

## UNIVERSITI TEKNOLOGI MALAYSIA

BORANG PENGESAHAN  
LAPORAN AKHIR PENYELIDIKAN

**TAJUK PROJEK :** **The Implementation of Collaborative Network for Innovation Process in Higher Education Institutions (HEIs): A Knowledge Management Perspective.**

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**The Implementation of Collaborative Network for  
Innovation Process in Higher Education Institutions  
(HEIs): A Knowledge Management Perspective.**

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## **Abstract**

The Implementation of Collaborative Network for Innovation Process in Higher Education Institutions (HEIs): A Knowledge Management Perspective. The scopes of this study are (1) to produce a computer-supported collaborative working model to support the innovation processes in higher education institutions which concentrate on the knowledge sharing perspectives, (2) to develop a mechanism of collaborative innovation in term of knowledge communication among research group, (3) To identify the roles of information technology in collaborative working environment specifically in research and development activities from the knowledge management perspective. The steps of the study are (1) Preliminary Study, (2) Literature Review, (3) Data collection, (4) Design, (5) Development and testing. The expected result are (1) A collaborative networking model for knowledge management to assist research activities mainly among researcher in HEIs, (2) A prototype of knowledge management systems based on the proposed model, (3) Results from the evaluation of knowledge management systems prototype.

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## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Project Background**

One of the most important and most difficult issues facing today's organizations is the problem of innovation. The development of new products and the improvement of existing ones may be the lifeblood of many organizations. As new technologies and new markets engage in high complexity, firms must deal with enormous discontinuities, increasing volatility, and the rapid evolution of industries.

One avenue that can be overlooked as a source of innovation ideas is through academic research. University-sponsored research is an excellent opportunity to offset the full responsibility of new product development. After all, university researchers are charged with the responsibility of exploring and delivering new knowledge, which can result in new product ideas and concepts. Moreover, research has shown that many of the fastest growing companies are those companies that have availed themselves of college or university resources.

There are clearly organizational trends, which focus on knowledge management in innovation. The modes of knowledge production are changing from the conventional disciplinary-based model, to a new model where knowledge is produced interactively at the point of application among heterogeneous groups. In short, innovation processes are becoming more interactive – more dependent on knowledge, which is widely distributed – therefore knowledge management is increasingly central.

Knowledge management for interactive innovation has distinct implications for the deployment of information and communication technologies (ICTs). It is recognized that ICTs can play a decisive role in knowledge management literature to date in terms of understanding innovation has been limited by a rather narrow focus on ICT-based tools and systems, premised on a cognitive information-processing view of knowledge management. These ICT-based tools and systems create the structural networks but, as shown by Swan (1999), it does not necessarily encourage the social networking processes so necessary for communication and sense making. Swan (1999) suggest that this IT emphasis needs to be balanced by an approach which takes greater account of localized communities of practice and the importance of social networking in KM. This is especially critical when trying to understand innovation processes, which are characteristically interactive.

Knowledge exists only among people. Therefore the main objective of this research is not on developing and implementing ICTs infrastructure for managing knowledge. The purpose of this research is to understand the value of ICTs in order to create an environment whereby knowledge can be shared and communicated among peoples. It will apply the perceptions of KM in public sector (mainly in higher education institutions - HEIs) to enable collaborative innovation processes to take place among research group and for suitable knowledge management developments to be advanced in the HEIs.



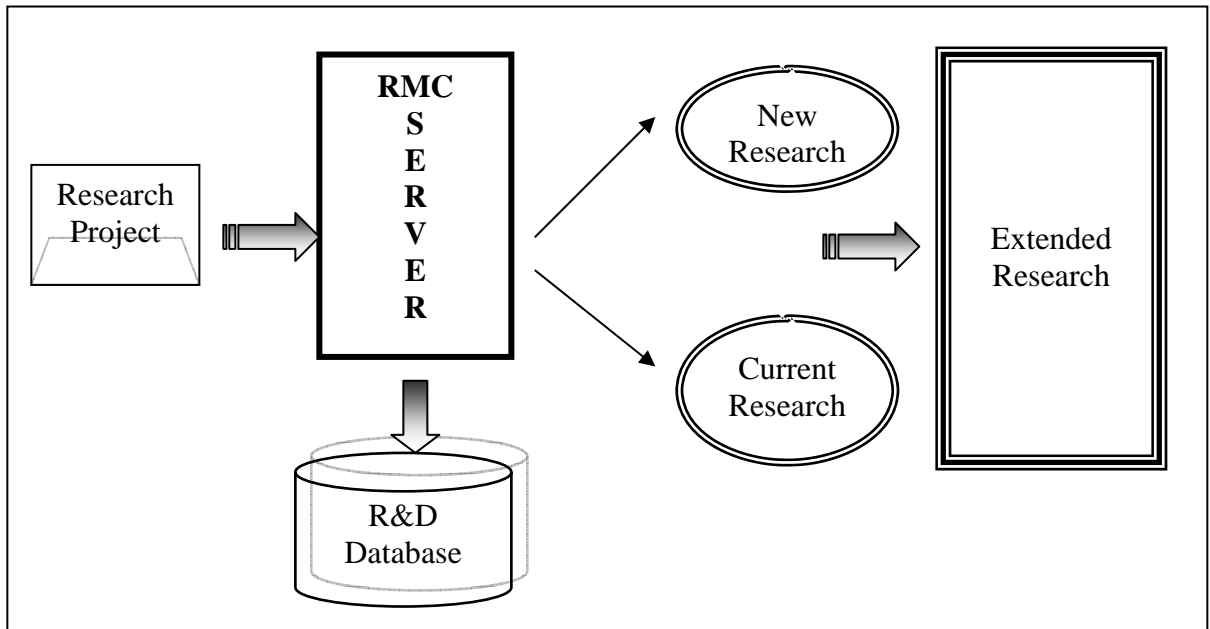
## **1.2 Objective**

To produce a computer-supported collaborative working model to support the innovation process in higher education institutions which concentrate on the knowledge sharing perspectives.

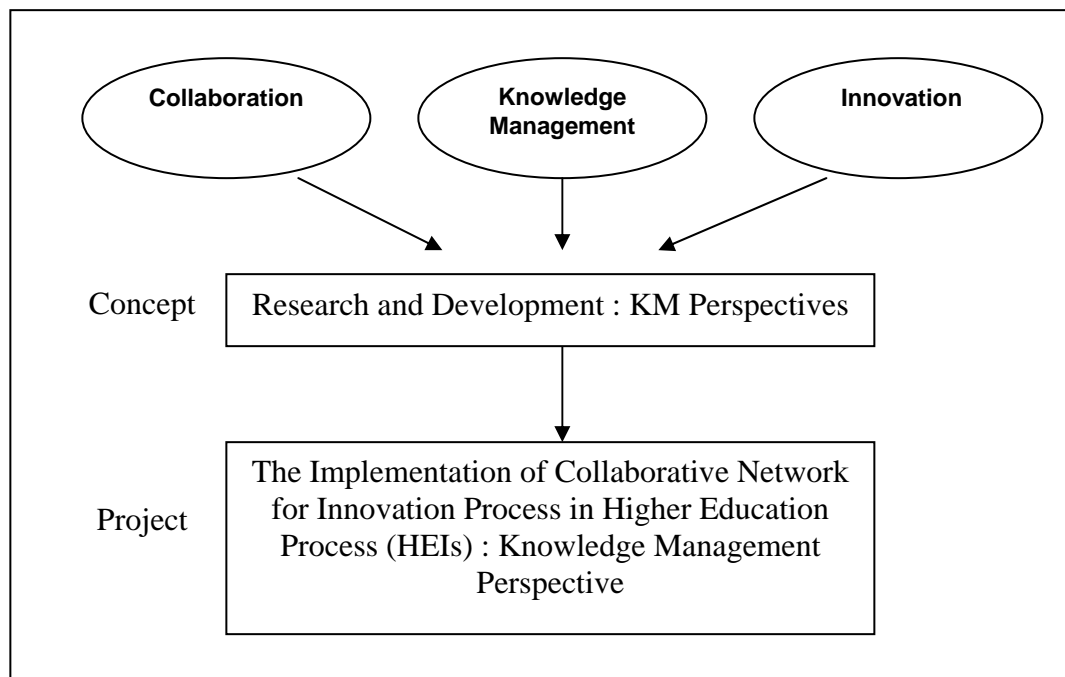
## **1.3 Scope**

- a. To develop a mechanism of collaborative innovation in term of knowledge communication among research group.
- b. To identify the roles of information technology in collaborative working environment specifically in research and development activities from the knowledge management perspective.

## 1.4 Project Scenario



## 1.5 Research Framework



## **CHAPTER II**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The broad range of knowledge management related articles, papers, books, authors, disciplines conferences and lately training is evidence that knowledge management is a discipline which needs to be considered in any strategy and planning. There are a number of aims in writing this paper and in proposing the knowledge management concept as a framework for understanding knowledge management application and technologies.

