this field. These issues are:

- Can the public sector, and in particular, education and learning institutions realistically play a major role in shaping knowledge-driven communities and hence in the knowledge-driven economy?
- Can the strengthening of user-producer interactions improve the management of knowledge within the public sector and more specifically within education and learning?
- How can schools and other learning environments develop a commitment to knowledge management?
- How can teachers and learners in education and learning systems be given incentives to promote knowledge and learning organizations?

7.4.1 Detailed KM Implementation

In this report, the researcher focused more into creating a conceptual knowledge management framework and developed an application to support the theory of the proposed framework. In future, more substantial guidelines of the knowledge management project can be described, which take into account the proposed knowledge management framework as part of the project. For example, the future work of this research can describe about creating knowledge management committee and the roles of each committee member. Besides that, it should also emphasis on the cultural environment for knowledge activities.

7.4.2 Redesign the proposed framework

The conceptual knowledge management framework created based on the current situation at FCSIT. As this framework is a stepping stone for discovering the more into knowledge management, after a certain period of time, some changes or redesign might be necessary to suit with the new situation. For example, the positions of knowledge management Infrastructure and Knowledge Sharing Culture can be exchanged. At this moment, there is no knowledge management system available at this faculty. So, in order to motivate the members of this faculty, the knowledge management infrastructure was placed first before moving to Knowledge Sharing Culture.

7.4.3 A Complete KM Infrastructure

The web based infrastructure developed for this project is just an example to show how Information System can be related with knowledge management. The website only meant for staff of this faculty and not for the students. In future, there should be a better system/portal, which meant for students and staff of FCSIT. This system must be

integrated and easier to use by the members in this faculty. The criteria of the future portal should be as follows:

- Portal for student services for both students and for faculty and staff at the institution so that they are well informed to advice students. Information could include policies and procedures related to admissions, financial aid, registration, degree audit, billing, payment process, advising and tutoring, housing, dining, and other services. This portal could be personalized for individual schools or student groups to customize service offerings.
- Portal for career placement services (potentially part of a large portal for all corporate connections) to provide a one-stop service center for students, but also for faculty and staff to ensure they are informed.
- Repository of student affairs services for faculty and staff to ensure all constituents understand existing services and can provide proper advising.

Security aspects should also be considered to avoid unauthorized users or outsiders from accessing the system. For example, the members should be given username and password in order to access the system.

7.4.4 Focus on Knowledge Repository

Knowledge repository is the place where the information is made as faculty's knowledge and placed into a database. This knowledge will be universal knowledge for the members of FCSIT and make use the knowledge to handle their work for the benefit of the faculty. Based on these points, the researcher can realize the importance of knowledge repository. The database must be able to accommodate a large amount of information and reliable. In terms of security, the knowledge repository must be

protected from hackers and virus. For this reason, a database administrator can be appointed to take in charge of the knowledge repository.

7.4.5 Additional Suggestions

There are few more improvements that can be done to the website and included to the knowledge management portal/system in future. These specifications are listed as below:

- Integration of tools for virtual meetings, virtual workspaces, virtual classrooms, discussions, group scheduling, etc.
- Management of individuals, competencies, expertise, temporary and permanent groups/communities.
- Peer-to-peer information sharing.
- Features to allow users to rate content provide alternatives and comments.
- Powerful search capabilities across structure, content and metadata.
- Easy content reuse.
- Workflow, lifecycle, process automation and security functions applied to the validation and publishing of content.
- User-configurable proactive agents, which monitor sources and repositories to automatically alert users to relevant new information.

7.5 Summary

In this project the researcher proposed a conceptual knowledge management framework for FCSIT. This framework can be as a reference for the establishment of knowledge management at this faculty. Besides that, the researcher also presented a web-based

knowledge management infrastructure to support the idea of proposed framework. Both of these elements can provide a good foundation and be a pioneer for implementing knowledge management at FCSIT. Furthermore, this research proved that colleges and universities have significant opportunities to apply knowledge management practices to support every part of their mission—from education to public service to research.

REFERENCES

[1] Abecker, A., Bernardi, A., & Sintek, M. (1999). *Developing a knowledge management technology: an encompassing view on KnowMore, Know-Net, and Enrich*. In Proceedings of IEEE WET-ICE '99 workshop on knowledge media networking (pp. 216-222). Stanford: CA.

[2] Alavi, M. (1997, July 11). KPMG Peat Marwick U.S: One Giant Brain. *Harvard Business School*, *9*, 397-108.

