



Knowledge Management: Building a Successful Knowledge Management System

By

Mr. Yuthapong Thaloengchok

A Final Report of the Three - Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University

November 1999

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Project Title Knowledge Management: Building a Successful Knowledge
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Name Mr. Yuthapong Thaloengchok


Project Advisor Dr. Chamnong Jungthirapanich

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The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

Approval Committee:

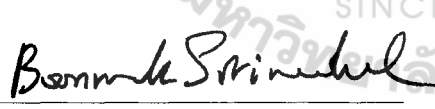




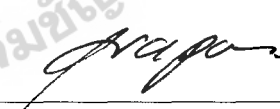
(Dr. Chamnong Jungthirapanich)
Dean and Advisor



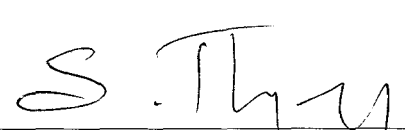
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Chairman



(Asst. Prof. Dr. Boonmark Sirinaovakul)
Member



(Dr. Prapon Phasukyud)
Member



(Assoc. Prof. Somchai Thayarnyong)
MUA Representative

November 1999

ABSTRACT

In the economic crisis like this, many organizations fall in trouble with their working capital. One way to solve the problem is to restructure the organization, and reduce cost and employees. The problem that occurs when the organization decides to terminate some employees is knowledge, one of the most valuable assets of the organization, that resides in those employees will disappear with them.

When the economic crisis recovers, this is the time to expand the organization again. It is impossible to do this without recruiting new employees to the company. When new staff come into the organization, what they have to do is to study and adapt themselves to the organization. This process is always time consuming, but, finally there is something accumulated inside these employees, resulting from the studying and adapting to the organization, called knowledge. Therefore, there will be a great deal of benefits in gathering knowledge from the people in the organization.

Moreover, in the technical-service organizations that have to deal with the radical and incessant development of technology, to stay competitive in business, everyone in the company has to continuously study new technology that relates to their work. However, everyone cannot study every new technology because of its radical and incessant development. Consequently, if there is a mechanism that facilitates the sharing of knowledge and information for the people in the organization, these people will be able to learn more from the knowledge, information and experience of others.

This project will investigate the analysis and design of a knowledge management system for assisting people in the organization to share knowledge with each other along with the plan for introducing knowledge management to the organization.

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I. INTRODUCTION

1.1 Background of the Project

In the world of business today, knowledge in the mind of the organization's employee is one of the most valuable assets of any organization. When new employees come into the company, they study and gain knowledge for themselves. When they leave the company, knowledge goes out with them. After new employees are recruited for the vacant position, they have to study all over again. If all knowledge can be retained within the organization, there would be a great deal of advantages.

Nowadays, there is a vehicle that moves the paradigm into a motion that facilitates the needs of an organization, it is known as knowledge management (KM). The mechanisms of knowledge management will include the processes of creating, disseminating, and transferring knowledge to everyone within the corporate infrastructure.

As many organizations and enterprises understand the importance of knowledge management, enterprises are realizing how important it is to "know what they know" and be able to make the maximum use of the knowledge. This is their corporate knowledge asset as it is mentioned above. These knowledge assets of the organization exist in many places such as database, knowledge bases, filing cabinets and employees' brain, etc. They are distributed right across the enterprise. The knowledge, which the enterprises need to know, is what the corporate knowledge assets of the organization are and how to manage and make use of these assets to get maximum return.

1.2 Background of Knowledge Management

Knowledge management has evolved over a series of changing economies and processes. The aspect of integrating, analyzing, and sharing the knowledge has been

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occurring since the beginning of mankind, therefore the foundation of knowledge management was incremented through time.

From the early era, knowledge was focused on how to make the most with limited resources but after that the scope of knowledge shifted to making “clever products” which ingrain the “ingenious solutions” and focused on “customer relationship”. According to this concept it made many companies successful in their businesses. Although knowledge management was started together with the human being, it has not been of interest as much as it should have been. Human beings did not know how to collect their knowledge systematically and what knowledge was.

Until the eighteenth and nineteenth century, it entered through the Industrial Revolution during which period, the knowledge system was promoted and developed through better organization, efficiency, and mechanization as workers were subscribed to highly standardized routines. Unfortunately, knowledge was limitedly developing to only a few specialists who had common interests.

Currently, knowledge management is interesting again, and many organizations realize the importance of knowledge as it is an intangible asset of the organization. Knowledge management is applied to many companies and enterprises. Many vendors adopt the new knowledge management model to deal with the new enterprise objectives under the following intentions:

- (a) Companies such as “Chaparral Steel” used the knowledge management initiative to develop a sound internal organization.
- (b) Knowledge management is used as a tactical “corporate strategy” to become a world leader among mini mills.

Till now, many organizations agree and enthuse to accept knowledge management as the organization’s important asset. There are many books that explain how to manage

knowledge. The Knowledge Management Forum establishes itself on the Internet and many World Wide Web (WWW) provide the information for knowledge management. Moreover, there are many consulting companies such as The American Productivity and Quality Center (APQC) and Arthur Andersen who conduct the “Knowledge Imperatives Symposium” with over 300 attendees.

1.3 Objectives of the Project

The objectives of this project are:

- (a) To analyze and design Knowledge Management System.
- (b) To design hardware, application software and network infrastructure to meet the system requirements.
- (c) To present the plan for introducing knowledge management system to the organization and gaining awareness from people in the organization.
- (d) To study the feasibility of implementing the proposed system compared with the existing system.

1.4 Scope of the Project

This project intends to cover the following areas:

- (a) A computer system analysis and design planning for knowledge management system.
- (b) A recommendation of application software, hardware and network infrastructure.
- (c) A plan for introducing knowledge management to the organization and gaining awareness from the people in the organization.
- (d) A feasibility study for implementing the proposed system to the organization compared with the existing system.

- (e) Duration of the project implementation and introducing the knowledge management system to the organization is 6 months.

1.5 Definition of Terms

As it is defined in the Lotus knowledge management homepage, by learning and using knowledge management terms, members of an organization can effectively share their ideas about knowledge management and develop plans for implementing and improving knowledge management strategies. Knowledge management terminology is discussed as follows:

- (a) Data, Information, and Knowledge

Everyday speech, the terms of data, information and knowledge are used interchangeably. But for the purposes of knowledge management they are quite distinct. For knowledge management:

- (1) Data

Data is used as a single musical note. It is the raw material that provides the building blocks for information and knowledge. In order to be useful, data needs to be validated or tested for accuracy, and tested to make sure it is not redundant. Still, data in and of itself is not particularly valuable.

- (2) Information

Information is also analogous to a musical score. It is data arranged in a meaningful context. In the past, most computer applications have focused on information management or on turning data into information. It is important to remember that information does not necessarily translate into business power. In fact, the value of information is based on several factors. Information must reflect its

data accurately. It must be delivered in a timely fashion and in a manner that allows easy access and engages the user. It must be applicable to the user's problems, and it must not be commonly known.

(3) Knowledge

Knowledge is the capability that creates action from information. In other words, knowledge means applied judgement, know-how, and skill, and it often requires collaboration. For example, people understand 10% of what they hear, 20% of what they see, and 80% of what they do. Besides knowledge requires action. Compared to the music analogy, knowledge is an improvised jazz performance based on a musical score.

(b) Knowledge Forms

According to Ikurio Nonaka and Hirotaka Takeuchi, authors of the widely read, "The Knowledge Creating Company," we are accustomed to think that knowledge can be separated into two categories:

(1) Explicit knowledge

Explicit knowledge is formally articulated, collected or codified information in the form of written reports, manuals, analyses, etc. This is the knowledge that organizations tend to focus on.

(2) Tacit knowledge

Tacit knowledge is the knowledge in people's heads, direct experience, mental models, beliefs, and the like. For example: tacit knowledge in people's heads leaves the building every night to go

home, and it remains unexpressed. Therefore, it is critical for tacit knowledge to be shared into the forms of the explicit knowledge.

(c) Knowledge Types

There are three kinds of knowledge types:

(1) Content knowledge

Content knowledge is explicit. It is the type of knowledge we run into most on a daily basis like reports, news feeds, e-mail and the like. As content knowledge is distributed, discovery takes place, and the organization begins to uncover what it knows. But the distribution of content can also be overwhelming. Too much poor content can cause information overload.

(2) People knowledge

People knowledge is based on the skills, capabilities, and the knowledge of people within a company. In other words, it is the answer to the questions “Who knows what?” and “Who can do what?” People knowledge is frequently captured through resume or skill databases. But it is important to remember that employees gain new knowledge and experience every day. A resume or skill database may not be updated often enough to leverage people knowledge effectively. For this reason, people knowledge often remains underutilized.

(3) Process knowledge

Process knowledge is the knowledge of how to get things done. When workers find and use knowledge they use a process to do so, and this process can be recorded. When an organization records a

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process for using knowledge, the process can be replicated across the organization. Then process knowledge can be leveraged across the organization and in new products and services.



II. LITERATURE REVIEW

2.1 Definition of Knowledge

Before identifying the meaning of knowledge, describing the knowledge-related terms, which are data and information, to distinguish them from knowledge is an important part.

(a) Data

In an organization context, data is usually described as structured record of transaction. When a customer comes to our company for product and service, the transaction that occurs can be partly described by data: when he came to our company; what kind of product or service he took; how many products he bought; how much service we gave and; how much he paid. Data does not tell us why he came to our company, why he did not go to the others. It also cannot predict whether he will come back again for our product and service or not. Data itself describes nothing about its own importance or irrelevance, but it is very important to the organization because it is vital raw material for creating information.

(b) Information

Information can be described as a message, which always has a sender as well as a receiver. The objective of information is to change the way the receiver notices something and to have an impact of judgement on the behavior of the receiver. Information is usually in the form of document or an audible or visible communication.

Information travels around the organization through media. It can be hard network, a visible and definite infrastructure: wires, satellite dishes,

post offices, addresses, e-mail boxes, as well as soft network, less formal and visible, such as a note or a copy of article sent from someone in the organization with a mark FYI (For Your Information).

Unlike data, information has the relevance and purpose. It is data that the creator adds meaning to, for some purpose. Data can be transformed into information by adding value in a variety of ways:

- (1) Contextualized: to know why the data was gathered
 - (2) Categorized: to know the units of analysis or key component of the data
 - (3) Calculated: to analyze some kinds of data by mathematical or statistical method
 - (4) Corrected: to remove errors from the data
 - (5) Condensed: to summarize the data in a more concise form
- (c) Knowledge

Most people instinctively understand that knowledge is broader, deeper and richer than data or information. Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. From the definition, it is clear that knowledge is not neat or simple. It is a mixture of various elements; it may be unstructured as well as formally structured; it is also hard to capture in words or understand completely in logical terms. Knowledge exists within people minds. It is the fundamental of human complexity and unpredictable.

In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms. As a corporate asset, usually definable, knowledge assets are much harder to identify and measure.

As information is derived from data, knowledge can be transformed from information by:

- (1) Comparison: to know the difference between the information about this situation and the information from other situations
- (2) Consequence: to know the implication of information for decisions and action
- (3) Connection: to know how this bit of knowledge relates to others
- (4) Conversation: to know the idea from other people about this information

Obviously, these knowledge-creating activities take place within and between humans. As data can be found in records or transactions, and information can be found in messages, knowledge can be obtained from individuals or groups of knowers, or in the organizational routines or processes.

2.2 Definition of Knowledge Management

In today's economy, many organizations are now starting to determine knowledge as an asset. As we are all familiar with the term information management, the term that came about when people realized, that information is a manageable resource, knowledge management also applies to the same principle except that, what we try to manage is knowledge.

According to many sources concerning knowledge management, the definition of knowledge management can be defined as follows:

- (a) Knowledge assets are the knowledge regarding markets, products, technologies and organizations, that a business owns or needs to own and which enables its business processes to generate profits.
(<http://www.aiai.ed.ac.uk/alm/kam.html>)
- (b) Knowledge management involves the identification and analysis of available and required knowledge, and the subsequent planning and control of actions to develop knowledge assets so as to fulfill organizational objectives. (<http://www.aiai.ed.ac.uk/alm/kam.html>)
- (c) In term of Lotus, they try to create a definition of knowledge management (KM), as knowledge management is the systematic leveraging of information and expertise to improve the organization's innovation, responsiveness, productivity and competency. Moreover, Lotus said knowledge management is more than just a definition. It is a cycle that involves acquiring, creating, packaging, distributing, applying and maintaining knowledge (Davenport, et al., 1996, Prusak, 1997). And contrary to ideas put forth by the business press, knowledge management is the domain of more than just "knowledge workers," or people involved in professional services. Since knowledge is a byproduct of our daily work, like carbon dioxide from breathing, all of us need to learn how to use it efficiently. (Lotus Knowledge Management Homepage)
- (d) Knowledge management is the way companies generate, communicate, and leverage their intellectual assets; it has only recently emerged as the

information economy's essential source of competitive advantage. (Harvard Business Review)

- (e) Knowledge management in terms of American Productivity and Quality Center (APQC) states that knowledge management is the broad process of locating, organizing, transferring, and using the information and expertise within an organization. There are four key factors that promote knowledge which include leadership, culture, technology, and measurement. (Elliot, Susan. "APQC Conference Attendees Discover the Value and Enablers of a Successful KM Program" Knowledge Management in Practice. Dec. 1996-Jan. 1997:1-5 American Productivity and Quality Center.)