The first aim was to review the theories and literature that will assist others who approach this topic to better understand and position the diverse aspects of knowledge management being presented in the literature. The second aim was to provide a checklist of knowledge management activities and processes that can be used to assess and organization's current level of knowledge management- related activity and then plan and communicate future knowledge management investments. While, the third aim is to understand the architecture of knowledge management.

#### **2.2 The knowledge management theories**

##### **2.2.1 A brief history of knowledge management**

A number of management theorists have contributed to the evolution of knowledge management, among them such notables as Peter Drucker, Paul Strassmann, and Peter Senge in the United States. Drucker and Strassmann have stressed the growing importance of information and explicit knowledge as organizational resources, and Senge has focused on the "learning organization," a cultural dimension of managing knowledge.

Chris Argyris, Christopher Bartlett, and Dorothy Leonard-Barton of Harvard Business School have examined various facets of managing knowledge.

Everett Rogers' work at Stanford in the diffusion of innovation and Thomas Allen's research at MIT in information and technology transfer, both of which date from the late 1970s, have also contributed to our understanding of how knowledge is produced, used, and diffused within organizations. By the mid-1980s, the importance of knowledge (and its expression in professional competence) as a competitive asset was apparent, even though classical economic theory ignores (the value of) knowledge as an asset and most organizations still lack strategies and methods for managing it.

Recognition of the growing importance of organizational knowledge was accompanied by concern over how to deal with exponential increases in the amount of available knowledge and increasingly complex products and processes. The computer technology that contributed so heavily to superabundance of information started to become part of the solution, in a variety of domains. Doug Engelbart's Augment (for "augmenting human intelligence"), which was introduced in 1978, was an early hypertext/groupware application capable of interfacing with other applications and systems. Rob Ackson's and Don McCracken's Knowledge Management System (KMS), an open distributed hypermedia tool, is another notable example and one that predates the World Wide Web by a decade.

The 1980s also saw the development of systems for managing knowledge that relied on work done in artificial intelligence and expert systems, giving us such concepts as "knowledge acquisition," "knowledge engineering," "knowledge-base systems, and computer-based ontologies.

The phrase "knowledge management" entered the lexicon in earnest. To provide a technological base for managing knowledge, a consortium of U.S. companies started the Initiative for Managing Knowledge Assets in 1989. Knowledge management-related articles began appearing in journals like *Sloan Management Review*, *Organizational Science*, *Harvard Business Review*, and others, and the first books on organizational

learning and knowledge management were published (for example, Senge's *The Fifth Discipline* and Sakaiya's *The Knowledge Value Revolution*).

By 1990, a number of management consulting firms had begun in-house knowledge management programs, and several well known U.S., European, and Japanese firms had instituted focused knowledge management programs. Knowledge management was introduced in the popular press in 1991, when Tom Stewart published "Brainpower" in *Fortune* magazine. Perhaps the most widely read work to date is Ikujiro Nonaka's and Hirotaka Takeuchi's *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation* (1995).

By the mid-1990s, knowledge management initiatives were flourishing, thanks in part to the Internet. The International Knowledge Management Network (IKMN), begun in Europe in 1989, went online in 1994 and was soon joined by the U.S.-based Knowledge Management Forum and other KM-related groups and publications. The number of knowledge management conferences and seminars is growing as organizations focus on managing and leveraging explicit and tacit knowledge resources to achieve competitive advantage. In 1994 the IKMN published the results of a knowledge management survey conducted among European firms, and the European Community began offering funding for KM-related projects through the ESPRIT program in 1995.

Knowledge management, which appears to offer a highly desirable alternative to failed TQM and business process re-engineering initiatives, has become big business for such major international consulting firms as Ernst & Young, Arthur Andersen, and Booz-Allen & Hamilton. In addition, a number of professional organizations interested in such related areas as benchmarking, best practices, risk management, and change management are exploring the relationship of knowledge management to their areas of special expertise (for example, the APQC [American Productivity and Quality Council] and ASIS [American Society for Information Science]).

### 2.2.2 Knowledge Management: definition

Knowledge is the full utilization of information and data, coupled with the potential of people's skills, competencies, ideas, intuitions, commitments and motivations. . Knowledge is the result of learning which provides the only sustainable competitive advantage. (**Denham Grey**)

Knowledge management is the management of the organization towards the continuous renewal of the organizational knowledge base - this means e.g. creation of supportive organizational structures, facilitation of organizational members, putting IT-instruments with emphasis on teamwork and diffusion of knowledge (as e.g. groupware) into place. (**Thomas Bertels**)

### 2.3 Knowledge management: Activities and processes

Knowledge management draws from a wide range of activities and practices:

- i. **Cognitive science.** Insights from **how** we learn and know will certainly improve tools and techniques for gathering and transferring knowledge.
- ii. **Expert systems, artificial intelligence and knowledge base management systems (KBMS).** AI and related technologies have acquired an undeserved reputation of having failed to meet their own — and the marketplace's — high expectations. In fact, these technologies continue to be applied widely, and the lessons practitioners have learned are directly applicable to knowledge management.
- iii. **Computer-supported collaborative work (groupware).** In Europe, *knowledge management* is almost synonymous with *groupware* ... and therefore with Lotus Notes. Sharing and collaboration are clearly vital to

organizational knowledge management — with or without supporting technology.

- iv. **Library and information science.** We take it for granted that card catalogs in libraries will help us find the right book when we need it. The body of research and practice in classification and knowledge organization that makes libraries work will be even more vital as we are inundated by information in business. Tools for thesaurus construction and controlled vocabularies are already helping us manage knowledge.
- v. **Technical writing.** Also under-appreciated — even sneered at — as a professional activity, technical writing (often referred to by its practitioners as *technical communication*) forms a body of theory and practice that is directly relevant to effective representation and transfer of knowledge.
- vi. **Document management.** Originally concerned primarily with managing the accessibility of images, document management has moved on to making content accessible and re-usable at the component level. Early recognition of the need to associate "metainformation" with each document object prefigures document management technology's growing role in knowledge management activities.
- vii. **Decision support systems.** According to Daniel J. Power, "Researchers working on Decision Support Systems have brought together insights from the fields of cognitive sciences, management sciences, computer sciences, operations research, and systems engineering in order to produce both computerised artifacts for helping knowledge workers in their performance of cognitive tasks, and to integrate such artifacts within the decision-making processes of modern organisations." That already sounds a lot like knowledge management, but in practice the emphasis has been on quantitative analysis rather than qualitative analysis, and on tools for managers rather than everyone in the organization.
- viii. **Semantic networks.** Semantic networks are formed from ideas and typed relationships among them — sort of "hypertext without the content," but with far more systematic structure according to meaning. Often applied in

such arcane tasks as textual analysis, semantic nets are now in use in mainstream professional applications, including medicine, to represent domain knowledge in an explicit way that can be shared.

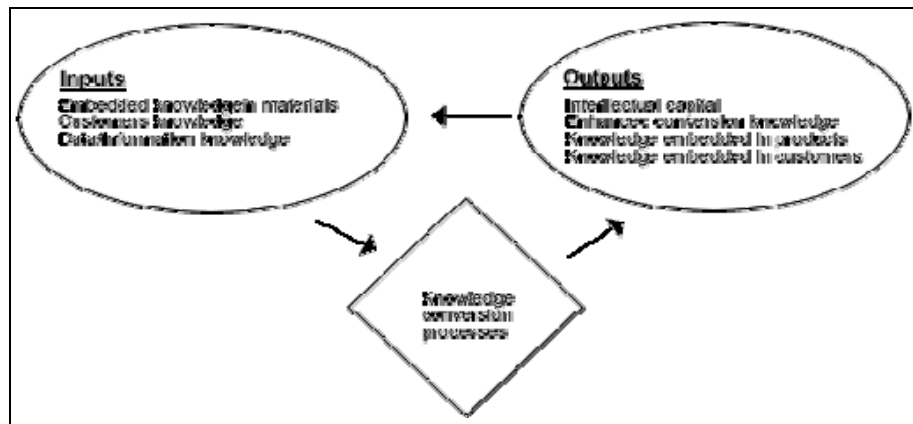
- ix. **Relational and object databases.** Although relational databases are currently used primarily as tools for managing "structured" data — and object-oriented databases are considered more appropriate for "unstructured" content — we have only begun to apply the models on which they are founded to representing and managing knowledge resources.
- x. **Simulation.** Knowledge Management expert Karl-Erik Sveiby suggests "simulation" as a component technology of knowledge management, referring to "computer simulations, manual simulations as well as role plays and micro arenas for testing out skills."
- xi. **Organizational science.** The science of managing organizations increasingly deals with the need to manage knowledge — often explicitly.

