Assessing the outcome of Competencies Level from Knowledge-Based Project

By

Anyamanee Sungsinlert

Project dissertation submitted in partial fulfilment of
the requirements for the
Bachelor of Technology (Hons)
(Information and Communication Technology)

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CERTIFICATION OF APPROVAL

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Approved by,

b/p
(Ms Noreen Izza Bt Arshad)

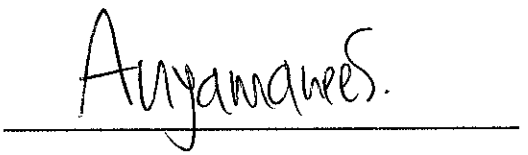
UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

January 2008

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



ANYAMANEE SUNGSINLERT

ABSTRACT

This project is the new idea to implement the Knowledge Management by applying the concept of Knowledge Map and Social Network Map, which are the basic implementation of Knowledge Management, with Artificial Neural Network (ANN) Algorithm of Artificial Intelligence System. This system is to capture the knowledge of the users as an input , furthermore, it considers another factor which is the competencies of each individual as the ingredients for ANN calculation. At the end, it will generate the outcome which said to be the Success Rate of the Learning process. Therefore, we shall now have the alternative way in order to provide the more accuracy assessment of the success rate , in Percentage, of the learning process at the learning centre which we have chosen Halliburton Excellence Centre to be our client. Each student will also being recommended according to their performances by our recommendation function.

ACKNOWLEDGEMENT

All along the one year of development of this project, there are some important parties who sacrificed their efforts for the success of this project together with me. Therefore, I would like to dedicate this page for returning to the graceful of;

1.) Ms Noreen Izza Arshad, Final Year Project Supervisor
: Who helps and suggests me all the along the development process. She and her efforts are to be respect as one of the best supervisor.

2.) Knowledge Management Team (Lecturers), Universiti Teknologi PETRONAS
: Who suggest and give recommendations towards the project improvement by time-to-time.

3.) Professor Woods, Knowledge Management professional advisor
: Who sacrifices his time in order to evaluate and gives the useful recommendation for the project.

4.) Zuraini Hanim Zaini , FYP 1 Student and Project collaborator
: Who is the main collaborator for this project and gives a very good collaboration for all the time.

5.) Ms Shan Appudurai, Manager of Halliburton Excellence Centre, UTP
: Who sacrifices the valuable time and provide a very good cooperation for the success of the project.

6.) Proton Sdn Bhd, Human Resources Department
: Who gives us the full cooperation for the research purpose.

7.) PETRONAS, my main sponsor
: Who all the time support me up until now that I could be able to contribute this useful project as a reference for the Knowledge Management field and its students in the future.

And absolutely, my family who gives me all of the will powers and being all the time supportive, until today that this project is completed and be successful.

TABLE OF CONTENT

TABLE OF ILLUSTRATIONS

FIGURES **PAGES**

TABLES **PAGES**

Knowledge Management ('KM') comprises a range of practices used by organisations to identify, create, represent, and distribute knowledge for reuse, awareness and learning **[1]**.

Knowledge Assessment is the process of documenting, usually in measurable terms, knowledge, skills, attitudes and beliefs **[19]**.

Knowledge audit is an evaluation of a person, organization, system, process, project or product. Audits are performed to ascertain the validity and reliability of information, and also provide an assessment of a system's internal control. The goal of an audit is to express an opinion on the person /organization/system etc. under evaluation based on work done on a test basis **[20]**.

Knowledge transfer in the fields of Organizational development and organizational learning, is the practical problem of getting a packet of knowledge from one part of the organization to another (or all other) parts of the organization **[21]**.

Knowledge mapping is commonly used to cover functions such as a knowledge audit (discovering what knowledge exists at the start of a knowledge management project), a network survey (Mapping the relationships between communities involved in knowledge creation and sharing) and creating a map of the relationship of knowledge assets to core business process. Although frequently carried out at the start of a Knowledge Management programme, it is not a necessary pre-condition or confined to start up **[22]**.

A social network map is a social structure made of nodes (which are generally individuals or organizations) that are tied by one or more specific types of interdependency. Social network analysis views social relationships in terms of *nodes* and *ties*. Nodes are the individual actors within the networks, and ties are the relationships between the actors **[22]**.

Competencies are measures of job performance that combines a person's skills, knowledge and most importantly behaviours that enable him/her to perform assigned tasks and roles.

It is also usually defined as the combination of knowledge, skills and attitudes that enable individuals or groups of individuals to perform work to defined standards**[6]**.

CHAPTER 1
INTRODUCTION

This project is to implement according to the following framework;

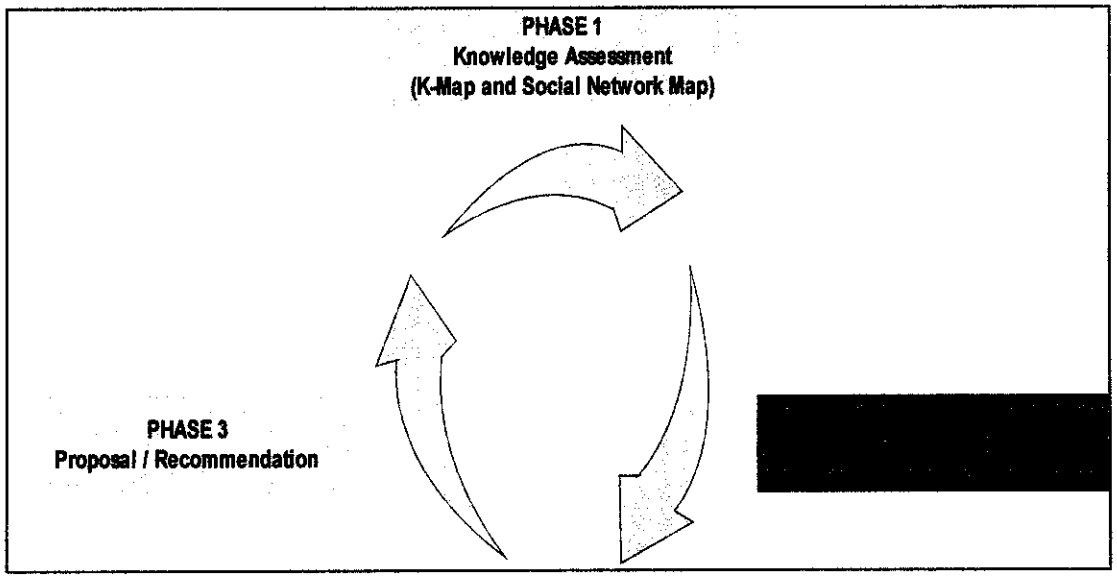


Figure 1.1: Implementation Phases of the Project

Phase	Status	Expected outcome
Phase 1	Completed	**Knowledge Map** : helps us to capture the knowledge flow between the key personals **Social Network Map** : helps to identify the personals who relate to the specified activities

Phase	Status	Expected outcome
Phase 2	Active	Knowledge Assessment system which helps to Assess the outcome of Competencies level of the Learning-based project implementation
Phase 3	Partially Active	Assessing the outcome of Competencies level from the Learning-based programme and Recommendation Terminal

TABLE 1.1: Implementation Phases of the Project

1.1 BACKGROUND INFORMATION

OVERALL PROJECT

As we have found the potential relationship between Social Network map and Knowledge Map with the Artificial Neural Network (ANN) Algorithm which could be explained as;

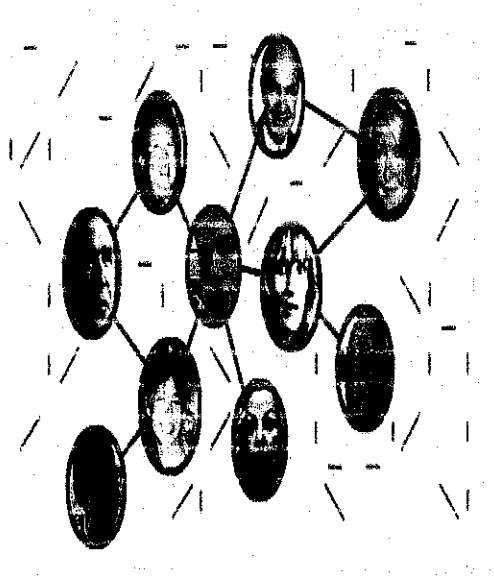


Figure 1.2: Social Network Map

Social Network Map which represents the inter-connection between persons in the particular project activities. By this each person is holding knowledge which can be translated into the brains coordination.

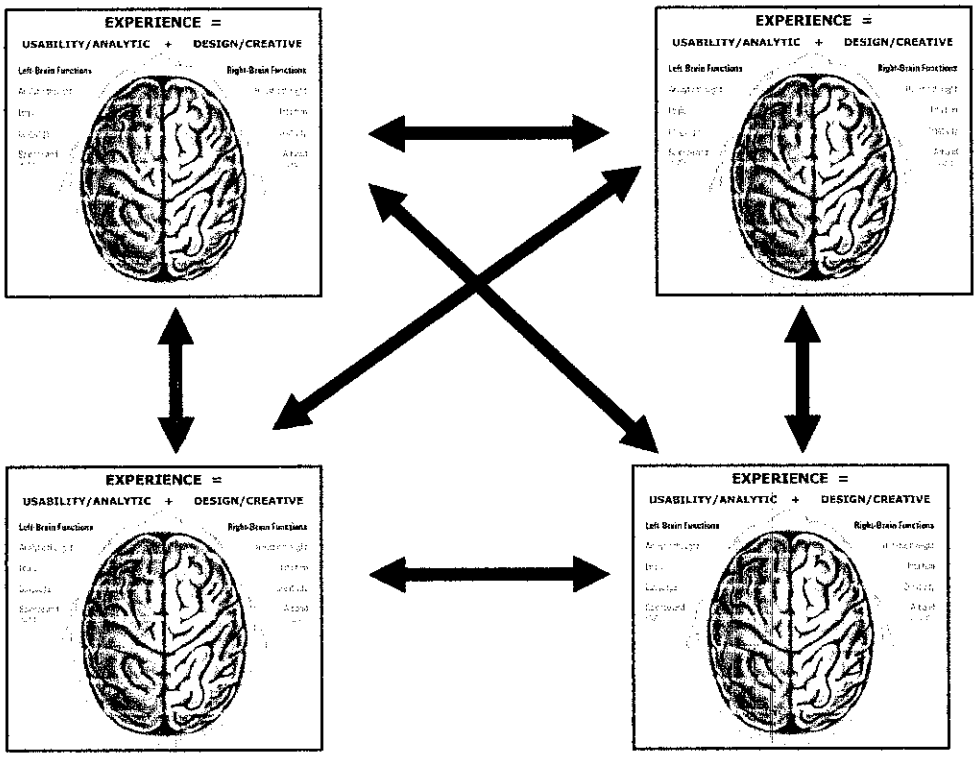


Figure 1.3: Brains Coordination

And from the Brain Coordination that mapped out from Social Network Map, we will see that the ideal outcome from the connection will be perfect if the coordination is as best as Brain Single unit operation.

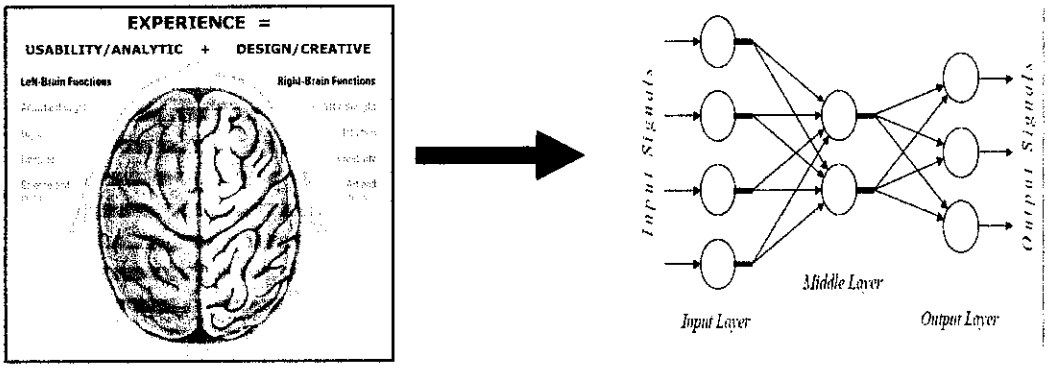


Figure 1.4: Brains Single unit and ANN Model

From Figure 1.4, we shall see that the Brain Single unit operation could be represented by the Artificial Neural Network (ANN) Algorithm proposed by McCulloch and Pitts. We have chosen the Supervised learning environment with the Linear activation function which will be explained in detailed as we move on.

For this Phase, we have the kind cooperation from Human Resources Department of Proton Sdn Bhd in order to be the test-base to develop the Knowledge Map and Social Network map.

Therefore, I would like to give you more background on the Knowledge Management itself as well as the Mappings that we are going to develop in order to picture out in the clearer way.

Knowledge assessment can be said to be HOT Topic recently since many organizations nowadays are trying to invest and have the detailed study of this activity in order for them to sustain in their competitive advantages.

Knowledge Assessment comprises a range of practices used by organizations to identify, create, represent, and distribute knowledge for reuse, awareness and learning. It has been an established discipline since 1995 with a body of university courses and both professional and academic journals dedicated to it. Most large companies have resources dedicated to Knowledge Management, often as a part of 'Information Technology' or 'Human Resource Management' departments, and sometimes reporting directly to the head of the organization. As effectively managing information is a must in any business, Knowledge Management is a multi-billion dollar in the world wide market.

Knowledge Assessment programs are typically tied to organizational objectives and are intended to achieve specific outcomes, such as shared intelligence, improved performance, competitive advantage, or higher levels of innovation.

One aspect of Knowledge Assessment, knowledge transfer, has always existed in one form or another. Examples include on-the-job peer discussions, formal apprenticeship, corporate libraries, professional training and mentoring programs. However, with computers becoming more widespread in the second half of the 20th century, specific adaptations of technology such as knowledge bases, expert systems, and knowledge repositories have been introduced to further simplify the process **[1]**.

Knowledge Assessment is a systematic and scientific examination and evaluation of the explicit and tacit knowledge resources in the company. The Knowledge Assessment investigates and analyses the current knowledge-environment and culminates, in a diagnostic and prognostic report on the current corporate 'knowledge health'. The report provides evidence as to whether corporate knowledge value potential is being maximized. In this respect the Knowledge Assessment measures the risk and opportunities faced by the organization with respect to corporate knowledge **[2]**.

From those definitions, I would like to simplify into an easy-understanding definition as Knowledge Assessment is the process to identify the existing knowledge of an organization from many attributes such as People's practices, Inventories, Documentaries ,etc together with the relationship and knowledge distribution within an organization. It is to further purpose to identify the gap from the existing knowledge to

the ideal knowledge of an organization in order to move the overall organization forward.

How difference between Knowledge and Information Management ? [3]

Most managers of knowledge initiatives concede their organizations lack a clear, widely-shared understanding of what knowledge is and how it can be distinguished from information. A consensus view is that, while information is defined as a flow of messages, knowledge is the combining of information and context in a way that makes it actionable. In reality, most projects we studied are a mixture of knowledge and information management. But knowledge management projects have several characteristics that differentiate them from traditional information management or information systems projects. These characteristics include:

Knowledge Management Project	Information Management Project
Goals emphasize value-added for users	Goals emphasize delivery and accessibility of information
Support operational improvement and innovation	Support existing operations
Adds value to content by filtering, synthesizing, interpreting, pruning content	Delivers available content with little value added
Usually requires ongoing user contributions and feedback	Emphasis on one-way transfer of information
Balanced focus on technology and culture issues in creating impacts	Heavy technology focus
Variance in inputs to system precludes automating capture process	Assumes information capture can be automated

TABLE 1.2: Comparison between Knowledge Management Project - and Information Management Project

What are the types of Knowledge Management Projects ?[3]

a.) Capturing and reusing structured knowledge.

Leaders of these projects recognize that knowledge is often embedded in component parts of organizational outputs, such as product designs, project proposals and reports, documented implementation procedures, and software code that can be reused to reduce the time and resources needed to produce a new output.

For example, Skandia, a Swedish-based financial services company, has cut its start up time for operating units in new countries from seven years to seven months by

packaging its cumulative experience into administrative modules that enable it to reduce costs while expanding international operations much faster.

b.) Capturing and sharing lessons learned from practice.

This type of project captures softer, more experiential knowledge that must be interpreted and adapted by the user in a new context. These efforts often involve sharing learning through a data base like Lotus Notes, and they may also take on a more interpersonal approach, using face-to-face sharing of stories and experiences.

For example, the US Army's Center for Lessons Learned is now at the heart of an elaborate infrastructure developed for capturing and sharing new knowledge gained from field operations.

c.) Identifying Sources and Networks of Expertise.

Instead of trying to capture and deploy knowledge content, some projects are designed merely to make expertise more visible and accessible to employees. The underlying

strategy here is to facilitate connections between those people who possess and those who need knowledge.

For example, Teltech, a small firm based in Minneapolis, has created a network of external experts for clients who seek technical expertise in a specified domain.

d.) Structuring and Mapping Knowledge Needed to Enhance Performance.

Another type of project impacts efforts like new product development or process redesign by making explicit the specific knowledge needed at particular stages of the initiative.

One project at Hoffman-LaRoche created a "knowledge map" of the new drug application process. This map made clear what knowledge would have to be developed and packaged to answer the questions that customers -- in this case, FDA regulators -- wanted answered before approving a particular new drug.

e.) Measuring and Managing the Economic Value of Knowledge.

Virtually all firms possess structured intellectual assets, such as patents, copyrights, software licenses, and customer data bases. Recognizing that these assets create both revenues and costs for the firm, another type of project seeks to manage these assets more judiciously. Dow Chemical, for example, set up an infrastructure to organize and classify its patents to determine which ones represent strategic advantage, which present revenue opportunities from licensing, and which patents should be abandoned to reduce the company's tax burden.

f.) Synthesizing and Sharing Knowledge from External Source.

A turbulent business environment increases the importance of organizational intelligence systems. Traditionally, these systems have been little more than information delivery "clipping services" that routed articles and reports to executives. But the electronic information avalanche, combined with increasing complexity, specialization, and the speed of market changes has raised the knowledge component of these systems. External intelligence systems are an easily overlooked type of knowledge management project.

Hewlett-Packard, for example, is currently developing systems to provide marketing intelligence for both domestic and international business units. These systems will require editors, reporters, and analysts to synthesize and provide context to the tremendous volume of market information available.

g.) Embed Knowledge in Products and Processes.

Finally, another type of project seeks to enhance or create new knowledge-intensive products, services, and processes. By recognizing the potential market value of knowledge that the firm is generating, the value of existing offerings can be enhanced or new revenue sources created.

For example, AutoDesk recognized that the engineering designs created by customers, using its product AutoCAD was source of potential design knowledge. It is buying these designs from its customers and will re-sell them to other firms wanting a "head start" on designs in similar areas. In another case,

many high technology companies are working together in the Customer Support Consortium to capture and leverage knowledge in customer support processes.

We have combined all of those BLUE-Font project types into the implementation and the outcome of this project.

[redacted]

For this Phase, we have the Halliburton Technical Excellence Centre to be our collaborator which the ordinary operation is purely about Training and Development of Halliburton Employees in Various subject matters.

What is Artificial Neural Network? [4]

There is no precise agreed upon definition among researchers as to what a neural network is, but most would agree that it involves a network of simple processing elements (neurons), which can exhibit complex global behavior, determined by the connections between the processing elements and element parameters. The original inspiration for the technique was from examination of the central nervous system and the neurons (and their axons, dendrites and synapses) which constitute one of its most significant information processing elements (see Neuroscience). In a neural network model, simple nodes (called variously "neurons", "neurodes", "PEs" ("processing elements") or "units") are connected together to form a network of nodes — hence the term "neural network." While a neural network does not have to be adaptive per sé, its practical use comes with algorithms designed to alter the strength (weights) of the connections in the network to produce a desired signal flow.

These networks are also similar to the biological neural networks in the sense that functions are performed collectively and in parallel by the units, rather than there being a clear delineation of subtasks to which various units are assigned (see also connectionism). Currently, the term Artificial Neural Network (ANN) tends to refer mostly to neural network models employed in statistics, cognitive psychology and artificial intelligence. Neural network models designed with emulation of the central nervous system (CNS) in mind are a subject of theoretical neuroscience (computational neuroscience).

[5] A neural network can be defined as a model of reasoning based on the human brain. The brain consists of a densely interconnected set of nerve cells, or basic information-processing units, called neurons. The neurons are connected by weighted links passing signals from one neuron to another.

The output signal is transmitted through the neuron's outgoing connection. The outgoing connection splits into a number of branches that transmit the same signal. The outgoing branches terminate at the incoming connections of other neurons in the network. For the better understanding, please refer to the figure below;

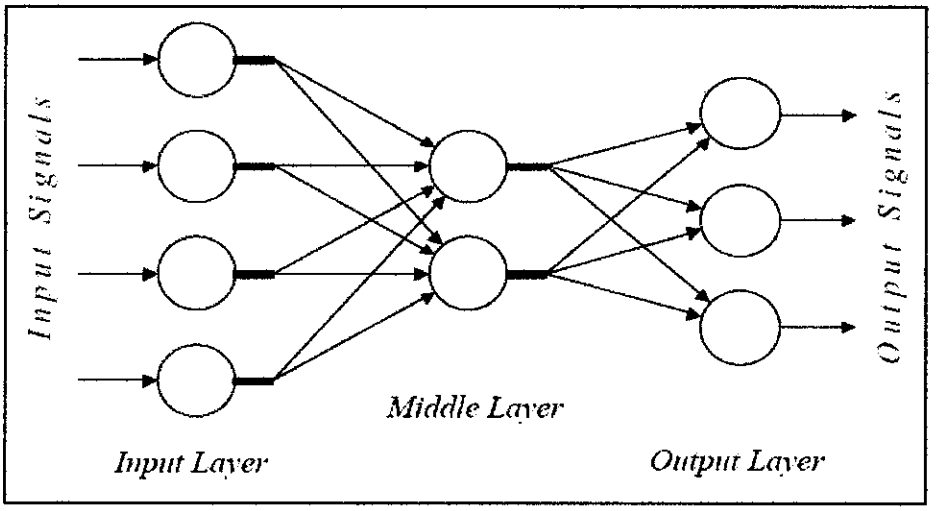


Figure 1.5: Artificial Neural Network (ANN)

What are Competencies? [6]

Competencies are measures of job performance that combines a person's skills, knowledge and most importantly behaviours that enable him/her to perform assigned tasks and roles.

It is also usually defined as the combination of knowledge, skills and attitudes that enable individuals or groups of individuals to perform work to defined standards.

