ORGANIZATIONS LEARNING –
THE CASE STUDY OF KNOWLEDGE
FORMATION AND TRANSFORMATION
AMONG IT PROFESSIONALS IN
SINGAPORE ORGANIZATIONS

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Abstract
Knowledge formation and transformation among IT professionals has not received adequate attention in the current studies even though it plays important role in development in both Information Technology and business sectors. Therefore, the exploration of knowledge formation and transformation among IT professionals through empirical study to verify the proposed theoretical framework is useful practically and academically. This study gives the proposed framework a fresh way to understand the learning and sharing processes among IT professionals. In addition, this study also explores influential factors that have impact on knowledge formation and transformation among IT professionals.

Keywords:
Knowledge formation and transformation, Levels of knowledge, Knowledge Management, learning cycle.
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Preface

This report presents the results of a master thesis study, conducted from the 1st March 2010 to the 31st May 2010 in Borås University (Sweden). The purposes of the study are to investigate and present the learning and sharing process that IT professionals, who work in Singapore, experience. The study is the results of literature study to suggest framework which represent steps in learning and sharing process (knowledge formation and transformation) among IT professionals together with the empirical study to verify the framework.

I would like to thank my supervisor Bertil Lind for his support and advice during this master thesis. Additionally, I would like to thank Anders Hjalmarsson for his supportive contribution during progress seminars. I would also like to thank the respondents who accepted the invitation to the interview, and actively answered my questions and contributed to my results.

Do Thi Kim Yen, Christina Chew, Nguyen Ba Quoc An, Wu Tingli, Dhruv Sagar, Vu Thuy Linh, Benny Tan, Kim Thi Nhu Quynh, Nguyen Thi Nhat Anh

Besides, I would like to thank my friend Pham Tran Nhat Huy for his valuable feedback which allowed me to improve the presentation of this report in a more comprehensive manner.

Finally, I would like to thank my classmates for their supports during the progress seminars.
1. Introduction

1.1. Background

In the area of Information Technology expansion, any imaginable piece of information is available on the Internet. Moreover, with the effective search engines, the information seems to be accessible by everyone especially the IT professionals since they have expertise in computers and the Internet; additionally, they are the ones who can make the best use of the Internet. However, using the huge amount of information in the Web is far from perfect (as expectation). The question raised is, how to receive the best benefit from the freely available knowledge in the Internet or from other resources such as books, people, etc.? Moreover, nowadays knowledge has been the most precious property of any organization generally and employees specifically. Therefore, knowledge management plays an essential role in achieving and maintaining the competitiveness of the organizations as well as the competency of employees. Thus, the value of knowledge management should be considered in the relation to effectiveness. In other words, the managed knowledge can enable the employees to deal with this competitive environment. The contemporary researches on knowledge management concern two aspects, namely the management aspect and the technical aspect. The management aspect in knowledge management deals with organizational learning, personal management, cultural, etc (Drucker, et al., 1998). While the technical aspect includes models, support tools and environments (Zhuge, 2002).

In an organizational context, the definition and value of knowledge should be realized and distinguished from data and information. Data stands for facts or values of results, and information represents relations between data and other relations. Then, knowledge is the human’s ability to convert data and information into a certain context. Patterns of relations of data and information and other patterns have the capacity to represent knowledge (www.http://www.systems-thinking.org/dikw/dikw.htm). In addition, with easy access to the Internet, knowledge is fairly distributed to everyone especially IT professionals in the organization because the Internet is an important resource for them. However, they have to deal with two challenges: knowledge drains due to their capability and the gaps in experience when they work together in the team. Knowledge management provides the critical link between the information and technology resource inputs. So, in the organizations, knowledge management critically depends on the active participation and involvement of employees to transform knowledge into organizational effective performance.

This paper investigates the knowledge formation and transformation among IT professionals in organizations such as the steps involved in learning and sharing processes. The main source of knowledge formation considered is the Internet and from other members of the organization. In addition, the study also touches aspects of commitments and motivation when knowledge flows from one member to other members in the organization. The theoretical background is suggested
steps in knowledge formation and transformation among IT professionals; then the empirical study is conducted to verify and revised the framework.

1.2. Research questions

According to C.R Kothari (2004), a research problem “refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same”. Nowadays, the attention in individual learning process has been increasing to enhance the overall organizational learning processes. Nevertheless, there are not so many researchers studying in deep the process of knowledge formation in the organizational culture. In addition, the learning and sharing process among IT professionals in organization have been received little attention.