[3] Alavi, M., & Leidner, D.E. (1999). Knowledge Management Systems: Issues, Challenges, and Benefits. *Communications of the AIS, 1*, Article 7.

[4] Allee, V. (1997). *The Knowledge Evolution: Expanding Organizational Intelligence*. Boston: Butterworth-Heinemann.

[5] Amidon, D. (1997). *Innovation Strategy for the Knowledge Economy*. Boston: Butterworth-Heinemenn.

[6] Arthur Andersen & The American Productivity and Quality Center (1996). *The Knowledge Management Assessment Tool: External Benchmarking Version*. New York: Macmillan.

[7] Becerra-Fernandez, I., & Sabherwal, R. (2001). Organizational Knowledge Management: A contingency perspective. *Journal of Management Information Systems, 18* (1), 23-55.

[8] Boland, R.J., Jr., & Tenkasi, R.V. (1995). Perspective Making and Perspective Taking in Communities of Knowing. *Organization Science, 6*(4)*,* 350-372.

[9] Brown, J.S. & Duguid, P. (1991). Organizational Learning and Communities of Practice: Toward a Unified View of Working, Learning, and Innovation. *Organization Science, 2* (1)*,* 40-57.

[10] Brown, J.S., & Duguid, P. (1998). Organizing Knowledge. *California Management Review, 40* (3)*,* 90-111.

[11] Burk, C.F., & Horton, F.W. (1988). *Infomap: A complete guide to discovering your corporate information resources*. Prentice Hall.

[12] Chatzkel, J. (2000). A Conversation with Hubert Saint-Onge. *Journal of Intellectual Capital*, *1*, Issue 1.

[13] Cook, S.D.N., & Brown, J.S. (1999). Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing. *Organization Science, 10* (4)*,* 381-400.

[14] Corrall, S. (1998). *Knowledge Management: Is it our business*. Retrieved February 3, 2004, from http://www.ariadne.ac.uk/issue18/knowledge-mgt/

[15] Davenport, T.H. et al. (1996). Improving Knowledge Work Processes. *Sloan Management Review* (pp. 53-65). London: Sage.

[16] Davenport, T.H., & Prusak, L. (1997). Working Knowledge: How Organizations Manage What They Know. *Harvard Business School Press*. Cambridge, MA.

[17] Davenport, T.H., De Long, D.W. & Beers, M.C. (1998). Successful knowledge management projects. *Slonn Management Review*, *39* (2)*,* 43-57.

[18] Demarest, M. (1997). Understanding Knowledge Management. *Long Range Planning, 30* (3), 374-384.

[19] Denning, S. (1998). *What is knowledge management? A background paper to the World Development Report*. Retrieved January 29, 2004, from http://www.stevedenning.com/knowledge.htm

[20] Drucker, P.F. (1994). The Theory of Business. *Harvard Business Review*, pp. 95-104.

[21] Fenn, J. (1996). *Knowledge management de_ned*. Gartner Group Research Note. Boston, MA.

[22] Garvin, D.A. (1993). Building a learning organization. *Harvard Business Review, 71* (4), 78–92.

[23] Grant, R. (1996). Towards a knowledge-based theory of the firm. *Strategic Management Journal*, *17*, 109–122.

[24] Hahn, J. & Subramani, R. (2000). *A Framework of Knowledge Management Systems: Issues and Challenges for Theory and Practice*. In Proceedings of the 21st International Conference on Information Systems. Brisbane, Australia.

[25] Hansen, M.T., Nohria, N., & Tierney, T. (1999, March-April). What's Your Strategy for Managing Knowledge. *Harvard Business Review*, pp. 106-116.

[26] Holsapple, C.W., & Joshi, K.D. (1999). *Description and Analysis of Existing Knowledge Management Frameworks*. In Proceedings of the 32nd Hawaii International Conference on System Sciences.

[27] Kentucky Initiative Knowledge Management (KIKM), University of Kentucky. Retrieve March 10, 2004, from http://www.uky.edu/BusinessEconomics/dssakba/kikm.htm

[28] Kidwell, Jillinda J., Vander Linde, Karen M., & Sandra, L. (2001). "Applying Corporate Knowledge Management6 Practices in Higher Education." In Bernbom, Gerald, editor, *Information Alchemy*: *The Art and Science of Knowledge Management*. EDUCAUSE Leadership Series #3 (pp. 1-24). San Francisco: Jossey-Bass.