Unlike skills or knowledge, which exists only in its own right, competencies, are wider in scope. It reflects individual ability to perform on the job, taking into cognisance their knowledge, skills and behaviours For e.g. a Mechanic will require the necessary technical skills to repair engines to the desired standards specified by the relevant recognized institution or bodies like the National Occupational Skills Standards (NOSS) or an organisation. In addition, the mechanic must demonstrate desired behavioural traits like communication, initiative and a safety orientation that will enable him/her to perform the tasks successfully.

When is a person said to be Competent?

A person is said to be Competent when he or she is assessed by a trained assessor and is found to have demonstrated the Required Competencies (Behavioural, Role & Functional) at an acceptable level set by the industry or an organisation.

A Competency Dictionary and Competency Anchors guide the Assessor, in his/her assessment of individual employee's competencies. Individual employees may also present evidence to support their level of competency.

Evidence may be in the form of past experiences or relevant tests undertaken by the employee that is recognised by the Assessors.

What are Competency Dictionaries and Competency Anchors?

A Competency Dictionary is a document that lists competencies for each trade or job and describes the level of performance expected for each competency. It is organised based on Competency Clusters, Units of Competency, Elements of Competency and the Performance Criteria, which describes the performance to which individuals must demonstrate to be assessed as Competent.

A Competency Anchor describes the Level of Competency a person has demonstrated or assessed. Typically there are 6 Competency levels namely;

Level 1: Awareness

A person assessed as having basic awareness of the competency.

Level 2: Basic Skill

A person assessed as having basic skill in the competency and always requires supervision in order to perform to desired standards.

Level 3: Skilled

A person assessed as skilled in the competency, but requires occasional supervision.

Level 4: Advance Skilled

A person assessed as exceeding the skilled level and does not require any supervision to carry out the task.

Level 5: Mastery

A person assessed as competent with the ability to supervise and train others in the competency.

Level 6: Industry Expert

A person who is acknowledged as an expert in the competency by specific industry or professional association.

For e.g. An experienced individual who sits in the advisory board of the Institute of Engineers advising on matters related to mechanical engineering may be considered as an expert in the competency related to mechanical engineering.

How is the Competency Assessment different from the Performance Appraisal?

Performance appraisal focuses on your output or results in a performance period against a set target, goals or objectives. Competency Assessment, on the other hand, focuses on what you can do against a set performance criteria or defined standards. What you can do (Competency Assessment) does not necessarily translate into output or results. Therefore, the Performance Appraisal will still be used to assess your output.

In essence, there are distinct differences in the two assessments. One is to measure your ability to carry out assigned tasks (Competency Assessment) against desired standards or criteria while the other is to measure your output or results (Performance Appraisal or Assessment) against the target set within a specified period.

How is competency linked to Employee's development?

Reconciliation between the Required Competency Level and your Current competency Level will determine whether there are gaps to be addressed.

The gaps will allow you to focus on the training and development programmes necessary. There is no longer a need for you to wonder what training is necessary. You could also decide whether you want to move your employees to higher level competencies.

How is competency linked to performance measurement?

Competencies are enablers, i.e. the knowledge, skills and attributes to enable you to carry out your job duties and responsibilities. By default, a competent person will normally be able to produce the desired results in job execution. However, there may some instances where a competent individual may not produce the desired results on the job. There may other factors that influencing his on-the job performance. This must be investigated so as remedial actions are taken to remove the impediment to performance.

Performance is defined as a series of activities that produce desired results. For example, a Welder's task is to join two metal plates together. He is said to have performed, when he carries out the task within the specified time, cost and quality. Therefore the measure of his performance is based on him/her welding the two joints in a timely and cost effective manner that meets the specified quality standards. The Welder will require the necessary competence (e.g. competent in using arch welding equipment) to carry out the welding of the two joints.

How was the competency for each job identified?

The competencies are derived primarily from a task analysis or job analysis. This involves identifying the critical task of the job together with the jobholder

and the immediate superior. It is important that only the critical tasks are considered, as these are the ones that enable the jobholder to perform. The critical tasks are then recorded as competency requirements. In addition, the Performance Criteria which the jobholder must satisfy are described. The Performance Criteria are the standards to which the jobholder must demonstrate when carrying out the tasks.

For e.g. a Welder when joining two metal sheets together must ensure that the workplace is safe for him to carry out the task. He/she must also ensure that the weld that he/she produces meets the quality standards and that he/she welds within the specified time frame.

The identified competencies, the Performance Criteria and the Required Competency Level are then validated by the Head of Department to ensure that it reflects the current competency requirement of the jobholder and standards set by the Company on the Performance Criteria.

What is about Halliburton Excellence Center ?

[7] The new 'technical excellence center' (TEC), providing training support in geology and geophysics to both new graduates and oil industry professionals, is the first of its kind to be set up by Halliburton outside of North America.

'One of the main challenges that the exploration and production industry faces is its aging expertise and the need to develop its human capital to extract the best out of the technology and its assets,' says Dr Rosti Saruwono, vice president of Petronas' education division. 'Petronas is therefore looking to industry service providers to assist us in training and developing local resources.'

Mark McCurley, a vice president in Halliburton's Production Optimization divison, adds: 'This is a major commitment by Halliburton for a training facility in the eastern hemisphere, which is the largest economic and energy consumption growth area in the world today.'

The collaboration is a winning strategy for both companies, according to McCurley. 'As this generation of employees begins retiring over the next five years, the need to invest in the training and development of the younger generation becomes crucial.'

Halliburton says it will also be investing more than US$700,000 in the TEC this year, some of it allocated to classroom and office renovation but a significant portion going into IT and communication infrastructure. Like the company's other three TECs - in Texas, Colorado and Mexico - the Malaysian center will have the latest broadband and videoconferencing technology, allowing trainees to participate in the global lectures given by subject-matter experts anywhere in the world and also to interact with participants at other TECs.

The first training semester began recently with studies covering cementing services, production enhancement and completion tools. There are a total of 26 students from both Halliburton and Petronas from Asia, Africa and the Middle East.

As part of the collaboration agreement, Halliburton Digital & Consulting Solutions will play a major role through the provision of petroleum information technology. In May the division announced the award to UTP of $8.6 million in Landmark software licensing for students pursuing engineering degrees. The grant, spanning a three-year period, will provide the students at UTP with access to Landmark's top drilling, production optimization, field development and prospect generation applications.

'Landmark is very pleased with the opportunity to provide UTP access to our suite of exploration and production software as it will help them prepare technically competent and skilled graduates trained to utilize cutting-edge technology in this very specialized field,' says Landmark president Peter Bernard. 'This grant is instrumental in preparing UTP graduates for joining the industry workforce as experienced and highly qualified geoscientists or engineers.'

Associate Professor Dr Ibrahim Kamaruddin, UTP's director of undergraduate studies, notes: 'The grant represents a part of our overall effort to increase the recognition of UTP as an advanced exploration and production education and training center. Our undergraduate students will now have access to leading-edge software to facilitate cutting-edge research in our newly completed academic complex, which provides the students with state-of-the-art facilities in a dynamic learning environment. When they earn their degrees, the students will be familiar with the functionality of Landmark's software and will have a shorter learning curve for using such tools, thus helping them prepare for a career in the earth sciences.'

The university's mechanical engineering program is designed to produce skilled graduates who are creative and innovative in the design, analysis and operation management of mechanical engineering systems, with research and development and

leadership capabilities to serve the nation's interest and to fulfill the technological needs and advancement of Petronas.

Using the software included in the grant, the university plans to research drilling fluid formulation and optimization using palm-oil derivatives, formation damage control in and around the wellbore, and the feasibility of air injection in Malaysian reservoirs.

1.2 INITIATIVE IDEA / PROBLEM STATEMENT

Knowledge Management is one of the subject matter that considered to be new and yet to have single standard to follow. Hence, it is still broad and complicated. In turns, most companies are now getting to realize the importance of Knowledge and Information within the organizations as well as the term " Knowledge Management ".

Many organizations are trying to find the Knowledge Management solution in order to have the framework to implement the Knowledge Assessment of the organization.

[redacted]

Currently there is a crucial issue for an organization which is about the way to manage the information and knowledge inside the organization smartly. Some organizations have faced the problem of information sink since there is the only key person who hold those information without flowing them to another people.

The crucial topic raised when those people leave the organization , consequently , the new staffs and some other existing staffs will get affected directly. Same goes to the case that there is some staffs who have lack of information that they supposed to. The organization will face the difficulty to maximize the capability of itself and its staffs.

For further information, Knowledge Assessment is being implemented in many organizations nowadays, and in many forms as below;

- A satellite communications company seeks to reduce its cycle time for producing new satellite launch vehicles by reusing relevant pieces of its existing product designs.

- Recognizing that project management is a core competence in Hewlett-Packard, a group is set up to improve the quality of project management in the firm's IT function by capturing and sharing best practices, and by facilitating "lessons learned" sessions at the conclusion of individual projects.

- Threatened by a Japanese competitor that was underpricing them by 50%, a major auto parts supplier creates a competitive intelligence system that captures information related to elements in a predefined cost model of the business. The information is synthesized and interpreted by company analysts and internal experts before being loaded into a data base which is easily accessed by company managers [3].

However, for my project I will base the project as to appreciate three important questions as;

1.2.1 Who are the key persons in our organization?

1.2.2 How much information that each of them holding?

1.2.3 How to map out their interconnections?

These three questions could assist the study of how we shall implement the Knowledge Map and Social Network Map. Hence, we could further into PHASE 2 to expose the study in order to appreciate the project objectives.

[redacted]

Since we could recognize the similarity and potential application to map the Social Network to be Artificial Neural Network (ANN) Algorithm.

Since, Social Network Map and Knowledge Map have been recognized to be the effective tools in order to apply in Knowledge Management activities. Hence, the study of the new tool to apply with those maps such as ANN Algorithm, should be worthy and innovative to the next step of Knowledge Management world. Also in order to appreciate the demand of the foresee market which is the Learning-based program such as Training as the organizations putting more investment on Human Resource said by statistic to be 54% out of all compensation of the companies.

1.3 OBJECTIVES

The objectives have been divided into three parts which are the Project Objectives, PHASE 1 Objectives and PHASE 2 Objectives as below;

PROJECT OBJECTIVES

a.) To be able to identify and implement framework of Knowledge Assessment Implementation.

b.) To develop a system in order to implement knowledge assessment.

c.) To find the new initiative idea for the coming market of Learning-Based activities such as Training, using Competencies level as a key idea.

d.) To introduce the Artificial Neural Network (ANN) algorithm to the Knowledge Management Assessment.

[redacted]

Objectives of Implementing Knowledge Assessment

a.) Knowledge Assessment helps an organization to clearly identify what knowledge is needed to support overall organization goals and individual and team activities.

b.) It gives tangible evidence of the extent to which knowledge is being effectively managed and indicates where improvements are needed.

c.) It explains how knowledge move around in, and is used by, that organization.

d.) It provides a map of what knowledge exists in the organization and where it exists , revealing both gaps and duplication.

e.) It provides an inventory of knowledge assets , allowing them to become more visible and therefore more measurable and accountable.

f.) It provides vital information for the development of effective knowledge management programmes and initiatives that are directly relevant to the organization's specific knowledge needs and current situation.

Objectives of implementing Knowledge Map and Social Network Map

a.) To be able to create the Social Map , Knowledge Map from the information in order to Identify the people , knowledge , the distribution and the storages of knowledge.

b.) To create the template for assessing knowledge through Knowledge Assessment Process using the off-line and on-line bases.

[redacted]

a.) To calculate the outcome of Competencies level of Learning Base programme.

b.) To capture/identify the level of expertise based on the online questionnaires.

c.) To calculate knowledge weight of the expert using the Artificial Neural Network (ANN)

d.) To generate recommendations according to user capability

1.4 SCOPE OF STUDY

PROJECT SCOPE OF STUDY

a.) Knowledge Management implementation.

b.) The opening opportunities in the market so that we shall make sure that it is going to be worth of investing.

c.) Social Network Map and Knowledge Map.

d.) Artificial Neural Network(ANN) algorithm and its models.

e.) Competencies and competencies level

[redacted]

To assist the real implementation, I have divided my project into 3 main sections which are as below;

a.) Development of Maps

: It is to develop the social map as well as the knowledge map.

The scope of study in this section is the most since it is the heart of overall project in order to implement the knowledge assessment. By this time, we need to study about;

- The organizational chart of the company
- The relationship between staffs in the company

- The daily routines of the staffs
- The inventory or documents that dealing with each staffs.
- The knowledge distribution channels between each staffs
- The tools that available to assist the knowledge distribution.

b.) Analysis of Maps

: It is to analyze the maps in order to identify the gaps , duplications , key persons , way of distributions , information sinking zones , inventory and etc in order to come up with the suggestion on improvement. Therefore, the scope of study in this section is the analysis of what we have mapped plus the ideal maps from the staffs' suggestions and management's point of view.

c.) Development of future templates/framework

: This is the development of the templates and framework for the future assessments.

[redacted]

a.) Halliburton as the TEST BASE
    - The trainee that undergo the training with Halliburton

b.) Expert-people that going to be as input

c.) Knowledge.

d.) ANN algorithm.
    - The model.
    - Parameter of the model.
    - The Formula of the model.

e.) Social Network Analysis.

f.) Structure of the Questions.

g.) C Language in order to develop the Tailor-made system for Halliburton.

CHAPTER 2
LITURATURE REVIEW / THEORIES

Since so far there is no single accepted theory in order to implement the Knowledge Assessment. As it is result-based which considers the results rather than how to have those results depends on many criteria such as type of organization, size of organization, type of works, and etc.

As well as in my project, I shall integrate many theories, past experiences and articles to introduce my own process in order to implement the knowledge assessment.

[redacted]

There are some literatures about Knowledge Assessment such as the below topics;

Knowledge Management—Emerging Perspectives

Yes, knowledge management is the hottest subject of the day. The question is: what is this activity called knowledge management, and why is it so important to each and every one of us? The following writings, articles, and links offer some emerging perspectives in response to these questions. As you read on, you can determine whether it all makes any sense or not **[8].**

You may have the full detail of this article in **[APP1] :** Knowledge Management as a Hot topic.

Importance of knowledge management

Byline: Anuja Ravendran

Edition: Computimes; 2*

Section: Business News

ORGANISATIONS that want to succeed in the knowledge economy (k- economy) need to be prepared with the ability to perform knowledge management or effective planning and organising of data. This includes thorough gathering, organising, sharing and analysing of information or knowledge which may consist of resources, documents, and people skills, said online information provider and content aggregator Lexis-Nexis Asia Pacific **[9].**

This is referred to the knowledge economy that will be gained from the knowledge assessment activity.

Knowledge Management initiative is all about survival and dominance in today's market. In a firm's bid to gain the upper edge, the knowledge-centric models for an organization is becoming increasingly crucial. With knowledge being intangible, it is very important for an organization to comprehend the loss of knowledge **[10].**

This literature is describing about the increasing importance of Knowledge Assessment to each organizations which is the strong reflection of the TREND nowadays, to focus more on how to sustain the information as treasures of the companies.

[redacted]

[11] Unraveling the Strange Problem: Changing Perceptions

The core of this problem has to do with that important postmodern word: *perception.*

For decades now – centuries, arguably – training has been seen as something that supports the workforce. This position stems largely from the perception that training is an extension of education. Since education has been traditionally viewed as a system of supporting human growth and development, workforce training has slid conveniently, some might say logically, into this existing groove of thinking.

So why is this a problem of perception?

Because in the modern workforce – and that of the foreseeable future – the idea that workforce training exists as a *support system* is dangerously outdated. The notion of *support* implies that something is important; but not necessarily vital, and certainly not essential. And it's because of this view that in many workplaces, training is viewed as an *enhancer*; something valuable, yes, but ultimately optional. Something to invest in or focus upon if revenues support it, or if time permits it. But certainly nothing essential.

This perception is *utterly out of date!*

[11] Training is no longer *optional*. It's not an enhancer, a supporter, or a *nice to have* thing. In the 21st century, an organization's capacity to effectively train its people is part of its ability to survive. And if that capacity isn't there – or if it's defective – then the organization itself will reveal that flaw in a number of destructive ways, including loss of bottom line profits.

Why the Skilled Workforce Makes Training Essential

It's a misnomer to think that so-called *skilled workers* are those human beings who emerge from university or college and bring with them some kind of technical or practical acumen. That may have been true a few decades ago; but no longer, and never again.

In today's world, *everyone* is a skilled worker. From the receptionist with the high school education to the CFO with an MBA, the entire workforce has become a skilled landscape; and that means that there is arguably *no* position that isn't in need of continuous training.

Each member of a team, a unit, and a company can no longer be viewed as individual silos focusing on their singular task within a limited sphere of activities. Rather, today, *each person is a part of a skilled workforce*; and if there are gaps or lacks in any area, the entire workforce will suffer. And make no mistake: this suffering isn't merely emotional or cultural (though that is a part of it). This suffering is financial.

[11] Training = Profit

When there are gaps in the skilled workforce – gaps caused by lack of training – then, automatically, work become inefficient and money is lost.

How *much* money is lost depends on the type of gap and how it manifests; but without doubt, regardless of whether a company sells flowers or microchips, a gap in the skilled workforce costs money.

In the past, this gap was typically seen only in terms of sales, such as whether a lack of training caused a sale to be lost. Now, however, we know without *any* economic doubt that the costs of ineffective or non-existent training gaps go *far* beyond lost sales. These additional financial costs include: rework, missed profits (smaller profits due to inefficiency), and misallocated resources (money spent trying to fix a gap could be better spent elsewhere). There's also lost market share, lost potential word-of-mouth advertising from satisfied (or merely served) customers, and the list goes on.

Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyze. This expert can then be used to provide projections given new situations of interest and answer "what if" questions. **[12]**

This literature is describing about the ability of neural network to extract the complicated data.

Despite the computational complexity involved, artificial neural networks offer several advantages in pattern recognition and classification in the sense of emulating adaptive human intelligence to a small extent. **[13]**

This literature is describing that ANN has several advantage in pattern recognition.

The input to the system consists of patient's glucose levels, insulin intake, and observed hypoglycemia symptoms during a short time period. The output of the first neural network provides the insulin regime, which is applied as input to the second neural network to estimate the appropriate insulin doses for a short time period. *Results*: The system's ability in order to recommend on insulin regime is excellent, while its performance in adjusting the insulin dosages for a specific patient is highly dependent on the data set used during the training procedure. *Conclusions*: Despite the limitations of computer-based approaches, this study shows that artificial neural networks can assist diabetes patients in insulin adjustment. **[14]**

This literature are describing the ability of ANN in estimated the output from the input which dependant on the data set during the training procedure.

CHAPTER 3
METHODOLOGY

For the ease of understanding, I have map out the steps that will be taken through out this project according to the PHASE as below;