Based on these initial problematic inquiries, the main research questions emerged to form the basis of an attempt to discover knowledge formation and transformation in the organizations. The research and sub-research questions listed below are derived mainly from practical problem such as the experiences employees have in knowledge formation and transformation. Besides, the empirical study is also based on the theories in learning cycle and then the results are used to revise and verify the suggested learning steps.

How will knowledge formation and transformation activities among IT professionals happen in organizations?

In order to specifically address the current issues in previous studies conceptually and theoretically about knowledge formation and transformation, the following issues will be explored. The author intends to reflect the overall opinions in how the concepts are related in the previous researches.

- What are data, information and knowledge?
- What are the differences between knowledge, data and information?
- What are the steps involved in knowledge formation and transformation among IT professionals?
- What resources IT professionals use to form their knowledge?
- What are the factors that influence the processes of forming and transforming knowledge faced by organizations and IT professionals?

In this study, the learning and sharing with the role of IT professionals and organizations will be analyzed and discussed. The thesis also aims to draw clear distinction between knowledge and information/data so that the processes of knowledge formation and transformation are understood more thoroughly. Knowledge management has been the concern for many organizations which seek to increase effectiveness by enabling the members to deal with business situations and envision future development. Thus, it is essential to have profound
understanding on how knowledge is formed and transferred among IT professionals in organizations. The study consists of steps in learning and sharing processes among IT professionals.

### 1.3. Purpose

With the popularization of computers in society, especially after the birth of the Internet, the amount of information we receive everyday from the Internet or other people is enormous. Thus, the steps in seeking and processing information is crucial in forming useful knowledge especially for IT professionals who are heavily using the Internet as the main resources to carry out their jobs. They increasingly search from the Internet or seek from colleagues whenever the knowledge is acquired in the organizations.

On the other hand, knowledge management has been the topic under many attentions in every organizations or researches as knowledge can be considered as a basis for firm competitive advantage. However, knowledge management comprise of many aspects such as strategies and practices to identify, create, present, distribute and enable the experiences in the organization. In other words, knowledge management is an immense topic to consider. Therefore, in this master thesis, the author has narrowed down the knowledge management field into the learning and sharing process which are two of the most important aspects in knowledge management. In addition, the main actors in the processes are IT professionals in the organizations. Meanwhile, the study also tries to address factors that impact the building and transferring knowledge in the organizations. Additionally, the questions about motivations of knowledge transformation and transfer are answered. In short, the study focuses on three different perspectives: knowledge, learning, sharing in order to improve performance in individual facet.

The purpose of this master thesis is to contribute to the current researches in knowledge management area by presenting the suggested learning model in learning and sharing that minimize the impact of problems faced by IT professionals and organization.

### 1.4. Expected result

This master thesis’s general aim is the contribution to the existing model in knowledge formation and transformation among IT professionals in the organizations considering the Internet and the other IT professionals as the main resources of knowledge. Moreover, the study also suggests a framework representing steps in learning and sharing processes in order to make the best use of knowledge to improve effectiveness. Meanwhile, the motivations and commitments of IT professionals are also studied. This will be achieved by means of the study in knowledge and the distinctions between knowledge and information/data; current studies in knowledge formation and transformation from the enormous resources such as the Internet. This study seeks to develop the theoretical understanding of learning and sharing processes in the context of
organizations among IT professionals in order to solve issues faced by organizations as well as IT professionals.

1.5. **Target group**

The target group directly addressed in this thesis is IT professionals working in organizations whose business nature can be either Information Technology or in which contemporary organizational activities have the information systems as an essential role. In the context of this master thesis, IT professionals are basically the stakeholders in the organization Information System (IS) – stakeholders are the persons who involve and have a stake in the information system project. In other words, stakeholders can be software engineers, designers, IT manager, testers, etc. who participate in the research and development of IS project in the organization (Avison, D., et al., 2006). Additionally, Avison D. (2006) also emphasized that one aspect that must be highly paid attention is that most projects do not fail due to technical problems but “people problem” because we cannot deny the significance of users’ involvement in the information system development process as well as improvements phases. This study seeks to develop the pattern that IT professionals formulate and transform knowledge to facilitate their job. Even though, there are 9 software engineers taking part in the interviews, the master thesis aims to keep the objectives focusing in general IT professionals in context of knowledge formation and transformation. Last but not least, the researchers who are interested in the field of knowledge management or learning cycle are also a important target group of this study. They can use the findings from this research to extend and develop for the future research.