That's only a partial list. Other technologies include: object-oriented information modeling; electronic publishing technology, hypertext, and the World Wide Web; help-desk technology; full-text search and retrieval; and performance support systems.



## 2.4 Processes

In this section, we will study a knowledge management model for research supervision.



**Figure 2.1:** knowledge management processes

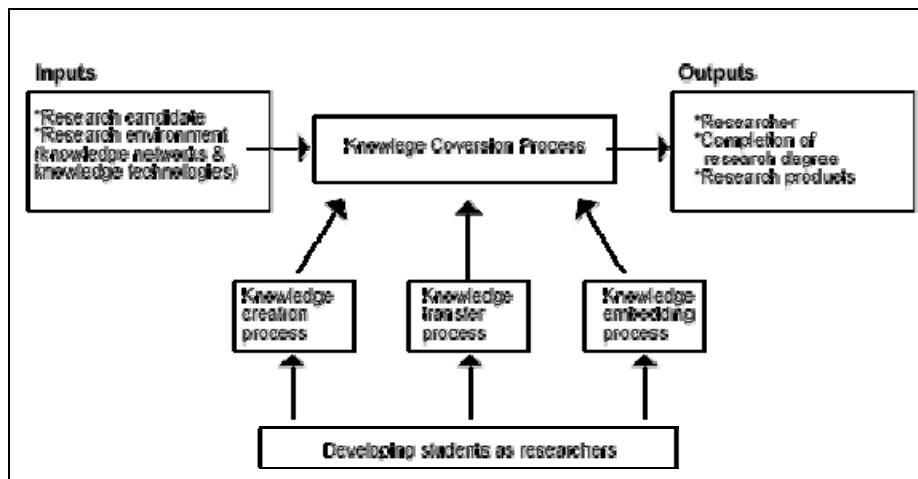
(Adapted from Armistead, 1999)

Figure 2.1 above explores knowledge management from the perspective of operational process, that is, the basic input-output transformation process. At the input end, we have a combination of knowledge of customer's needs and expectations, knowledge of raw materials and resources to be used, knowledge of products and services to be delivered as well as data information or knowledge. The process clearly indicates that knowledge management takes information, knowledge and people as its basic inputs, and applied knowledge and intellectual capital as its desired outputs.

The knowledge conversion process is actually a changing and/or improving process. It consists of preserving, embedding and enhancing knowledge of process, products and services. The knowledge conversion process can also be seen as one of knowledge creation, transferring and sharing, and a process of knowledge access improvement as well. Fostering a knowledge environment that is conducive to knowledge

development, use and transfer is vital in the knowledge conversion process (Armistead, 1999). The knowledge management process is not a one-stop process but a spiral cycle of continuous improvement and development. The outputs of the cycle may be supplied as inputs for the next transformation process.

Knowledge management in different organisations may serve different purposes. Universities have a significant level of knowledge management activities associated with the creation and maintenance of knowledge repositories, improving knowledge access, enhancing knowledge environment and valuing knowledge (Rowley, 2000). The supervision of research students is undoubtedly an integral part of the knowledge management activities in universities. The author maintains that the effectiveness of research supervision process to achieve quality improvement and increased productivity will be enhanced if knowledge management concepts are effectively integrated into the process.



**Figure 2.2:** A knowledge management model for research supervision

Figure 2.2 above illustrates a model of research supervision which is incorporates the core knowledge management concepts summarised above into research supervision

process. The model demonstrates close synergies between knowledge conversion process and that of research supervision.

The above knowledge management model for research supervision is new and innovative in nature because it takes a non-conventional approach, that is, a knowledge management approach to address research supervision. That is different from the exiting models that have been developed to address issues of supervisory structures and/or learning/teaching patterns as mentioned in the paper. However, is the innovative model feasible in the real world? The following section addresses the question of how to implement the model in actual research supervision.

## **2.5 Categorization of knowledge management approaches**

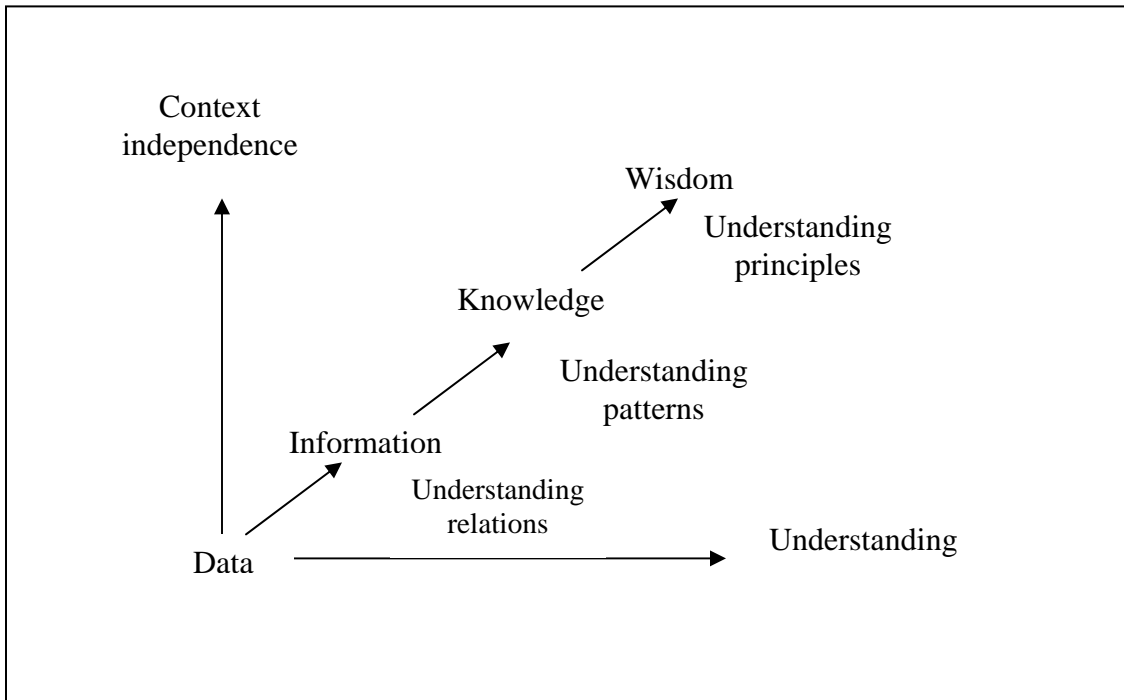
The term "knowledge management" is now in widespread use, having appeared in the titles of many new books about knowledge management as a business strategy, as well as in articles in many business publications, including *The Wall Street Journal*. There are, of course, many ways to slice up the multi-faceted world of knowledge management. However, it's often useful to categorize them.

In a posting to the Knowledge Management Forum, Karl-Erik Sveiby identified two "tracks" of knowledge management:

- i. **Management of Information.** To researchers in this track, according to Sveiby, "... knowledge = Objects that can be identified and handled in information systems."
- ii. **Management of People.** For researchers and practitioners in this field, knowledge consists of "... processes, a complex set of dynamic skills, know-how, etc., that is constantly changing."

## 2.6 The architecture of knowledge management

To define knowledge management, it is important to look at the two parts that make up the term, knowledge management. The architecture of knowledge is part of the hierarchy made up of data, information, knowledge and wisdom.



**Figure 2.3: The architecture of Knowledge Management**

The figure above shows the basic architecture of knowledge management. The architecture comprises the components as below:

- i. **Data** – are raw statistics and facts
- ii. **Information** – comprises the basic facts with context and perspectives
- iii. **Knowledge** – is information which provides guidance for action
- iv. **Wisdom** – is understanding which knowledge to use for what purpose

## **2.7 Innovation concepts in Knowledge Management**

### **2.7.1 Introduction to Innovation**

The innovation of new knowledge is the most popular topic in today's management literature. Innovation – based knowledge management applications focus on providing an environment in which knowledge workers, often from differing disciplines, can come together in teams to collaborate in the creation of new knowledge. The focus of knowledge management applications in this element is on providing an environment in which knowledge workers of various disciplines can come together to create new knowledge. The most common application referenced in the literature is the creation of new products or company capabilities.

### **2.7.2 Knowledge Innovation**

Innovation theories in knowledge management embody the concept that innovation is the one competence needed for the future. It addresses all the fundamental management dimensions in the process of innovation - the creation and conversion of ideas into viable commercial products in addition to building a foundation for future sustainable growth. It recognizes that knowledge is the core component of innovation - not technology or finances per se. Nurturing and managing the flow of knowledge may be the most distinctive competence of the decade.

### **2.7.3 Innovation in the knowledge management spectrum**

Derek Binney developed the knowledge management spectrum in 2001. Knowledge management works as a framework for understanding the knowledge management applications and technologies. The spectrum provides a checklist of knowledge management applications and technologies which can be used to assess an organization's current level of KM – related activity and then plan and communicate

future knowledge management investments. The knowledge applications found in the research have been mapped to the elements of the knowledge management spectrum. Figure 1 below shows the innovation spectrum.