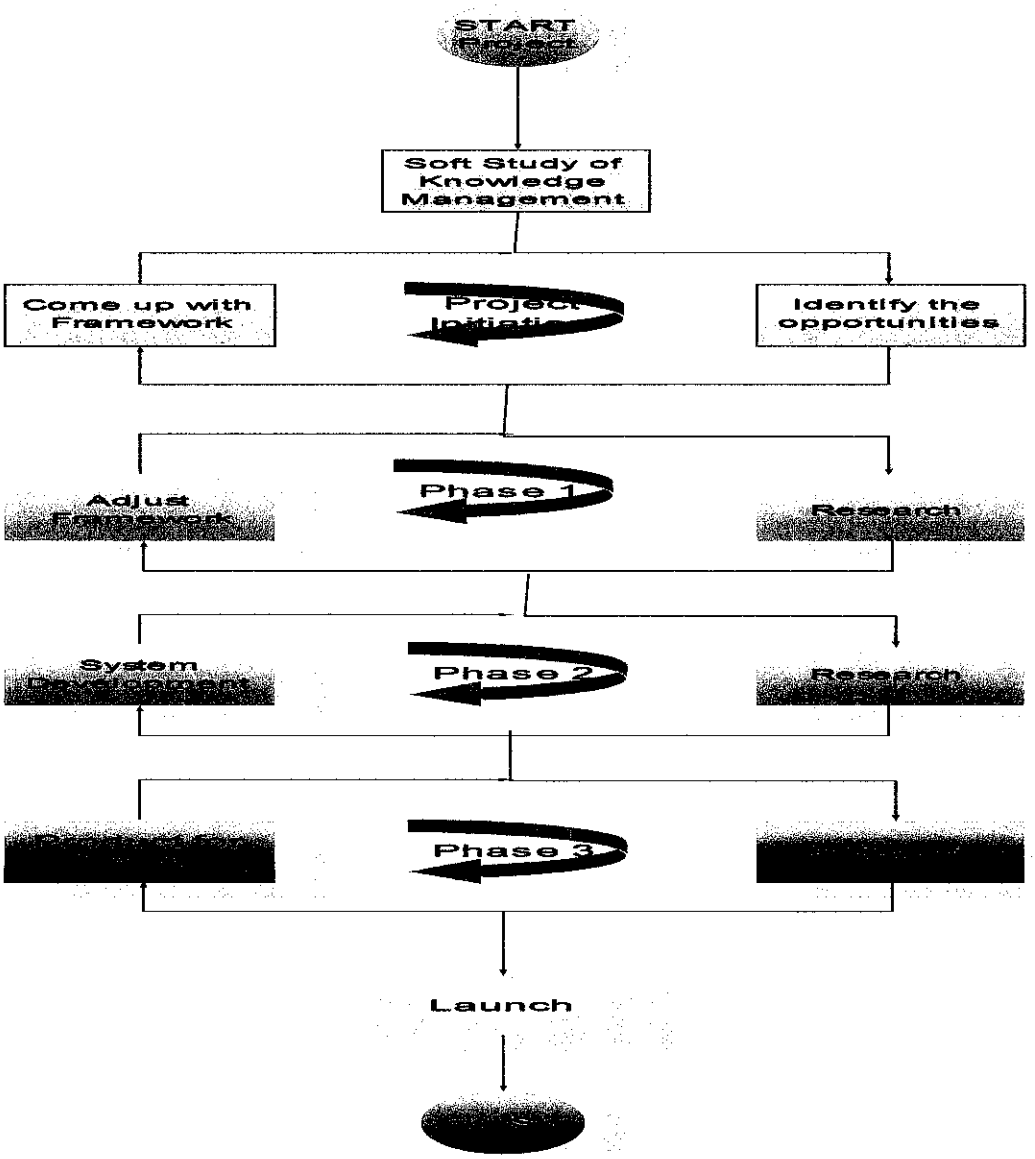


Figure 3.1: Overall Project Methodology

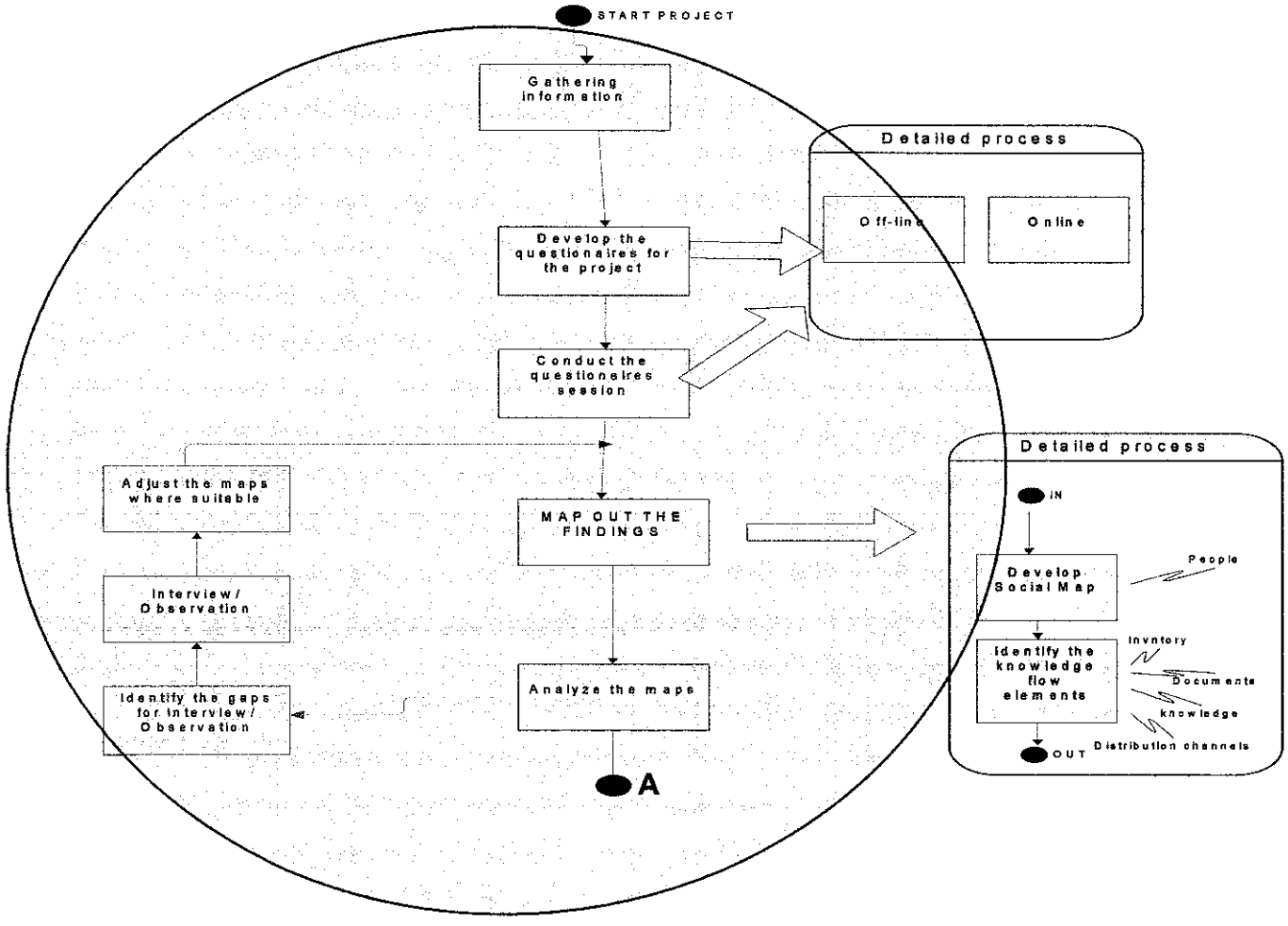


Figure 3.2 : Development of Maps

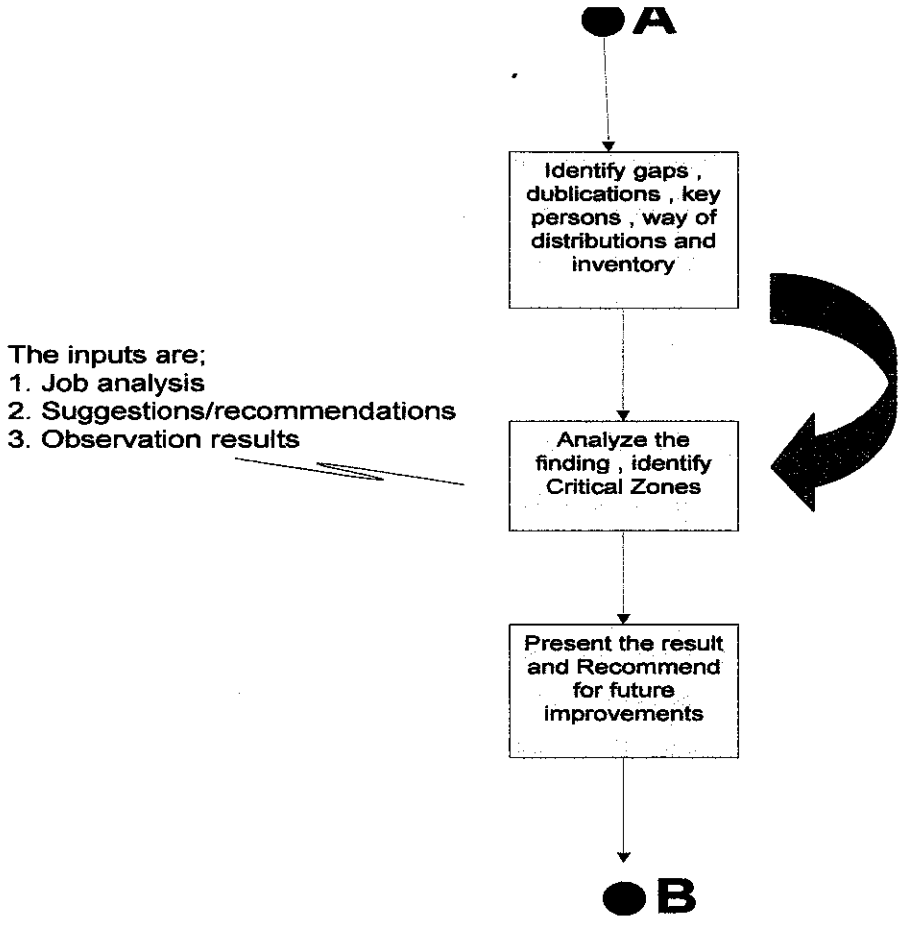


Figure 3.3 : Analysis of Maps

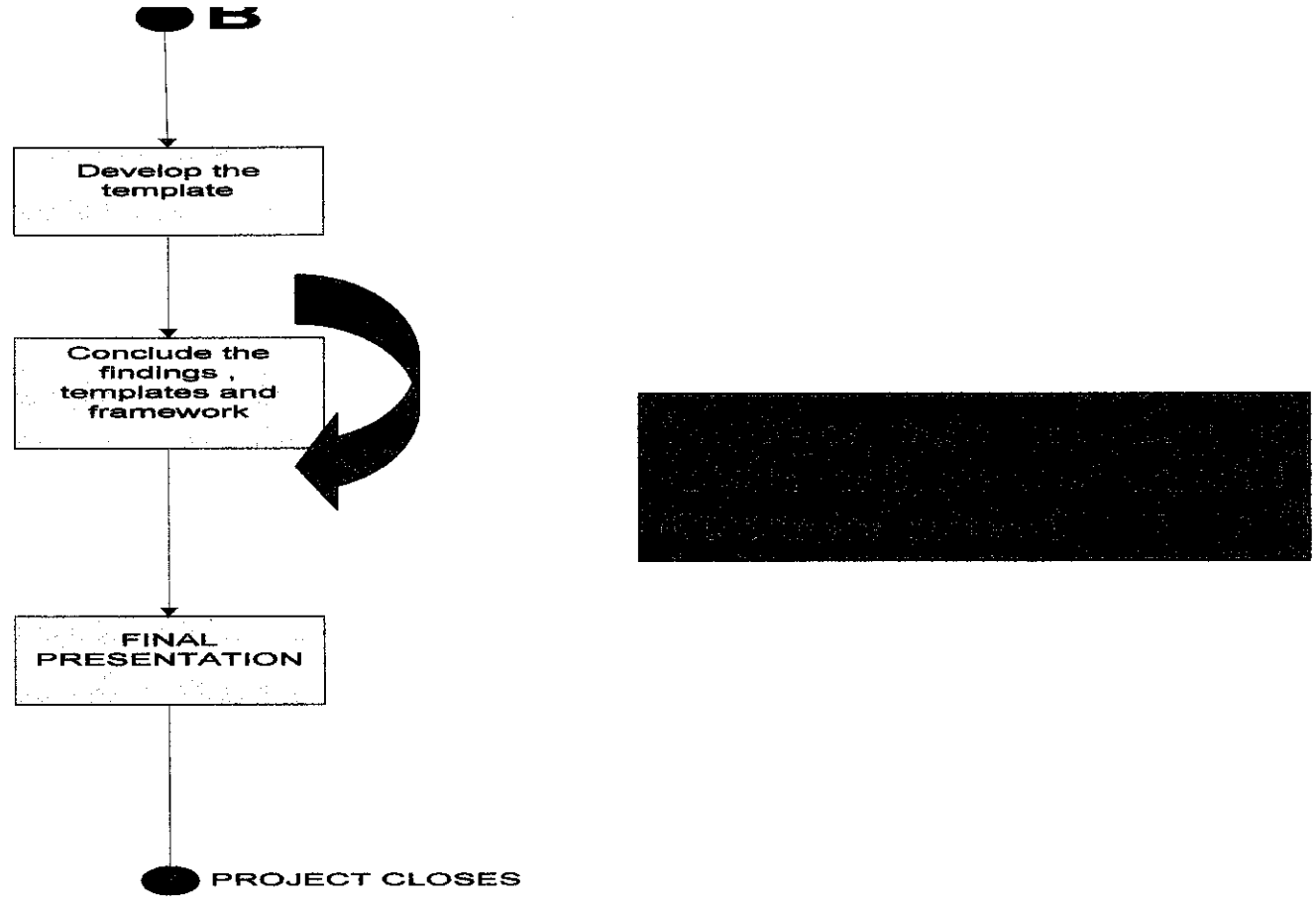


Figure 3.4 : Development of Templates

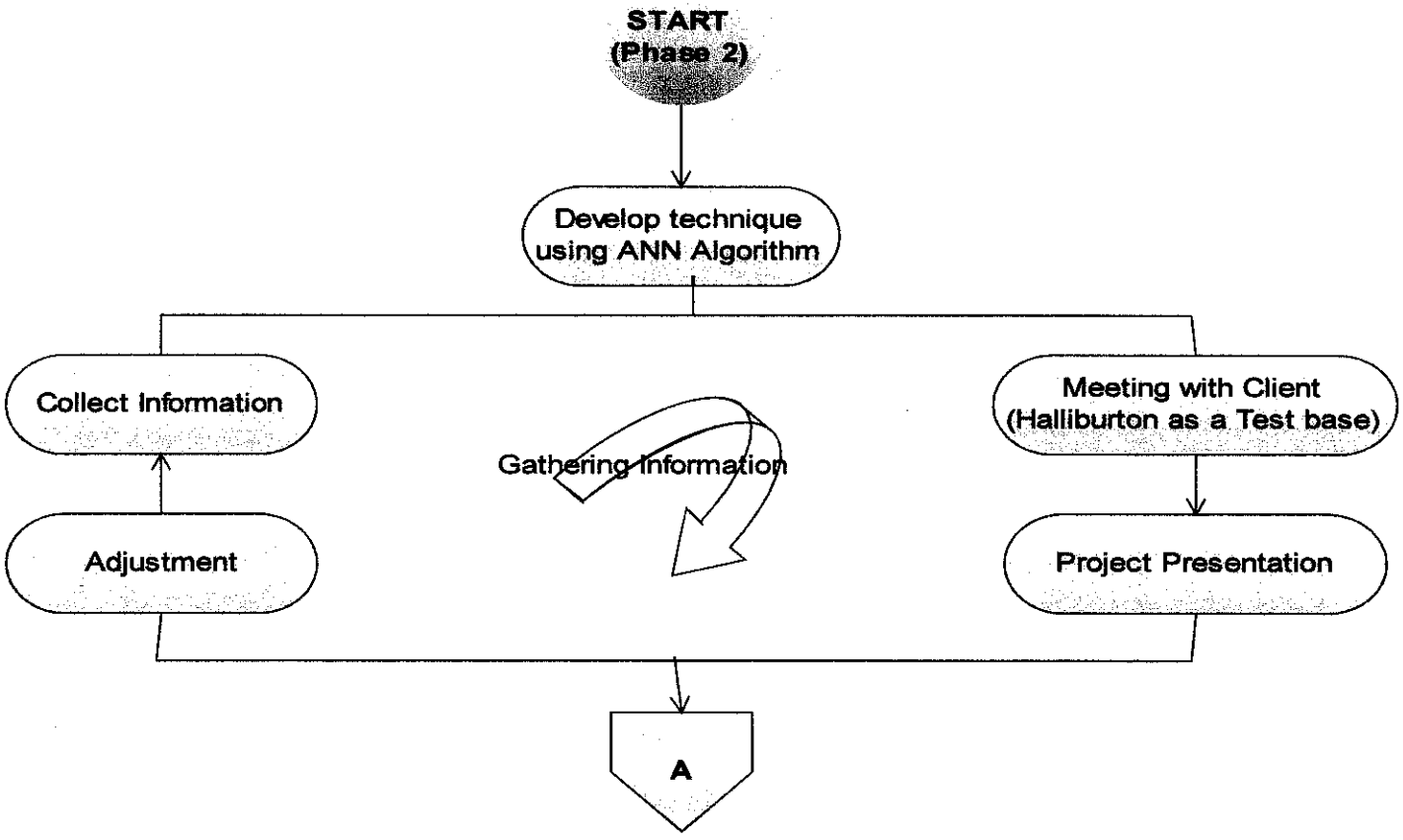


Figure 3.5 : ANN Algorithm and System requirement

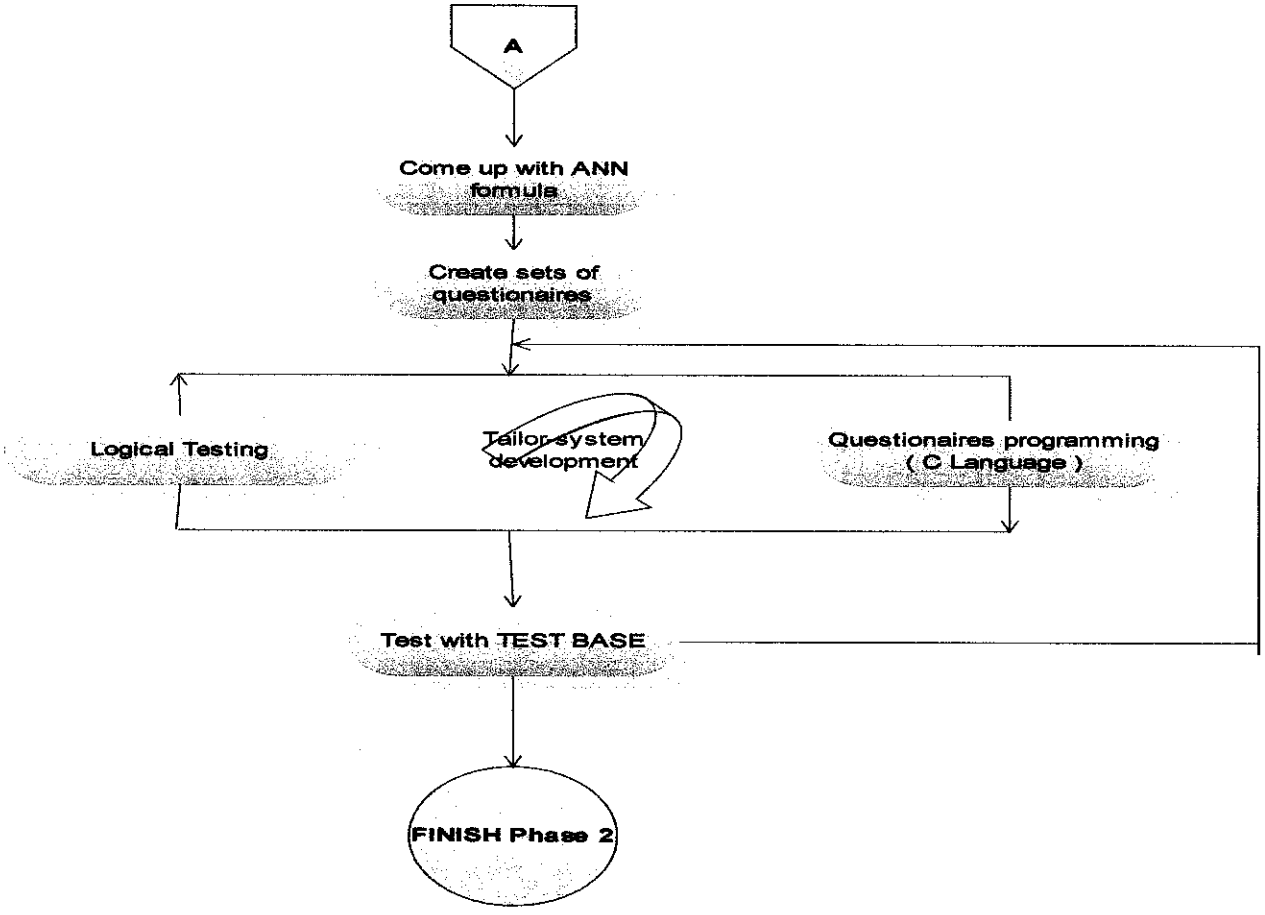


Figure 3.6 : System Development

Along the processes in both Phase 1 and Phase 2 , there will be the involvement of the below methodologies that we are going to use mainly for gathering the information, mapping out the findings and develop the system.

- Structured and unstructured questionnaires-based surveys.
- Site Observation.
- Structured and unstructured interviews with relevant personnel and stakeholders..
- Focus group discussions and forums.
- Mapping using software (if alternative choices required, as stated below).
- Theory references

3.1 TOOLS

There are many types of Software available in the market in order to implement the Knowledge Assessment and Knowledge Mapping. Below I have attached the information for two Softwares that will take into consideration of my project.

[redacted]

For this Phase, we have chosen Microsoft Excel in order to map out the findings. However, you may refer the mapping tools from the below software for your own implementation later.

1.) InfoRapid KnowledgeMap 2005e

Type: Freeware

by Ingo Straub Softwareentwicklung

InfoRapid KnowledgeMap can be used to draw knowledge maps, organizational charts, decision trees and work breakdown structures, taking down your ideas when

brainstorming, or generating structure diagrams from XML files. Knowledge maps can be published on the Web or your intranet, can be added to WinWord, Excel and PowerPoint documents, and can be printed in almost any size you choose **[15]**.

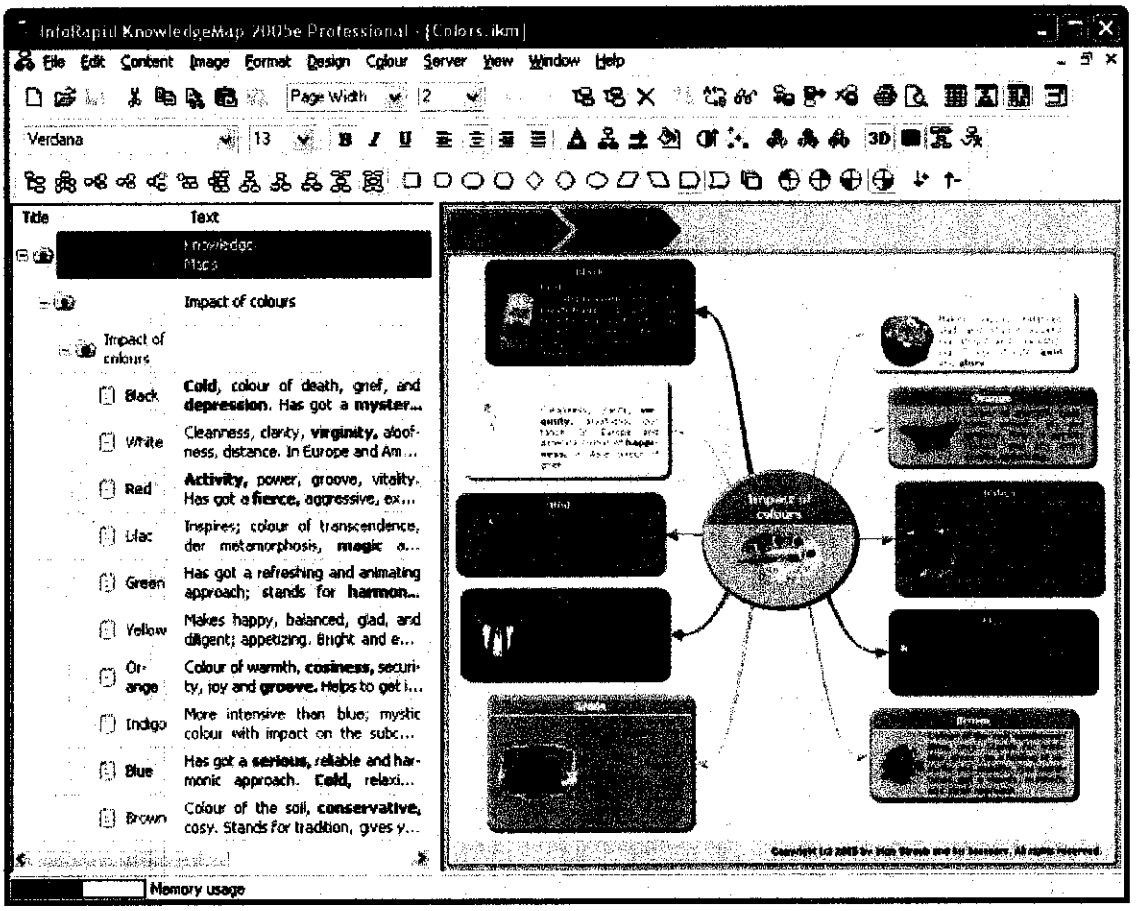


Figure 3.7: InfoRapid KnowledgeMap 2005e

2.) MindModel

Type: Commercial (US$ 200)

MindModel is very easy-to-use relational database software that allows you to store and recall information on any topic. Use it to create databases of people, companies, products, ideas, or anything else, all without programming. Since it's truly relational, you can look up information from any angle. Look up a person and see where they work. Look up a company and see who works there. MindModel runs on your PC, to keep

your information completely private. We also offer versions that allow you to share your data on a LAN or on the Web. Free technical support and data conversion services for users of the trial and registered versions.