In addition, this report is dedicated to several related audiences such as the author’s examiners, tutor, classmates and others who are interested in the field of knowledge formation and transformation in organizations.

1.6. **Acronym list**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full text</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS</td>
<td>Information System</td>
<td></td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
<td></td>
</tr>
<tr>
<td>KM</td>
<td>Knowledge Management</td>
<td></td>
</tr>
<tr>
<td>MKO</td>
<td>More Knowledgeable Other (MKO, Vygotsky, 1978)</td>
<td></td>
</tr>
<tr>
<td>MSDN</td>
<td>Microsoft Software Developer Network</td>
<td></td>
</tr>
<tr>
<td>MSN</td>
<td>Microsoft Network</td>
<td></td>
</tr>
<tr>
<td>NCS</td>
<td>National Computer System</td>
<td>Name of one organization in Singapore</td>
</tr>
</tbody>
</table>
Table 1: Acronyms list

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>PRM</td>
<td>Plant Resource Management</td>
</tr>
<tr>
<td>PST</td>
<td>Partial Stroke Test</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and development</td>
</tr>
<tr>
<td>www</td>
<td>World Wide Web</td>
</tr>
<tr>
<td>PDA</td>
<td>Personal Digital Assistant</td>
</tr>
<tr>
<td>VS2008</td>
<td>Visual studio 2008</td>
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1.7. Author’s background

The author graduated from Nanyang Technological University (Singapore) with Bachelor in Computer Engineering in June 2007. After her graduation, the author worked as Computer Engineer in Yokogawa Engineering Asia (Singapore) in R&D 1 Department from June 2007 till June 2009. In Yokogawa, she joined the developing team of Plant Resource Management (PRM) which is “Yokogawa's value-added asset management software that integrates and manages maintenance information from field instruments, monitors online conditions, and records historical data” (Yokogawa website, March 2010). During two years working with PRM, she achieved good understanding in the project development life cycle. In addition, she also gained great experiences in collecting data/information, knowledge from resources such as the Internet and other colleagues in order to improve the productivity of her job. That is one of the main inspirations for the author to conduct this master topic because she has already gone through the process of forming and transferring knowledge when she was working as software engineering. Thus, it is the most useful experience for the author to continue with this thesis. In addition, she also has network with other IT professionals in her previous work places and from her classmates in University as target group for the empirical study.

Currently, the author is a master student in Information in Högskolan i Borås. The programme equips her with essential knowledge in research methodology and informatics which is very crucial and practical in the master thesis. For example, the knowledge gained in Human Information Processing and System Development Philosophies are very practical and valuable for the author to go on with this study. Moreover, the author also utilizes the other knowledge taught in Högskolan i Borås to support and have strong arguments for the thesis.
2. Describe the scientific approach

This chapter discusses the scientific approach used in the thesis; the chapter comprises of two sections: scientific perspective and method. Firstly, section 2.1 scientific perspective defines the methodology used in this study as well as what the method to approach the method group is. Secondly, section 2.2 - methods section, describes the methods applied such as data collection, analyzing, evaluation and presentation.

2.1. Scientific perspective

In this thesis, the author uses the creative research type which involves the development of proposed learning model in knowledge formation and transformation. According to Wayne Goddard, et al. (1996) creative research comprises of both practical and theoretical researches – which is exactly how this study is going to be carried out. Firstly, the study is based on theoretical background in order to propose learning steps in knowledge formation and transformation. Then, the study also investigates how the knowledge formation and transformation happens among IT professionals in organization by having interviews with them to find out their experiences in learning cycle. Therefore, a smaller but focused data from interviews with IT professionals will be collected and then the data is analyzed to verify if the proposed models in knowledge formation and transformation are valid. After that, the proposed learning steps are revised using data from qualitative data. This study is motivated by the inspiration in the processes of learning and sharing among IT professionals and the role of the actors in these processes – as well as the involved commitments and motivations.

First of all, the author identifies the current theories and studies in the knowledge formation and transformation among IT professionals in the organizations. Then, this thesis is about the discovery and creation of new models in both knowledge formation and transformation in organization among IT professionals. The practical aspect of this study is the development of processes in knowledge formation and transformation. However, in creative research, there is much less structured and cannot always be preplanned – which can lead to changes of plan. Despite of that, the author tries to develop a comprehensive scientific approach applied including the methods in data collection, analyzing, evaluation and presentation. Moreover, all modifications related to research methodology used will be updated in this report.