From several definitions above, It can be concluded that knowledge management is the identification and analysis of available and required knowledge, and the subsequent planning and control of action to develop knowledge assets to improve the organizational innovation, responsiveness, productivity and competency. More than just a definition, knowledge management is the management of the organization towards the continuous renewal of the organizational knowledge base that includes creation of supportive organizational structures, facilitation of organizational members putting IT-instruments with emphasis on teamwork and diffusion of knowledge into place.

Knowledge management is a conscious strategy of getting the right information to the right people at the right time so they can take action and create value. When people have access to organizational knowledge, they can understand their environment and give it meaning. They can find new and better ways to perform, work together, breakdown barriers, share a vision, fill gaps of knowledge, increase productivity, satisfy customers, and ultimately compete.

In the past, knowledge has always been managed. However, effective and active knowledge management requires new perspectives and techniques and touches on almost all facets of an organization. We need to develop a new discipline and prepare personnel of knowledge professionals with a blend of expertise that we have not previously seen.

2.3 Why Knowledge Management is Important

In the 1990's, the success of businesses depended critically on the quality of knowledge that those organizations apply to their business processes. For example the supply chain adapts the knowledge of diverse areas including raw materials, planning, manufacturing and distribution. Otherwise product development also requires knowledge of consumer requirements, new science, new technology, marketing to improve their processes to become more effective.

From the above stated, the challenge of deploying the knowledge assets of an organization helps to create competitive advantage as follows:

- (a) The marketplaces are increasingly competitive and the rate of innovation is rising, so that knowledge must evolve and be assimilated at a faster rate.
- (b) Corporations are organizing their businesses to be focused on creating customer value. Staff functions are being reduced as the management restructures. The reductions of staff create a need to replace informal knowledge with formal methods.
- (c) Competitive pressures reduce the size of the work force that holds valuable business knowledge.
- (d) Knowledge takes time to be experienced and acquired, while employees have a less time for studying. Thus, this knowledge management helps to diminish the amount of time available to experience and acquire knowledge.

- (e) There is a trend of early retirements and increasing mobility leading to loss of knowledge.
- (f) There is a need to manage increasing complexity, as small operating companies are trans-national sourcing operations.
- (g) A change in strategic direction may result in the loss of knowledge in a specific area as a subsequent reversal in policy may lead to a renewed requirement for this knowledge, but misunderstanding will occur among the employees and the employees with that knowledge may no longer be with the organization.
- (h) Most of the working is information based.
- (i) Organizations are complete on the basis knowledge.
- (j) Products and services are increasingly complex, endowing them with a significant information component.
- (k) The need for life-long learning is an inescapable reality.

Due to the importance of knowledge, all organizations realize the way to find the appropriate strategy for managing their knowledge and use it to the utmost.

2.4 Benefit of Knowledge Management

A successful knowledge management program:

- (a) Enables the organization to realize the greater value by leveraging its existing assets. The more knowledge is applied in the use of complex information technology assets and in the support of the products you market, the more those assets are worth to the organization.
- (b) Leverages everything an organization does. Every customer's interaction teaches someone in the company more about the customer, the market, the

company's image, and the product. The entire organization learns and can put its new knowledge to immediate use.

- (c) Brings senior management closer to the day-to-day field level experience of the staff who has the greatest contact with customers, so that intelligence can be used.
- (d) Promotes more stable staffing by making the customer support organization institution the business standard that promotes excellence and personal satisfaction.
- (e) Enables management to evaluate a reward support staff directly for contributions to the corporate knowledge resources.
- (f) Helps the organization manage the turnover that cannot be avoided, by capturing knowledge to bring new staff up to speed quickly.
- (g) Makes the company's products more valuable to customers. The product is partly a tangible deliverable, and partly the knowledge (document and support) that come with it. Knowledge management can dramatically increase the value of that knowledge content, and, by extension, the value of the product as a whole.
- (h) Leads to greater customer satisfaction and lower support costs.
- (i) The marketplace is increasingly competitive and the rate of innovation is rising, so that knowledge must evolve and be assimilated at an ever-faster rate.
- (j) Fulfills and enhances other organizational initiatives such as Total Quality Management (TQM), Business Process Re-engineering (BPR) and Organizational Learning.

2.5 Barriers for Implementing Knowledge Management

Knowledge management is a new and technological system for the organization. Then, there are many problems associated with finding out these knowledge assets and being able to use them in an efficient and cost-effective manner. The following problems are the barriers, which the enterprises have to be aware of:

- (a) To have an enterprise which has a wide vocabulary to ensure that the knowledge is correctly understood.
- (b) To be able to identify, model and explicitly represent their knowledge.
- (c) To share and re-use their knowledge among differing applications for various types of users. This implies, being able to share existing knowledge sources and also future ones.
- (d) Companies spend more than 1/3 of their time, neglecting the content, organizational structure, and motivational approaches that will make a knowledge management system useful.
- (e) It is a bad idea to refer to knowledge as the best practice, benchmark, or information resource, because none of these terms justify the entire domain of knowledge.
- (f) Knowledge management will not succeed if there are no workers and managers who have it, paving the way for knowledge networks and setting up and managing knowledge technology infrastructures.
- (g) Knowledge management is a highly political undertaking. It is necessary to tread lightly in giving access to knowledge to those who formerly lacked it.

2.6 How to Manage Knowledge

There are three steps in the process of managing knowledge. The first step is surveying and categorizing knowledge. The next step is appraising and evaluating

knowledge and the last one is synthesizing knowledge-related activities. Besides, the activities of conceptualizing, reflecting, specifying and reviewing are recommended as the increased step of processing.

When starting to do a knowledge management system, it is to make sure that knowledge management covers the following:

- (a) Identifying what knowledge assets a company possesses
 - (1) Where is the knowledge asset?
 - (2) What does it contain?
 - (3) What is its use?
 - (4) What form is it?
 - (5) How accessible is it?
- (b) Analyzing how knowledge can add value
 - (1) What are the opportunities for using the knowledge asset?
 - (2) What would be the effect of its use?
 - (3) What are the current obstacles to its use?
 - (4) What would be its increased value to the company?
- (c) Specifying what actions are necessary to achieve better usability and added value
 - (1) How to plan the actions to use the knowledge asset?
 - (2) How to enact actions?
 - (3) How to monitor actions?
- (d) Reviewing the use of knowledge to ensure added value
 - (1) Did the use of it produce the desired added value?
 - (2) How can the knowledge asset be maintained for this use?
 - (3) Did the use create new opportunities?

2.7 Critical Success Factors

There are many organizations that fail to implement knowledge management. Some of them failed because they attempted to use technology as the only answer to knowledge problems. Others did so because they were designed without regard for end-users. But those knowledge management programs that thrived have helped us to isolate a number of critical success factors:

(a) Culture

Culture is cited widely as the single most critical success factor for knowledge management. Some suggest that more than 60% of knowledge management efforts should focus on making the culture compatible for knowledge management. The key to success is to reward people for sharing information and knowledge instead of hoarding it.

Promoting, supporting, and recognizing knowledge creation, knowledge sharing, and learning can help the organization accomplish the creating of knowledge management culture. Many knowledge management programs have shown that the most effective way to change behavior is to incorporate knowledge sharing as criteria in performance evaluations, promotions, and recognition programs. It is important to remember, that incorporating a new system means inevitable bumps in the road. Employees need to be able to respond to knowledge management process in an atmosphere of openness and trust.

Some company cultures may be more attuned to knowledge management solutions than others did. But it is incorrect to assume that a certain type of culture can adapt to benefit from knowledge management. In fact, an appropriate knowledge management solution may exist outside the

company's culture. The employee of a software development company, for example, may believe that technology is the answer to most problems involving related work. But in reality, transforming the way that groups cooperate usually requires more than installing collaborative technology.

(b) Leadership and incentives

Leadership and incentives from senior management play an important role in helping to create a knowledge management culture. Changing behavior often means modifying incentives and rewards, which the senior management has the power to do, and do not forget to emphasize on the positive: it is better to encourage changes toward the desired behavior, than to dispense punishment to people who retain old, ineffective behavior.

(c) Strategic alignment

Strategic alignment with the company's business goals helps emphasize the knowledge management programs on success. By linking knowledge management programs to the business processes that are critical to its mission, an organization is more likely to experience a payoff. Knowledge management programs that are implemented without considering strategic business processes run the risk of capturing knowledge for the sake of doing so.

(d) Measurements

Measurements of success or failure are critical to the accurate assessment and improvement of knowledge management programs. Factual measures, such as increased number of patents, quicker development of new products, or reduction in travel expenses, provide a better justification of the existence of knowledge management programs than a blind faith in the

knowledge management vision or the fear that competitors have better knowledge management programs. To take accurate readings, a business should start with a baseline assessment of financial and non-financial factors. Then, after a knowledge management program is implemented, comparative measurements can be made.

(e) Technology

Technology does not play a dominant role in knowledge management, but it is an important enabler in terms of knowledge management infrastructure and adoption. So, a high rate of technology adoption is a potential asset to implementing knowledge management programs. It is necessary to coordinate Knowledge management programs with other technology projects that affect an enterprise's technology infrastructure. Technology and Knowledge management programs should complement each other, not clash.

III. THE EXISTING SYSTEM

3.1 Overview

In the organization today, in order to be competitive, working fast and effectively, including gathering and analyzing data accurately are extremely important. It is inevitable that these organizations have to adopt information technology to facilitate and accommodate the way people in the organization work. Moreover, information technology helps people in the organization cooperate and communicate with business partners, suppliers, customers and other related organizations more effectively.

System integrators and business solution provider services are emerging to help those organizations mentioned above adopting information technology into their organization. Furthermore, the system integrator assists the new IT adopting organization to maintain that new system to effectively operate.

The following are services provided by the system integrator and solution provider:

- (a) Provide consulting service for improving business process by adopting information technology.
- (b) Provide business solutions utilizing the most powerful information technology.
- (c) Provide system-maintaining service to keep the system working constantly and effectively.

From the services mentioned above, the system integrator is obviously the working organization that deals with knowledge all the time. All staff have to use knowledge to solve problems for providing business solution for their customer. Furthermore, the system integrator has to continuously learn and analyze new

technology and then bring those new technologies to innovate new, more efficient and effective solutions to their customers.

3.2 Company Background

TB Company, founded on 1996, is a service-oriented organization providing business solutions through the effective use of information technology. The major business of this company is the system integrator and solution provider in the field of computer technology and information systems, including Hardware and Software system design, Application Development, and on-going Technical Support. The objective of the company is to enable the clients to accomplish their goals better, easier, and more effectively.

Now the company has twenty technical staff working in four main departments, Technical Support department, Network Support department, Software Support department and Business Analyst department, with an independent administrative department as shown in Figure 3.1. The following are the major responsibilities of each department:

(a) Technical Support department

The major purpose of the technical support department is to create solution for solving business problems of the customers. This department also has to provide on-site services and system maintenance for the customer.

(b) Network Support department

The network support department is responsible for designing the network infrastructure that supports the specific solutions for solving business problems for the customers.

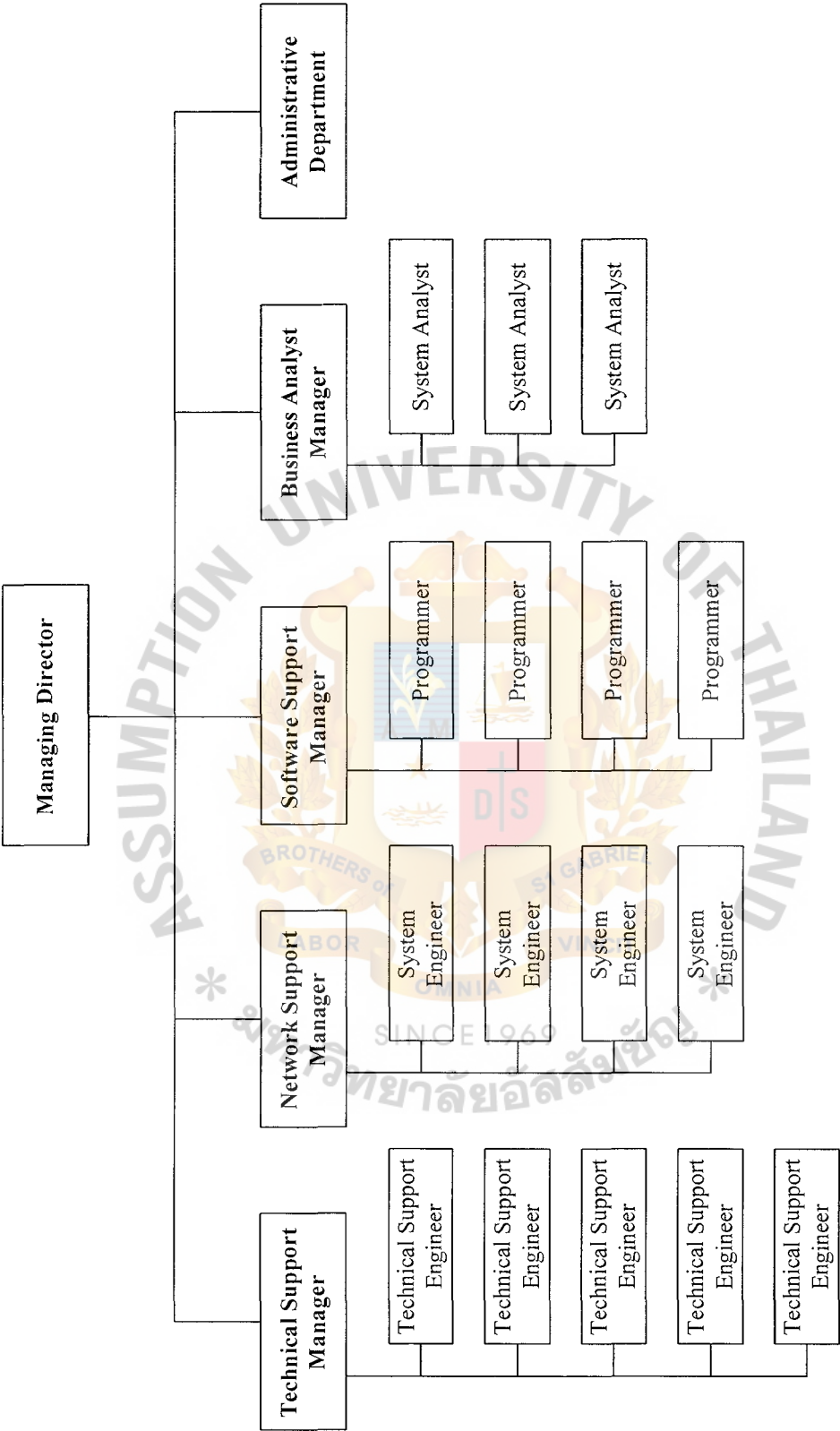


Figure 3.1. Organization Chart of the Company.