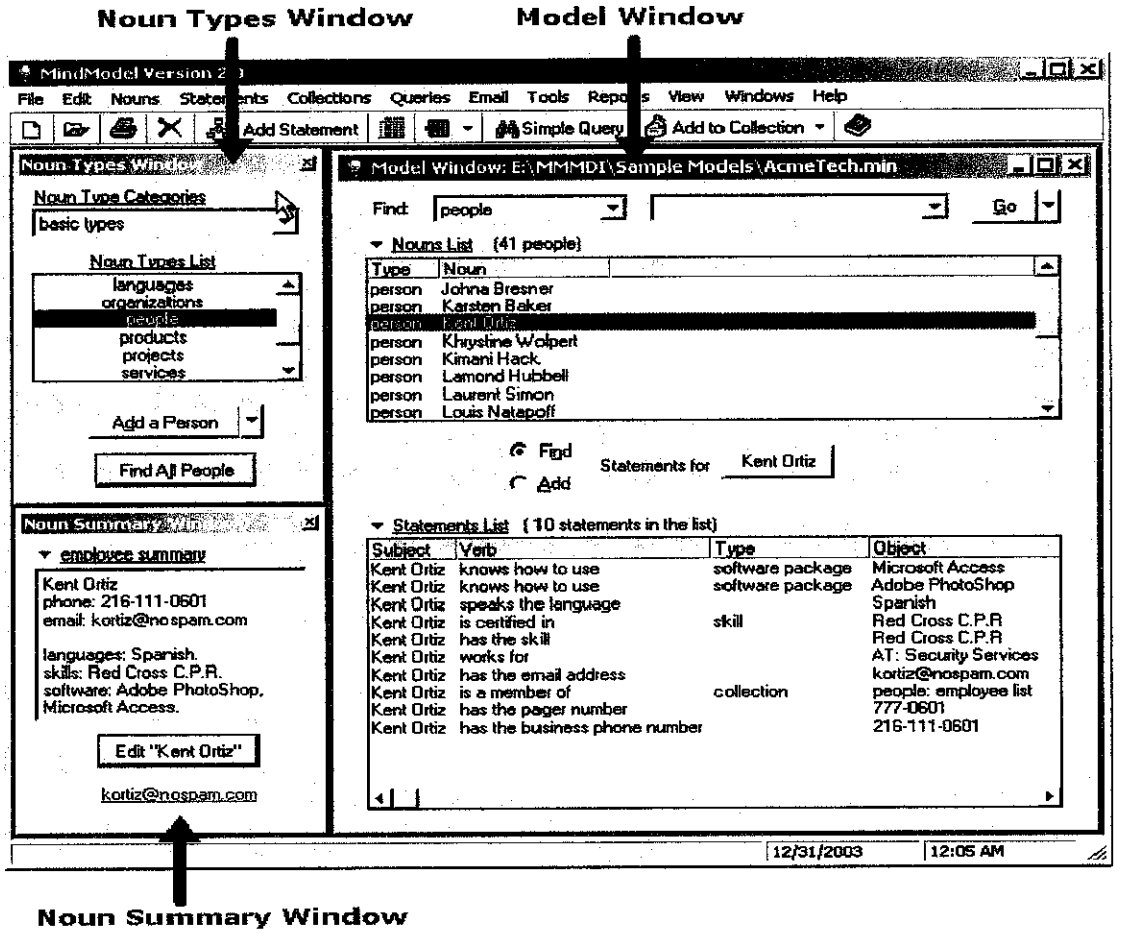


Figure 3.8 : MindModel

[redacted]

1.) C Language

Developing the system by using C language shall be the excellence choice in order to appreciate the client requirements which are;

- Cost-saving
- Consistency

Especially the Cost-saving requirement as the reasons below;

- C Environment is considered to be low cost since it is available everywhere
- It reduces time used in the system development which eliminate the GUI development time. Hence, the reduction could translate to be time-saving which is the direct factor of cost-saving.
- C language has its own memory arrangement and storage identity, therefore, it needs fewer time in order to create the data allocation structure.

CHAPTER 4
RESEARCH

4.1 KNOWLEDGE TRANSFER [16]

A key component to engaging talent is the transference of knowledge from experienced employees to new and developing employees. For this report, knowledge transfer is defined as the process by which information and insight is captured, shared, synthesized and utilized.

Knowledge may also be categorized as explicit or tacit knowledge, such as facts, processes and systems – "how" things are done – is generally documented and more readily transferred. It is difficult to capture tacit or implied knowledge created through personal experience because often, tacit knowledge requires context, which the recipient of this knowledge rarely has access to. This context is the "why" behind the processes or procedures required to get a job done efficiently and effectively. Often tacit knowledge is lost when longtime employees retire or leave UC. With this loss of knowledge comes decreased efficiency coupled with increased error (e.g., lack of familiarity with the application of a policy in practice, standards for exceptions, or ability to follow procedure).

The illustration below provides an example of an approach for capturing and transferring knowledge.

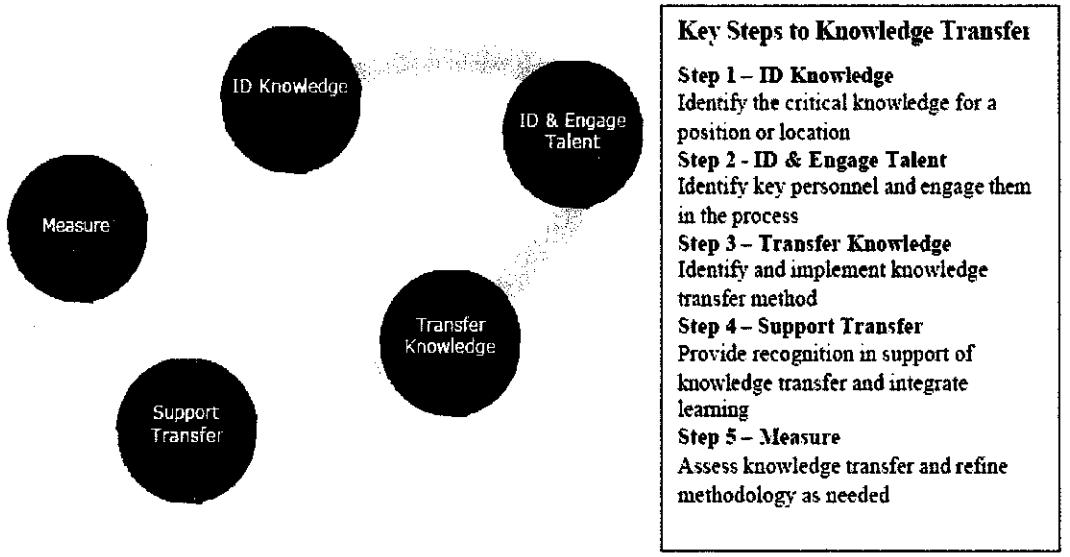


Figure 4.1: Knowledge Transfer

4.1.1 Key Steps to Knowledge Transfer

Step #1 – ID Knowledge

Knowledge transfer begins with a knowledge risk assessment. Ask employees at all levels,

- What knowledge is needed to perform a function successfully?
- What are we at risk of losing?
- What is the most efficient way to capture, articulate and transfer this knowledge?

It is important to note that not all knowledge is worth retaining, for example some knowledge may grow obsolete due to advances in technology or alternatively may be outsourced to experts.

Step #2 – ID and Engage Talent

It is critical to engage personnel in the transfer of knowledge throughout their careers, to capture both macro and micro, and explicit and tacit knowledge. The sharing of knowledge is a circular process beginning with the orientation of new employees continuing through the development of continuing employees concluding with the sharing experience of employees nearing retirement.

At this phase, we should ask who holds the knowledge needed to perform a function successfully, and who needs to receive this information to keep UC functioning properly.

Step #3 – Transfer Knowledge

Knowledge transfer methods range from face-to- face story telling to complex computer systems. However, large and costly programs and systems alone will not transfer knowledge. The most effective method is the informal exchange between people, built on interpersonal relationships and trust. Successful knowledge transfer methods also require leadership commitment, clear goals and measures, adequate resources and support, and recognition and rewards for
achievement. In this phase, it is crucial to recognize diversity as a key component of knowledge transfer.

Step #4 – Support Transfer

In this phase, managers, supervisors and knowledge transfer leaders need to recognize successful knowledge transfer by encouraging and rewarding employees who actively engage in knowledge transfer activities. Leaders must actively communicate the value of knowledge transfer programs and participation

in those programs. Knowledge transfer programs include measures and assessments that are reflected in performance reviews and compensation. Short-term incentives, such as award programs, enhance these larger, organizational efforts.

Step #5 – Measure

This is the follow- up to the process and is necessary to ensure that UC continues to effectively transfer useful and meaningful knowledge. Knowledge recipients and knowledge holders must be held accountable for successes and failures. In this phase, we will need to assess whether knowledge is still relevant and measure the effectiveness of our transfer methodology.

Flexibility in changing knowledge transfer methodologies may be necessary to facilitate diversity and to accommodate differences in learning styles, staff personalities, barriers caused by age, gender, or cultural differences.

4.1.2 Knowledge Transfer Models

Eight knowledge transfer models are presented in this report. Many of the knowledge transfer models presented may be scaled in size to meet the needs of a work group, department, campus or system-wide.

A. Orientation, general and job specific
B. Mentorship, formal and informal
C. Internship
D. Job rotation
E. Staff development model
F. After-action review
G. Communities of practice
H. Phased retirement

Most knowledge transfer models include a form of documentation: knowledge collected and shared in paper or electronic form. Policy records, program files, resource databases, and video archives are a few of the documentation methods used. However, documentation alone does not transfer knowledge from one person to another. Employee engagement is necessary and face-to-face strategies are most effective. Documentation is best used in support of personal interaction.

A. Orientation Model

Description: Orientation programs fall into two basic categories. The first may be characterized as a general orientation, covering mission, organizational structure, site and facilities, health and safety, compensation and benefits, and services and resources. General orientation activities are often conducted by human resource professionals.

The second category of orientation is job specific, addressing roles, responsibilities, expectations, procedures, work environment and providing an introduction to colleagues. Most often the supervisor or manager conducts the job specific orientation.

Purpose: Orientation activities are designed to assist employees in adjusting to their job and work environment. The main objective is to provide information that will help employees understand the context and content of their work so they may perform readily and effectively.

Participants: Orientation activities are offered most often to new employees. However, employees entering new positions, at all levels, could benefit from an orientation. Orientation activities ma y be adapted to meet the unique needs of a diverse workforce.

Structure: Orientation activities vary in length from two hours to several days; participation may be optional or mandatory. Topics covered include –

• Overview of site
• Mission and vision
• Work culture and ethics
• Policies and procedures
• Health and safety
• Benefits, services and resources
• Groups and organizations
• Specific departmental, group or position knowledge and duties

Other orientation resources may include –
• Web channel or page with links to comprehensive resources
• Checklists for supervisors and employees
• Follow- up activities with on-site service providers
• Special events or networking groups to introduce staff to associates
• Mentoring program or "point of contact" (resource person)

Measures: Program measures assess the timing and content of the orientation, clarity and understanding of information presented, and employee satisfaction and performance following the orientation. Generally, feedback is solicited formally through a written or web-based survey.

Costs: Programs costs vary by type and size. One-on-one activities may have no direct cost. Programs at the campus or system-wide levels may have significant costs associated with policy and procedure development, and program implementation and management.

B. Mentorship Model

Description: Mentorship programs are intended to provide a mechanism for the transfer of knowledge from one generation of employees to the next to preserve institutional

memory and to help offer professional development opportunities for both "mentees" and mentors.

Purpose: For *mentees*, the effective mentorship program is intended to reduce individual isolation, enhance career development, improve employee satisfaction, engender an environment of cooperation, aid in the improvement of technical skills, and help to define career paths.

In the case of *mentors*, the program is structured to help build successful teams, identify high potential individuals, improve communication with different levels of the organization, and encourage new and innovative approaches to problem-solving.

At the *organizational level*, the mentorship program is focused on training upcoming mid-level and senior managers, promoting continuous learning throughout the organization, increasing productivity and competency, and helping to tie the organization's purpose and vision to the daily work environment.

Participants: The mentorship program is typically a volunteer program that pairs experienced, senior level staff with junior level career staff who are interested in developing their expertise within their field of specialization and/or expanding their skill set beyond the current position.

Structure: Mentors are identified through a nomination process, while mentees simply apply to participate. Mentees are requested to contact several potential mentors to set up informational interviews. After meeting, the mentees and potential mentors separately submit their ranked matched preferences to a mentorship program committee. The

committee then completes the matching process. If selected for a match, the mentor and mentee work together to establish mutually agreeable terms for the mentorship arrangement.

Measures: To be effective, the rules for participation in the mentorship program should be transparent, simple to follow, extensively communicated, and accessible to a diverse workforce.

There should also be a large pool of mentors available at the outset, representing a wide variety of disciplines throughout the organization so that potential mentees may select the best match. Program goals must be clearly defined and mentor- mentee expectations spelled out. Success will depend on the extent of the support of the senior leadership of the organization, who will provide credibility and resources for the program in general and who, ideally, will participate in the program as mentors. Finally, the successful program should dovetail with the culture of the organization, in particular with those support programs already developed by human resources that identify high potential individuals and nurture their advancement.

Costs: Because the participants and members of the mentorship committee typically volunteer their time, the direct costs are minimal. For a nominal amount, administrative involvement can help support periodic gatherings to generate pairings and conduct follow-up evaluations.

C. Internship Model

Description: Internships and fellowships offer training and experiential learning opportunities. Provided by organizational leaders, volunteer managers or supervisors, and professional trainers, internships and fellowships are typically awarded to high-achieving individuals for a 6- month to 1-year period.

Purpose: The employee experiences career development growth through participation in the program, and the employer gains a talent pool with specialized skills, knowledge, and institutional expertise. Programs can also improve retention of highly performing staff committed to organizational objectives. Further, these programs build a more diverse talent pool of skilled workers better reflecting the local workforce pool.

Participants: Newly hired and career track employees (both academic and staff classifications) at all levels benefit, though programs may target classification transition points such as analyst to manager, or academic to administrative. Particular attention is paid to creating a diverse pool of applicants for positions with underrepresented applicant pools. For ensuring equal employment opportunities, the recruitment pool is enhanced through training, mentoring, orientation, and evaluation of employees identified as high-potential.

Structure: Typical models provide either rotation through positions or orientation. Implementation can be inter-departmental, intra-campus, and inter-campus. Program officers typically identify critical positions, solicit partners, design training components and evaluation, screen applicants, make assignments, identify funding, and assist with back-fill.

Measures:

- Diverse applicant pool
- Increased number of qualified internal applicants
- Promotion of internal staff
- Retention of highly qualified career staff

Costs: Staff salary costs can be paid by hosting locations from existing salary budgets or salary savings. Alternatively, central funds can be provided (either at campus or system wide level) for meeting affirmative action goals and recruiting highly qualified candidates. Local program can have limited cost, or be funded centrally with funding subsidies for departments needing to temporarily replace interns/fellows.

D. Job Rotation Model

Description: Job rotation participants move through a variety of departments and are given assignments and training similar to that given to a new full-time employee. The program operates similar to a medical training rotation program. Administrative units are often designated as "host" departments. Some programs "hold" the participant's career position for them during training, others require the participant to resign from their position to participate. In the later case, the expectation is that the participant will apply and be accepted for a higher- level position when the training is complete.

Purpose: To effectively transfer corporate knowledge from one generation to another and to develop existing staff in a way that allows them to move upward in the organization. Specific objectives include:

- Providing a developmental experience for the participant, enhancing his/her existing skills to a level that will support upward mobility.
- Expanding the participant's professional perspective by providing exposure to the policies, procedures, and protocols of a variety of administrative offices.
- Providing participants with an understanding of the purpose, functions and skill sets of the host department.
- Allowing the host manager and staff to develop a professional working relationship with the participant in order to enhance future professional interaction.
- Assessing the participant's skill level, technique and potential for upward mobility.

Structure: Typical models are one- to two-year full- time programs in which participants leave their existing positions to engage in the training opportunity. However, a similar rotational concept can be applied in a less formal way, providing "cross-training" within or between departments. Based on the resources of a host department, one or more participants are assigned to the unit for a designated period (often 3 months) and are given training and participate in departmental activities/assignments. Participants often "shadow" managers and/or senior staff

members to gain exposure to the issues and protocols effective in carrying out departmental responsibilities. Participant performance is reviewed frequently to make the learning experience valuable and to identify strengths and weaknesses.

Measures: Participant gain understanding of administrative functions through the perspective of the host unit and knowledge is effectively transferred from one generation to another. Other measures of success include, but are not limited to:

- An increased number of qualified candidates for higher- level positions
- Retention of talented career staff
- Increased morale/commitment to the organization

Cost: Participant salaries and benefits may be assumed by a central administrative office in a formal job rotation program. However, informal rotation programs can be set up where each unit is responsible for the salary and benefits of its participant. Other expenses should be limited and can be absorbed by the host units.

E. Staff Development Model

Description: Investing in a workforce that will enhance skills, knowledge, abilities, creativity, and productivity through professional development opportunities that improve individual and organizational performance.

Purpose: Maintenance of a well- trained workforce, increased customer service, increased employee satisfaction and retention.

Participants: Staff development should be available to all employees at all levels. Additionally, certain training should be structured for entering new employees, continuing employees, and employees that provide specialized services.

Structure: Staff development in itself is very broad; organizations should tailor programs and training to meet their own needs. However, typical staff development models should include training to:

- Help employees adjust to new work environments.
- Provide knowledge of appropriate policies and procedures.
- Support and encourage skill development by providing training opportunities in computer applications, leadership, teambuilding, or writing.
- Improve interpersonal and communication skills between managers and employees.
- Promote networking, good employee relations, and employee retention, by sponsoring programs that lead to greater job satisfaction, promotional, and leadership opportunities.
- Enhance the quality of work life.

Measures: Staff development measures may include, but are not limited to, employee satisfaction measurements, employee retention numbers, number of job changes, turnover rates, training hours and dollars devoted to staff, reduction in hiring costs, and return on employee investment.

Costs: The costs of a development program may vary depending upon the scope of the program. The cost can be provided at a campus level or at a System-wide level, devoting resources to a Training and Development Department, plus supplies and expenses to sustain such a program. Local departmental programs can devote a percentage of their total budget per FTE.

These costs will generally be offset by increases in moral, productivity, employee startup costs, etc.

F. After-Action Review Model

Description: An after-action review is a professional discussion of an event, focused on performance standards, enabling team members to discover what happened, why it happened, and how to sustain strengths and improve weakness in performance. After-action reviews are not intended to critique performance of any one individual, but rather to identify trends and patterns inhibiting the success of a team.

Purpose: To capture both explicit and tacit knowledge and provide a greater context for that knowledge.

Participants: After-action reviews can be used at all levels of the organization by all employees.

Structure: This framework can be formally established or may happen informally. To hold an after-action review a team should:

- Review the unit or team mission or objective for the project
- Establish the "ground truth" of what transpired by means of recap of critical events.
- Explore what might have caused the actual results by focusing on one or more key issues.
- Give the unit or team the opportunity to reflect on what it should learn from the review, including what they did well, what they wish to continue into the future, and what they need to improve.
- Conclude with a preview of the next mission or project and what issues might arise.
- Document the review so that the knowledge gained can be used as a tool, imbedded into current processes, or retained for historical reference.

Measures:

- Increased quality, usefulness, and effectiveness of documented procedures
- Decrease in repetitive errors

Costs: Programs costs may vary by type and size, however an effective After Action Review will have little cost other than time. If this approach is used correctly, project managers and supervisors may build these meetings into their project plans or their processes.

G. Communities of Practice

Description: Communities of Practice are groups of people who come together to share and learn from one another face-to-face and virtually. They are held together by a common interest in a body of knowledge and are driven by a desire and need to share problems, experiences, insights, templates, tools and best practices. Communities of practice are exceptionally effective when formed by employees and structured around strategic goals.

Purpose: To capture and share tacit knowledge.

Participants: Communities of Practice may be implemented in a variety of ways. They may be informal groups networking together or may be forma lized groups with shared accountability and goals.

Structure: This framework may be formally established or may happen informally.

Informal Community Structure;

• Review the organization by questioning longtime employees to determine the existence of informal communities.

• Upon discovering informal group, determine whether the group's goals align with organizational strategies and goals.

• Seek employee within the group to be the leader and to serve as the liaison between executive leadership and the group.
• Assign executive sponsor to filter knowledge and provide support and broad leadership for group.

Formal Community Structure;

• Look for areas in the organization which would benefit from interaction, for example health care facilitators, employee assistance professionals, benefits officers, Education Abroad site directors, executive vice chancellors, etc.
• Identify a leader from within the group. This person must have a strong excitement for the topic and must be willing to commit to the success of the group.
• Organize a face-to- face meeting to foster relationships and build the community.
• Publicize the existence and accomplishments of the community to inform other employees and groups.
• As the community begins to capture knowledge, design a repository to store the community's knowledge so it may be disseminated across the organization. An information repository may be a knowledge base, shared web space, etc.

Measures: The effectiveness of a community can be measured once it has had time to establish itself. General measures of success include an increase in awareness and documented knowledge around the community's theme.

Costs: An effective community will have some startup costs. These costs will vary depending upon size and scope. The most expensive step is the face-to-face meetings.

H. Phased Retirement Model

Description: Phased retirement is a work option that provides employees at or nearing retirement with a transition from full- time to work to full- time retirement.

Purpose: To enable employers to retain the services of highly skilled, highly motivated employees who are at or nearing retirement. These are employees who are looking for meaningful work, flexible schedules, reduced hours, and in some cases, additional time to save for retirement and receive needed medical plan coverage.

Participants: Employees with critical skills who are at or nearing retirement. Formal phased retirement programs in existence today are typically found in state and local governmental agencies and higher education. A 2001 survey of universities found that 27% have formal phased retirement programs for tenured faculty (Refer to January 2006 study, "Phased Retirement: Who Opts for It and Toward What End?" http://assets.aarp.org/rgcenter/econ/2006_01_retire.pdf).

Structure: Formal retirement programs are generally for a specific period of time; e.g., one to three years. The percentage of time worked may vary. Salary is pro-rated based on the percentage of time worked. The treatment of pension and benefits varies. Eligibility is not guaranteed and is typically based on a number of criteria. Examples include:

- The employee has unique and unduplicated knowledge, competencies and leadership qualities;
- The phased retirement option is practical and workable for the position and work plan that is developed;
- The department is financially able to afford it; and
- The proposed work plan incorporates mentoring and training of new employees.

Measures: The value of a phased retirement program may be assessed by conducting a cost-benefit analysis, comparing the cost to retain an employee with the cost to recruit, hire and train a new employee.

Cost: Costs vary. In addition to salary and benefits, there is the cost to administer the program. There may be an incentive to encourage participation such as a "phased retirement supplement".

4.2 About ANN Algorithm

How many learning types categorized by ANN Algorithm?

[4] There are three major learning paradigms, each corresponding to a particular abstract learning task. These are supervised learning, unsupervised learning and reinforcement learning. Usually any given type of network architecture can be employed in any of those tasks.