<b>Innovation</b>	
<b>Knowledge Management Application</b>	<ul style="list-style-type: none"> <li>▪ Communities</li> <li>▪ Collaboration</li> <li>▪ Discussion Forums</li> <li>▪ Networking</li> <li>▪ Virtual teams</li> <li>▪ Research and Development</li> <li>▪ Multi – disciplines teams</li> </ul>
<b>Enabling Technologies</b>	<ul style="list-style-type: none"> <li>▪ Groupware</li> <li>▪ E – mail</li> <li>▪ Chat rooms</li> <li>▪ Video conferencing</li> <li>▪ Search Engines</li> <li>▪ Voice Mail</li> <li>▪ Bulletin boards</li> <li>▪ Push technologies</li> <li>▪ Simulation technologies</li> </ul>

**Figure 2.3:** Application and enabling technologies in knowledge management spectrum

#### **2.7.4 Core Principle of Knowledge Innovation**

There are four core concepts that distinguish knowledge management innovation from other knowledge and innovation approaches:

- i. Innovation Value System (not value chain) - value chain thinking is linear and static. The innovation value system is dynamic and shows all the interdependent relationships that are need to be developed for successful innovation.
  
- ii. Strategic Business Network (not Strategic Business Units) - strategic business unit management tends to create isolated islands of knowledge. The Strategic Business Network encourages the flow of knowledge between partners, customers, suppliers, research organisations and other stakeholders, including competitors, in the innovation process.
  
- iii. Collaborative (not Competitive) Advantage - Competitive strategies create win-lose scenarios, often competing for a share of the same pie. Collaborative strategies encourage win-win situations through symbiotic relationships. Knowledge grows and the pie gets bigger for all.
  
- iv. Customer Success (not Satisfaction) - Customer satisfaction meets today's articulated need. A focus on the success of your customer helps identify those future unarticulated needs, the source of growth and future success.

## CHAPTER III

### METHODOLOGY

#### 3.1 Introduction

The methodology of the research can be divided into several phases as follows:

a. Phase 1 (Preliminary Study)

- Identify research problems
- Research objectives
- Scope of the research
- Identify expected outcomes

b. Phase 2 (Literature Review)

Thorough understanding on the major issues of the research will be on:

- Collaborative working concept – existing theories, model, practices, etc.
- Knowledge management concept – theories, activities/ processes, architecture,
- Model construction – techniques, methods, framework, tools,
- Higher education institutions (HEIs) – activities, organizational behaviour, characteristics,

c. Phase 3 (Data Collection)

- Gather the requirements of knowledge management model from HEIs.



- Several techniques will be applied (questionnaire, interview, etc).
- d. Phase 4 (Design)
- The design (model/ system) will be formulated based on the data collected in the previous phase.
  - Based on the data collected, a model of knowledge management for research activities will be design.
  - A system/ tools to assist knowledge management in research activities will also be construct.
- e. Phase 5 (Development & Testing)
- A prototype of knowledge management will be develop based on the model proposed.
  - The prototype will be tested in the real environment (HEIs) in order to evaluate the effectiveness of the systems.
  - The evaluation process also should justify the validity of the model proposed by the researchers.

### **3.2. Questionnaire**

The Questionnaire for data data collection purposes is shown in Appendix A

## **CHAPTER IV**

### **RESULT**

#### **4.1 Introduction**

The chapter will discuss about the result or the outcome from this research.

#### **4.2. Conference Paper (1)Qualitative Research: Knowledge Management Perspective**

Using a qualitative research methodology, this study explored reasons and focused an important of innovation based on knowledge management between research focus groups in Higher Education Institutions (HEIs). The resource-based view of the university in strategic management has been extend by theory on knowledge management to claim that a university's competitiveness stems from the specialized knowledge held by its researchers, the ability of the firm to generate new knowledge and innovation, and strategic action enabled by innovation. Thus, there has been a general shift in focus group research away from technological to managerial and organizational issues, hence an increasing interest in the application of qualitative research methods. Qualitative Research can be found in many disciplines and fields, using a variety of approaches, methods and techniques. Based on that, several techniques are used include (a) collecting information, (b) intentionally observing surroundings, (c)choosing a broad range of informants, (d) finding a key of informant, (e)conducting interviews, (f)recording observation, interviews and impressions, (g) respecting privacy.

This paper was presented in the 2<sup>nd</sup> Qualitative Research Covention 2003 "Theory and Practice" P. J. Hilton, Malaysia, 22-23 October, 2003. The complete Paper in in Appendix B

#### **4.3 Conference Paper (2) The Implementation of Collaborative Network for Innovation Process in Higher Education Institutions (HEIs): A Knowledge Management Perspective**

Knowledge management based works are increasingly becoming a key part of our organizations today. Knowledge management is the way that organizations create, capture and re-use knowledge to achieve organizational objectives. The changing environment has profound implications for research education/training in universities where knowledge dominates. The central issue confronting research supervisors is how to achieve quality, effectiveness and productivity of their work in the new changing environment. This research aims to develop an innovative networking - model using knowledge management approach to research supervision to address the central issue. Computer supported collaborative working (CSCL) has grown out of wider research into computer supported collaborative work (CSCW) and collaborative learning. CSCW is defined as a computer-based network system that supports group work in a common task and provides a shared interface for groups to work with. The objective of this research is to produce a computer-supported collaborative working model to support the innovation processes in higher education institutions that concentrate on the knowledge sharing perspectives. We use the knowledge management approach it is because this approach is transforming the use of development knowledge in many organizations and the way in which knowledge is shared between these organizations and individuals. The methodology of these research start with preliminary study, literature review, data collection, design, development and finally test the systems. With this knowledge it will help to develop a mechanism of collaborative innovation in term of knowledge communication among research group. These systems can support communicating ideas and information, accessing information and documents, and providing feedback on problem-solving activities. An alternative approach to understanding the collaborative

working is to try and ascertain exactly what are the unique problems and concerns that might make a separate problem area for researchers. By having some shared concepts and some agreement about what the object of study is, the field could develop more coherently, rather than simply exist as a place for quite different ideas.

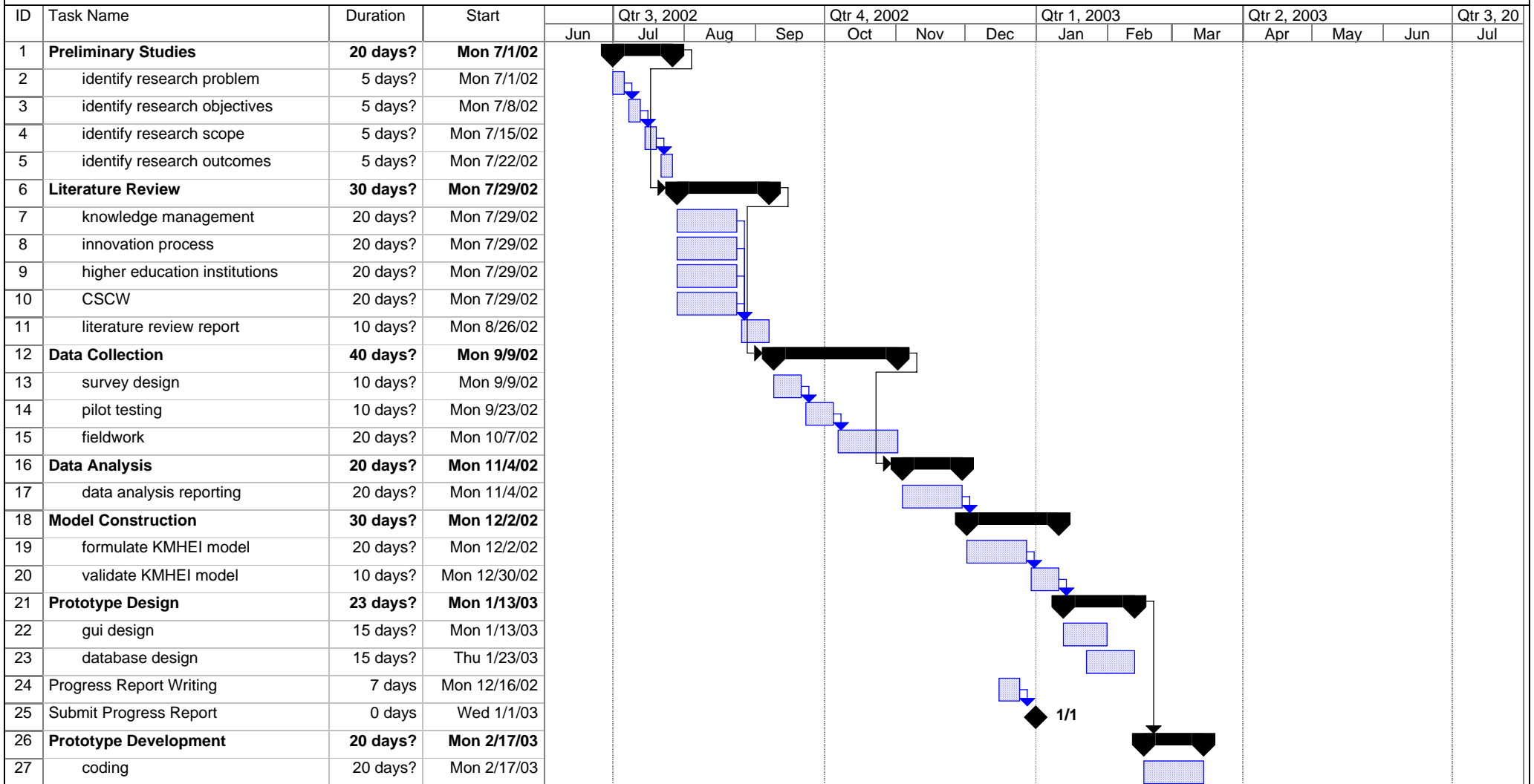
This paper was presented in the NATIONAL CONFERENCE ON INFORMATION AND COMMUNICATION TECHNOLOGY 2003 (NCICT'03) "BUILDING A KNOWLEDGE SOCIETY: KNOWLEDGE CREATION THROUGH PEOPLE, KNOWLEDGE, AND ICT" Prince Hotel & Residence, Kuala Lumpur 21-22 October 2003 (24-25 Sya'ban 1424). The complete Paper is in Appendix B