(c) Software Support department

The main objective of this department is to develop application software or select suitable application software for solving the business problems of the customers.

(d) Business Analyst department

The business analyst department deals with analyzing the business system of the customer's company to learn the relevant facts about business activities emphasizing on gathering information and determining the requirements of the customer.

In each project, staff from the four main departments will be set in a team to support each specified project. Normally, the project leader of each team is one of the four managers of each department depending on the specific type of the project.

3.3 Problems of the Company

The following are the major problems from the existing system.

- (a) With the radical and incessant development of technology, to stay competitive in business, every member of staff in the company has to continuously study new technology that relates to their work. However, everyone cannot study every new technology because of its radical and incessant development.
- (b) With the increasing importance of the information system, system integration becomes a business that is worth investing. Several groups of people start doing this kind of business. To remain competitive in the business, most enterprises have to retain their specialists and recruit trained employees from other corporations. This situation causes the turnover problem to the company. Recruiting new employees will cause the company

to pay for the training course. The more volume of new employment, the higher amount of money is paid.

- (c) Because of the limitation of specialists in the company, many projects have to be delayed in some processes that are required to be reviewed or solved by those specialists. These delays can cause the company to lose the profit from the jobs.

3.4 The Existing Knowledge Management System

Knowledge management is not a new concept; moreover it has existed in almost every organization for a long time, but those organizations may not know that, what they are doing comes from the same concept as knowledge management. In the past, knowledge remained in the organization and had been transferred across the organization, but it had not been formally gathered and systematically categorized in-groups.

Like any other organizations, TB Company is the working unit that deals with knowledge all the time and may work on the concept of knowledge management for a long time. The following are forms of knowledge that already exist in the company:

- (a) Working or processing manuals

In today's working environment of an organization, each personnel should not only understand and function solely in their own work that is specified in the job description and explained in the working manuals, they should also comprehend the task of other related colleagues. There would be a great deal of benefits if all the staff of the company share their working experiences and problem solving strategy, so that knowledge can be used by others in the company to improve their work cooperatively.

(b) Data and information files

Normally, without proper categorization, data and information are only numbers and records, if they are analyzed by one who does not relate and understand the purpose of those data and information. To maximize the usage of those data and information, one who relates and understands them should, therefore, analyze the data and information and then share that knowledge with others in the company.

(c) Electronic mail

Nowadays, electronic mails are widely used for both personal and business purposes. Those e-mails vary from junk mails to ideas, facts or even knowledge that should be brought to share with others. It should be the duty of each individual in the company to select those good things and share with others.

(d) Internet

Internet, currently the biggest library in our world, can be counted as one of the most crucial sources of knowledge for everyone in the company. It is a good idea if everyone in the company shares what he or she has learnt from surfing and searching through the Internet.

(e) Books

Similar to the Internet, books that each individual chooses to read are varied to fit one's need. Knowledge and ideas from reading each book are different from one writer to another. However, some employees that work separately in the company may require the same kind of knowledge, but it is impossible that everyone will be able to read all the books that are related to

their need. Consequently, there would be a great deal of advantages to the company if everyone shares their knowledge and ideas from reading books.

Obviously, many organizations are now starting to adopt the concept of knowledge management, but, with the existing working environment, it is difficult to collect and share knowledge. Presently, new technology supports cooperative working and sharing information more than it used to be, but there is still no system that properly works with the knowledge management concept. Consequently, building a knowledge management system that helps and supports the creation, transferring and utilization of knowledge is what many organizations should be concerned with.

3.5 The Existing Network Infrastructure

The existing network infrastructure consists of several personal computers, portable computers and printers connecting to the server on the star topology. The network operating system is Windows NT Server 4.0 as shown in Figure 3.2.

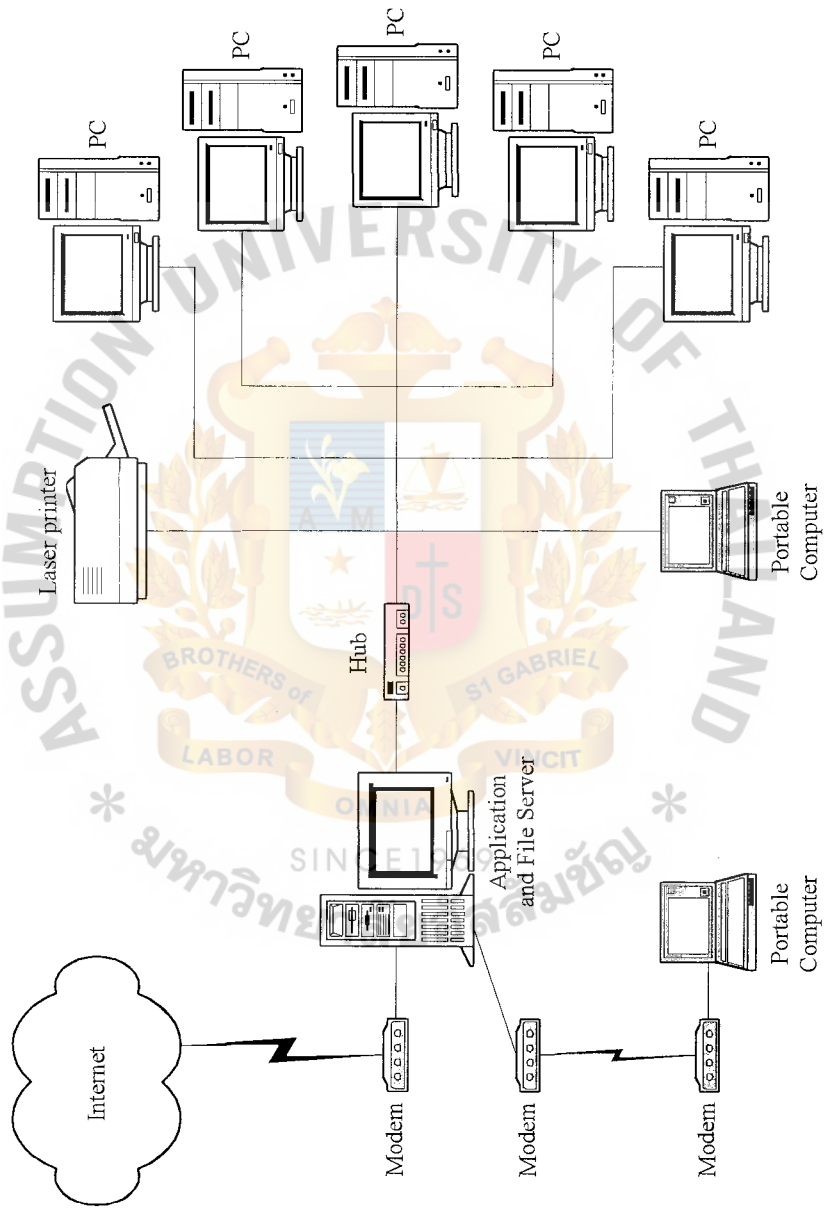


Figure 3.2. The Existing Network Infrastructure.

IV. THE PROPOSED SYSTEM

Like other kinds of information systems, knowledge management system is also the integration of information technologies used for facilitating the collection, coordination, and distribution of knowledge between employees in the organization. This section addresses some of the characteristics and benefits of knowledge management systems, discusses some of the specific technologies available for building a knowledge management system, and also introduces the proposed knowledge management system along with the action plan for introducing knowledge management and gaining awareness from people in the organization.

4.1 Key Features of a Knowledge Management System

Although individual knowledge management systems are different among organizations, they should have basic features in common as follows:

(a) Open and Distributed

In implementing a unifying knowledge management system, the organization must ensure that the information architecture is flexible enough to meet the evolving needs of each individual organization. Knowledge management system must also be able to be distributed over various host computers and physical locations.

(b) Customizable

A good knowledge management system should supply user interfaces in the form of templates which users can easily customize using tools such as Hypertext Markup Language (HTML) and JavaScript.

(c) Measurable

Measurement is a critical aspect of any knowledge management effort to strike the right balance between organizational and technological changes. A knowledge management system should include tools that allow managers to measure and verify the usage to get a clear picture of how the system is being used, locate performance bottlenecks and, most importantly, use the data to improve organizational knowledge transfer processes.

(d) Secure

While traditional applications usually require the administrator to grant access to those who need particular information, knowledge management applications focus on maximizing access to knowledge. However, this does not mean that knowledge management systems do not have security. A knowledge management system needs to provide secure repositories while allowing access across the organization to those who need it.

4.2 Benefits of a Knowledge Management System

Building a knowledge management system is not a simple task, but if it was successfully implemented, the organization will gain a great deal of benefits as follows:

(a) Awareness

Everyone in the organization knows where they can search for the knowledge and information they want. It helps to save people time and effort.

(b) Accessibility

All individuals in the organization can use knowledge and experience in the context of their own roles.

(c) Availability

Knowledge is usable wherever it is needed whether in the office, on the road, at the customer's site, or even at the employee's home. This enables increased responsiveness to customers, partners and coworkers.

(d) Timeliness

Any employee can access to the organization's knowledge anytime they need. It helps to eliminate time wastage for distributing information just-in-case people may be interested.

4.3 Technology for Enabling Knowledge Management

Knowledge management is not solely about technology. It is a multi-disciplinary field that draws on the aspect of information science, interpersonal communications, organizational learning, cognitive science, motivation, training, publishing, and business process analysis. There is no single technology that fills all the criteria required for completing knowledge management system. The following sections will discuss about the specific technologies that play important roles in an organizational knowledge management environment.

(a) Intranet

Intranet is the network that uses Web technology inside corporate firewalls running on Internet Protocol (IP). It can be broken down into two distinct areas: the technology infrastructure (IP networks, web browser, client application and the HTML format), and the web server as a content repository.

Intranet is an ideal environment for sharing information that is both dynamic and richly linked. Although many organizations attempt to put every information needed for everyone, it begins to suffer the same

problems that have occurred on the World Wide Web; no one knows where everything is. Consequently, no one can quickly find the information they are looking for.

(b) GroupWare

GroupWare system is the application that users in workgroups or department in the organization use to communicate and collaborate. GroupWare allows formal and ad hoc conversations in cases when the participants cannot communicate in real time. This makes GroupWare an important technology for enhancing the exchange of tacit information. However, like other applications, GroupWare databases become crucial knowledge storage that must be integrated into the enterprise knowledge architecture.

(c) Workflow System

Workflow is concerned with the automation of procedures where documents, information or tasks are passed between participants according to a defined set of rules to achieve, or contribute to, an overall business goal. While workflow may be manually organized, in practice most workflow is normally organized within the context of the IT system to provide computerized support for the procedural automation.

Knowledge transfer process often occurs on an ad hoc basis when the need for specific knowledge arises somewhere in the organization, but organizations also have a large number of formalized processes that regulate the flow of information. Workflow systems enable users to systematically arrange knowledge transfer processes when they require a more rigid method of dissemination.

(d) Relational and Object Databases

Most of an organization's knowledge is not contained in relational tables, but in documents, e-mail, discussion databases, and other primarily textual stores. However, Relational Database Management Systems (RDBMS) are the primary containers of data in the corporation and a knowledge management system must provide meaningful access to that data by supporting standard protocols such as Open Database Connectivity (ODBC) and Structured Query Language (SQL).

Relational database and object-oriented database technologies are also increasingly expected to support critical knowledge-based applications. Most companies have made large investments implementing databases across the enterprise and in training staff on installation, maintenance, back up and recovery. Therefore, RDBMSs are not only important knowledge silos, but also important platforms on which organizations can build knowledge applications.

Enterprise applications, whether a financial system or a knowledge management system, should make use of the robustness, reliability and scalability of RDBMSs. In order to make use of the organization's databases specific investments in technology and training, enterprise applications should make use of industry standards such as SQL and ODBC so that the customer can access information from its RDBMS.

Object databases and object-relational databases are gaining footholds in specialized areas of some organizations. These technologies offer increased flexibility for storing and manipulating complex data types such as binary executables, images, sound and video. Object technology is well

positioned to become the foundation of future knowledge management systems; however, most corporations lack the familiarity, experience and confidence to base their current business-critical knowledge management activities on them. Therefore, knowledge management systems have to be open enough to integrate object-relational databases when and if the organization decides to use them.