Supervised learning

(We have chosen this paradigm to implement the project Phase 2)

In supervised learning, we are given a set of example pairs and the aim is to find a function f in the allowed class of functions that matches the examples. In other words, we wish to infer the mapping implied by the data; the cost function is related to the mismatch between our mapping and the data and it implicitly contains prior knowledge about the problem domain.

Unsupervised learning

In unsupervised learning we are given some data x, and the cost function to be minimized can be any function of the data x and the network's output, f.

The cost function is dependent on the task (what we are trying to model) and our a priori assumptions (the implicit properties of our model, its parameters and the observed variables).

Reinforcement learning

In reinforcement learning, data x is usually not given, but generated by an agent's interactions with the environment. At each point in time t, the agent performs an action

yt and the environment generates an observation xt and an instantaneous cost ct, according to some (usually unknown) dynamics. The aim is to discover a policy for selecting actions that minimizes some measure of a long-term cost, i.e. the expected cumulative cost. The environment's dynamics and the long-term cost for each policy are usually unknown, but can be estimated.

What are the steps needed in order to implement Supervised Learning of ANN?

The reason to choose Supervised Learning is mainly because it is the same model with the learning process in work life since there are working level and supervision level. The model that we have chosen is named "McCulloch and Pitts";

[17] In 1943 Warren S. McCulloch, a neuroscientist, and Walter Pitts, a logician, published "A logical calculus of the ideas immanent in nervous activity" in the Bulletin of Mathematical Biophysics 5:115-133. In this paper McCulloch and Pitts tried to understand how the brain could produce highly complex patterns by using many basic cells that are connected together. These basic brain cells are called neurons, and McCulloch and Pitts gave a highly simplified model of a neuron in their paper. The McCulloch and Pitts model of a neuron, which we will call an MCP neuron for short, has made an important contribution to the development of artificial neural networks -- which model key features of biological neurons. This model requires the steps as below;

The steps involved in Supervised learning are;

1. Initiation
   : It is when you need to collect data for all variables to fit in the Formula leading to Output.
2. Activation
   : It is the way to adjust the process in order to have the expected set of Outputs. There are four Activation functions which are;

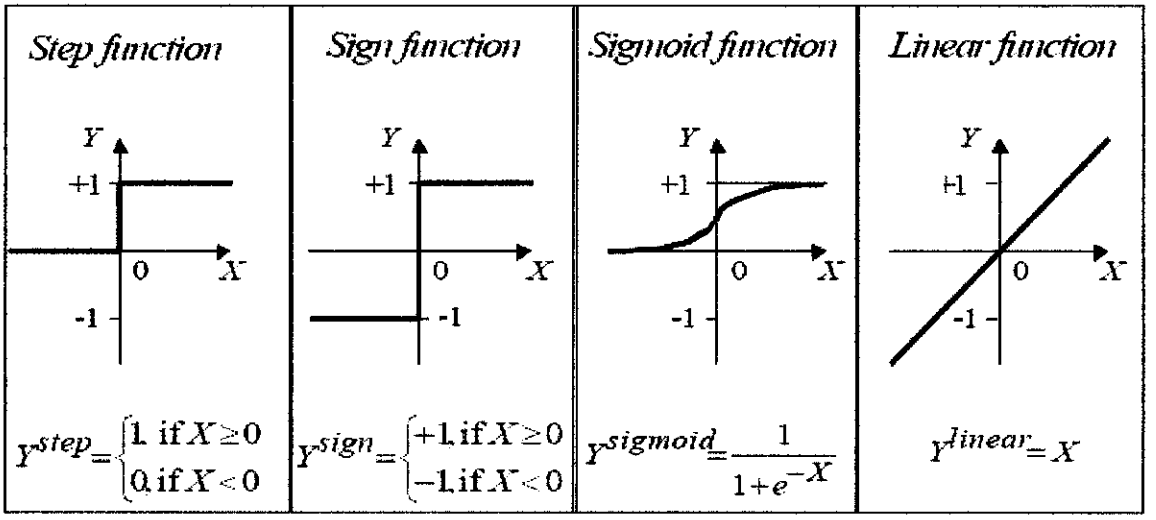


Figure 4.1 : Activation functions (X= ∑ xiwi - Θ)

What does each activation function means?

1.) STEP Function

: The Step function is to calculated the inputs in order to get the single outcome from two possibilities either 1 or 0.

RECOMMENDATION:

This function may fit well with the system that requires the outcome action to be YES/NO rather than the system that requires various possibilities.

2.) SIGN Function

: The Sign function is almost the same concept with the Step activation function which calculate the inputs in order to get the single outcome from two possibilities either 1 or -1.

RECOMMENDATION:

This function may fit well with the system that requires the options to be an outcome. It is basically represents the equity of the answers.

3.) SIGMOID Function

: The Sigmoid function is the multi-valued function which requires additional inputs as well as the accuracy of the weight applied in the formula. The outcome from this activation function is in the range between 0 and 1.

RECOMMENDATION:

This function is well fit with the system that requires various possibilities of outcome as well as it is a supportive function for external factors which might affect the outcome. The result may finally converted into pointed-value or percentage. However, this function is quite sensitive in terms of the accuracy of the input-values' assignments.

4.) **LINEAR Function**

: The Linear function is also the multi-valued function and it is able to provide the unlimited outcome means that the value of the result is infinite.

RECOMMENDATION:

This activation function is fit with the system that does not require considering the external factors but the internal and related inputs only.

Hence, among the four, we have chosen LINEAR Function since the outcome is varied infinitely and adjustable to fit the requirement which is to produce the outcome in percentage. It leads to the more realistic more suitable for the client requirement.

3. Calculate the outcome

: Is the output **Y (Activation Function)** from **$X= \sum xiwi - \Theta$**. The value is mainly depended on the activation function that has been applied.

CHAPTER 5

PHASE DEVELOPMENT

[redacted]

SAMPLE QUESTIONNAIRES

The questionnaires are very important in order to extract the useful data from the staffs which will represent the Social Network Nodes later on when we do Knowledge Mapping. As well as some other related information with the jobs natures in order to identify the information that each node is holding.

Therefore, questionnaires need to be well-planed by combining the information from Theories , Job analysis , company expectations and applied from some templates available which were proved likely to gain accuracy of response.

Here is the sample of Questionnaires concerning in this project;

[redacted][18]
PROTON PARTS CENTRE SDN. BHD. Proton Parts Centre Sdn. Bhd. is inviting dynamic and result-oriented candidates with working experience to join us for the following position:- Position : **Executive Maintenance** No. of positions : One (1) Qualification : Degree in Electrical or Mechanical Engineering Experience : Three (3) Years

Work activities include:

- Designing maintenance strategies, procedures and methods including the designing of historical record for equipments;
- Planning and scheduling planned and unplanned preventative maintenance works;
- Diagnosing breakdown problems;
- Directing, instructing and supervising maintenance technicians and fitters;
- To monitor works carried out by external contractors;
- Arranging specialist procurement of fixtures, fittings or components;
- Controlling maintenance tools, stores and equipment;
- Monitoring and controlling the maintenance of the physical plant systems and facilities;
- Good team leadership, verbal and written communication skills.

i.) QUESTIONNAIRES

Name .....

Position .....

- How many years have your work with the organization?

.....

- What are your daily activities?

.....1.....

.....2.....

.....3.....

.....4.....

.....5.....

- Who are the person(s) you need to report to? Please state the relationship

No.	Name	Relationship	Activities

- Who are your subordinates or person(s) needs to report to you? Please state the relationship

No.	Name	Relationship	Activities

- Who are the person(s) you need to contact with further than mentioned? Please state the relationship

No.	Name	Relationship	Activities

- To Diagnose breakdown problems, what are the documents needs to prepared? And where are the references of those documents?

.....1.....

.....2.....

.....3.....

.....4.....

- What are the critical things in order to perform your job? Based on your point of view

.....1.....

.....2.....

.....3.....

.....4.....

.....5.....

- What are the things that need to be improved in order to reach the higher performance of an organization? Based on your opinion

.....1.....

.....2.....

.....3.....

.....4.....

.....5.....

- What are the things/skills do you need in order to reach your best performance in this job?

.....1.....

.....2.....

.....3.....

.....4.....

.....5.....

[redacted]

ii.) SET OF QUESTIONS (PRE/POST TEST)

HALLIBURTON
TECHNICAL EXCELLENCE CENTRE
UNIVERSITI TEKNOLOGI PETRONAS

Question No. 1

QUESTION: What can you pick out the special words that give clues to the operation?

1. Addition and Multiplication
2. Substraction and division
3. All of above
4. None of above

Question No. 2

QUESTION: Given a word problem I can:

1. highlight the situation sentence and separate it from the question sentences
2. highlight the situation sentence and separate it from the situation sentences
3. highlight the situation sentence and merge it to the question sentences
4. highlight the situation sentence and merge it to the situation sentences

Question No. 3

QUESTION: Given a word problem, I can _____ the question sentence so that makes more sense (make it into a real question).

1. re-say
2. rewrite
3. repeat
4. re-ask

Question No. 4

QUESTION: I am comfortable putting _____ of information in a WHM chart.

1. enough
2. small amount
3. no
4. lots

Question No. 5

QUESTION: I can redraw a wellbore diagram and label _____ the information I need to solve my problem.

1. all
2. none of
3. only
4. some of

Question No. 6

QUESTION: Which one is the correct statement?

1. I can multiply by a conversion constant and its units and cancel the units so that I know my answer makes sense
2. I can cancel a conversion constant and its units and multiply by the units so that I know my answer makes sense
3. I can substract by a conversion constant and its units and cancel the units so that I know my answer makes sense
4. I can cancel a conversion constant and its units and substract by the units so that I know my answer makes sense

Question No. 7

QUESTION: I can construct a problem solving tree to help me _____ the many things to do in a problem.

1. answer
2. find
3. organize
4. list

Question No. 8

QUESTION: I can combine below problem solving strategies to help me figure out what needs to be done and to do it.

1. writing things in my own words, making problem solving trees

2. drawing schematics, WHM chart
3. All of above
4. None of above

Question No. 9

QUESTION: I know the different problem solving strategies and look forward to experimenting with them _____.

1. to define my company style
2. to copy my company style
3. to replicate my co-worker style
4. to create my own style

For Question No. 10

QUESTION: I can use _____ strategy to replace the goal-driven problem solving

1. Sprint technique
2. Top-down stand
3. Bottom-up stand
4. All of above

SYSTEM DEVELOPMENT

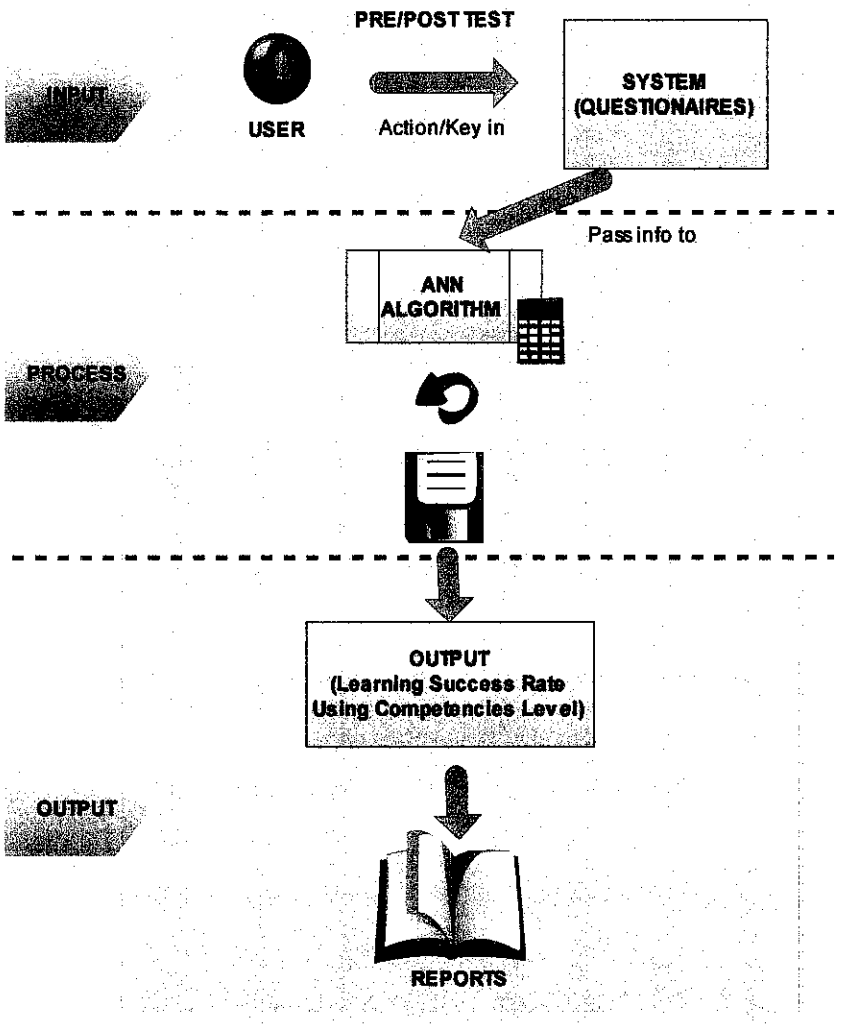


Figure 5.1: System flow

1.) The system flow is going to start with the Pre-Test and Post-Test assessments that require the input from the users or the training students in this project.

2.) The values that have been entered by the users is going to fulfill the requirements of ANN Algorithm. Hence, the process of calculating will begin.

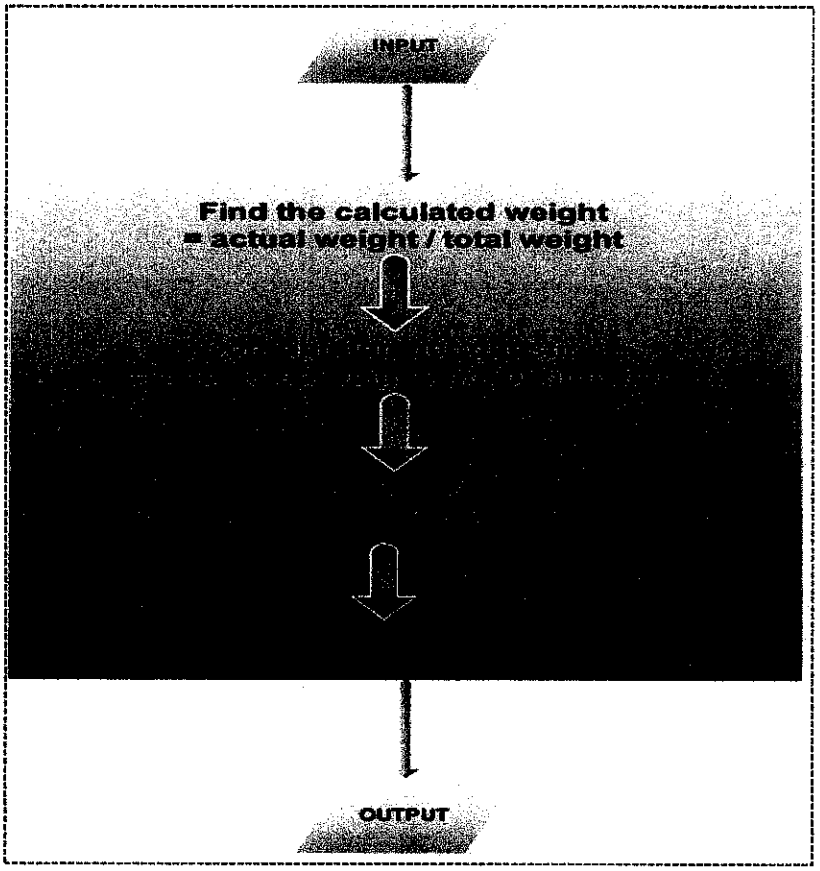


Figure 5.2: Inside ANN Algorithm

$$Y^{\text{Linear}} = \sum xiwi - \Theta$$

Y = Output from the calculation

Xi = Knowledge assessed from each expert which calculated from the On-line Questionnaires

Wi = The assigned value according to the importance or contribution required from each personal

Θ = The value assigned to the possibility of External factor that might effect the performance of the project

3.) The results after calculation of ANN Algorithm is going to be displayed in the form of reports using percentage to be the identifier.

CHAPTER 6
RESULTS AND DISCUSSION

6.1 PHASES' OUTCOMES

After we have implemented with Proton Sdn Bhd as a collaborator, the outcome is as below;

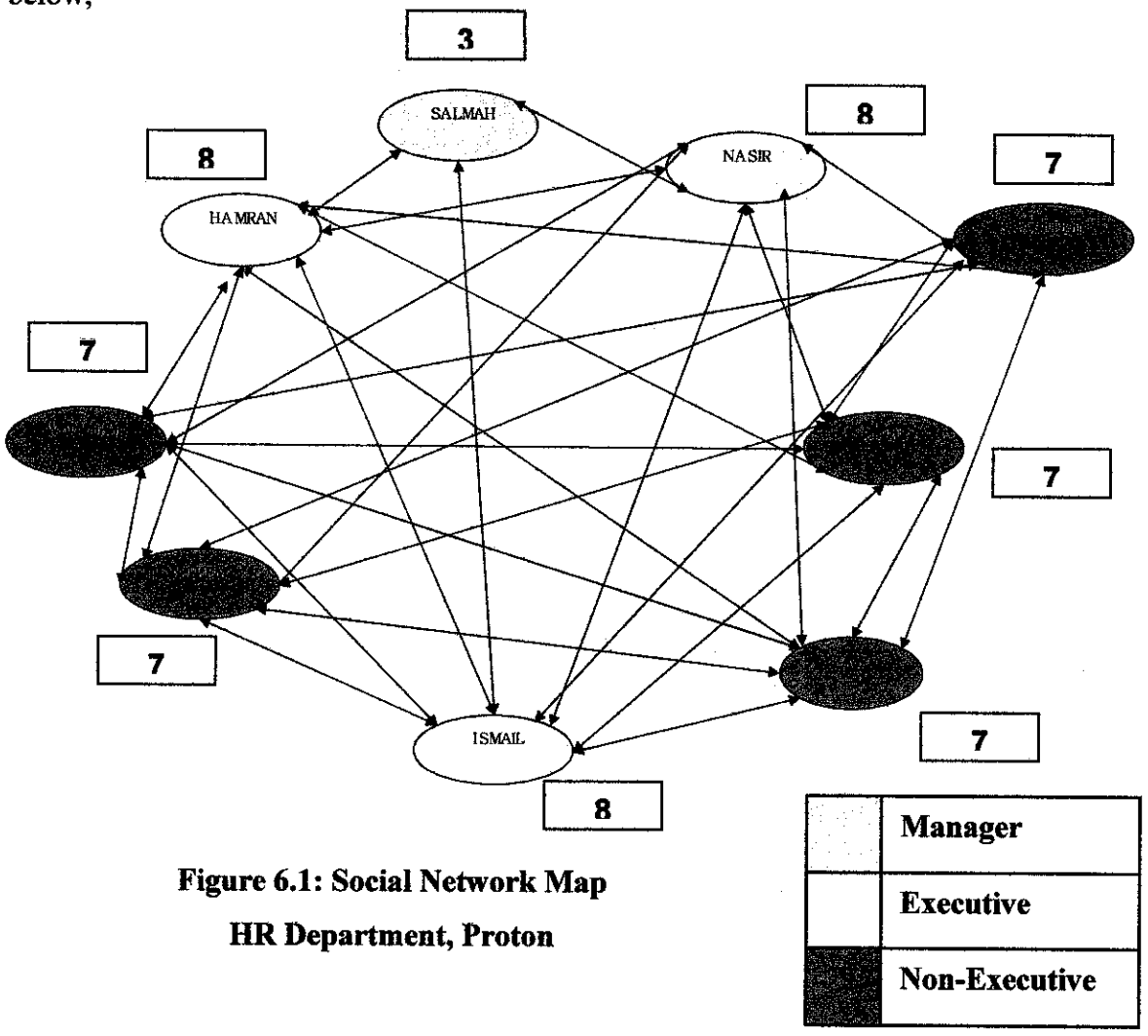


Figure 6.1: Social Network Map
HR Department, Proton

From the map, we shall see the internal department Social Network Map from how these people are connected. The numbers in the boxes showing the crucial level of that person to the communication or we could say the level of impaction that those people could affect the overall connections.