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## The Implementation of Collaborative Network for Innovation Process in Higher Education Institutions (HEIs): A Knowledge Management Perspective. (VOT 71899)



Project: schedule Date: Tue 11/28/06	Task		Milestone		External Tasks	
	Split		Summary		External Milestone	
	Progress		Project Summary		Deadline	

**The Implementation of Collaborative Network for Innovation Process in Higher Education Institutions (HEIs): A Knowledge Management Perspective.**  
**(VOT 71899)**

ID	Task Name	Duration	Start	Qtr 3, 2002				Qtr 4, 2002			Qtr 1, 2003			Qtr 2, 2003			Qtr 3, 20
				Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
28	<b>Testing</b>	<b>20 days?</b>	<b>Mon 3/17/03</b>														
29	alpha testing	10 days?	Mon 3/17/03														
30	beta testing	10 days?	Mon 3/31/03														
31	Final Report Writing	30 days	Mon 5/12/03														
32	Submit Final Report	0 days	Mon 6/30/03														<b>6/30</b>

Project: schedule Date: Tue 11/28/06	Task		Milestone		External Tasks	
	Split		Summary		External Milestone	
	Progress		Project Summary		Deadline	



## Strategies Innovation: Knowledge Management Perspective

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### ABSTRACT

Today, knowledge management has become a well-known term. Knowledge management is the ability to create and retain greater value from core business competencies. But the real challenge facing most companies is that of faster innovation. It is a matter of strategy and leadership. Knowledge drives strategy, and strategy drives knowledge management. The purpose of the following analysis is to identify the most promising organisational strategies of innovative agents under different environmental constraints. To do so, the processes of the relationships between these agents are taken into account by putting three aspects together. First, it is shown that the transfer, storage, and use of knowledge are significantly influenced by this knowledge's characteristics. Second, the main principles of the generation and selection of innovation are introduced from the systemic point of view. As a third element, the variety of possible relationships between innovative agents are categorised to identify the different organisational principles that can be employed. By putting all these elements together, it is possible to show which strategies are the most promising under different constraints given by the innovation possibilities, the relevant institutions, the knowledge employed, and the kind of innovation expected.

**Keywords:** knowledge, knowledge management, innovation, organisation, innovation systems

### 1.0 INTRODUCTION

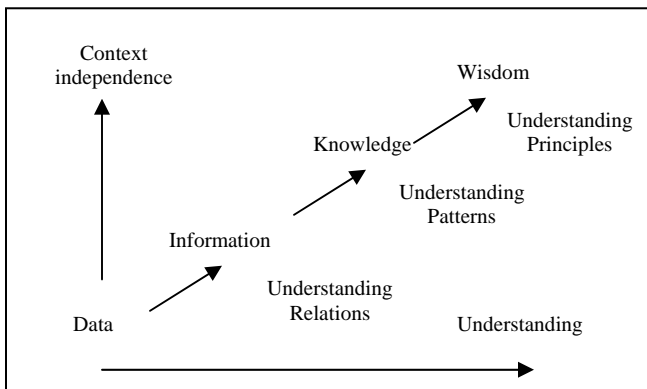
The innovation of new knowledge is the most popular topic in today's management literature. Innovation – based knowledge management applications focus on providing an environment in which knowledge workers, often from differing disciplines, can come together in teams to collaborate in the creation of new knowledge. The focus knowledge management applications in this element is on providing an environment in which knowledge workers of various disciplines can come together to create new knowledge. The most common application referenced in the literature is the creation of new products or company capabilities.

### 2.0. DEFINING KNOWLEDGE MANAGEMENT

The broad range of knowledge management related articles, papers, books, authors, disciplines conferences and lately training is evidence that knowledge management is a discipline that needs to be considered in any strategy and planning. There are numbers of aim in writing this paper and in proposing the knowledge management concept as a framework for understanding knowledge management application and technologies. Knowledge is the full utilization of information and data, coupled with the potential of people's skills, competencies, ideas, intuitions, commitments and motivations. Knowledge is the result of learning which provides the only sustainable competitive advantage. While Thomas Bertels (2000) defines, Knowledge management is the management of the organization towards the

continuous renewal of the organizational knowledge base - this means e.g. creation of supportive organizational structures, facilitation of organizational members, putting IT-instruments with emphasis on teamwork and diffusion of knowledge (as e.g. groupware) into place.

The knowledge management supports three main functions; they are formation, assimilation and distribution. The formation explains that knowledge management must have a sub process to connect the planned actions with the result to learn from any projects. The architecture of knowledge is part of the hierarchy made up of data, information, knowledge and wisdom. The Figure 1 below shows the basic architecture of knowledge management. The architecture comprises the components as below a) **Data** – are raw statistics and facts, b) **Information** – comprises the basic facts with context and perspectives, c) **Knowledge** – is information which provides guidance for action d) **Wisdom** – is understanding which knowledge to use for what purpose



**Figure 1: The Architecture of Knowledge**

### 3.0 KNOWLEDGE INNOVATION

Innovation was defined mostly as reinvention that enabled existing ideas to be used in a different setting. It is also means applying or using knowledge in a way that has not been done before. It is finding a new way to do something or a new product that no one else has thought of/ The innovation for new knowledge is the most popular topic in today's management literature. Innovation – based knowledge management applications focus on providing an environment

in which knowledge workers, often from differing disciplines, can come together in teams to collaborate in the creation of new knowledge. The focus knowledge management applications in this element is on providing an environment in which knowledge workers of various disciplines can come together to create new knowledge. The most common application referenced in the literature is the creation of new products or company capabilities.

Innovation theories in knowledge management embody the concept that innovation is the one competence needed for the future. It addresses the all the fundamental management dimensions in the process of innovation - the creation and conversion of ideas into viable commercial products in addition to building a foundation for future sustainable growth. It recognizes that knowledge is the core component of innovation. Nurturing and managing the flow of knowledge may be the most distinctive competence of the decade.

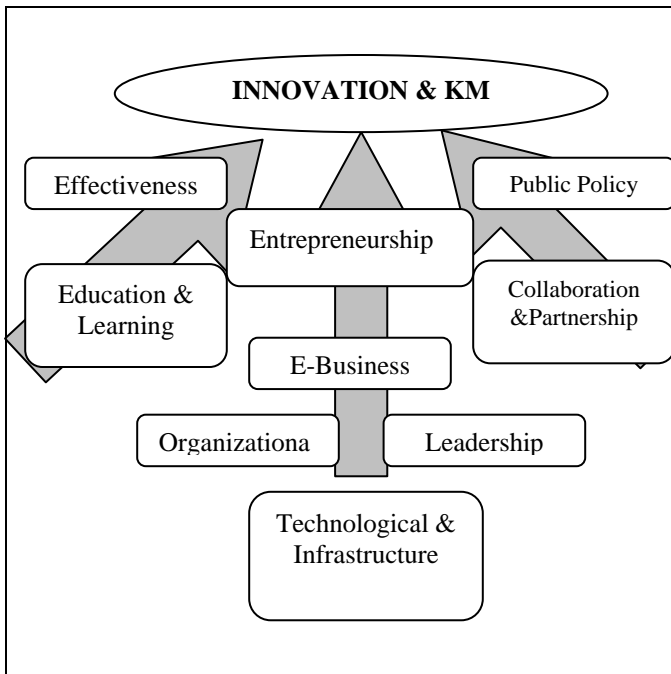
### 3.1 KNOWLEDGE MANAGEMENT AND INNOVATION

Knowledge management has received a great deal of attention over the past few years. The innovation of new knowledge is the most popular topic in today's management literature. Innovation – based knowledge management applications focus on providing an environment in which knowledge workers, often from differing disciplines, can come together in teams to collaborate in the creation of new knowledge. The focus knowledge management applications in this element is on providing an environment in which knowledge workers of various disciplines can come together to create new knowledge. The most common application referenced in the literature is the creation of new products or company capabilities.