(e) Information Retrieval Engines

Information retrieval technology, whether it be in the form of corporate text repositories or Intranet search facilities, exists in many organizations as a knowledge Storage containing legacy information.

4.4 The Proposed Knowledge Management System

(a) Intranet

To develop the Intranet system, a new Intranet server has to be set up to the network system. Lotus Domino R5 is selected to function as the Intranet server with the following features:

(1) Internet messaging and directories

- (a) Provide full-fidelity messaging for your users, with native Multipurpose Internet Mail Extensions (MIME) and Simple Mail Transfer Protocol (SMTP) support.
- (b) Use the new Directory Catalog to save space and provide quick name lookups.
- (c) Use new Lightweight Directory Access Protocol (LDAP) features to authenticate users in external directories and customize the directory.

(2) Expanded Web application services

- (a) Design applications with Common Object Request Broker Architecture (CORBA) standard distributed objects, Java, or JavaScript.
- (b) Use Web clusters for high availability of Web services, expanded security options, and more.

(3) Database improvements

- (a) Use transactional logging for faster restarts and data recovery.
- (b) Convert to the new On-Disk Structure (ODS) for better performance and data integrity.

(4) Easier administration

- (a) Manage users, databases, and servers with the new Domino Administrator.
- (b) Migrate users from cc:Mail, Microsoft Mail, Microsoft Exchange, Novell GroupWise, Netscape Mail, LDAP, or Windows NT with the redesigned user registration.
- (c) Use new tools for server monitoring and message management.

Lotus Domino R5 Server provides many powerful features for setting up an Intranet server. As an Internet messaging server, Domino integrates the features needed for providing full-fidelity messaging for users. In addition, it includes many exciting new directory features that can be customized for different organizations. For Web applications, Domino provides effective tools for designing application, and Domino Web application services to ensure availability and security for the application. Domino can also be integrated with the Microsoft Internet Information

Server (IIS). R5 also provides reliability, availability, and scalability databases together in a single server. Finally, the day-to-day administration of the server is made easy with task-oriented, drag-and-drop administration.

Figure 4.2 shows the proposed network infrastructure after applying Lotus Domino R5 server to the existing network infrastructure.



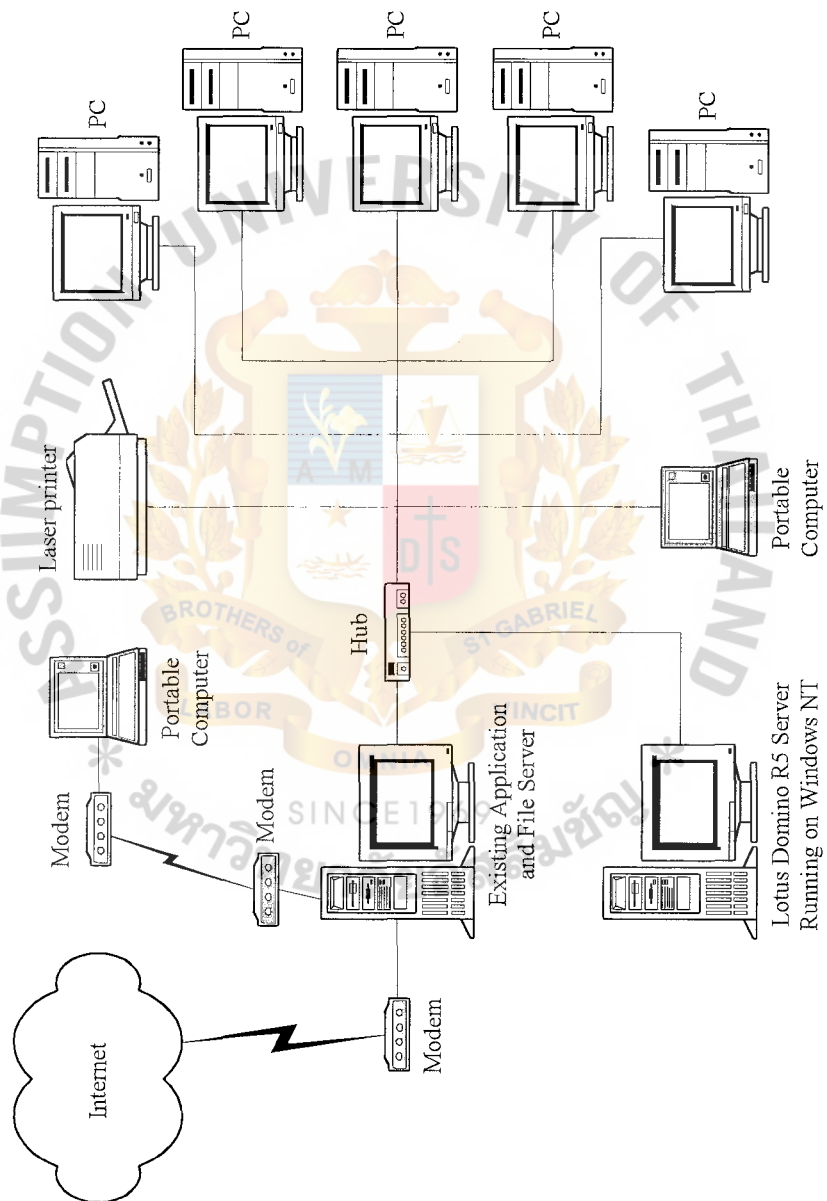


Figure 4.1. The Proposed Network Infrastructure.

(b) Workflow System

(1) Knowledge Creation Process

In knowledge management system, the knowledge creation process starts when someone in the organization gathers his knowledge and/or experiences, composes in a literary form for sharing with others and then sends it to the system. The knowledge creator should also specify a proper category for the created knowledge in order to be transferred for the right reviewer for content approval. After receiving new knowledge, the system will create a serial number for this new knowledge for further references and will send it to the related reviewer. The duty of the reviewer is to verify the knowledge and filter improper knowledge off the system.

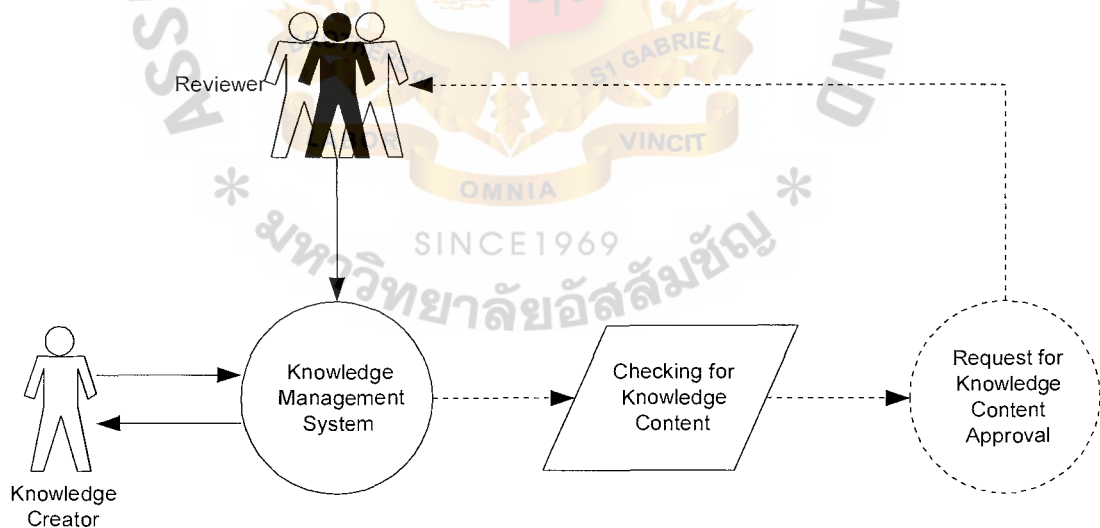


Figure 4.2. Workflow Diagram Level 0 for Knowledge Creation Process.

For the rejected knowledge, the knowledge-rejected form will be sent to the knowledge creator along with some comments that discuss the reason why the knowledge is rejected and the point that should be included in that knowledge. After receiving the knowledge-rejected form, re-editing the rejected knowledge and sending it back to the system, the system will check for the existing serial number and send to the associating reviewer for verifying again.

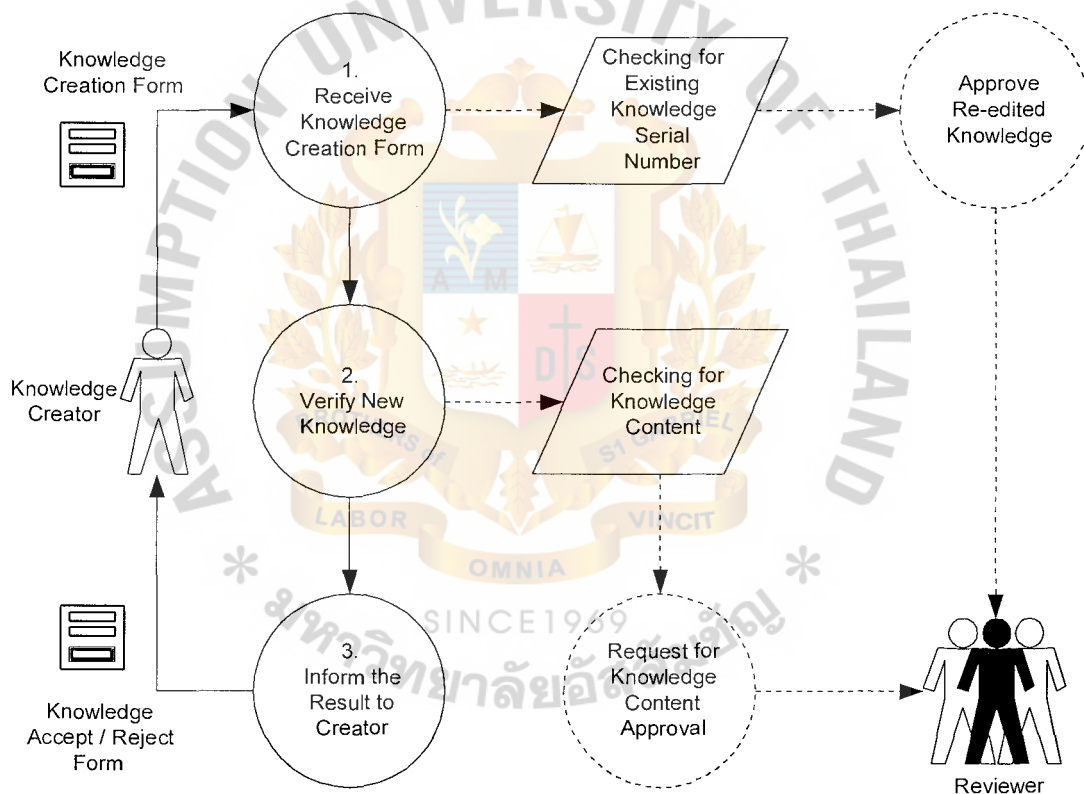


Figure 4.3. Workflow Diagram Level 1 or Knowledge Creation Process.

(2) Knowledge Acquisition Process

Knowledge acquisition process begins when a user needs some help and requests for knowledge. After the system receives the

knowledge acquisition form from the user, the system will search for knowledge that relates to the requirements of the user specified in the form. If there is some knowledge found from searching through the knowledge base, the system will send the user the required knowledge including the creator's contacting information for the user to communicate for more detail.

On the other hand, if the system cannot find any related knowledge from searching through the knowledge base, the system will then distribute the knowledge acquisition form to other users in the system.