[29] Knowledge Management Center, University Putra Malaysia (UPM). Retrieve April 3, 2004, from http://www.ppi.upm.edu.my

[30] Knowledge Management Implementation, University Teknologi MARA (UiTM). Retrieve April 4, 2004, from http://www.ifcomputer.com/inap/inap2001/program/Workshop.html

[31] Koennecker, A., Jeffery, R., & Low, G. (1999). *Lessons Learned From the Failure of an Experience Base Initiative Using a Bottom-Up Development Paradigm*. In Proceedings of the Twenty-Fourth Annual Software Engineering Workshop.

[32] Leonard-Barton, D. (1995). Wellsprings of knowledge. *Harvard Business Press*.

[33] Liebowitz, J., & Wilcox, L.C. (1997). *Knowledge management and its integrative elements*. Boca Raton: CRC Press.

[34] Liebowitz, J. (2000). *Building Organizational Intelligence: A Knowledge Management Primer*. Boca Raton: CRC Press.

[35] Lisa, A. & Thad R. (2003). *Knowledge Management in Education: Defining the Landscape*. The Institute For The Study Of Knowledge Management in Education. Retrieved February 10, 2004, from http://www.iskme.org

[36] Maglitta, J. (1995, June 4). "Marten Up!". *Computerworld*, *29* (23), pp. 84-86.

[37] Marsh, G. (2000). *Knowledge Management: a cookbook for beginners*. In Proceedings of the 28th annual ACM SIGUCCS conference of user services: Building the future (pp. 181-185). Virginia, USA.

[38] Mayo, A. (1998, January) .Memory bankers. *People Management*, *4* (2), pp. 35-38.

[39] McDermott, R. (1999). Why Information technology inspired but delivers knowledge management. *California Management Review*, pp. 103-117.

[40] Newman, B.D., Conrad, K.W., (2000, October). *A framework for characterizing knowledge management: methods, practices, and technologies*. In Proceedings of the third International Conference on Practical Aspects of Knowledge Management (pp. 16-18). Basel, Switzerland.

[41] Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, *5* (1), 14-37.

[42] Nonaka, I., & Takeuchi, H. (1995). *The Knowledge Creating Company.* Oxford University Press.

[43] O'Leary, D.E. (1998). Using AI in knowledge management: knowledge bases and ontologies. *IEEE Intelligent System, 13* (3), 34-39.

[44] Polanyi, M. (1962). *Personal Knowledge: Towards a Post-Critical Philosophy*. New York: Harper Torchbooks.

[45] Pornchulee, Achava-Amrung. (2001). *Knowledge management in higher education.* Bangkok: Chulalongkorn University.

[46] Pressman, Roger S. (2001). *Software Engineering: A Practitioner's Approach* (5th ed). New York: McGraw-Hill.

[47] Salopek, J. J. (2000). *Common knowledge: How companies thrive by sharing what they know*. Training & Development, pp. 63-64.

[48] Sawhney, M., & Prandelli, E. (2000). Communities of creation: Managing distributed innovation in turbulent markets. *California Management Review*, pp. 24-54.

[49] Senge, P. M. (1998). *Sharing knowledge*. Executive Excellence, 11-12.

[50] Spender, J.-C., and Grant, R. (1996). Knowledge and the firm: An overview. *Strategic Management Journal, 17* (Winter Special Issue), pp. 5-9.

[51] Stewart, T. A. (1997). *Intellectual capital: the New Wealth of Organizations*. Bantam Books.

[52] Sveiby, K. (1997). *The New Organization Wealth*. San Francisco: Berrett-Koehler.

[53] Taylor, R. (1996). *Unisys Decision Support Systems Programme.* London: City Gate.

[54] Thorn, Christopher A. (2001). "Knowledge Management for Educational Information Systems: What Is the State of the Field?". *Educational Policy Analysis Archives, 47(9)*. Retrieved March 21, 2004, from http://epaa.asu.edu/epaa/v9n47/

[55] Van der Spek, R., & Spijkervet, A. (1997). Knowledge Management: Dealing Intelligently with Knowledge. *Knowledge Management and Its Integrative Elements*, *Eds*. New York: CRC Press.

[56] Wiig, K. (1993). *Knowledge Management Foundations*. Arlington: Schema Press.

[57] Zack, M.H. (1999). Developing a Knowledge Strategy. *California Management Review, 41* (3), 125-145.

[58] Zack, M.H. (2000). If Managing Knowledge is the Solution, then What's the Problem?. In *Knowledge Management and Business Model Innovation*, Y. Malhotra (Ed.). Hershey: Idea Group Publishing.