While many performance improvement programs have talked about innovation and the word is showing up increasingly in advertisements and mission statements, there seems to be little genuine understanding of how to build an innovation organization. We believe that the shift to innovation organizations will not come through programs, regardless of how well thought out they are. It will come by severing ties with the past. It will come through a

dramatic shift in how we think about work and life in organizations. And, it will come because we have a new vision of working together in organizations.

items, but rather necessities and a means of sustaining economic development and competitiveness.



**Figure 2: Transformation element through the innovation and knowledge management.**

Knowledge and innovation play an increasingly vital role in technological advances and the transformation of society. The transformation of society from agrarian to industrial and now to information and knowledge has largely been brought about as a result of the accumulation and increasingly sophisticated deployment of knowledge. Figure 2 shows the important role in the process of the combination between innovation and knowledge management.

Knowledge management looks at a wide range of issues that involves information management, knowledge acquisition, knowledge sharing, organizational culture, organizational learning, communities of practice, best practices, and learning organizations.

The emergence of the knowledge based economy, the threat of globalization, and the intensification of competition have profound implications for organizational growth, adaptability, sustainability and survival. For many organizations and countries alike, innovation and knowledge management are no longer luxury

### 3.2 PRINCIPLES OF INNOVATION

There certain principles of innovation that are related with the concept of knowledge management. Based on the literature by Bart R. Meijer(1999), we can identify the principles, they are:

- a. **Innovation requires a vision** -- innovation requires change, risk and upheaval. Innovation is not done for innovation's sake; there must be a driving motivator compelling the organization to develop the systems, resources and culture needed to support innovation. In today's environment, the innovation driver is the need to survive in a world of rapid change.
- b. **Innovation is customer-driven and bottom line focused** -- the purpose of innovation is to find better ways to delight customer and create a financially viable organization.
- c. **Innovation requires a foundation of ethics** -- only in an environment of mutual trust and respect, not only within the organization but also within the surrounding community and global environment, can an organization develop a truly innovative approach to problems and opportunities.
- d. **Innovation requires innovative thinking** -- innovative thinking is a skill needed by every member of the organization. It is the ability to constantly look for new possibilities, generate ideas, think together productively, make sound decisions and gain the commitment needed for rapid and effective implementation.
- e. **Innovation looks at the whole system** -- creating solutions in one area that cause problems in another is not innovation
- f. **Innovation requires a diverse, information- and interaction-rich environment** -- people with different perspectives, working together toward a common objective, with accurate, up-to-date information and the proper tools are the only source of innovation.

**g. Innovation involves and rewards every member of the organization** -- there are no longer "thinkers" and "doers," "owners" and "workers." Innovation requires the very best thinking and doing from everyone and treats everyone as an "owner" equitably sharing the rewards generated by those best efforts.

**h. Innovation requires a continuous scan of future plans** -- the destiny of an organization may be determined by the efforts of an unknown team working in a basement laboratory of a small mid-western university.

**i. Innovation requires a learning orientation** - only by creating an environment where every member of the organization is continuously learning more about its products, services, processes, customers, technologies, industry and environment can an organization successfully innovate year after year.

**j. Innovation always involves resistance** -- innovation requires change; change requires moving away from the comfort of the status quo. Resistance is normal and should not be used as an excuse not to innovate.

#### **4.0. INNOVATION IN KNOWLEDGE MANAGEMENT ORGANIZATION**

Knowledge management is the management of the organization towards the continuous renewal of the organizational knowledge base - this means e.g. creation of supportive organizational structures, facilitation of organizational members, putting IT-instruments with emphasis on teamwork and diffusion of knowledge (as e.g. groupware) into place.(Thomas Bertels)

Individual learning is the cornerstone of successful learning organizations. And personal mastery is the foundation of individual learning. Without individuals who are proficient, engaged, and productive an organization is incapable of creating change at the speed necessary to secure its future. Exploring and clarifying individual gifts, dreams, hopes, values, beliefs and purpose, and discovering ways to express these through work provides a vital--and often overlooked--first step for tapping into the energy, commitment and creativity people innately want to bring to their jobs. The alignment of individual potential with organizational need unleashes the power of the learning organization to the benefit of the

organization and the individual. There are distinct parallels between the efficiency, effectiveness and success of an organization with a clear mission, vision, values and awareness of its strengths, and individuals operating with clarity of purpose, dreams, personal beliefs and strengths. No one in the business world would argue that an organization passionate about why it exists and focused on what it does well has an advantage over its competitors. But organizations aren't passionate. Companies don't create, innovate or succeed. Individuals do.

Many of the elements that foster innovative teamwork exist within the knowledge management organisation. The learning organization is in effect a collective process of reflecting on new ideas, knowledge and insights in order to continually improve its performance. Innovation and the learning organization are therefore inextricably linked, and can be considered companion pillars of high-performing organisations. The learning organization provides the supporting conditions for innovation, innovative teams generate significant leaps of progress, and the learning organization captures this new knowledge and integrates it throughout the organization.

As Gregory E. Kersten (1999), states in his literature review, we can identify the key elements of a knowledge management organization, including:

- **Common purpose** (expressed in the guide a "shared vision") can bring clarity to what members of a team or an organization want to accomplish together. It requires aligning the team's values, principles and beliefs in terms of what the team wants to achieve and how it wants to achieve it.

- **Multiplicity** can help maximize creativity by bringing together people with differing skills, abilities and backgrounds. If everyone on the team is of like mind, opposition to the majority view can be considered troublesome and "buy in" can be considered excessively important.

- **Discussion** helps to ensure that ideas are freely and candidly shared. It can help build awareness, understanding and commitment. It is about honest conversation, careful listening and open discussion. Team members teach each other new things and support each other. This is a true culture of learning.

- **Creative conflict** is designed to ensure that constructive and healthy conflict is not avoided because it can play a creative role, providing a means of challenging assumptions, revealing biases, scrutinizing evidence, and making arguments persuasive. Ideally, diverse views are brought to the table and new ideas flow from this creative conflict.

- **Modesty** is about public servants recognizing existing limitations of the knowledge they have and being challenged to seek the knowledge they do not have.

The learning organization can also help senior management to effectively identify and elect those fundamental and critical issues that justify a more comprehensive approach to innovation. To further build upon the innovative foundation provided by the learning organization and to make innovation more deliberate, the next part of the toolkit provides teams with a practical approach to innovation

## CONCLUSION

Knowledge with an innovation is a vital organization resource. It is the raw material, work-in-process, and finished good of decision making. Distinct types of knowledge used by decision makers include information, procedures, and heuristics, among others. An ability to adeptly manage such diverse types of knowledge is crucial for the productivity of both individual decision makers and the organizations within which they work. A variety of computer-based techniques for managing knowledge (i.e., representing and processing it) have been and will continue to be devised to supplement innate human knowledge management skills. As a field of study, knowledge management is concerned with the innovation strategies, invention, improvement, integration, usage, administration, evaluation, and impacts of such techniques. Progress in this field has significant implications for individual effectiveness within organizations, organizational competitiveness in the global marketplace, and economic success of states or regions.

Developing a knowledge management practice requires a well-balanced approach. Technology is a required foundation for managing knowledge assets and bringing people together in dispersed organizations. At the same time, creating incentives for sharing knowledge and having focused business goals will help avoid many of the common pitfalls of .While knowledge management offers cost savings, the real value is in more forward-looking and adaptive organizations. Companies will see benefits in faster product development, improved decision-making, more skilled employees, and enhanced services that better meet customer needs. These benefits will surface in measures such as cycle-time reductions, better resource returns, higher product satisfaction indexes, and increased employee education levels.

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## Qualitative Research: Knowledge Management Perspective

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### Abstract

Using a qualitative research methodology, this study explored reasons and focused an important of innovation based on knowledge management between research focus groups in Higher Education Institutions (HEIs). The resource-based view of the university in strategic management has been extend by theory on knowledge management to claim that a university's competitiveness stems from the specialized knowledge held by its researchers, the ability of the firm to generate new knowledge and innovation, and strategic action enabled by innovation. Thus, there has been a general shift in focus group research away from technological to managerial and organizational issues, hence an increasing interest in the application of qualitative research methods. Qualitative Research can be found in many disciplines and fields, using a variety of approaches, methods and techniques. Based on that, several techniques are used include (a) collecting information, (b) intentionally observing surroundings, (c)choosing a broad range of informants, (d) finding a key of informant, (e)conducting interviews, (f)recording observation, interviews and impressions, (g) respecting privacy.