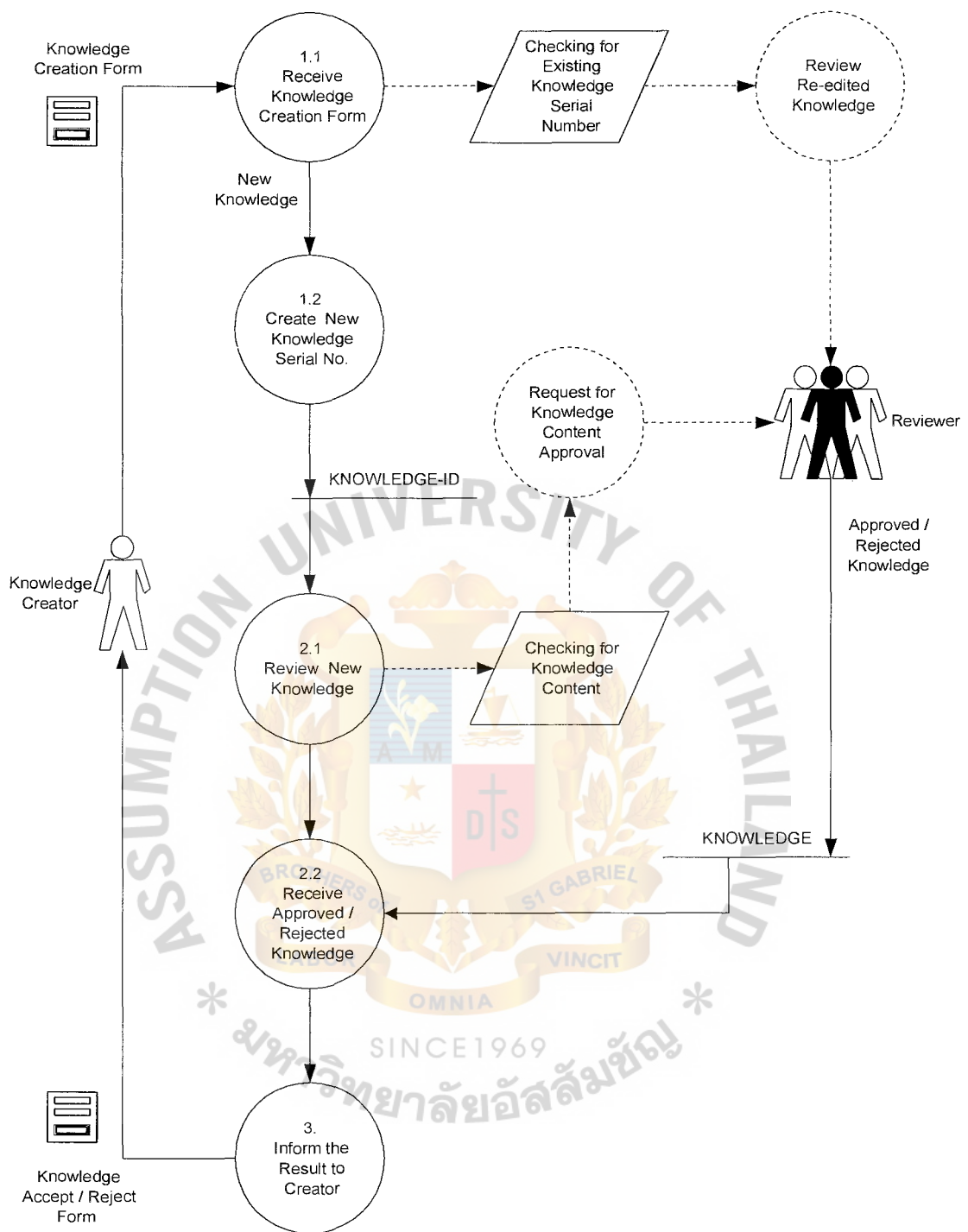


Figure 4.4. Workflow Diagram Level 2 or Knowledge Creation Process.

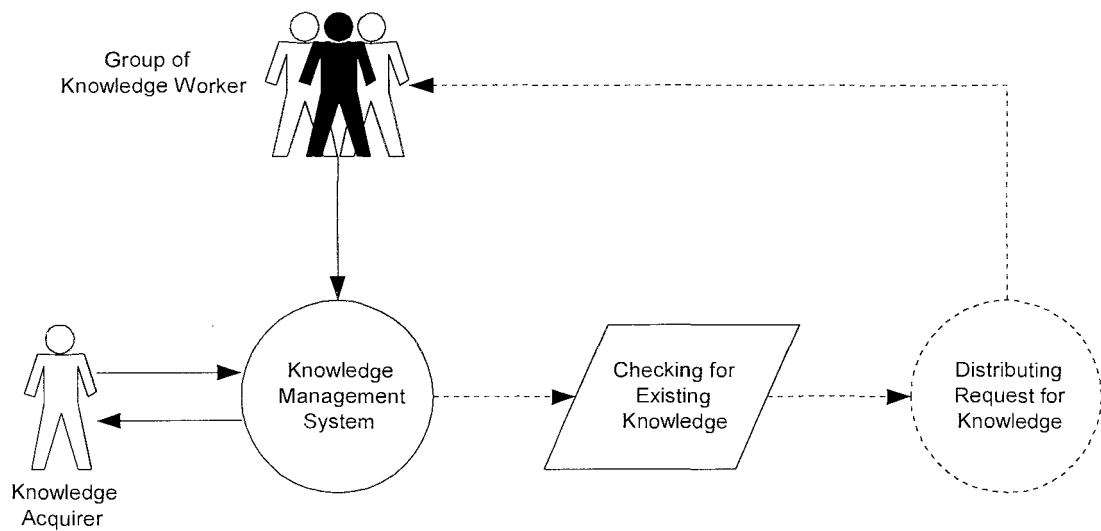


Figure 4.5. Workflow Diagram Level 0 for Knowledge Acquisition Process.

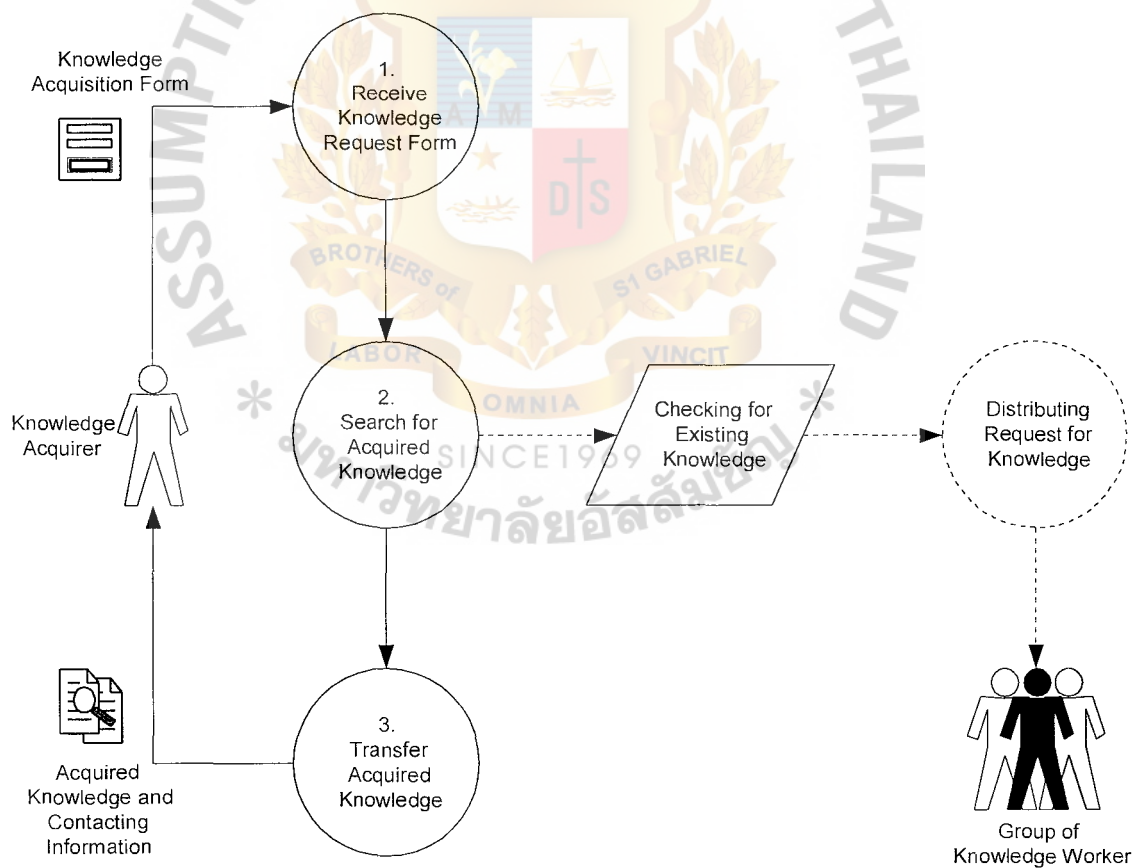


Figure 4.6. Workflow Diagram Level 1 for Knowledge Acquisition Process.

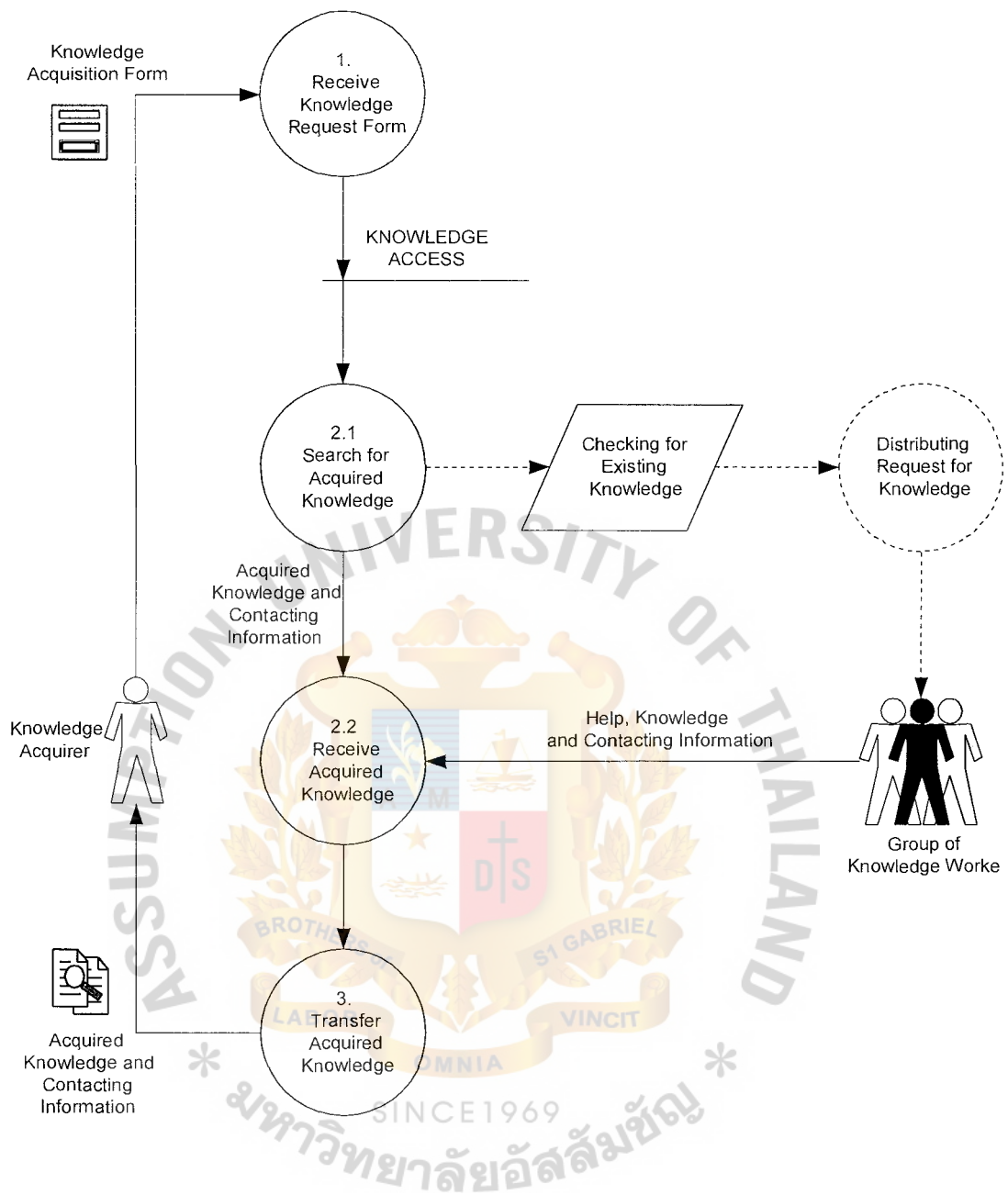


Figure 4.7. Workflow Diagram Level 2 for Knowledge Acquisition Process.

(c) System Development on Lotus Notes and Lotus Domino Server

After designing the system for knowledge creation and knowledge acquisition process in the previous section, in this section, the workflow diagrams that have been designed in the previous section will be used to develop the knowledge management system by using Lotus Notes as the developing tool.

Lotus Notes is the tool that assists in developing the workflow system which is suitable for developing the knowledge management system. Moreover, Entity Relationship model is normally used in designing a database system, but, in Lotus Notes, forms are used for collecting data instead of tables. Consequently, designing Entity Relationship diagram for database is not necessary for this project.

The following are forms that are designed to facilitate the sharing and acquiring of knowledge.

- (1) The main form of knowledge management system is divided into three major sections. The first section, on the left of the screen, is used for selecting display type of knowledge grouping. Those knowledge groupings are all knowledge, by author, by category, review status and my favorites. The second section, on the top, is the button to operate the command. Those command buttons are new knowledge for knowledge creation and search for knowledge acquisition. Figure 4.8 and 4.9 show the main form of knowledge management system on Lotus Notes and the web browser.

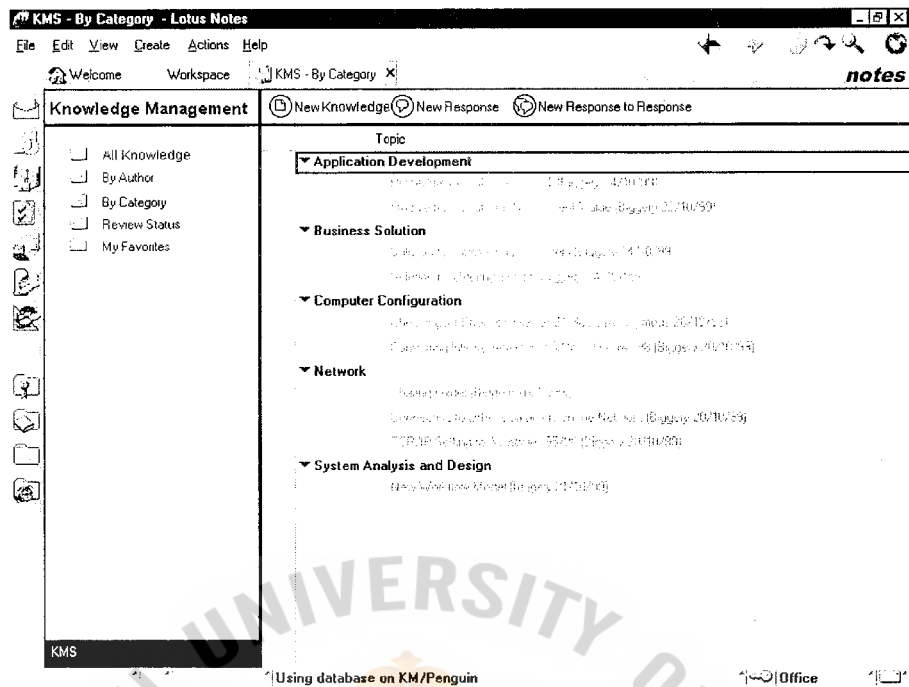


Figure 4.8. Main Form of the Knowledge Management System on Lotus Notes.