[59] Faculty of Computer Science & Information Technology (FCSIT), University of Malaya. Retrieved May 17, 2004, from http://www.fsktm.um.edu.my

User Manual

Introduction

This website is created especially for staff at Faculty of Computer Science & Information Technology and called FCSIT's Knolwedge Management. Basically, the main function of this website is to facilitate the staff to share their knowledge where they can ask any questions related to their work and provide solutions to the problem asked. In other word, this website is a message board and available at http://www.websamba.com/knowledgefsktm.

What are the system requirements?

To access the website, a user must have a computer with access to the Internet. The software required for viewing the page is Internet browser such as Internet Explorer, Netscape Communicator, etc.

How to start?

1. Open the browser by double clicks on the browser's icon.
2. Go to address part and type the URL address:
   http://www.websamba.com/knowledgefsktm
3. Press Enter or click on "Go" for Internet Explorer users.
4. The main page will be displayed (refer to **Figure 1**).

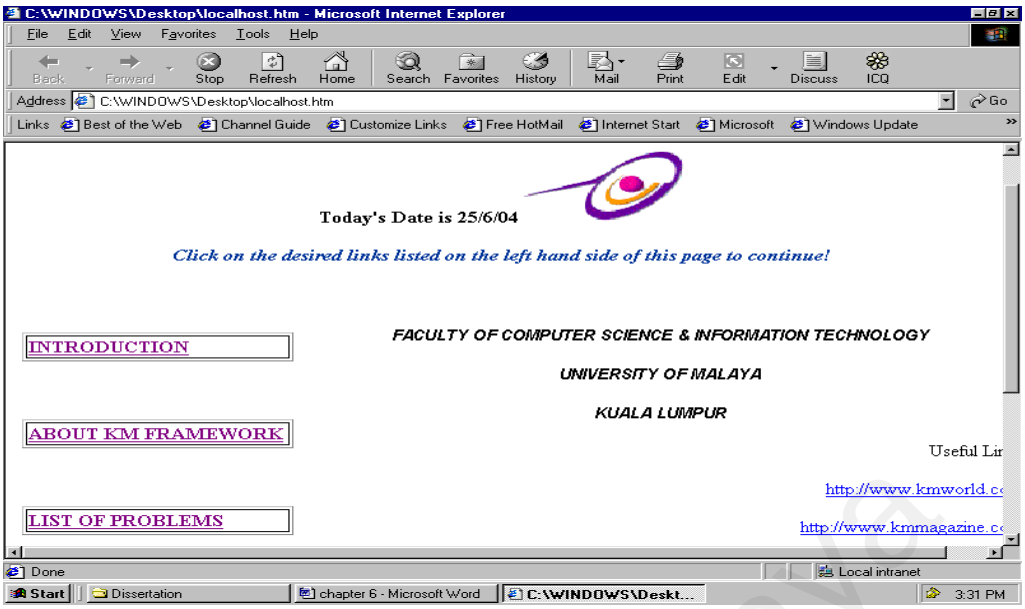


Figure 1: Main page

How to view the existing problem?

1. Click on the List of Problems icon.
2. The page shown **Figure 2** will appear.

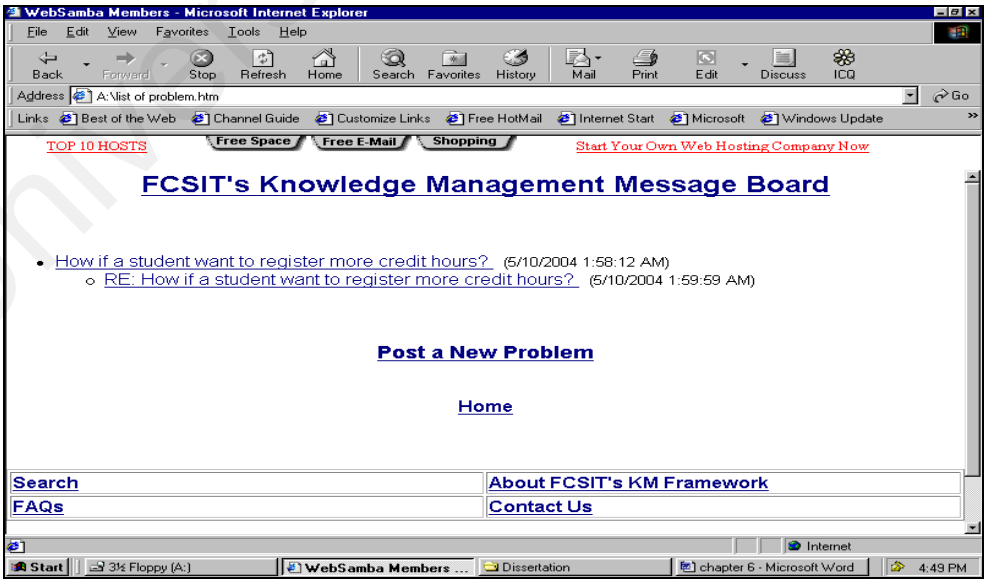


Figure 2: List of Problems page

How to view and response to a problem?