**Keywords:** *Knowledge management, qualitative research, innovations*

### 1. Introduction

Knowledge management is based on a simple philosophy: organizations of all shapes and sizes - especially those involved in international development - need to optimally use all resources available to them, including the knowledge and skills of their staff and partners. But to capture and use that knowledge requires more than just better file and information management; effective qualitative research method and techniques are essential. An effective knowledge management consultant needs to understand an organization's subject area, its definition of "knowledge," and its knowledge culture.

There are different forms of qualitative research such as ethnography, case study, action research and evaluation which often combine and overlap. There are also many perspectives or schools of thought which interpret qualitative research in different ways. A fuller understanding of these perspectives enable us to reflect upon our own perceptions, collect data in a different way and enhance our analyses of the data we collect. We discuss these analysis based on the knowledge management perspectives.

In the rapidly changing world of qualitative research, it will be a combination of innovation and creativity with true research integrity. Each methods and techniques are screened not only for their industry and qualitative research knowledge but also for their overall knowledge of the research process. Thus,

they can work cooperatively and intelligently throughout a research or planning program

## **2. Qualitative research: definitions, techniques and methods**

Qualitative research as an approach to inquiry is customarily distinguished from other human science research both conceptually and methodologically. Conceptual distinctions relate to the philosophical, theoretical, and disciplinary traditions from which qualitative researchers draw. Because these traditions are several and diverse, they contribute to the multiplicity of conceptual stances held by those calling themselves qualitative researchers (Atkinson, Delamont, & Hammersley, 1988; Jacobs, 1987, 1988).

Qualitative research is based on and grounded in descriptions of observations. Most qualitative research designs are intended to address this question. It can be asked about anything ordinary occurrences, extraordinary events, or circumstances puzzling to some investigator. What is crucial is the attention to the unfolding of events in the natural flow of human activity (Thompson B., 1994).

Qualitative research involves the use of qualitative data, such as interviews, documents, and participant observation data, to understand and explain social phenomena. Qualitative researchers can be found in many disciplines and fields, using a variety of approaches, methods and techniques. In Information Systems, there has been a general shift in IS research away from technological to managerial and organizational issues, hence an increasing interest in the application of qualitative research methods.

Qualitative research methods are used by a number of fields in both the social sciences and the humanities. Qualitative research tends to be either based on archival research or utilizes a number of direct observational techniques. These may include ethnographic studies and case analysis. The resources included in this guide cover theoretical aspects of qualitative research as well as more applied topics such as conducting field notes and data analysis.

## **3. Knowledge Management**

Knowledge Management is the collection of processes that govern the creation, dissemination, and utilization of knowledge. In one form or another, knowledge management has been around for a very long time. Practitioners have included philosophers, priests, teachers, politicians, scribes, Liberians, etc. (Brian (Bo) Newman, 1991). These processes exist whether we acknowledge them or not and they have a profound effect on the decisions we make and the actions we take, both of which are enabled by knowledge of some type. Knowledge management is not a "a technology thing" or a "computer thing" If we accept the premise that knowledge management is concerned with the entire process of discovery and creation of knowledge, dissemination of knowledge, and the utilization of knowledge then we are strongly driven to accept that knowledge management is much more than a "technology thing" and that elements of it exist in each of our jobs.

KM is the systematic and explicit management of knowledge related activities, practices, programs and policies within the enterprise (Wiig, 2000). Knowledge management is an audit of "intellectual assets" that highlights unique sources, critical functions and potential bottlenecks which hinder knowledge flows to the point of use. It protects intellectual assets from decay, seeks opportunities to enhance decisions, services and products through adding intelligence, increasing value and providing flexibility. (Denham Grey. 1999)

Knowledge Management (KM) (Maarten Sierhuis, 2000). This is, as the word implies, the ability to manage "knowledge". We are all familiar with the term Information Management. This term came about when people realized that information is a resource that can and needs to be managed to be useful in an organization. From this, the ideas of Information Analysis and Information Planning came about. Organizations are now starting to look at "knowledge" as a resource as well. This means that we need ways for managing the knowledge in an organization. We can use techniques and methods that were developed as part of Knowledge Technology to analyze the knowledge sources in an organization. Using



these techniques we can perform Knowledge Analysis and Knowledge Planning.

There are two broad approaches to Knowledge Management (KM). One focuses on the 'hard' aspects, the deployment and use of appropriate technology, the other focuses on the 'soft' aspect, the capture and transformation of knowledge into a corporate asset. This second approach includes the management of people and processes. Sveiby's (2001) two categorizations of KM capture this hard and soft approach. His first categorization is the management of information. This approach views knowledge as objects that can be handled by information management systems. The key goal of this approach is to increase access to information through enhanced methods of access and reuse of documents through, for example, hypertext linking, databases, and full-text search. Networking technology in general (especially intranets), and groupware in particular, are key solutions. This approach is based on the idea that technology harnessed to a great volume of information will make KM work.

The second categorization of KM is the capture and transformation of knowledge into a corporate asset through the management of people. This approach views knowledge as a process - a complex set of dynamic skills, know-how, etc that is constantly changing. This approach tends to view the "knowledge problem" as a management issue. Management approaches tend to focus more on innovation and creativity - the "learning organization" as advocated by Senge (1990). Organizational behaviours and culture need to be changed as well. To make this approach work, a "holistic" view is required, and often theories of behaviour of large-scale systems are invoked. The aim here is to get people to share what they know. Processes are what matter, not technology.

Although management is increasingly aware of the potential of KM, there is still no clear consensus about just what knowledge is and how knowledge resources should be managed (Bhatt, 2001)

#### 4. KM theory and practice using qualitative research

Qualitative Research can be found in many disciplines and fields, using a variety of approaches, methods and techniques. There are research methods which obtain a lot of in-depth information from people. Based on that, several techniques are used include (Carliner S., 1999):

**a. Collecting Information** -- The *collecting information* dimension involves linking people with information. It relates to the capturing and disseminating of explicit knowledge through information and communication technologies aimed at codifying, storing and retrieving content, which in principle is continuously updated through computer networks. Through such collections of content, what is learned is made readily accessible to the information needed. Current examples in the nowadays feature include various intranets, the internets, database, library, and many more. Even where comprehensive collections of materials exist, effective use may still need knowledgeable and skilled interpretation and subsequent alignment with the local context to get effective results, just as reading a newspaper article on brain surgery does not qualify or enable a reader to conduct brain surgery. An organisation that focuses completely on collecting and makes little or no effort at connecting tends to end up with a repository of static documents.

**b. Intentionally observing surroundings** -- From the KM perspectives, this method helps to enhance the intelligence and knowledge between individuals, groups or any higher institutions. This method is one of the ethnographies techniques that apply in the qualitative research techniques. It is a way to describe of the physical environment in which the culture exists. Physical space often defines the way people's responses to situations in their environment so qualitative researchers try to record as much detail as possible about it. And this also will help to identify the community's priorities within specific sectors or issues.

**c. Choosing a broad range of informants** -- In a qualitative research study, informants are the people with whom the researcher meets to learn about the environment, issues or industries. Informants describe the focus study from their perspectives, explaining patterns of their work.

The more an informant shares about their knowledge, experiences and feeling, the richer the understanding of that knowledge (Lincoln and Guba, 1986). There many different types of informants provide different types of information about the knowledge in knowledge management environment from the qualitative research method e.g. Executives, lecturers, researchers, trainers, staff, students, knowledge experts and other professionals.

**d. Finding a key of informant --** Although each informant provides crucial insight into a knowledge management environment, a key informant that main person who not only provides insights, but is able to respond to the researchers observations and also provides opportunities that researcher might not otherwise find by themselves. This is one of the important elements in the knowledge management environment which allow the researcher to gain the correct and accurate information.

**e. Conducting interviews –** The interview is probably the most widely used method in qualitative research. It is a process of learning about certain knowledge or environment through another person's thought. In the ethnographic technique of interview, it is widely describes a interviewing technique that begins with a tour, in which someone from the environment being studied provides an overview of the environment, followed by a descriptions of specific aspects of an environment. Using the ethnographic techniques in qualitative research with several representatives of a singe culture can provide the rich perspective of knowledge needed to fully understand topic or issue.

**f. Recording observation, interviews and impressions –** observation is probably the most common way of findings out about things. Observation in everyday prepares us for observation in research. When we observe in everyday life we combine information from all our senses in order to understand or make sense I particular situation. In qualitative research, the reason why systematic observation is so important in research is because as researchers we are attempting to derive knowledge that can be generalised. The information generate from data contributes to the advancement of knowledge.

**g. Respecting privacy --** the qualitative research ethics requires researchers and knowledge

experts to respect the information shared with them.