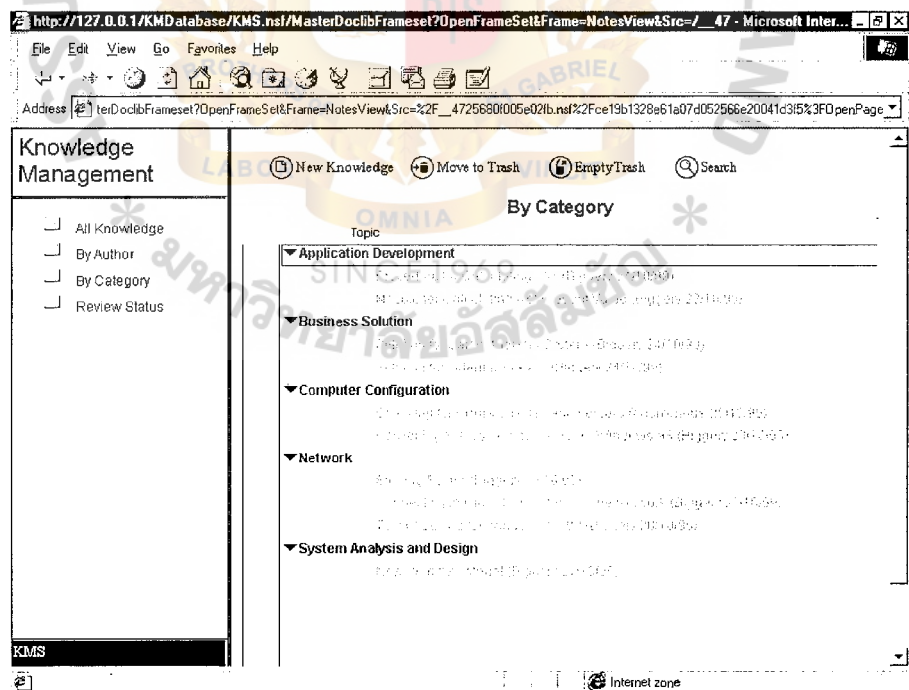


Figure 4.9. Main Form of the Knowledge Management System on Web Browser.

- (2) The second form is used to search for knowledge from the knowledge management system. Figure 4.10 and 4.11 exhibit the knowledge acquisition form of knowledge management system on Lotus Notes and the web browser.
- (3) The last form is used for knowledge creation process. Figure 4.12 and 4.13 are the knowledge creation form of knowledge management system on Lotus Notes and the web browser.

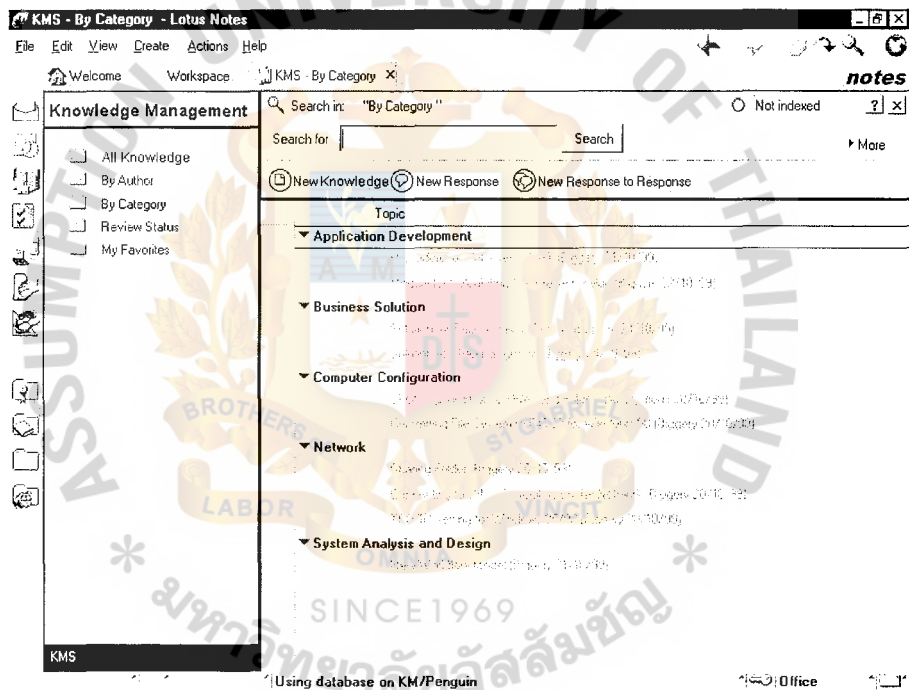


Figure 4.10. Knowledge Acquisition Form on Lotus Notes.

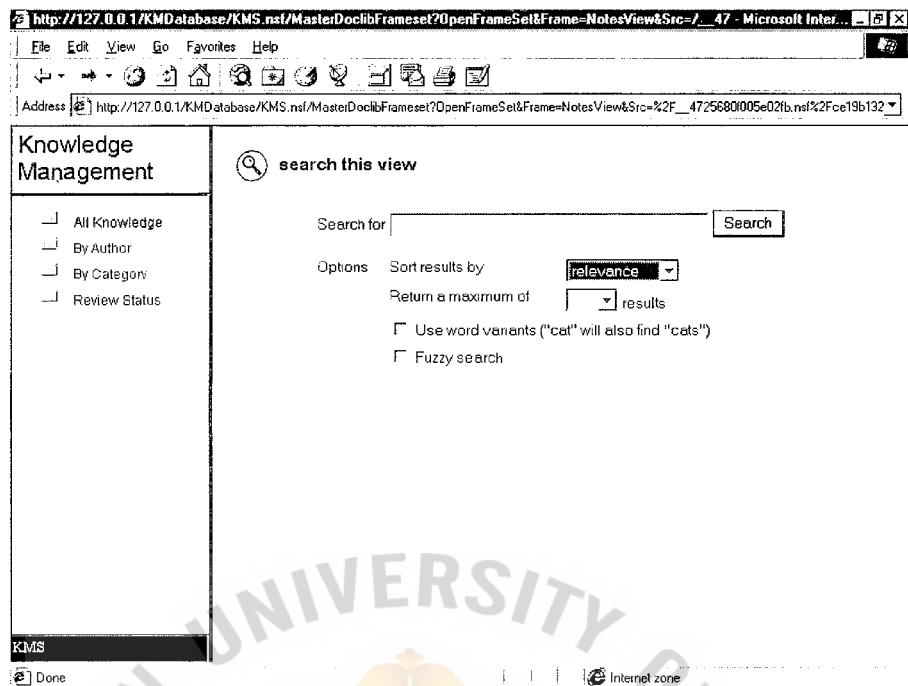


Figure 4.11. Knowledge Acquisition Form on Web Browser.

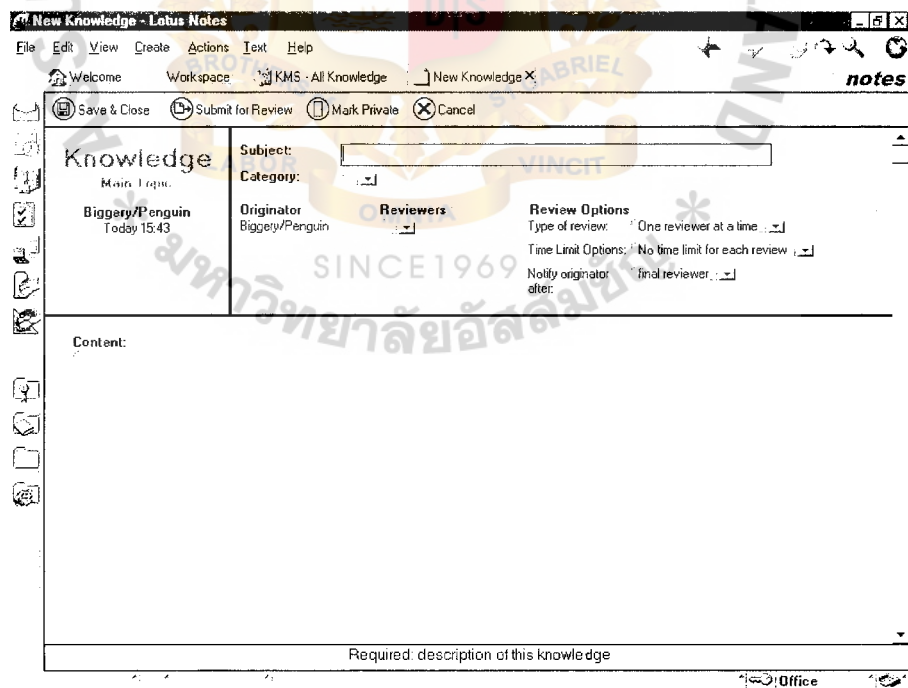


Figure 4.12. Knowledge Creation Form on Lotus Notes.

Figure 4.13. Knowledge Creation Form on Web Browser.

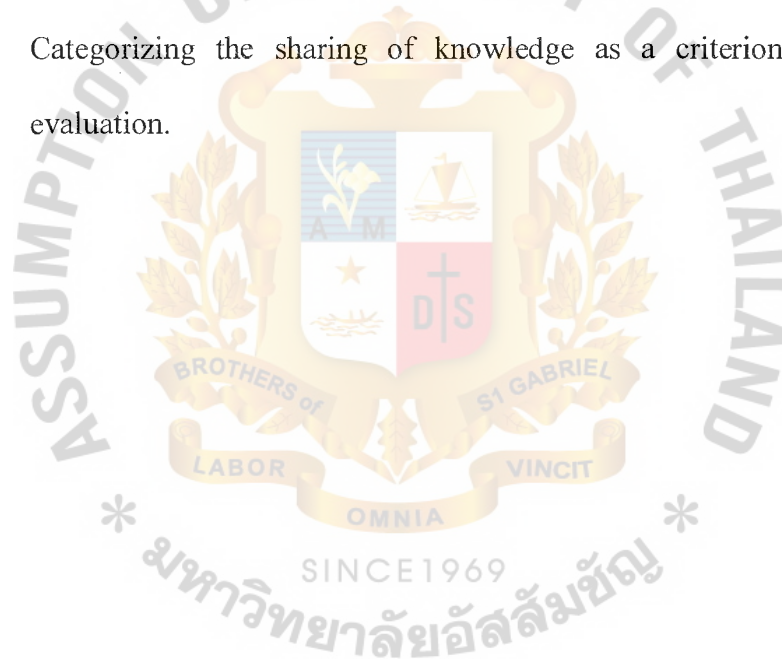
4.5 Action Plan for Introducing Knowledge Management to the Company

In order to apply knowledge management to the company, building an information system that supports the sharing of knowledge is not adequate for the achievement of the system. The system that has been built will be useless if people do not understand and realize the importance of knowledge management. Consequently, they will not bring those experiences, knowledge and information to share with others in the company or, in the worst case, the knowledge management will absolutely not be used. Finally, the investment for building the proposed knowledge management system would totally be wasted.

To make people in the company understand and realize the importance of knowledge management, an effective plan for introducing knowledge management to the company should be set up. The company should also declare the benefit from

sharing knowledge and motivate all the staff in the company to share knowledge and absorb the value of sharing knowledge. The following are strategies that can be used for introducing knowledge management and gaining awareness from people in the organization.

- (a) Organizing the seminar for introducing the concept of knowledge management.
- (b) Training for using the knowledge management system.
- (c) Using incentives for motivating employees to share knowledge.
- (d) Using programs for motivating people in the company to share knowledge.
- (e) Categorizing the sharing of knowledge as a criterion in performance evaluation.