1. Click on the title of the problem.
2. The page shown in **Figure 3** will appear.
3. In order to response, click on "Post a response to this message".
4. The page shown in **Figure 4** will appear.
5. Key in the required field and click "Post". (Note: If the required field is empty, you are not able to post the message!).

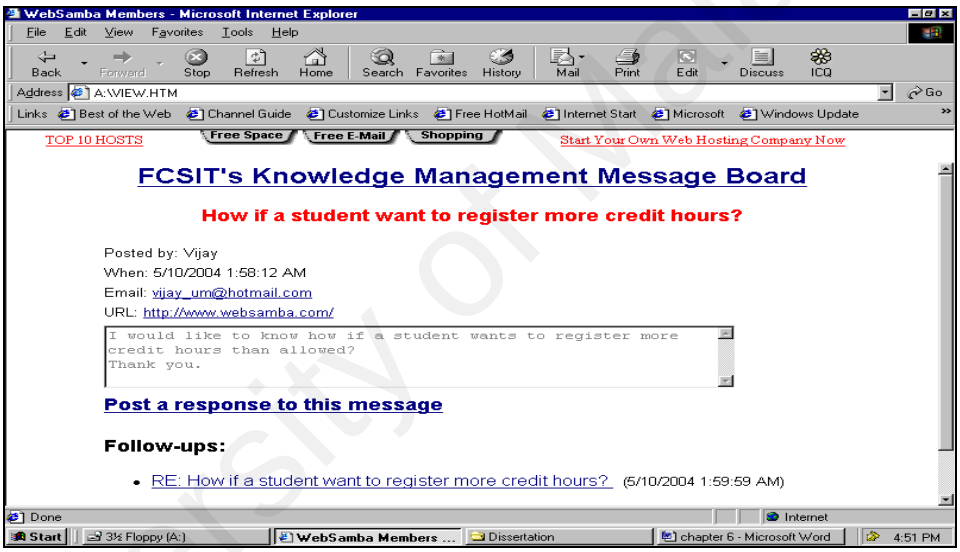


Figure 3: Details of Problem page

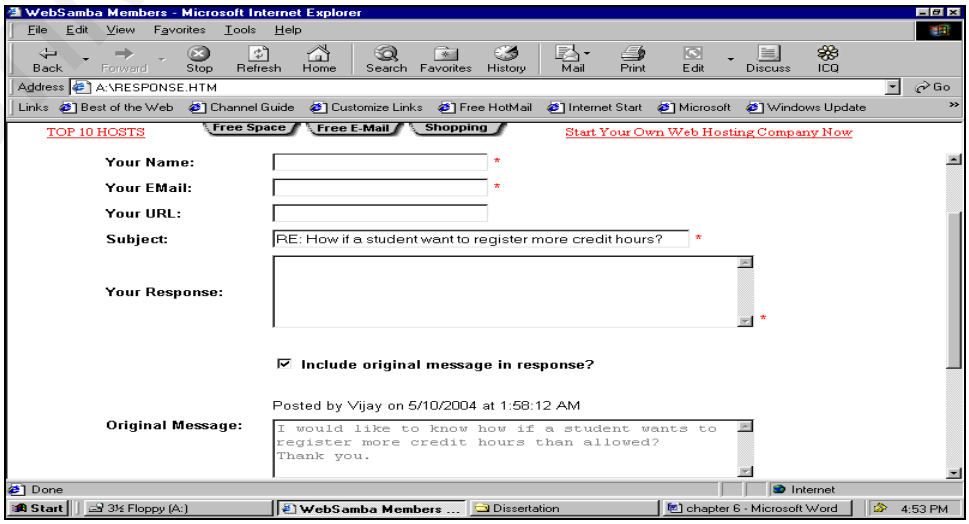


Figure 4: Response page

How to post a new problem?