In order to relate to the Phase 2, we might be able to re-arrange the mapping according to the level of Knowledge distribution as below;

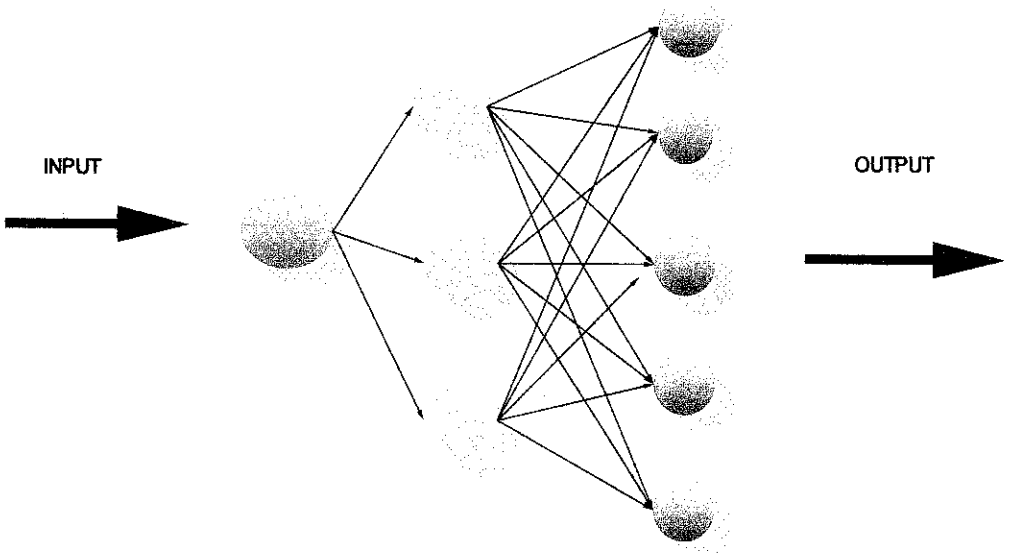


Figure 6.2: Internal Knowledge Mapping

Then we have also captured the external (inter-department) relationship as well which will sample by the executive level as the outcome as below;

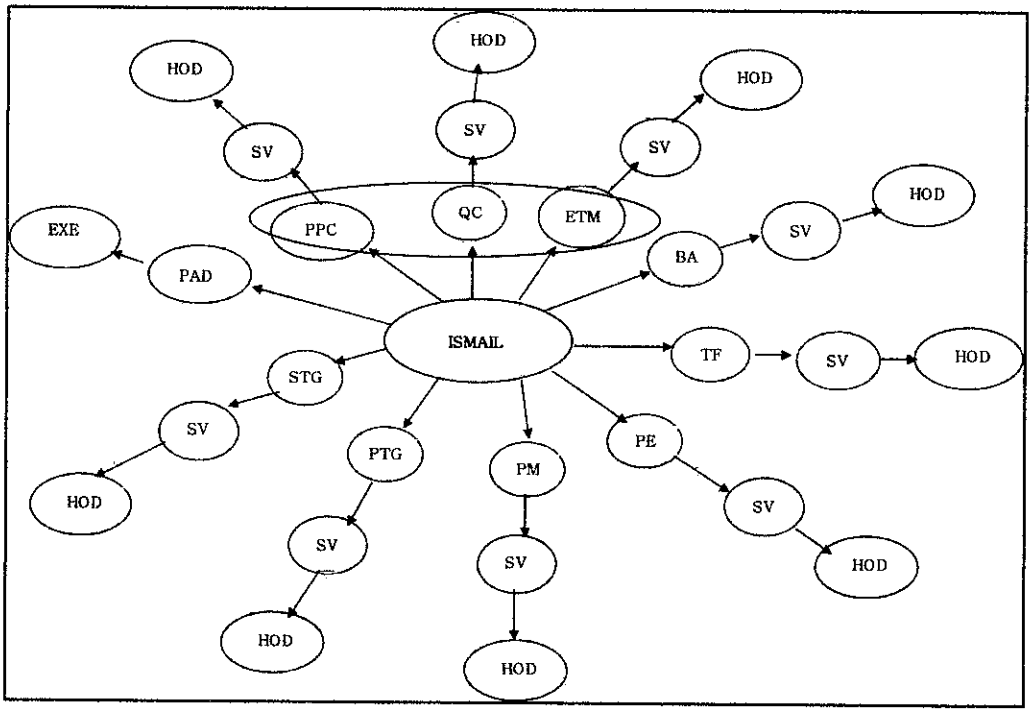


Figure 6.3: ISMAIL external Network

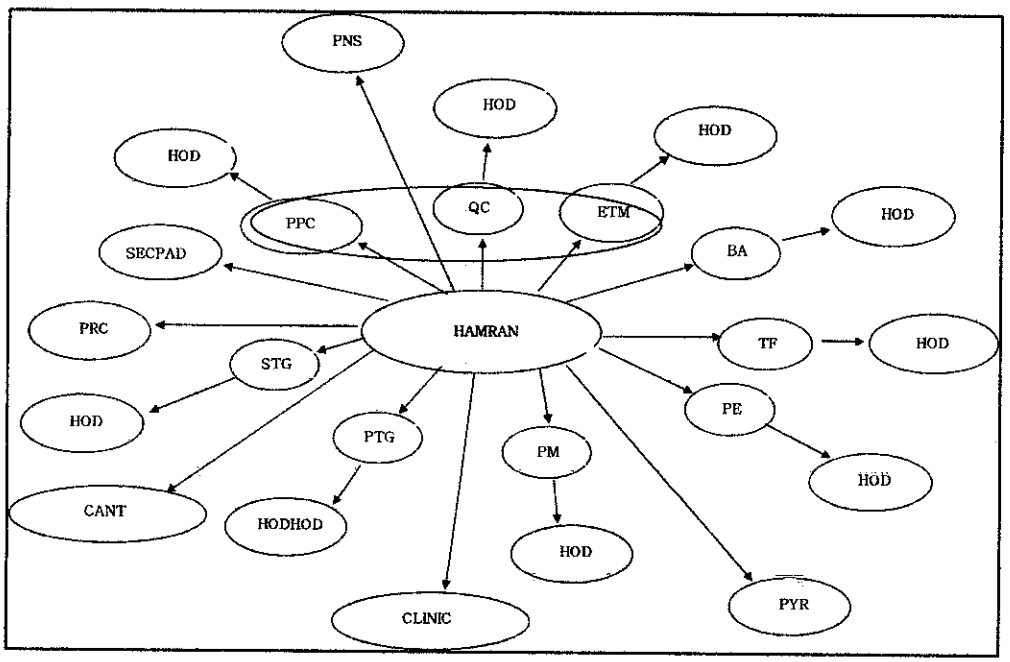


Figure 6.4: HAMRAN external Network

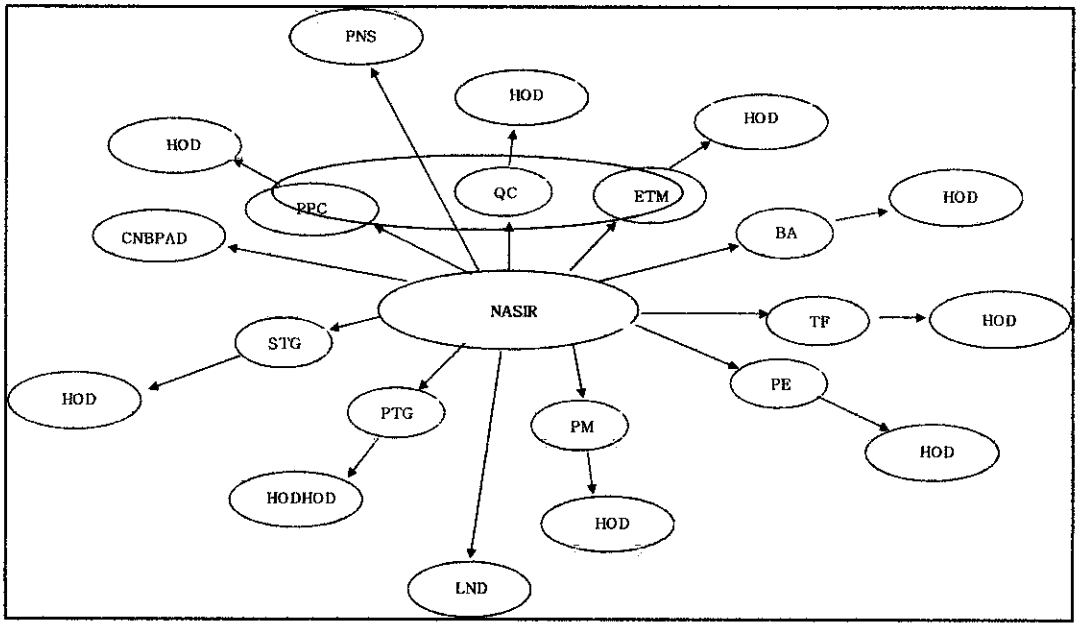


Figure 6.5: NASIR external Network

From the outcomes we shall see that three of them have the shared information distribution paths which are PPC, QC and ETM. Hence, we shall map out the Knowledge distribution path as below;

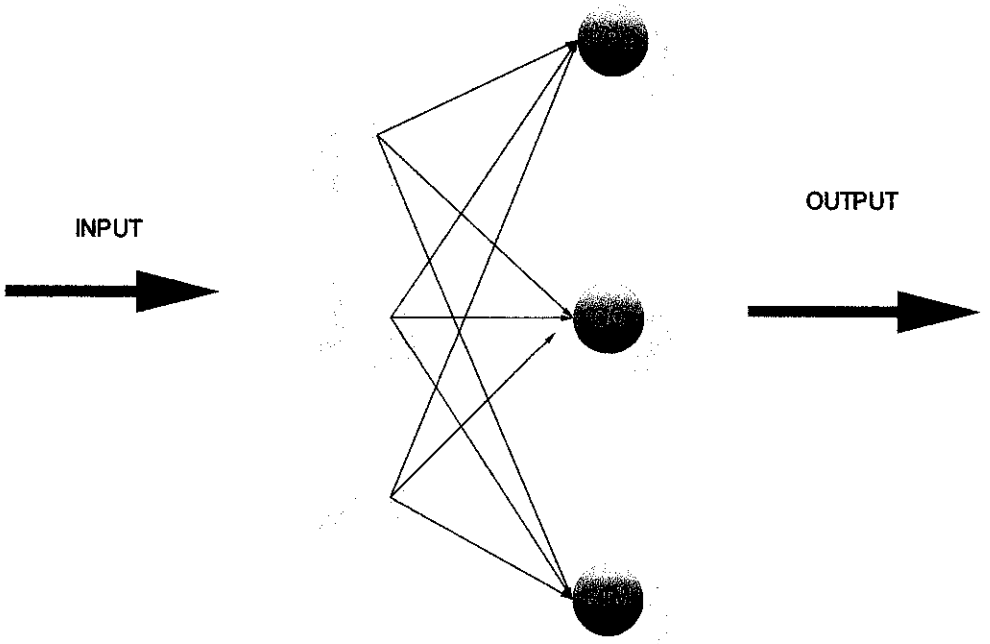


Figure 6.6: External Knowledge Mapping

[redacted]

SYSTEM

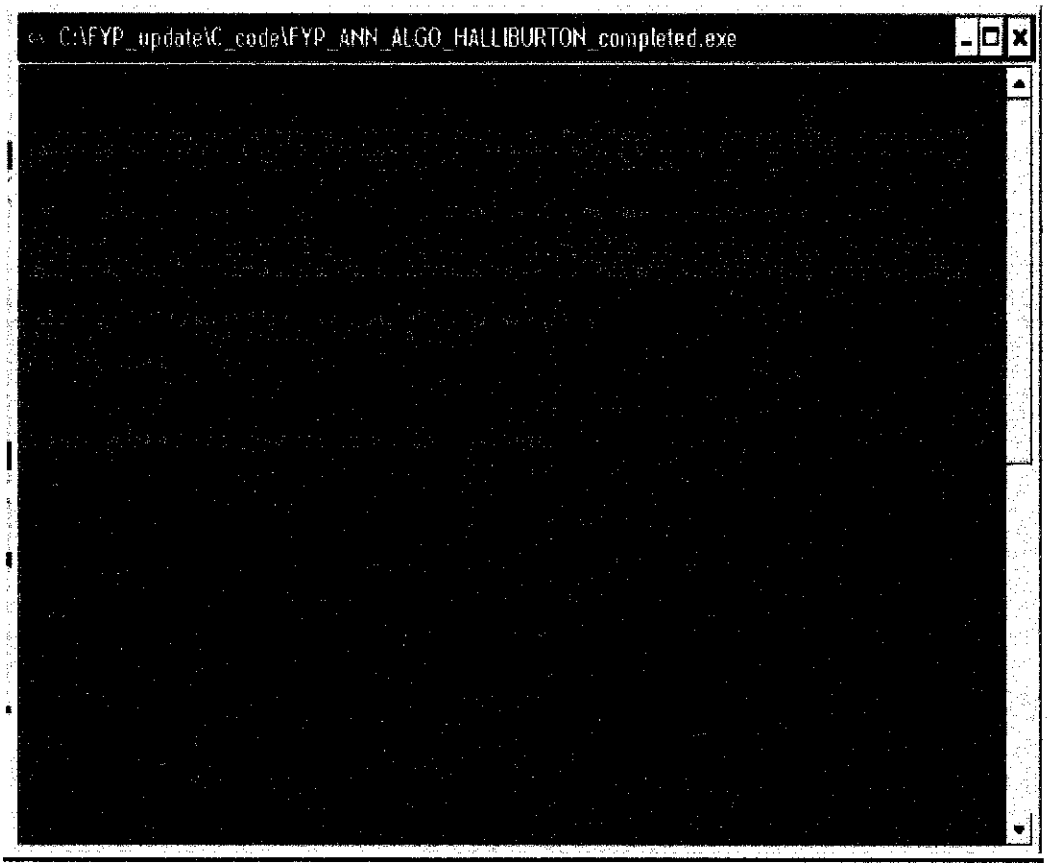


Figure 6.7: Tailor-made system for Halliburton

ASSESSMENT RESULTS

USER TESTING

The assessment has implemented with Halliburton Technical Excellence Centre training students;

Number of students: 5

Duration: 2 weeks training (April 01 – 14 , 2008)

Number of questions: 10

Weights level:

4	**Manager**
3	**Engineer**
2	**Technician**
1	**Ordinary worker**

Condition: Confidential of Information Policy Applied

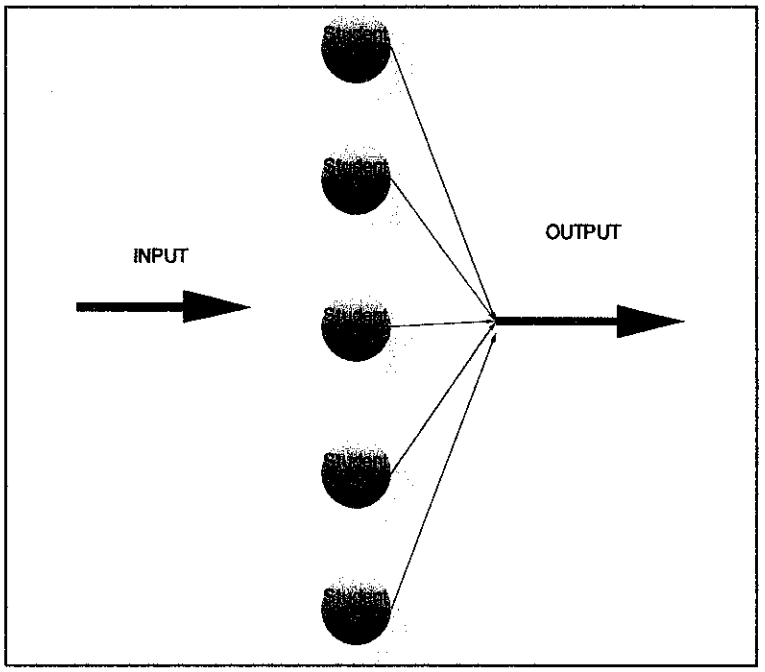


Figure 6.8: Halliburton Training Map

Result:

S	=	**Student No.**
Pre	=	**Pre-Test**
Post	=	**Post-Test**
Q	=	**Question**
0	=	**Incorrect answer**
1	=	**Correct answer**

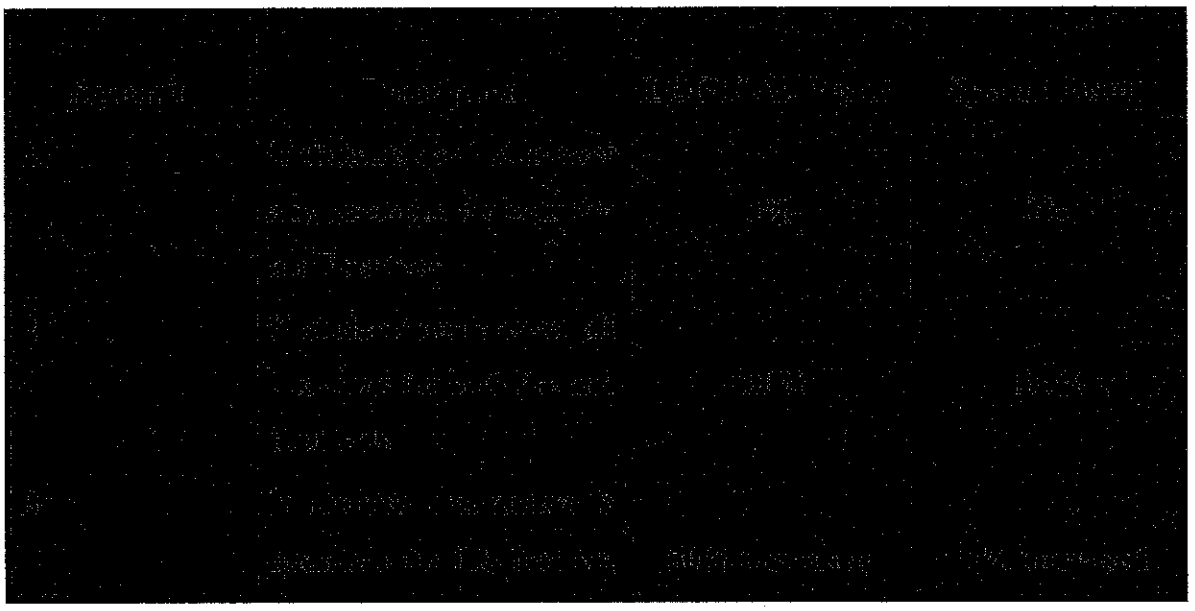
Students / Assess-ments	
Q1	
Q2	
Q3	
Q4	
Q5	
Q6	
Q7	
Q8	
Q9	
Q10	
Weight	
Compe-tencies (%)	

Pre-Test (%)	
Post-Test (%)	
Compe-Tency (%)	

TABLE 6.1 : Halliburton System Testing Results

Consistency Requirement Testing

We have implemented the LOGICAL TESTING in order to proof against the CONSISTENCY attribute of client requirement.



CONCLUSION	**Since the system could be able to deliver the same results as the logical values.** **Hence, this system is able to appreciate the Consistency system attribute.**

TABLE 6.2 : Logical Testing

6.2 PROBLEMS FOUND

Along the way in implementing this Project, I have faced the two key problems which have affected the planning and Timeline of the Project which are as explained below;

6.2.1 Confidentiality of Information

Since this project is Implementation of Knowledge Assessment in Oil and Gas company. My target clients are all oil and gas operations.

I have conducted two meetings with Halliburton Technical Excellence Centre at UTP. By this, there is an appreciable respond from Mr Shan B. Appudurai , Manager of the centre. However, there was the concern about Information Confidentiality regulations of the company which no employees are allowed to violate or disburse those information.

In turns, Knowledge Assessment activities need the detailed information in order to map out the most accurate result consequence for future use. That is the reason that the Knowledge Assessment team will mostly created from within the organization itself.

6.2.2 Availability of resources

The resources that I am going to mention in this section are Vocal people, Time and manpower. The following information are the problems regarding these three constraints;

- Vocal people

To assess any companies, the most important thing is the cooperation from the vocal people. Vocal people in the targeted companies are the key group of people who will deliver the fact further than some other documents available in the organization.

However, Vocal people themselves have their own daily schedules which need to be understood by the Knowledge Assessment implementer, and to be applied the project schedule in order to fit the availability of those people.

In Malaysia during this time, it is Festival season therefore, many long holidays and official leaves of Vocal person leads the schedule of this project to be reconsidered.

- Time

As to assess people especially the working people who does not have much time since they need to complete their daily jobs. The Knowledge Assessment implementer needs to be the one who provide time in order to watch, observe and catch up the available time of assessing group.

The project needs the real location of site, and most of the targeted sites are in Kuala Lumpur while my university is in Seri Iskandar. It is difficult to have the continuity contacts with the sites. As the result, I need to rescheduling to assist the changing Semester Calendar ,to be able to proceed at the sites.

CHAPTER 7
CONCLUSION AND RECOMMENDATION

This project is the next step of Knowledge Management Assessment which is increasingly realized to be importance by most organizations everyday. This project has combined the core matter of Knowledge Management such as the Social Network Map and Knowledge Map with the Artificial Neural Network (ANN) Algorithm which has been introduced widely in Engineering process.

As well as the potential capability of this system to catch up with the trend of the market as the statistic has mentioned the willingness of the companies in order to spend for Learning-based project such as Training is about 54% out of all compensations of the companies. Since this project is the "Assessing the outcome of Competencies Level from Learning-based project", it is worth of investing for the sooner market.

In the future, we shall improve the GUI as we realize the market demand for Ease-of-use system as shown.

As well as the expert system which may attached to the Recommendation in the future.

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APPENDICES

APPENDIX 1 : Knowledge Management as a Hot topic

Knowledge Management—Emerging Perspectives

Yes, knowledge management is the hottest subject of the day. The question is: what is this activity called knowledge management, and why is it so important to each and every one of us? The following writings, articles, and links offer some emerging perspectives in response to these questions. As you read on, you can determine whether it all makes any sense or not.

Content

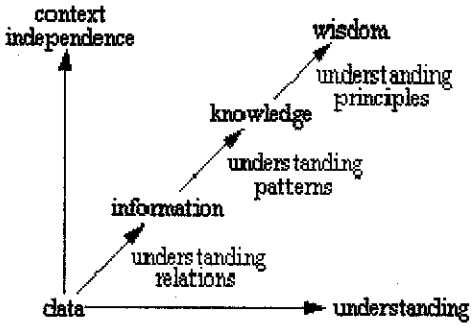
▲Developing a Context

Like water, this rising tide of data can be viewed as an abundant, vital and necessary resource. With enough preparation, we should be able to tap into that reservoir -- and ride the wave -- by utilizing new ways to channel raw data into meaningful information. That information, in turn, can then become the knowledge that leads to wisdom. Les Alberthal[alb95]

Before attempting to address the question of knowledge management, it's probably appropriate to develop some perspective regarding this stuff called knowledge, which there seems to be such a desire to manage, really is. Consider this observation

made by Neil Fleming[fle96] as a basis for thought relating to the following diagram.

- A collection of data is not information.
- A collection of information is not knowledge.
- A collection of knowledge is not wisdom.
- A collection of wisdom is not truth.



The idea is that information, knowledge, and wisdom are more than simply collections. Rather, the whole represents more than the sum of its parts and has a synergy of its own.

We begin with data, which is just a meaningless point in space and time, without reference to either space or time. It is like an event out of context, a letter out of context, a word out of context. The key concept here being "out of context." And, since it is out of context, it is without a meaningful relation to anything else. When we encounter a piece of data, if it gets our attention at all, our first action is usually to attempt to find a way to attribute meaning to it. We do this by associating it with other things. If I see the number 5, I can immediately associate it with cardinal numbers and relate it to being greater than 4 and less than 6, whether this was implied by this particular instance or not. If I see a single word, such as "time," there is a tendency to immediately form associations with previous contexts within which I have found "time" to be meaningful. This might be, "being on time," "a stitch in time saves nine," "time never stops," etc. The implication here is that when there is no context, there is little or no meaning. So, we create context but, more often than not, that context is somewhat akin to conjecture, yet it fabricates meaning.

That a collection of data is not information, as Neil indicated, implies that a collection of data for which there is no relation between the pieces of data is not information. The pieces of data may represent information, yet whether or not it is information depends on the understanding of the one perceiving the data. I would also tend to say that it depends on the knowledge of the interpreter, but I'm probably getting ahead of myself, since I haven't defined knowledge. What I will say at this point is that the extent of my understanding of the collection of data is dependent on the associations I am able to discern within the collection. And, the associations I am able to discern are dependent on all the associations I have ever been able to realize in the past. Information is quite simply an understanding of the relationships between pieces of data, or between pieces of data and other information.

While information entails an understanding of the relations between data, it generally does not provide a foundation for why the data is what it is, nor an indication as to how the data is likely to change over time. Information has a tendency to be relatively static in time and linear in nature. Information is a relationship between data and, quite simply, is what it is, with great dependence on context for its meaning and with little implication for the future.

Beyond relation there is pattern[bat88], where pattern is more than simply a relation of relations. Pattern embodies both a consistency and completeness of relations which, to an extent, creates its own context. Pattern also serves as an Archetype[sen90] with both an implied repeatability and predictability.