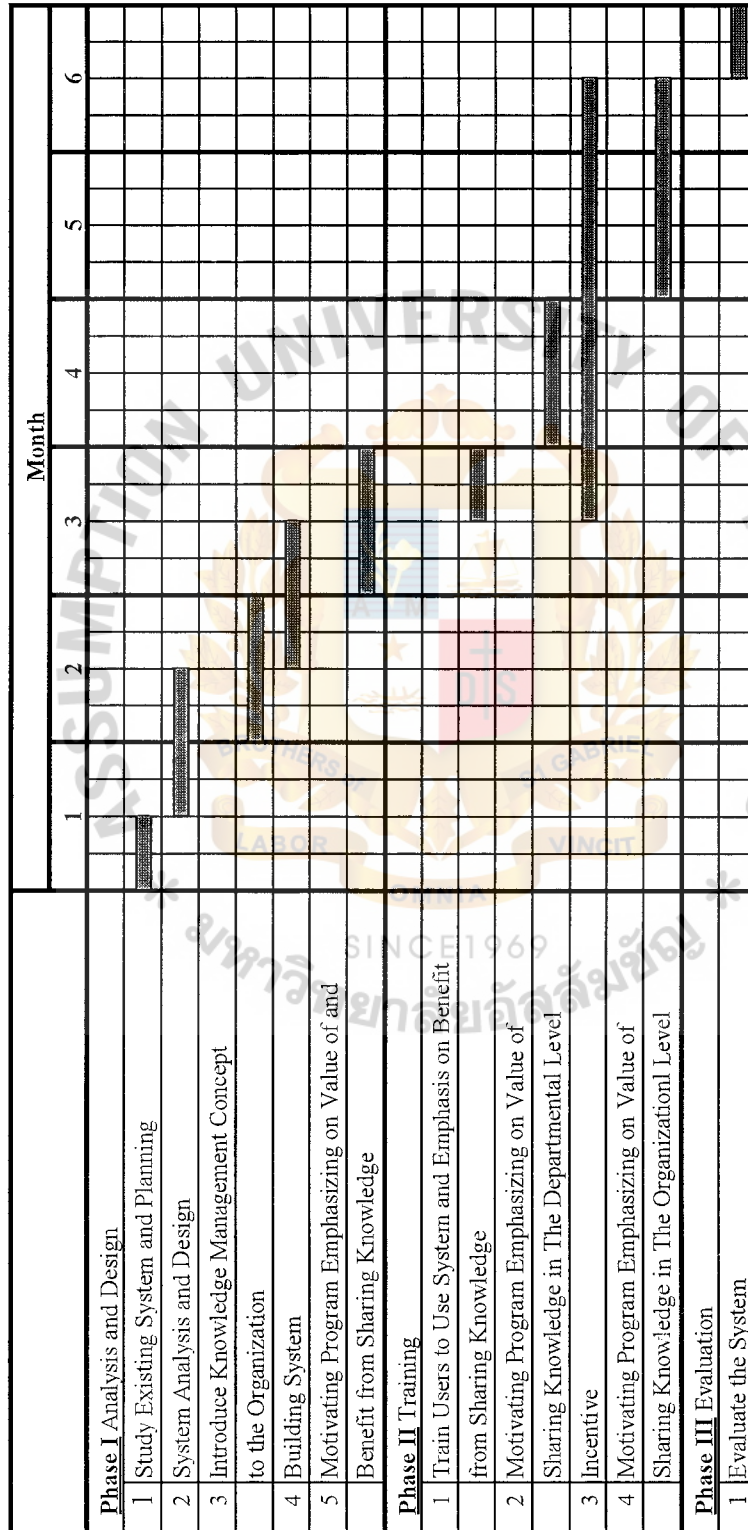


Figure 4.14. Action Plan for Introducing Knowledge Management and Gaining Awareness from People in the Organization.

V. THE FEASIBILITY STUDY

5.1 Economic Feasibility Study

In this section, the tangible and intangible benefits gained from the proposed system are more than from those of the existing system. The second method will be the net present worth that discounts the value of money of both the proposed system and DO NOTHING to the present value and then compare. The third method will be the benefit to cost ratio that will compare the present value of benefit to the present value of cost to find whether the proposed system is worth investing. The last method will be the payback period that is the expected number of years required to recover the cost of investment.

The following is the process of feasibility analysis:

- (1) Define both tangible and intangible benefits of the proposed system.
- (2) Estimate the expected benefits of the proposed system
- (3) Estimate the cost of the proposed system
- (4) Compare the net present worth of the proposed system to DO NOTHING
- (5) Analyze the benefit to cost ratio
- (6) Analyze the payback period

5.2 Tangible and Intangible Benefits

(a) Tangible Benefits

- (1) Costs that can be saved from the salary of employees and other overhead costs, which can be wasted for acquiring knowledge and information for solving the problems.
- (2) Time that can be saved when employees can find related knowledge and information for solving problems from the system.

- (3) Net present worth of 902,720.063 baht, compared to 389,677.42 baht of DO NOTHING, shows that the proposed system is worth investing.
- (4) Benefit to cost ratio of 3.3166 indicates that the proposed system is worth investing.
- (5) Payback period of 2.4070 reflects that the investment on this system will be recovered in about 2 years and 5 months.

(b) Intangible Benefits

- (1) Cost for training employees can be saved because most employees can learn by themselves from the system.
- (2) Cause of turnover problem can be reduced because new employees will quickly learn and adapt to the company through the system.
- (3) Performance of work will be increased.
- (4) Time for solving problems can be reduced.
- (5) Since most employees will have similar skill from learning through the system, the opportunity of having more qualified personnel for different projects will also be increased.

5.3 Expected Cost Saving and Cost of the Proposed System

(a) Expected Cost Saving

From the proposed knowledge management system, the benefit will come from the cost that could be saved. The expected cost saving would come from reducing the time in acquiring knowledge and information for solving problems of the people in the organization. Table 5.1 shows the expected cost saving that would occur through 5 years.

Table 5.1. Expected Cost Saving Through 5 Years.

Year	Number of Employees	Average Number of Problems per Day	Percentage of More Information	Percentage of Knowledge Hits	Average Time for More Informaiton	Cost Saving per Minute	Cost Saving per Year
1	20	5	30.00%	15.00%	45	1.42	75,913.20
2	22	5	30.00%	30.00%	45	1.42	167,009.04
3	24	6	30.00%	40.00%	45	1.42	291,506.69
4	27	7	30.00%	50.00%	45	1.42	478,253.16
5	30	8	30.00%	60.00%	45	1.42	728,766.72

From Table 5.1, expected cost saving each year can be calculated from many factors:

- (1) Number of employees in the organization that expect to increase about 10-15 percent every year from 20 persons to 30 persons through 5 years.
- (2) The average number that each employee has to solve each day is about 5 problems and expected to be increased with the support of the proposed system.
- (3) Percentage of problems that each employee has to acquire more knowledge and information when solving problems. Since people in this company mostly find information from the Internet, percentage of more information will be calculated from the number of different knowledgeable web site accesses, such as search engine and portal web site, supplier web site, etc., divided by the number of total web site accesses from the Internet access log file of the company each day. The number of web site accesses is counted as different user access and different time access to the same web site to be a different

web site access. The statistics of Internet access in one week is as shown in Table 5.2.

Table 5.2. The Statistics of Internet Access in One Week.

	Total Web Site Access	Total Knowledgeable Web Site Access	Percentage of More Information per Day
1	253	79	31.23%
2	239	73	30.54%
3	249	78	31.33%
4	247	76	30.77%
5	267	84	31.46%

Percentage of more information:

$$\begin{aligned}
 &= (79 + 73 + 78 + 76 + 84) / \\
 &\quad (253 + 239 + 249 + 247 + 267) \\
 &= 390 / 1255 \\
 &= 31.08 \%
 \end{aligned}$$

For the convenience of calculation, 30 percent will be used instead.

Since technology is now radically developing, the trend that people in the company have to acquire more knowledge and information should be increased every year. However, everyone in the company has to continuously learn new technology. Consequently, the percentage of more information would remain at the same rate through five years.

- (4) Percentage of knowledge that is expected to be found on the knowledge management system. The organization expects to have a

percentage of knowledge hits about 15 percent in the first year and increasing to 30, 40, 50 and 60 consecutively from the second year to the fifth year.

- (5) The average time in acquiring more knowledge and information for solving a problem can vary from minutes to more than one day, but, in most cases, the knowledge and information can normally be found within 30-60 minutes from many sources, such as from colleagues, the Internet, suppliers, etc. Therefore, the average time in acquiring more knowledge and information will be as shown below.

$$= (30 + 60) / 2$$

$$= 45 \text{ minutes}$$

- (6) Cost saving per minute at 1.42 baht can be calculated from the minimum salary of 15,000 baht for new employees who works 22 days per month and 8 hours per day. The cost saving per minute equals the salary of employee divided by the total number of working minutes and can be calculated as shown below.

$$\text{Cost Saving / Minute} = 15,000 \text{ baht} / (22 \text{ days} \times 8 \text{ hours} \times 60 \text{ minutes})$$

$$= 1.42 \text{ baht}$$

From the factors above, the expected cost saving for the first year can be calculated from:

- (1) Total number of problems per day equals the number of employees multiplied by the average number of problems per day:

$$= 20 \text{ employees} \times 5 \text{ problems / day}$$

$$= 100 \text{ problems / day}$$

- (2) Total number of problems that need more knowledge and information to solve per day equals the number of problems per day multiplied by percentage of problems that each employee has to acquire more knowledge and information when solving problems:

$$= 100 \text{ problem} \times 30 \%$$

$$= 30 \text{ problems / day}$$

- (3) Expected number of problems that can find knowledge and information from the proposed knowledge management system can be calculated from the number of problems that need more knowledge and information to be solved per day multiplied by percentage of knowledge that would be found on the proposed system:

$$= 30 \text{ problems} \times 15 \%$$

$$= 4.5 \text{ problems}$$

- (4) Total time that can be saved equals the expected number of problems that can find knowledge and information from the proposed knowledge management system multiplied by the average time in acquiring more knowledge and information for solving a problem:

$$= 4.5 \text{ problems} \times 45 \text{ minutes}$$

$$= 202.5 \text{ minutes / day}$$

- (5) Total cost saving per day equals the total time that can be saved per day multiplied by the cost saving per minute:

$$= 202.5 \text{ minutes} \times 1.42 \text{ baht}$$

$$= 287.55 \text{ baht}$$

St. Gabriel's Library

- (6) Total cost saving per year equals the total cost saving per day multiplied by the number of working days in a year:

$$= 287.55 \text{ baht} \times 22 \text{ days / month} \times 12 \text{ months / year}$$

$$= 75,913.20 \text{ baht / year}$$

Expected cost saving for the second year:

$$= 22 \times 5 \times 30 \% \times 30 \% \times 45 \times 1.42 \times 22 \times 12$$

$$= 167,009.04 \text{ baht}$$

Expected cost saving for the third year:

$$= 24 \times 6 \times 30 \% \times 40 \% \times 45 \times 1.42 \times 22 \times 12$$

$$= 291,506.69 \text{ baht}$$

Expected cost saving for the fourth year:

$$= 27 \times 7 \times 30 \% \times 50 \% \times 45 \times 1.42 \times 22 \times 12$$

$$= 478,253.16 \text{ baht}$$

Expected cost saving for the fifth year:

$$= 30 \times 8 \times 30 \% \times 60 \% \times 45 \times 1.42 \times 22 \times 12$$

$$= 728,776.72 \text{ baht}$$

- (b) Cost of the Proposed System:

- (1) The initial cost:

(a) Server = 109,800.00 baht

(<http://www.compex.com/pricelist/hpnw.htm>)

(b) Windows NT Server 4.0 = 64,360.00 baht

with 25 Client Access

Licenses

(<http://www.microsoft.com>)

- (c) Lotus Domino R5 Server = 174,200.00 baht
 with 25 Lotus Notes R5
 Client Access Licenses
 (<http://www.lotus.com/notes.nsf/welcome/store/>)

Total initial cost:

$$= 109,800 + 64,360 + 174,200$$

$$= 348,360.00 \text{ baht}$$

- (2) Maintenance cost is expected to be 5 percent of the server cost:

$$= 109,800 \times 5\%$$

$$= 5,490.00 \text{ baht per year}$$

- (3) Additional license cost on the fourth year:

- (a) Additional 5 Client Access Licenses for Windows NT:

$$= 5 \times 1,598$$

$$= 7,990.00 \text{ baht}$$

- (b) Additional 5 Client Access Licenses for Lotus Notes Client:

$$= 5 \times 3,680$$

$$= 18,400.00 \text{ baht}$$

Total additional license cost:

$$= 7,990 + 18,400 \text{ baht}$$

$$= 26,390.00 \text{ baht}$$

5.4 Net Present Worth Analysis

Before going through the calculation of the net present worth, the formula for calculation should be firstly defined:

The present worth:

$$P = F / (1 + i)^n$$

The net present worth:

$$\text{NPW} = \text{The summation of the present worth of each year}$$

From the formula, the calculation of the present worth of each year involves the interest rate. In order to accurately calculate the net present worth, the interest rate of the next year should be forecasted. The most suitable forecasting method for estimating the interest rate of the next year would be the Moving Average method because it is not so responsive to demand fluctuations.

The formula of the moving average can be calculated as follows:

$$\text{MA}_n = \Sigma D_i / n$$

Where

n = the number of periods in the moving average

D_i = the demand in period i

The record of the interest rate of Thailand since 1995 are as shown below:

Year 1995: 8.2 %

Year 1996: 8.9 %

Year 1997: 10.5 %

Year 1998: 8.2 %

Year 1999: 5.0 % (at the end of the third quarter)

The forecasting interest rate would be:

$$= [8.2 \% + 8.9 \% + 10.5 \% + 8.2 \% + 5.0 \%] / 5$$

$$= 8.16 \%$$

For the convenience of calculation, the interest rate of 8 percent will be used instead of 8.16 percent.

Net present worth of total expected cost saving:

$$= 75,913.20 / (1.08)^1 + 167,009.04 / (1.08)^2 +$$

$$\begin{aligned}
& 291,506.69 / (1.08)^3 + 478,253.16 / (1.08)^4 + \\
& 728,766.72 / (1.08)^5 \\
& = 1,292,397.47 \text{ baht}
\end{aligned}$$

Net present worth of total cost:

$$\begin{aligned}
& = 348,360 + 5,490 / (1.08)^1 + 5,490 / (1.08)^2 + \\
& 5,490 / (1.08)^3 + (5,490 + 26,390) / (1.08)^4 + \\
& 5,490 / (1.08)^5 \\
& = 389,677.42 \text{ baht}
\end{aligned}$$

Net present worth of the proposed system:

$$\begin{aligned}
& = 1,292,397.47 - 389,677.42 \\
& = 902,720.06 \text{ baht}
\end{aligned}$$

Net present worth of DO NOTHING would equal the net present worth of total cost, because if that amount of money is not invested on the proposed system, it will be deposited in the bank with the interest rate of 8 percent. Consequently, the net present worth of DO NOTHING is 389,677.42 baht.