1. Click on "Post a New Problem" icon.
2. The page shown in **Figure 5** will appear.
3. Key in the required field and click "Post". (Note: If the required field is empty, you are not able to post the message!).
4. The details of that message will be shown.

Alternatively, you may also post a new problem by clicking on "List of Problems" icon. Then click on "Post a New Problem" link and key in the required field.

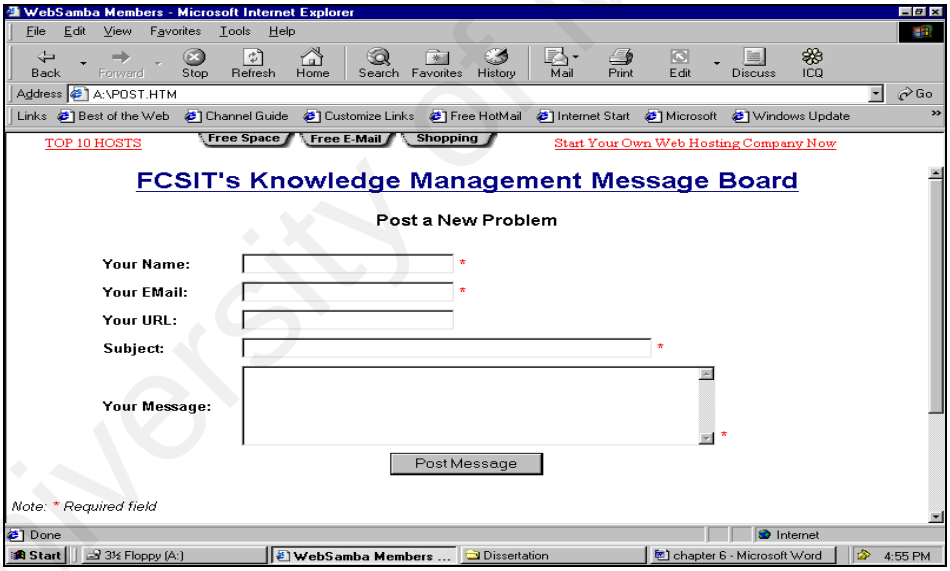


Figure 5: Post a New Problem

How to search?

1. Click on search icon, which is shown in **Figure 6**.
2. The Search page will appear (shown in **Figure 7**).
3. Input the keyword to perform search in the text box provided.
4. The search results will be displayed in a table.

Figure 6: Search icon

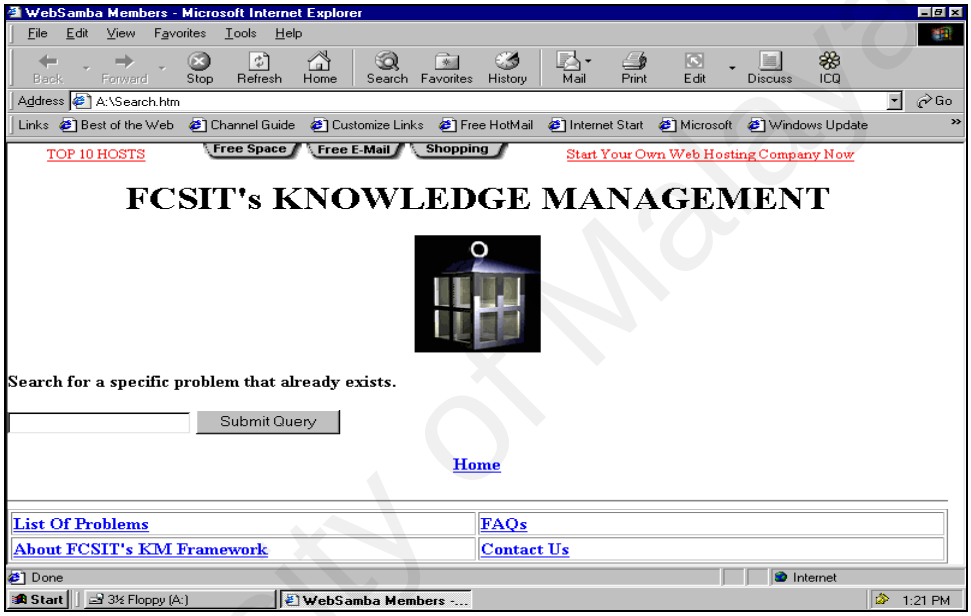


Figure 7: Search

Summary

Hopefully, this user manual will guide and useful to the user of this website. For further information or to ask any question related to this website, please send email to vijay_um@hotmail.com.