When a pattern relation exists amidst the data and information, the pattern has the *potential* to represent knowledge. It only becomes knowledge, however, when one is able to realize and understand the patterns and their implications. The patterns representing knowledge have a tendency to be more self-contextualizing. That is, the pattern tends, to a great extent, to create its own context rather than being context dependent to the same extent that information is. A pattern which represents

knowledge also provides, when the pattern is understood, a high level of reliability or predictability as to how the pattern will evolve over time, for patterns are seldom static. Patterns which represent knowledge have a completeness to them that information simply does not contain.

Wisdom arises when one understands the foundational principles responsible for the patterns representing knowledge being what they are. And wisdom, even more so than knowledge, tends to create its own context. I have a preference for referring to these foundational principles as eternal truths, yet I find people have a tendency to be somewhat uncomfortable with this labeling. These foundational principles are universal and completely context independent. Of course, this last statement is sort of a redundant word game, for if the principle was context dependent, then it couldn't be universally true now could it?

So, in summary the following associations can reasonably be made:

- **Information** relates to description, definition, or perspective (what, who, when, where).
- **Knowledge** comprises strategy, practice, method, or approach (how).
- **Wisdom** embodies principle, insight, moral, or archetype (why).

Now that I have categories I can get hold of, maybe I can figure out what can be managed.

▲An Example

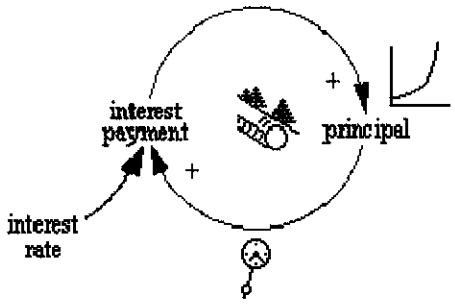
This example uses a bank savings account to show how data, information, knowledge, and wisdom relate to principal, interest rate, and interest.

Data: The numbers 100 or 5%, completely out of context, are just pieces of data. Interest, principal, and interest rate, out of context, are not much more than data as each has multiple meanings which are context dependent.

Information: If I establish a bank savings account as the basis for context, then

interest, principal, and interest rate become meaningful in that context with specific interpretations.

- Principal is the amount of money, $100, in the savings account.
- Interest rate, 5%, is the factor used by the bank to compute interest on the principal.



Knowledge: If I put $100 in my savings account, and the bank pays 5% interest yearly, then at the end of one year the bank will compute the interest of $5 and add it to my principal and I will have $105 in the bank. This pattern represents knowledge, which, when I understand it, allows me to understand how the pattern will evolve over time and the results it will produce. In understanding the pattern, I know, and what I know is knowledge. If I deposit more money in my account, I will earn more interest, while if I withdraw money from my account, I will earn less interest.

Wisdom: Getting wisdom out of this is a bit tricky, and is, in fact, founded in systems principles. The principle is that any action which produces a result which encourages more of the same action produces an emergent characteristic called growth. And, nothing grows forever for sooner or later growth runs into limits.

If one studied all the individual components of this pattern, which represents knowledge, they would never discover the emergent characteristic of growth. Only when the pattern connects, interacts, and evolves over time, does the principle exhibit the characteristic of growth.

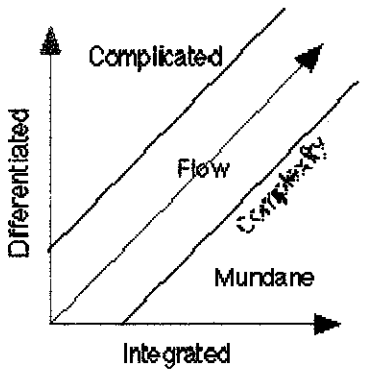
Note: If the mechanics of this diagram are unfamiliar, you can find the basis in Systems Thinking Introduction[bel96] .

Now, if this knowledge is valid, why doesn't everyone simply become rich by

putting money in a savings account and letting it grow? The answer has to do with the fact that the pattern described above is only a small part of a more elaborate pattern which operates over time. People don't get rich because they either don't put money in a savings account in the first place, or when they do, in time, they find things they need or want more than being rich, so they withdraw money. Withdrawing money depletes the principal and subsequently the interest they earn on that principal. Getting into this any deeper is more of a systems thinking exercise than is appropriate to pursue here.

▲A Continuum

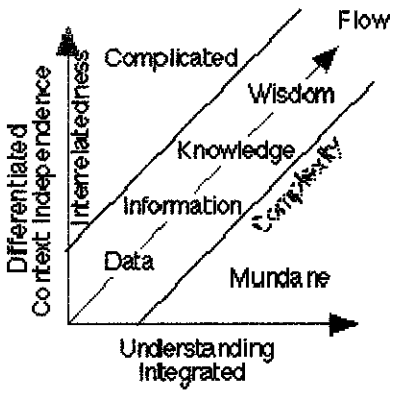
Note that the sequence data -> information -> knowledge -> wisdom represents an emergent continuum. That is, although data is a discrete entity, the progression to information, to knowledge, and finally to wisdom does not occur in discrete stages of development. One progresses along the continuum as one's understanding develops. Everything is relative, and one can have partial understanding of the relations that represent information, partial understanding of the patterns that represent knowledge, and partial understanding of the principles which are the foundation of wisdom. As the partial understanding stage.



▲Extending the Concept

We learn by connecting new information to patterns that we already understand. In doing so, we extend the patterns. So, in my effort to make sense of this continuum, I searched for something to connect it to that already made sense. And, I related it to Csikszentmihalyi's interpretation of complexity.

Csikszentmihalyi[csi94] provides a definition of complexity based on the degree to which something is simultaneously differentiated and integrated. His point is that complexity evolves along a corridor and he provides some very interesting examples as to why complexity evolves. The diagram below indicates that what is



more highly differentiated and integrated is more complex. While high levels of differentiation without integration promote the complicated, that which is highly integrated, without differentiation, produces mundane. And, it should be rather obvious from personal experience that we tend to avoid the complicated and are uninterested in the mundane. The complexity that exists between these two alternatives is the path we generally find most attractive.

On 4/27/05 Robert Lamb commented that Csikszentmihalyi's labeling could be is bit clearer if "Differentiation" was replaced by "Many Components" and "Integration" was replaced by Highly Interconnected." Robert also commented that "Common Sense" might be another label for "Mundane." If the mundane is something we seem to avoid paying attention to then "Common Sense" might often be a very appropriate label. Thanks Robert.

What I found really interesting was the view that resulted when I dropped this diagram on top of the one at the beginning of this article. It seemed that "Integrated" and "Understanding" immediately correlated to each other. There was also a real awareness that "Context Independence" related to "Differentiated." Overall, the continuum of data to wisdom seemed to correlate exactly to Csikszentmihalyi's model of evolving complexity.

I now end up with a perception that wisdom is sort of simplified complexity.

▲Knowledge Management: Bah Humbug!

When I first became interested in knowledge as a concept, and then knowledge management, it was because of the connections I made between my system studies

and the data, information, knowledge, and wisdom descriptions already stated. Saying that I became interested is a bit of an understatement as I'm generally either not interested or obsessed, and seldom anywhere in between. Then, after a couple months I managed to catch myself, with the help of Mike Davidson[dav96], as to the indirection I was pursuing.

I managed to survive the Formula Fifties, the Sensitive Sixties, the Strategic Seventies, and the Excellent Eighties to exist in the Nanosecond Nineties, and for a time I thought I was headed for the Learning Organizational Oh's of the next decade. The misdirection I was caught up in was a focus on Knowledge Management not as a means, but as an end in itself. Yes, knowledge management is important, and I'll address reasons why shortly. But knowledge management should simply be one of many cooperating means to an end, not the end in itself, unless your job turns out to be corporate knowledge management director or chief knowledge officer. I'm quite sure it will come to this, for in some ways we are predictably consistent.

I associate the cause of my indirection with the many companies I have been associated with in the past. These companies had pursued TQM or reengineering, not in support of what they were trying to accomplish, but as ends in themselves because they simply didn't know what they were really trying to accomplish. And, since they didn't know what they were really trying to accomplish, the misdirection was actually a relief, and pursued with a passion&SHY;&SHY;it just didn't get them anywhere in particular.

According to Mike Davidson[dav96], and I agree with him, what's really important is:

- **Mission**: What are we trying to accomplish?
- **Competition**: How do we gain a competitive edge?
- **Performance**: How do we deliver the results?

- **Change**: How do we cope with change?

As such, knowledge management, and everything else for that matter, is important only to the extent that it enhances an organization's ability and capacity to deal with, and develop in, these four dimensions.

▲The Value of Knowledge Management

In an organizational context, data represents facts or values of results, and relations between data and other relations have the capacity to represent information. Patterns of relations of data and information and other patterns have the capacity to represent knowledge. For the representation to be of any utility it must be understood, and when understood the representation is information or knowledge to the one that understands. Yet, what is the real value of information and knowledge, and what does it mean to manage it?

Without associations we have little chance of understanding anything. We understand things based on the associations we are able to discern. If someone says that sales started at $100,000 per quarter and have been rising 20% per quarter for the last four quarters, I am somewhat confident that sales are now about $207,000 per quarter. I am confident because I know what "rising 20% per quarter" means and I can do the math.

Yet, if someone asks what sales are apt to be next quarter, I would have to say, "It depends!" I would have to say this because although I have data and information, I have no knowledge. This is a trap that many fall into, because they don't understand that data doesn't predict trends of data. What predicts trends of data is the activity that is responsible for the data. To be able to estimate the sales for next quarter, I would need information about the competition, market size, extent of market saturation, current backlog, customer satisfaction levels associated with current product delivery, current production capacity, the extent of capacity utilization, and

a whole host of other things. When I was able to amass sufficient data and information to form a complete pattern that I understood, I would have knowledge, and would then be somewhat comfortable estimating the sales for next quarter. Anything less would be just fantasy!

In this example what needs to be managed to create value is the data that defines past results, the data and information associated with the organization, it's market, it's customers, and it's competition, and the patterns which relate all these items to enable a reliable level of predictability of the future.What I would refer to as knowledge management would be the capture, retention, and reuse of the foundation for imparting an understanding of how all these pieces fit together and how to convey them meaningfully to some other person.

The value of Knowledge Management relates directly to the effectiveness[bel97a] with which the managed knowledge enables the members of the organization to deal with today's situations and effectively envision and create their future. Without on-demand access to managed knowledge, every situation is addressed based on what the individual or group brings to the situation with them. With on-demand access to managed knowledge, every situation is addressed with the sum total of everything anyone in the organization has ever learned about a situation of a similar nature. Which approach would you perceive would make a more effective organization?[bel97b]

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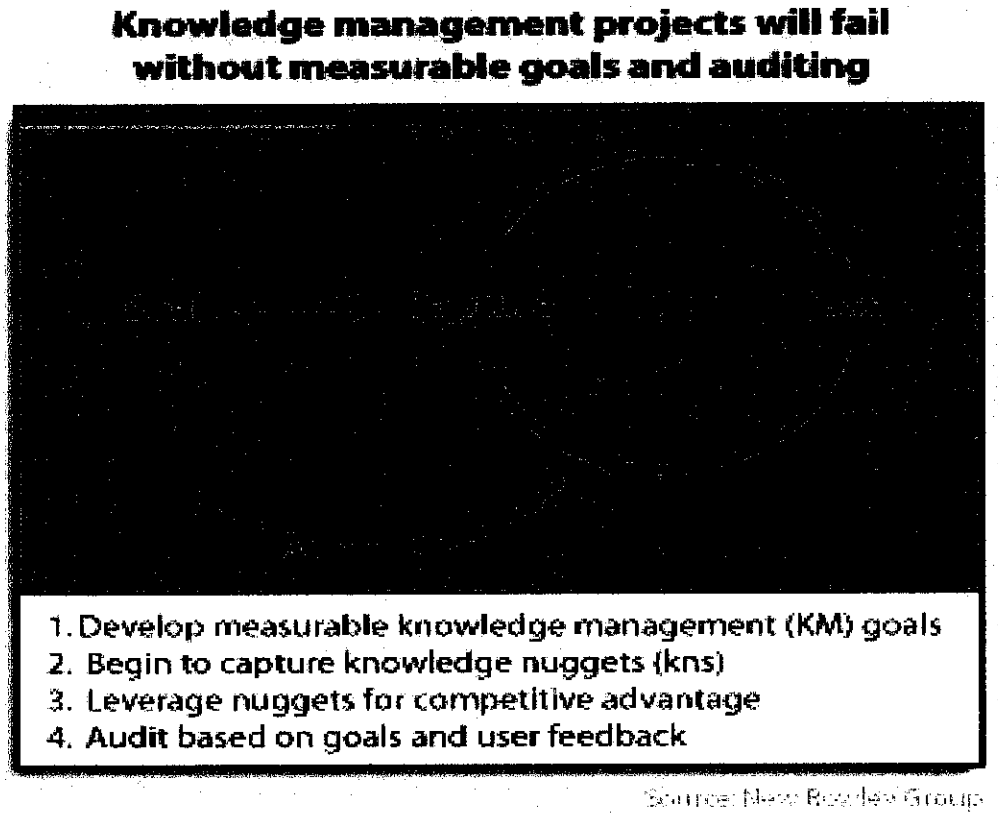
APPENDIX 2 : Knowledge management principles and best practices

Knowledge management principles and best practices

By: Tom Rhinelander, NRG Analyst



Organizations invest in knowledge management (KM) -- the practice and process of identifying, capturing and leveraging organizational knowledge -- for two primary reasons:

- **To improve their competitive advantage.** Knowledge management champions believe that capturing and disseminating critical knowledge will enable employees to make the right decisions quicker, shorten sales cycles, speed up product launches, and create a consistent and high level customer experience.

- **To manage the reality of the job market.** Employees and employers have little loyalty these days. With employees often eager to switch organizations,

employers ready to downsize at the sign of a bad quarter, and an aging population planning to retire soon, the prospect of organizational brain drain is continuous and real. While KM efforts cannot stop these trends, a KM initiative can hopefully mitigate the impact of these job market realities.

Focus on the KM4

The most effective KM systems make useful knowledge readily accessible to employees. The process and technology behind a KM project will differ by organization, but the same basic four principles will apply.

1. **Develop measurable project goals.** No project should get the green light unless the KM team can highlight business goals that are expected to be achieved. A project may eventually deliver more than promised, but it must, at the very least, create a core justification for its existence. This justification will not only drive initial budgets, but it will form the backbone for creating incentives for knowledge nugget (kn) contribution and create the metrics required for project auditing.

2. **Create effective capture processes.** The KM capture process must be user-friendly and mandatory. If the process is onerous, cumbersome, or unintuitive, users will avoid adding nuggets, add the bare minimum required, or simply fill up the KM database with substandard or unreliable kn data. While a voluntary or incentive-laden system sounds appealing, the reality is that participation must be mandatory; otherwise, employees will find valid and not so valid reasons for avoiding inputing nuggets.

3. **Enable intuitive and integrated knowledge access.** The KM database will store the nuggets, but the KM team should ensure that users are not limited to simply querying a database. While a central KM database (or knowledge base) will

serve as the knowledge repository, the nuggets should be farmed out to a variety of systems and documents using automated technologies to ensure that the latest and most useful information is made available to users. Employees should gains access to kns that are integrated into CRM systems, queried through a KM database tool, and presented in various portals, FAQs, and email newsletters.

4. **Audit the KM project.** Did the project meet the goal? Has it delivered more benefits than initially planned? Auditing of a KM project can use hard, soft, or a combination of both types of metrics. Surveying users is also critical. KM auditors should remember that the silent majority -- those that don't tend to fill out forms or send in surveys -- are most likely the group that can make or break the value of the KM initiative, so multiple efforts to solicit feedback should be pursued. For example, each nugget could provide a feedback form when directly accessed through the KM database ("Was this nugget helpful?"). In addition, the KM team could mail out random monthly surveys on the system, create a KM wiki or other collaborative discussion group, or simply target some employees for face-to-face interviews.

Beyond the 4: Other steps to increase KM success

While there is no shortage of opinion on how best to roll out and improve a KM project, we will highlight some effective to dos:

- **Define a useful kn.** What is a good knowledge nugget? Is it a sentence or a paragraph? Is an attached Word doc OK, or should there be a writeup? Sometimes knowledge takes other forms, such as an employee's business relationships (e.g., social networks, such as LinkedIn). Other times, knowledge seems so obvious that no one thinks it is necessary to write it down. In the KM world, there is also "tacit" knowledge -- something an employee may not even think he or she possess. Then there is the other problem -- overloading a KM database with well-intentioned kn spam. Too much "knowledge noise" will make it hard to surface useful nuggets.

The issue of what is an effective nugget is critical and well worth the time to discuss. For many organizations, effective kns can't be determined until after the first or second round of feedback.

- **Plan on protecting KM databases and limiting external nugget exposure.** Since the organizational knowledge trapped in individuals' heads and departments' collective brains is a competitive advantage, losing control of a KM database -- or even critical kns -- would be a major blunder. Imagine if your competitor had unlimited access to your KM database and could take advantage of your best tips on streamlining a product launch. Just as organizations protect their proprietary product data and customer lists, they need to safeguard KM repositories.

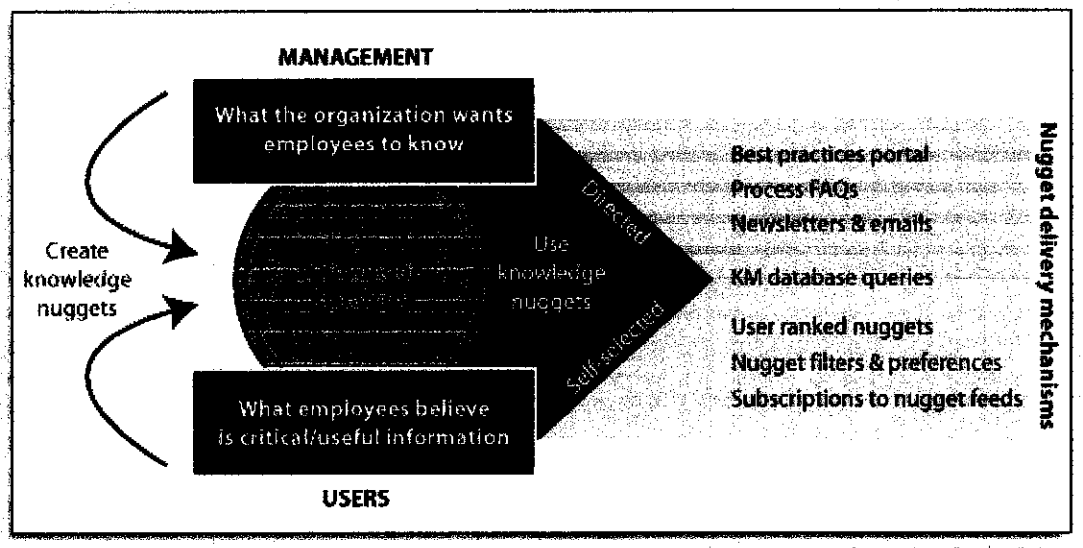
- **Develop and enforce kn entry rules.** As mentioned above, an all-volunteer KM entry process will fail. The KM database will end up populated by numerous entries from a few individuals who sacrifice their work time for nugget entry, while the masses will avoid the system to focus on the myriad near-term obligations of their job. An organization that doesn't want to apply the "stick" doesn't really care about KM and shouldn't invest in a system or, at the very least, expect much in terms of a return on investment.

- **Surface the best nuggets.** Not all nuggets are created equal. KM teams need a way to rate the value of kn entries. Examples of technology in use today include group moderation systems used on blogs and Web communities. For example, at slashdot, users are asked to occasionally rank peer posts, which in turn enables readers to set thresholds for viewing comments. Digg has it own system that allows positively rated stories to rise to the top. Instituting these types of solutions enables the users themselves to determine the most useful nuggets while not precluding executives and KM teams from highlighting their favored kns.

- **Avoid KM technology seduction.** There are plenty of KM tools -- including generic tools that can perform KM duties -- and vendors can paint a very

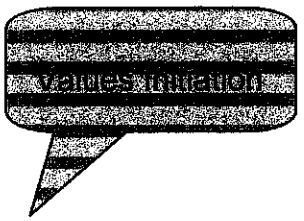
compelling vision of a tool's usefulnesses. However, well-planned KM initiatives can fail because a team or champion becomes too enamored with a certain type of technology, a specific tool, or a particular vendor. When in doubt, teams should rely on a simpler, standards-based technology and grow the solution. A project can begin with no-cost or inexpensive solutions, such as open source blog or wiki software, departmental databases, and existing assets, such as internal Web servers.