Since the proposed system has the net present worth of 902,720.06 baht, more than that of DO NOTHING, the proposed knowledge management system is worth investing.

5.5 Benefit to Cost Ratio

The benefit to cost ratio can be calculated from the formula:

$$\text{Benefit to Cost Ratio} = \text{Benefit} / \text{Cost}$$

The benefit to cost ratio of the proposed system will be:

$$\begin{aligned}
& = 1,292,397.47 / 389,677.42 \\
& = 3.3166
\end{aligned}$$

Since the benefit to cost ratio of the proposed system is more than 1.0, this knowledge management system is worth investing.

5.6 Payback Period

Payback period is the expected number of years required to recover the cost of investment. It can be calculated from the formula:

$$\text{Payback} = \text{Year before full recovery} + \frac{(\text{Unrecovered cost at start of year} / \text{Cash flow during year})}{\text{Cash flow during year}}$$

From the cumulative net cash flow in Table 5.2, the payback of the proposed system:

$$= 2 + 116,417.76 / (116,417.76 + 169,598.93)$$

$$= 2.4070 \text{ years}$$

The cost of the proposed system will be recovered in about 2 years and 5 months.

Table 5.3. Cash Flow of The Proposed System.

	Year					
	0	1	2	3	4	5
Expected Cost Saving		75,913.20	167,009.04	291,506.69	478,253.16	728,766.72
HP NetServer E60 PIII-500 Model 9	109,800.00					
Windows NT Server 4.0 with 25 Client Access Licenses	64,360.00					
5 Windows NT Client Access Licenses					7,990.00	
Domino Application Server R5 with 25 Lotus Notes R5 Client Access Licenses	174,200.00					
5 Lotus Notes R5 Client Access Licenses					18,400.00	
System Maintenance		5,490.00	5,490.00	5,490.00	5,490.00	5,490.00
Net Cash Flows	(348,360.00)	70,423.20	161,519.04	286,016.69	446,373.16	723,276.72
Cumulative Cash Flows	(348,360.00)	(277,936.80)	(116,417.76)	169,598.93	615,972.09	1,339,248.81
Interest Rate	8.0%					
NPW	902,720.06					
B/C	3.3166					
Payback Period	2.4070					

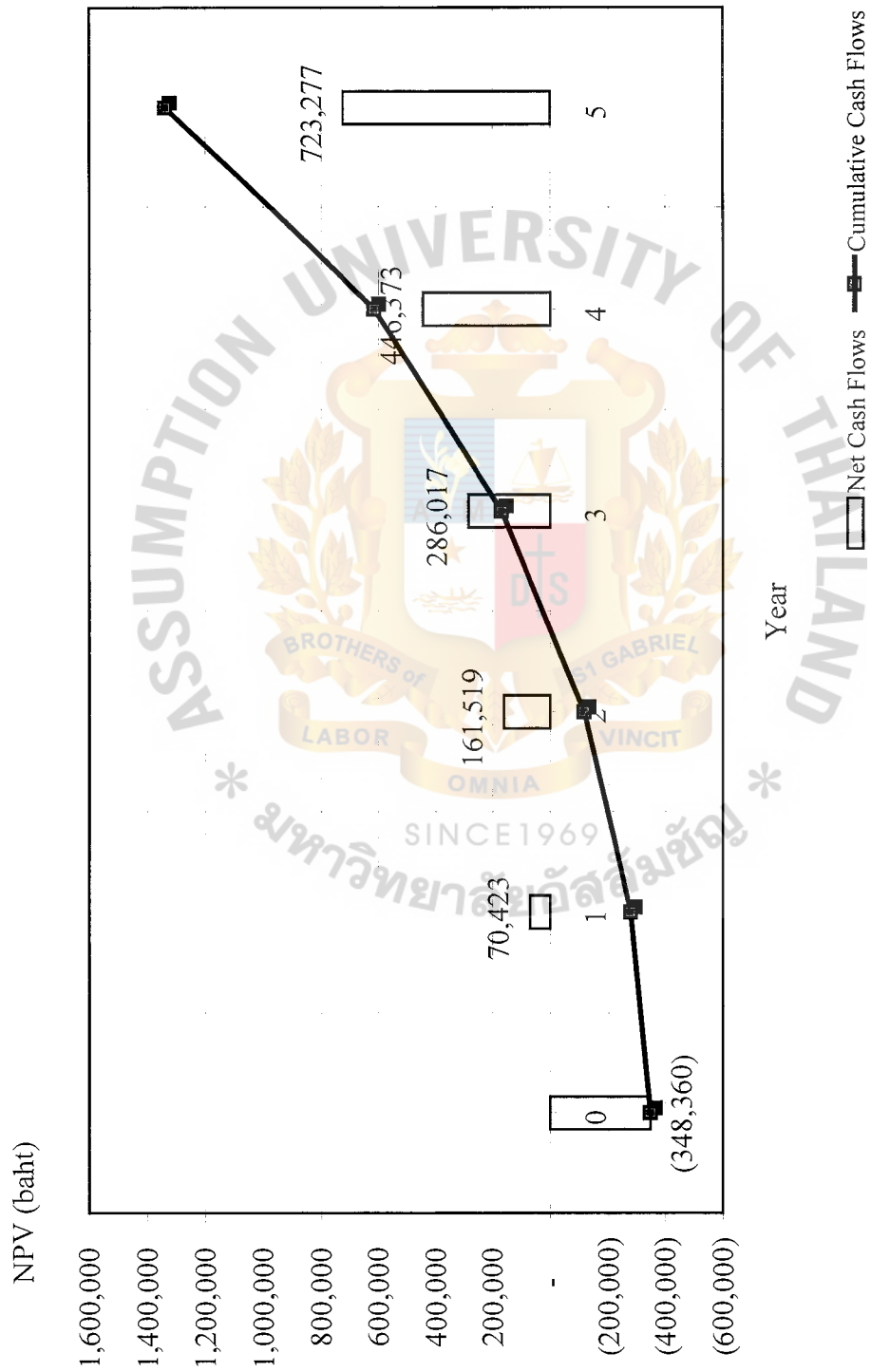


Figure 5.1. Graph Showing Net Cash Flows and Cumulative Cash Flow.

VI. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In the organization today, in order to be competitive, working fast and effectively includes gathering and analyzing data accurately are extremely important. It is inevitable that all organizations have to adopt information technology to facilitate and accommodate the way people in the organization work. Therefore, system integration and business solution provider services are emerging to help those organizations mentioned above adopting information technology into their organizations.

TB Company, founded on 1996, is a service-oriented organization providing business solutions through the effective use of information technology. The major business of this company is the system integrator and the solution provider in the field of computer technology and information systems, including Hardware and Software system design, Application Development, and on-going Technical Support.

After operating for 3 years, TB failed and was in trouble with the radical and incessant development of technology that makes all staff of the company continuously study the new technology that is related to their work. Moreover, with the increasing importance of information technology, several groups of people started doing this field of business. To remain competitive in the business, most enterprises have to retain their specialists and recruit trained employees from other corporations. This situation causes the turnover problem to the company. Furthermore, because of the limitation of specialists in the company, many projects have to be delayed in some processes that are required to be reviewed or solved by those specialists. These delays can cause the company to lose the profit from the jobs.

Knowledge management is not a new concept; moreover it existed in almost every organization for a long time, but those organizations may not know that, what they are doing comes from the same concept as knowledge management. In the past, knowledge remained in the organization and transferred across the organization, but it had not been formally gathered and systematically categorized in-groups.

Take TB company as an example: TB Company is the working unit that deals with knowledge all the time and may work on the concept of knowledge management for a long time. However, with the current working environment, it is difficult to collect and share knowledge. Presently, new technology supports cooperative working and sharing information more than it used to be, but there is still no system that properly works with the knowledge management concept. Consequently, building a system that helps and supports the creation, dissemination and utilization of knowledge is what the company plans to do.

After analysis and design, the proposed knowledge management system will come up with the Intranet system and the workflow system developing on Lotus Notes R5 and Lotus Domino R5 Application Server. Moreover, the action plan for introducing the knowledge management to the company is presented to gain awareness from the people in the company.

Finally, the feasibility study is conducted to determine whether the proposed knowledge management system is worth investing. The study shows the net present worth of 902,720 baht with the benefit to cost ratio of 3.31 that reflect the worth of investing on this proposed system. The study also shows the payback period of about 2.40, which indicates that the investment on the proposed system will be recovered in about 2 years and 5 months.

6.2 Recommendations

Knowledge management is not a new emerging concept, but it has existed for a long time. It may not be formally and systematically categorized. The hardest part in the knowledge management process is the implementation part. Therefore to effectively build up the system, requires some organization infrastructure. Some fundamental steps are:

- (1) The top management must turn the organization into a free flow communication on different levels, top down and bottom up, and crossed functional talk. The change can be done by frequently organizing social gatherings. This will develop acquaintance among employees. The acquaintance will help to develop relations, trust and rapport among employees. Thus knowledge sharing will flow through the informal networks of practice in the company. The culture of knowledge sharing practice is prerequisite to any attempt of adopting information technology.
- (2) Create a “tech club” or “talk room” for employees with similar backgrounds and orientation to discuss subjects of mutual interests. Thus it will encourage more active knowledge exchange and provide a source of think-tank which makes knowledge available when and where it is needed.
- (3) It is also sensible to look broadly for help inside the organization. It is useful for knowledge management to prosper if everyone has to help out. The more people and groups that buy into the effort, the more likely the knowledge management project will be successful.
- (4) The top management should initiate and have a strong commitment to support the change of culture. The rewards and promotion policy of the company should explicitly motivate knowledge sharing among employees.

Employees who share knowledge must be recognized and rewarded with career advancement.

- (5) An outside consultant will be helpful to study and identify what kinds of knowledge are important to the organization's needs and help to design technology infrastructure networks for knowledge management. Thus information technology networks that are adopted will be efficient and effective.
- (6) The organization needs to balance in using different approaches, which are technology, organization and culture, to knowledge management. Balance is required in trading off knowledge management with other change approaches.

There are undoubtedly other problem syndromes that can be discussed. The implement of knowledge management in the organization is a very slow process but it is important to start small. When most of the employees are familiar with the practice of active knowledge exchange and realize the virtue of the sharing of knowledge, then the project can be expanded to a full knowledge management system. Moreover, the organization success depends on the organization's abilities to maintain a culture of free flow sharing of knowledge among its employees and to develop updated usable knowledge at a reasonable cost.



Table A.1. Price of Microsoft Product.

Microsoft Product	Price in US \$	Exchange Rate	Price in Baht
Windows NT Server 4.0 with 25 Client Access Licenses Pack	\$1,609.00	40 baht / \$	64,360.00
Windows NT 1 Client Access License Pack	\$39.95	40 baht / \$	1,598.00

Note: From Microsoft Homepage (<http://www.microsoft.com>) on October 1999

Table A.2. Price of Lotus Product.

Lotus Product	Price in US \$	Exchange Rate	Price in Baht
Domino Application Server R5 with 25 Lotus Notes R5 Client Access Licenses Pack	\$4,355.00	40 baht / \$	174,200.00
Lotus Notes R5 1 Client Access License Pack	\$92.00	40 baht / \$	3,680.00

Note: From Lotus Store Homepage (<http://www.lotus.com/notes.nsf/welcome/store/>) on October 1999

Table A.3. Price of Hewlett Packard Product.

HP NetServer E60 Series	Price
HP NetServer E60 PII-400 Model 1	63,600.00
HP NetServer E60 PII-400 Model 9	79,800.00
HP NetServer E60 PII-450 Model 1	78,500.00
HP NetServer E60 PII-450 Model 9	94,200.00
HP NetServer E60 PIII-500 Model 1	95,900.00
HP NetServer E60 PIII-500 Model 9	109,800.00

Note: From Compex Co., Ltd. Homepage (<http://www.compex.co.th/pricelist/hpnw.htm>) on October 1999

Table A.4. Hewlett Packard NetServer E60 Series Specification.

Processors	Up to two Intel Pentium II 400MHz or 450MHz, or Pentium III 500MHz processors
Cache	512KB ECC L2 cache per processor
Memory	64MB ECC standard SDRAM memory, expandable to 1GB
Video	4MB standard SDRAM video memory (up to 1280x1024, 256-color)
Mass Storage	Seven mass storage shelves: three are front accessible (pre-installed CD-ROM drive and flexible disk drive on all models; integrated T20Xi tape drive on select models) and four are internal hard disk drive shelves.
SCSI Controller	Integrated dual-channel Ultra/Wide SCSI controller
Network Interface Controll	Integrated HP NetServer 10/100TX LAN adapter
Built-in I/O Ports	Built-In I/O Ports One 25-pin parallel, two adapter 9-pin serial, video, mini-DIN keyboard and mouse
Total I/O Slots	Six total: five PCI, one PCI/ISA combination
Backup	Integrated HP SureStore T20Xi with 10GB native storage capacity (and up to 20GB compressed) running Stac Replica Backup and disaster recovery software

Note: From Hewlett Packard Homepage (<http://www.hp.com>).

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