## Conclusion

Qualitative research in knowledge management group gives a chance to gain a broad qualitative understanding of the underlying reasons and motivations. This research is slightly same with the observation technique. Through the literature review, some of the qualitative research and analysis techniques have been helpful in learning a new knowledge management environment. The analysis of qualitative data from interview, transcript and observation notes or open-ended surveys can identify similarities across several knowledge sharing directories and trends. Data can be categorised into recurrent issues and topics that seem relevant to answer the evaluation question. These are research methods which obtain a lot of in-depth information from people especially for researchers and knowledge experts.

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**THE IMPLEMENTATION OF COLLABORATIVE NETWORK FOR  
INNOVATION PROCESS IN HIGHER EDUCATION INSTITUTIONS (HEIs)  
A KNOWLEDGE MANAGEMENT PERSPECTIVE**

Assalamualaikum w.b.t

Dear Sir / Madam;

Currently, we are conducting a study on innovative networking in HEIs that concentrate on knowledge sharing perspectives among research groups under the UTM short term research grant. Knowledge management is the way that organizations create, capture and re-use knowledge to achieve organizational objectives. With this, we believe that the outcome of this study will help us to develop a mechanism of collaborative innovation in term of knowledge communication among researchers.

The information you provide in the questionnaire is very important for our study. There is no "right" or "wrong" answers to the questions. You will only need approximately 20 minutes to answer all the questions in the questionnaire. We are divided into four sections; contact person and address, research and development activities, collaborative research and internal and external factors limiting your R&D activities. Please read the instructions carefully and give only your frank answer or perception. Please try to answer all questions. We assure you that your response will be strictly confidential.

Please return the completed questionnaire to your respective Penolong Pendaftar the latest by June, 2003. We thank you in advance for your cooperation. Wassalam.

Sincerely yours,

*Md. Hafiz Bin Selamat*

*Project Leader, FSKSM*

<b>SECTION A – CONTACT PERSON AND ADDRESS</b>
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Details of researcher completing this questionnaire:

Name: \_\_\_\_\_

Title:

- Research Officer  
 Tutor  
 Lecturer  
 Assoc. Professor  
 Professor

Faculty:

- FSKSM    FKKSA    FP    FKSG    FKM  
 FPPSM    FAB    FS    FKA    FKE

Telephone No: \_\_\_\_\_ Fax No: \_\_\_\_\_

Type of service:

- Permanent  
 Temporary  
 Contract

**SECTION B – RESEARCH AND DEVELOPMENT ACTIVITIES**

1. Which of the following best describes your R&D sector?

- F1010000 - Mathematical Sciences
- F1020000 - Physical Sciences
- F1030000 - Chemical Sciences
- F1040000 - Earth Sciences
- F1050000 - Information, Computer & Communication Technology (ICT)
- F1060000 - Applied Sciences & Technologies
- F1070000 - Engineering Sciences
- F1080000 - Biological Sciences
- F1090000 - Agricultural Sciences
- F1100000 - Medical And Health Sciences
- F1120000 - Material Sciences
- F1130000 - Marine Sciences
- F1140000 - Forestry Sciences
- F1150000 – Biotechnology

2. Describe how important research and development are to your organization.

- Critical
- Important
- Moderate
- Minor
- Non-existent

3. Which of the following best describes your annual R & D budget?

- < RM20, 000
- RM20, 001 to RM50, 000
- RM50, 001 to RM100, 000
- RM100, 001 to RM150, 000
- RM150, 001 to RM200, 000

4. Which collaborative opportunity is of interest to your organization?

- Fund a specific line of inquiry, i.e., sponsored research
- Fund clinical trials
- Share materials/personnel/equipment
- Donate equipment
- Other (Please Describe)
- 
- 

5. How long do you allow your projects to schedule development?

New iteration of existing research project:

- 6 months or less
- 6 months to 1 year
- 1 to 2 years
- More than 2 years

New research projects:

- Less than 1 year
- 1 year to 18 months
- 18 months to 2 years
- 2 years to 3 years
- More than 3 years

11. How often are project reviews held?

- Monthly
- Quarterly
- Annually
- Never

**Please provide your opinion about how strongly you agree or disagree with the following statements about general R&D activities:**

**1- Strongly Disagree 2- Disagree 3- Minor 4- Agree 5- Strongly Agree**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
a. Organization ever collaborated with other Focus Group					
b. R&D Group be interested in collaborating with other group					
c. Schedule the most important criterion for Project Leader success in your product development efforts					
d. Using R&D roadmaps					
e. A project plan created and approved as a contract for the project team					
f. Using metrics to measure R&D effectiveness					
g. R&D personnel know and understand upper and middle management objectives and success criteria for the project					
h. R&D teams multi-functional are including information technology, communication, aerospace, management, etc					
i. R&D personnel has regular contacts with customer					



**SECTION C – COLLABORATIVE RESEARCH**

**I. Questions concerning the position of the Collaborative Research Centre in its broader field of research**

1. Which is the best development assess of the broader field of research of the proposed Collaborative Research Centre for the next three or ten years?

- Online group work
- E-mail
- Webpage (Search engine)
- Teleconferencing

Others (please specify)

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**Please provide your opinion about how strongly you agree or disagree with the following statements about general collaborative activities:**

**1- Strongly Disagree 2- Disagree 3- Minor 4- Agree 5- Strongly Agree**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
a. Collaborative Research Centre (CRC) contribute to research development					
b. Topic of current CRC interest and relevance and have a long-term perspective					
c. CRC is a suitable instrument to promote research in this field					
d. The university of itself and compared to other institutions well suited for establishing a CRC with regard to the existing infrastructure (institutes, personnel, equipment, libraries, etc)					
e. Overlap with existing or planned coordinated research					
f. Additional researchers, disciplines or institutions be involved in the project					

**II. Questions concerning the projects**

1. How would you assess the project with regard to the following criteria:

a. The potential for new results for the IT field, other fields, or application

- Critical
- Important
- Moderate
- Minor
- Non-existent

b. Originality, innovation, and risk

- Critical
- Important
- Moderate
- Minor
- Non-existent

c. The present state of knowledge, preliminary work, methodology, objectives, experimental plan, feasibility

- Critical
- Important
- Moderate
- Minor
- Non-existent

d. Long-term concept?

- Critical
- Important
- Moderate
- Minor
- Non-existent

2. How would you assess the merit of the collaboration in research project :

- Excellent
- Very Good
- Not Worth funding

3. Is the project strongly connected with the collaborative research as a whole or can it be considered marginal?

- Whole
- Marginal

### III. Questions concerning the Collaborative Research in general

1. How would you assess the collaboration of the researchers involved?

- Critical
- Important
- Moderate
- Minor
- Non-existent

**Please provide your opinion about how strongly you agree or disagree with the following statements about general Collaborative Research activities:**

**1- Strongly Disagree 2- Disagree 3- Minor 4- Agree 5- Strongly Agree**

	1	2	3	4	5
a. There are a sufficient number of outstanding researchers involved who have carried out research in the field of the collaborative information sharing research or in a related field					
b. Collaboration can contribute to the overall goal of the research projects					
c. Additional researchers, disciplines, or institutions should be involved in the research projects					
d. The premises are sufficient and adequate for researchers, staff, students, equipment, etc.					
e. The information sharing, i.e. the relation between institutional support and the support provided from the RMC, adequate or a higher contribution by the university and other participating institutions is necessary.					
f. The establishment and funding of the collaborative learning on the information sharing in research projects are recommended.					
g. An interim report or colloquium as necessary is considered.					

<b>SECTION D – FACTORS AND LIMITING R&amp;D</b>
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**INTERNAL: Factors Limiting Your R&D Activities.**

**1- Strongly Disagree 2- Disagree 3- Minor 4- Agree 5- Strongly Agree**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
a. No clear policy on R&D					
b. No future direction					
c. Lack of R&D strategy					
d. Limited financial resources					
e. Lack of skilled R&D personnel					
f. No priority and thrust area					
g. Lack of infrastructure for R&D (space, equipment, etc.)					
h. Lack of commitment by top management					
i. Lack of emphasis on the importance of R&D for long term benefit					
j. Delays in making decisions by the management					
k. Lack of R&D management know-how					
l. Lack of proven analytical techniques					

**EXTERNAL: Factors Limiting Your R&D Activities.**

**1- Strongly Disagree 2- Disagree 3- Minor 4- Agree 5- Strongly Agree**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
a. Technology advances					
b. Rapid changing of consumer needs					
c. Increasing competition					
d. Increasing labour cost					
e. Too many government regulations					
f. Lack of government incentives					
g. Increasing capital costs (space, equipment, etc.)					
h. Shortage of R&D personnel with requisite expertise					
i. Shortage of other personnel					
j. Lack of consultancy services					
k. Poor physical infrastructural support					
l. Protection of right is not guaranteed					