Management and users can both promote useful knowledge



APPENDIX 3 : Coding and System functions

CODINGS




```
#include<stdio.h>
#include<conio.h>

int main()

{
 int       student_mark[5]= {0}, weight[5] = {0}, total_weight = 0 , i=0 , total_q_pre = 10, key=0 ,
pre_array_mark[5][30], post_array_mark[5][30];
int       student_mark2[5] = {0}, weight2[5] = {0}, total_weight2 =0, pre_answer[5][30] = {0},
post_answer[5][3] ={0};
 int   count = 0 , count2 = 1, choice2 =0 , performance_int = 0;
int       k = 0 , student_pre_mark = 0, student_total_pre_mark= 0, report_choice =0;
int       student_post_mark = 0 , student_total_post_mark =0;
 int      num = 0, count1 = 0, count_2 = 0, count3 = 0;
 float calculated_weight[5] = {0.0}, contribution_per_q[5]= {0.0}, student_pre_calculated[5] = {0.0};
float calculated_weight2[5] = {0.0}, contribution_per_q2[5] = {0.0}, student_post_calculated[5] =
{0.0};
 float pre_success_rate = 0.0, temp = 0.0, learning_rate =0.0;
float post_success_rate = 0.0 , temp2 = 0.0 , performance = 0.0;
  int   correct_answer[10] = {3,1,2,2,1,2,4,1,4,3};

printf("\n\n\n\n\*************************************************************************
******\n");
printf("*************************************************************************\n
");
printf("*************************************************************************\n
");
 printf("\n\n****  This is the Pre-test of Halliburton Excellence Centre August 2008  ****\n\n");

printf("*************************************************************************\n
");

printf("*************************************************************************\n
");

printf("*************************************************************************\n
");
        // Pre-test set weight and find actual weight


       printf("\n\nThis Set of Questions that you will be assessed\nConsists of 10 questions in
total\n\nAll the Best \n\n");
       //scanf("%d", &total_q_pre);
       printf("\n\n\nPlease press 1 to proceed with the Pre-test\n\n");
       scanf("%d" , &key);

       clrscr();
```

```
// QUESTION SET ----------------------------------------> Set of 10 Questions


for (i=0 ; i < 5; i++)

            { printf("\n\nPlease input the weight of the student no. %d\n\n", i+1);
            scanf("%d", & weight[i]);
            total_weight = weight[i]+ total_weight;

            }

clrscr();

for (i=0 ; i<5; i++)

   { calculated_weight[i] = ((float)weight[i]/total_weight)*100;

  //printf("%f\n\n", calculated_weight[i]);
  }


clrscr();

for (i=0; i<5;i++)

    { contribution_per_q [i] = calculated_weight[i]/total_q_pre ;

  //printf("%f\n\n", contribution_per_q[i]);
  }

// accumulating marks
//clrscr();

for (i=0 ; i<5; i++)
                    {

  printf("\n\nWelcome to the Pre-Assessment\n\nYour ID is %d\n\n", i+1);

  // Question 1  .. answer is 3

     printf("\nFor Question No. 1\n\n\nQUESTION: What can you pick out the special words
that give clues to the operation?\n\n1. Addition and Multiplication\n2. Substraction and division\n3.
All of above\n4. None of above\n\n");
     printf("\n\nPlease key in the correct answer\n\n");
     scanf("%d" ,&pre_answer[i][0]);

     // 3 is the correct answer

     if (pre_answer[i][0] == 3)
     { student_pre_mark =1;
     }
     else
     { student_pre_mark = 0;
     }
      pre_array_mark[i][0] = student_pre_mark;
      student_total_pre_mark = student_total_pre_mark + student_pre_mark;
```

```
clrscr();

// Question 2 .. answer is 2

printf("\nFor Question No. 2\n\n\nQUESTION: Given a word problem I can:\n1. highlight
the situation sentence and separate it from the question sentences\n\n2. highlight the situation
sentence and separate it from the situation sentences\n3. highlight the situation sentence and merge
it to the question sentences\n4. highlight the situation sentence and merge it to the situation
sentences\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][1]);

//assume 2 is the correct answer

if (pre_answer[i][1] == 2)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][1] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
clrscr();

// Question 3 .. answer is 2


printf("\nFor Question No. 3\n\n\nQUESTION: Given a word problem, I can _____
the question sentence so that makes more sense (make it into a real question).\n\n1. re-say\n2.
rewrite\n3. repeat\n4. re-ask\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][2]);

// 2 is the correct answer

if (pre_answer[i][2] == 2)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][2] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
clrscr();


// Question 4 .. answer is 4

printf("\nFor Question No. 4\n\n\nQUESTION: I am comfortable putting _____ of
information in a WHM chart.\n\n1. enough\n2. small amount\n3. no\n4. lots\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][3]);

// 4 is the correct answer
```

```
if (pre_answer[i][3] == 4)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][3] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
clrscr();


// Question 5 .. answer is 3

printf("\nFor Question No. 5\n\n\nQUESTION: I can redraw a wellbore diagram and label
_____ the information I need to solve my problem.\n\n1. all\n2. none of\n3. only\n4. some
of\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][4]);

// 3 is the correct answer

if (pre_answer[i][4] == 3)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][4] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
clrscr();


// Question 6 .. answer is 1

printf("\nFor Question No. 6\n\n\nQUESTION: Which one is the correct statement?\n\n1. I
can multiply by a conversion constant and its units and cancel the units so that I know my answer
makes sense\n2. I can cancel a conversion constant and its units and multiply by the units so that I
know my answer makes sense\n3. I can substract by a conversion constant and its units and cancel
the units so that I know my answer makes sense\n4. I can cancel a conversion constant and its units
and substract by the units so that I know my answer makes sense\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][5]);

//1 is the correct answer

if (pre_answer[i][5] == 1)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][5] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
```

```
clrscr();


// Question 7 .. answer is 3

printf("\nFor Question No. 7\n\n\nQUESTION: I can construct a problem solving tree to
help me _____ the many things to do in a problem.\n\n1. answer\n2. find\n3. organize\n4.
list\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][6]);

//3 is the correct answer

if (pre_answer[i][6] == 3)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][6] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
clrscr();


// Question 8 .. answer is 3

printf("\nFor Question No. 8\n\n\nQUESTION: I can combine below problem solving
strategies to help me figure out what needs to be done and to do it.\n\n1. writing things in my own
words, making problem solving trees\n2. drawing schematics, WHM chart\n3. All of above\n4. None
of above\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][7]);

//3 is the correct answer

if (pre_answer[i][7] == 3)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][7] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
clrscr();


// Question 9 .. answer is 4

printf("\nFor Question No. 9\n\n\nQUESTION: I know the different problem solving
strategies and look forward to experimenting with them _____.\n\n1. to define my company
style\n2. to copy my company style\n3. to replicate my co-worker style\n4. to create my own
style\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][8]);
```

```
//4 is the correct answer

if (pre_answer[i][8] == 4)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][8] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;
clrscr();


// Question 10 .. answer is 3

printf("\nFor Question No. 10\n\n\nQUESTION: I can use _____ strategy to replace the goal-driven problem solving\n\n1. Sprint technique\n2. Top-down stand\n3. Bottom-up stand\n4. All of above\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&pre_answer[i][9]);

// 3 is the correct answer

if (pre_answer[i][9] == 3)

{ student_pre_mark =1;
}
else
{ student_pre_mark = 0;
}
 pre_array_mark[i][9] = student_pre_mark;
 student_total_pre_mark = student_total_pre_mark + student_pre_mark;

student_mark[i] = student_total_pre_mark;
clrscr();



// clrscr();


 //printf("\n\nThis student has got %d\n\n", student_mark[i]);
 student_total_pre_mark = 0;

 }


for(i=0 ; i<5; i++)

{
 student_pre_calculated[i] = (float)student_mark[i] * contribution_per_q[i];

 temp = student_pre_calculated[i];
 // calculate the Pre-test success rate
```

```
  pre_success_rate = pre_success_rate + temp;

}

clrscr();
printf("\n\nThank you very much\n\nYou have completed Pre-Test Assessment\n\n");
printf("\n\n\n\nTo proceed with Post-Test, please kindly key 2 to Start\n\n");
scanf("%d",&key);


//------------------------------------------------------------------------------->POST TEST
 clrscr();

  printf("\n\n\n\n\*******************************************************************
*************\n");

printf("*******************************************************************************\n
");

printf("*******************************************************************************\n
");
    printf("\n\n**** This is the Post-test of Halliburton Excellence Centre August 2008
****\n\n");

printf("*******************************************************************************\n
");

printf("*******************************************************************************\n
");

printf("*******************************************************************************\n
");


   // Post-test set weight and find actual weight

clrscr();
   for (i=0 ; i < 5; i++)
            {
     performance = ((float)student_mark[i]/total_q_pre) *
     performance_int = (int)performance ;

   /*if( performance_int > 50 || performance_int
   { weight2[i] = weight[i] + 1;
   }
   else
   { weight2[i] = weight[i];
   }
      */
      if( performance_int > 80 || performance_int == 80)
   { weight2[i] = weight[i] + 2;
   }
   else if (performance_int > 60 && performance_int < 80)
```

Post Test weight allocation.

The higher the Pre-test
performance, the higher the

impactions towards the team
performance

```
    { weight2[i] = weight[i] + 1;
    }
    else
    { weight2[i] = weight[i];
    }

    total_weight2 = total_weight2 + weight2[i];
//printf("%d\n\n", weight2[i]);
                }


clrscr();

for (i=0 ; i<5; i++)

    { calculated_weight2[i] = ((float)weight2[i]/total_weight2)*100;

  //printf("%f\n\n", calculated_weight2[i]);
  }


// Tell number of questions and find the impact of each personal

printf("\n\nThere are %d questions in this Test\n\n", total_q_pre);


for (i=0; i<5;i++)

    { contribution_per_q2 [i] = calculated_weight2[i]/total_q_pre ;

   //printf("%f\n\n", contribution_per_q2[i]);
  }

// accumulating marks
//clrscr();

/*for (i=0 ; i<5; i++)

    {

  printf("\n\nWelcome to the Post-Assessment\n\nYour ID is %d\n\n", i+1);


  for(k=0 ; k < total_q_pre ; k++)
  {
    {
  printf("\n\nFor Question No. %d\nThe answer is (1 OR 0)\n\n" , k+1);
  scanf("%d", &student_post_mark);

  post_array_mark[i][k] = student_post_mark;

  student_total_post_mark = student_total_post_mark + student_post_mark;

  clrscr();
    }
```

```
}

student_mark2[i] = student_total_post_mark;


// clrscr();


  //printf("\n\nThis student has got %d\n\n", student_mark2[i]);
  student_total_post_mark = 0;

 }
*/

 for (i=0 ; i<5; i++)
                                {

 printf("\n\nWelcome to the Post-Assessment\n\nYour ID is %d\n\n", i+1);

 // Question 1  .. answer is 3

 printf("\nFor Question No. 1\n\n\nQUESTION: What can you pick out the special words
that give clues to the operation?\n\n1. Addition and Multiplication\n2. Substraction and division\n3.
All of above\n4. None of above\n\n");
 printf("\n\nPlease key in the correct answer\n\n");
 scanf("%d" ,&post_answer[i][0]);

 // 3 is the correct answer

 if (post_answer[i][0] == 3)
 { student_post_mark =1;
 }
 else
 { student_post_mark = 0;
 }
  post_array_mark[i][0] = student_post_mark;
  student_total_post_mark = student_total_post_mark + student_post_mark;
 clrscr();

 // Question 2  .. answer is 2

 printf("\nFor Question No. 2\n\n\nQUESTION: Given a word problem I can:\n\n1. highlight
the situation sentence and separate it from the question sentences\n2. highlight the situation
sentence and separate it from the situation sentences\n3. highlight the situation sentence and merge
it to the question sentences\n4. highlight the situation sentence and merge it to the situation
sentences\n\n");
 printf("\n\nPlease key in the correct answer\n\n");
 scanf("%d" ,&post_answer[i][1]);

 //2 is the correct answer

 if (post_answer[i][1] == 2)

 { student_post_mark =1;
 }
 else
```

```
{ student_post_mark = 0;
}
 post_array_mark[i][1] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();

// Question 3 .. answer is 2


printf("\nFor Question No. 3\n\n\nQUESTION: Given a word problem, I can _____
the question sentence so that makes more sense (make it into a real question).\n\n1. re-say\n2.
rewrite\n3. repeat\n4. re-ask\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&post_answer[i][2]);

//2 is the correct answer

if (post_answer[i][2] == 2)

{ student_post_mark =1;
}
else
{ student_post_mark = 0;
}
 post_array_mark[i][2] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();


// Question 4 .. answer is 4

printf("\nFor Question No. 4\n\n\nQUESTION: I am comfortable putting _____ of
information in a WHM chart.\n\n1. enough\n2. small amount\n3. no\n4. lots\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&post_answer[i][3]);

//4 is the correct answer

if (post_answer[i][3] == 4)

{ student_post_mark =1;
}
else
{ student_post_mark = 0;
}
 post_array_mark[i][3] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();


// Question 5 .. answer is 3

printf("\nFor Question No. 5\n\n\nQUESTION: I can redraw a wellbore diagram and label
_____ the information I need to solve my problem.\n\n1. all\n2. none of\n3. only\n4. some
of\n\n");
printf("\n\nPlease key in the correct answer\n\n");
```

```
scanf("%d" ,&post_answer[i][4]);

//3 is the correct answer

if (post_answer[i][4] == 3)

{ student_post_mark =1;
}
else
{ student_post_mark = 0;
}
 post_array_mark[i][4] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();


// Question 6 .. answer is 1

printf("\nFor Question No. 6\n\n\nQUESTION: Which one is the correct statement?\n\n1. I
can multiply by a conversion constant and its units and cancel the units so that I know my answer
makes sense\n2. I can cancel a conversion constant and its units and multiply by the units so that I
know my answer makes sense\n3. I can substract by a conversion constant and its units and cancel
the units so that I know my answer makes sense\n4. I can cancel a conversion constant and its units
and substract by the units so that I know my answer makes sense\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&post_answer[i][5]);

//1 is the correct answer

if (post_answer[i][5] == 1)

{ student_post_mark =1;
}
else
{ student_post_mark = 0;
}
 post_array_mark[i][5] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();


// Question 7 .. answer is 3

printf("\nFor Question No. 7\n\n\nQUESTION: I can construct a problem solving tree to
help me _____ the many things to do in a problem.\n\n1. answer\n2. find\n3. organize\n4.
list\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&post_answer[i][6]);

//3 is the correct answer

if (post_answer[i][6] == 3)

{ student_post_mark =1;
}
else
```

```
{ student_post_mark = 0;
}
 post_array_mark[i][6] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();


// Question 8 .. answer is 3

printf("\nFor Question No. 8\n\n\nQUESTION: I can combine below problem solving strategies to help me figure out what needs to be done and to do it.\n\n1. writing things in my own words, making problem solving trees\n2. drawing schematics, WHM chart\n3. All of above\n4. None of above\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&post_answer[i][7]);

//3 is the correct answer

if (post_answer[i][7] == 3)

{ student_post_mark =1;
}
else
{ student_post_mark = 0;
}
 post_array_mark[i][7] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();


// Question 9 .. answer is 4

printf("\nFor Question No. 9\n\n\nQUESTION: I know the different problem solving strategies and look forward to experimenting with them _____.\n\n1. to define my company style\n2. to copy my company style\n3. to replicate my co-worker style\n4. to create my own style\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&post_answer[i][8]);

// 4 is the correct answer

if (post_answer[i][8] == 4)

{ student_post_mark =1;
}
else
{ student_post_mark = 0;
}
 post_array_mark[i][8] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;
clrscr();


// Question 10 .. answer is 3
```

```
printf("\nFor Question No. 10\n\n\nQUESTION: I can use _____ strategy to replace the goal-driven problem solving\n\n1. Sprint technique\n2. Top-down stand\n3. Bottom-up stand\n4. All of above\n\n");
printf("\n\nPlease key in the correct answer\n\n");
scanf("%d" ,&post_answer[i][9]);

//3 is the correct answer

if (post_answer[i][9] == 3)

{ student_post_mark =1;
}
else
{ student_post_mark = 0;
}
 post_array_mark[i][9] = student_post_mark;
 student_total_post_mark = student_total_post_mark + student_post_mark;

student_mark2[i] = student_total_post_mark;
clrscr();



// clrscr();


 //printf("\n\nThis student has got %d\n\n", student_mark2[i]);
 student_total_post_mark = 0;

 }

for (i=0 ; i<5; i++)

{
 student_post_calculated[i] = student_mark2[i] * contribution_per_q2[i];

 temp2 = student_post_calculated[i];
 // calculate the Pre-test success rate

 post_success_rate = post_success_rate + temp2;
 //printf("\n\n%.2f\n\n",student_post_calculated[i] );
}

clrscr ();
printf("\n\nThank you very much\n\nYou have completed Post-Test Assessment\n\nSee you again\n\n");
```

```
// REPORTS      ----------> At the end of the code


        do {
        //clrscr();
        printf("\n\nPlease select the type of report\n\n 1. For Pre-Test Report\n\n 2. For Post-Test
Report\n\n 3. For Comparison Report\n\n 4. For Recommendation Report\n\n");
        scanf("%d",& report_choice);

       switch(report_choice)
       { case 1:{
        clrscr();

printf("\n\n\**********
***\n");

printf("**********
");

printf("**********
");
     printf("\n\n*****  REPORT ON Pre-test of Halliburton Excellence Centre August 2008
*****\n\n");

printf("**********
");

printf("**********
");

printf("**********
");
       printf("\n\n\nThe Success Rate after the Pre-test Assessment is %.2f %\n\n\n",
pre_success_rate);

       for (i=0 ; i < 5; i++)
       {  printf("\nThe expected contribution from student no. %d is %.2f %", i+1,
calculated_weight[i]);
          printf("\nStudent managed to give the correct answer for %d questions",
student_mark[i]);
          printf("\nCalculated to be Pre-test contribution of %.2f %", student_pre_calculated[i]);
          printf("\n\n                ######                \n\n");
       }
            } break;

         case 2: {clrscr();

printf("\n\n\**********
***\n");

printf("**********
");
```

```
printf("*********************************************************************************\n
");
        printf("\n\n****  REPORT ON Post-test of Halliburton Excellence Centre August 2008
*****\n\n");

printf("*********************************************************************************\n
");

printf("*********************************************************************************\n
");

printf("*********************************************************************************\n
");
        printf("\n\n\nThe Success Rate after the Post-test Assessment is %.2f %\n\n\n",
post_success_rate);

        for (i=0 ; i < 5; i++)
        {  printf("\nThe expected contribution from student no. %d is %.2f %", i+1,
calculated_weight2[i]);
           printf("\nStudent managed to give the correct answer for %d questions",
student_mark2[i]);
           printf("\nCalculated to be Post-test contribution of %.2f %", student_post_calculated[i]);
           printf("\n\n                ######                \n\n");
        }
                                  } break;
          case 3:{ clrscr();

           if (post_success_rate > pre_success_rate)
           { learning_rate = post_success_rate - pre_success_rate;
           }
           else
           {  learning_rate = (-1.00) * (pre_success_rate - post_succes
           }


printf("\n\n\*********************************************
***\n");

printf("*********************************************
");

printf("*********************************************
");
        printf("\n\nREPORT ON Performance Comparison o
2008\n\n");

printf("*********************************************
");

printf("*********************************************************************************\n
");

printf("*********************************************************************************\n
");
        printf("\n\n\nThe Learning Success Rate of this group is %.2f %\n\n\n", learning_rate);
```

```
        if (learning_rate > 0.00)
        {printf("\n\nThis group is considered as success learning group\n\nSince the success rate of
Post-test is higher than Pre-test\n\n\n\n");
        }
        else
        {printf("\n\nThe learning has failed!\n\nSince there is no improvement in learning
process\n\n\n\n");
        }

        printf("\n\nComparison No. 1: The number of correct answer from Pre-test and Post-
test\n\nNumber 1 represents the CORRECT answer\n\nNumber 0 represents the WRONG
answer\n\n");

        for (i=0 ; i < 5; i++)
        {  printf("\n\nStudent No. %d\n\n", i+1);
           for(k=0 ; k < total_q_pre ; k++)
           {
             printf("Question No. %d      Result of Pre-test is  %d      Result of Post-test is %d
\n\n", k+1, pre_array_mark[i][k], post_array_mark[i][k]);

           }
           printf("\n\n                #####                \n\n");
           printf("\n\nEnter 1 to continue\n");
           scanf("%d",&key);
           clrscr();

        }

        printf("\n\nPlease ENTER 1 to view the Comparison No.2\n\n");
        scanf("%d", &key);

        clrscr();
        printf("\n\nComparison No. 2: The weights assigned for Pre-test and Post-test\n\n");

        for (i=0 ; i < 5; i++)
          {printf("\n\nStudent No. %d\n\n", i+1);
           printf("Weight of Pre-test is  %d      Weight of Post-test is %d \n\n", weight[i],
weight2[i]);
           }

        printf("\n\n               #####               \n\n");


        printf("\n\nPlease ENTER 1 to view the Comparison No.3\n\n");
        scanf("%d", &key);

         clrscr();
        printf("\n\nComparison No. 3: The expected contributions for Pre-test and Post-test\n\n");

        for (i=0 ; i < 5; i++)
        {  printf("\n\nStudent No. %d\n\n", i+1);
           printf("Expected contribution of Pre-test is  %.2f\n\nExpected contribution of Post-test is
%.2f \n\n", calculated_weight[i], calculated_weight2[i]);
        }
```

```
        printf("\n\n                #####                \n\n");

        printf("\n\nPlease ENTER 1 to view the Comparison No.4\n\n");
        scanf("%d", &key);

         clrscr();
        printf("\n\nComparison No. 4: The actual contributions for Pre-test and Post-test\n\n");

        for (i=0 ; i < 5; i++)
        {  printf("\n\nStudent No. %d\n\n", i+1);
           printf("Actual contribution of Pre-test is  %.2f\n\nActual contribution of Post-test is %.2f
\n\n", student_pre_calculated[i], student_post_calculated[i]);
        }
           printf("\n\n                #####                \n\n");



                }break;

 case 4:{
         clrscr();

printf("\n\n**********************************************************************************
***\n");

printf("**********************************************************************************\n
");

printf("**********************************************************************************\n
");
       printf("\n\n**  REPORT ON Recommendation of Halliburton Excellence Centre August 2008
**\n\n");

printf("**********************************************************************************\n
");

printf("**********************************************************************************\n
");

printf("**********************************************************************************\n
");

         printf("\n\nSince the Result is as below:\n\n\
        for (i=0 ; i < 5; i++)
        {
          printf("\nStudent No. %d\n\n", i+1);
          printf("\n\t\tPre-test answer\t\tPost-test ans
```

```
          for (k=0 ; k< total_q_pre ; k++)
        {
          //printf("\n\t\tPre-test answer\t\tPost-test answer\tCorrect answer\n\n");
          printf("\n\nQuestion %d:\t%d\t\t\t%d\t\t\t\t%d",k+1, pre_answer[i][k],
post_answer[i][k], correct_answer[k] );
          if (post_array_mark[i][k] == 0)
          {  {
             if(k == 0 || k == 1 || k == 2)
             { count1 = count1 + 1;
               num = 0;
             }
             else if( k== 3 || k==4 || k==5)
             {  count_2 = count_2 + 1;
               num = 1;
             }

                  else
             {  count3 = count3 + 1;
               num = 2;
             }
             }

          switch(num)
          {       case 0: {if(k == 2 && count1 > 1)
                                                printf("\n\n\n\nRECOMMENDED TO: Send for
FOUNDATIONS OF PROBLEM SOLVING course\n\n ");
                  //printf("\n\n              #####              \n\n"); }
                   else {break;}
                                                break;}
                          case 1: {if(k == 5 && count_2 > 1)
                                                printf("\n\n\n\nRECOMMENDED TO: Send for
PROBLEM SOLVING USING SCHEMATICS AND DIAGRAMS course\n\n ");
                  //printf("\n\n              #####              \n\n"); }
                   else {break;}
                                                break;}
             case 2: {if(k == 9 && count3 > 1)
                                                printf("\n\n\n\nRECOMMENDED TO: Send for
ADVANCE PROBLEM SOLVING course\n\n ");
                  //printf("\n\n              #####              \n\n"); }
                   else {break;}
                                                break;}

          }
          }
        }

printf("\n\n\n**********************************************************************
**\n\n\n");
        printf("\n\nPlease ENTER 1 to view the Recommendation for the next student\n\n");
        scanf("%d", &key);

       clrscr();
      }

           } break;
        default: break;
```

```
        }



        //----------------------------------------------------------------------> Repeatition asking for reports


        printf("\n\n\nDo you wish to have another type of reports \n\nType 1 for continue or 0 to
terminate?\n\n");
        scanf("%d", &choice2);

        /*if( choice2 == 'Y' || choice2 == 'y')
        { count =0;
          count2 =0;
          count2 = count +1;
        }

        else
        { count =0;
          count2 =0;
          count2 = count -5;
        }
           */
        clrscr();

        } while ( choice2 != 0 );



getch();
return 0;

}
```