The author will conduct a preliminary literature study to give the readers a feeling for the subject area and to create an understanding of how the proposed study will fit into the existing researches. After the preliminary study, the author will provide suggestions on how solutions of this research can be useful in the further research. In addition, the preliminary literature study also helps the author to avoid approaches which do not work. It is vital to find out what other researchers have discovered in the field of knowledge formation and transformation generally and the existing models particularly. Therefore, the study commences with literature study on
different aspects of the topics such as: definition of knowledge and distinction between knowledge and information/data, current researches on knowledge formation and transformation focusing on IT professionals using the Internet as the main resources, motivation in knowledge formation and sharing, and the discovered models in the above processes.

Secondly, the author will carry out full literature study, which will be described in chapter 3 to get more comprehensive acquaintance which will provide strong background for the proposed results. The author then develops a theoretical framework describing how knowledge is formed and transformed among IT professionals (learning cycle model). The theoretical validation of the framework requires the theoretical development of knowledge that author studies from previous researches. The proposed model, representing steps in learning and sharing processes among IT professionals, provides a platform for individuals to improve effectiveness and efficacy when they are working. The full literature study will be done before the empirical study so that the results of the study can be verified and revised to be ready for using.

Finally, this thesis collects and analyzes qualitative data from the respondents – IT professionals. The results obtained from an empirical study will be used to validate the proposed theoretical framework which can be applied in the organizations. The author attempts to fulfill the objectives mentioned earlier within the scope of this study. The details of data collection methods will be described in section 2.2.1. Additionally, data analyzing, evaluation and presenting methods will be discussed in section 2.2.2, 2.2.3, 2.2.4 correspondingly.

2.2. Methods

2.2.1. Data collection methods

After the research problem is defined, the task of data collection begin. In any research, data collection is an important task because inaccurate data collection can lead to invalid result. There are two approaches in data collections namely: theoretical background and empirical study.

Firstly, the theoretical study is built using various theoretical backgrounds from various sources such as books, journals, research papers, the Internet, etc. Since the knowledge management topic has been studied by many researchers, there are various types of references for building theoretical backgrounds that support this master thesis. Basically, the author gives the readers the feel of subject area by quoting the contemporary studies in definitions of data, information, knowledge; the relations among them; the processes of knowledge formation and transformation; the factors influence these processes; and motivations of knowledge learners. Based on that, the author starts building the suggested framework in knowledge formation and transformation. Additionally, the author also builds the theoretical backgrounds from comments giving by her supervisors. Chapter 3 discusses the theoretical backgrounds from contemporary researches and suggested framework in knowledge formation and transformation.
Secondly, in the empirical study, this master thesis applies qualitative data collection method; the primary data collection method consists of structured interviews which will be conducted geographical remote. Interviewees are selected from IT professionals working in Singaporean organizations. They are working as software engineers, system designers, system analysts, testers in software and information system development. They have declared themselves willing to participate in the interviews. Because the interviews will be carried over geographic remote, the author decides to use the Internet as the main media to conduct them. This may cause lack of personal interactions between the author and the interviewees. Therefore, the author tries to accomplish the interviews which involve the usage of a set of predetermined questions, sometimes the structured interview can be known as “questions and answers session”. The author prepares a set of interview questions and arranges time to interview respondents through MSN or Yahoo. In addition, the author also sends emails to the respondents to clarify any doubts in their answers. The purpose of the interviews is to understand how IT professionals form their knowledge to support their job which involving in Information System. Kvale (1996) describes the qualitative research interview as an “attempt to understand the world from the subject’s point of view, to unfold the meaning of peoples’ experiences, to uncover their lived world”. In addition, from the interviews the author verifies how IT professionals transform knowledge within and beyond the organizations’ boundary; the commitments and motivation of knowledge sharing will also be collected. One assumption made is that the perspective of the participants is “meaningful, knowable and able to be made explicit” (Patton, 2002).

2.2.2. Analyzing methods

The collected data is processed and analyzed in accordance with the purpose of this master thesis which is very crucial for scientific study to ensure that the data is relevant for making contemplated comparisons and analysis.

Before collecting data, a proposed framework in learning and sharing is presented with 7 steps involved, and then the qualitative data can be used to verify and revised proposed framework. At first, the data will be processed through editing, classifying so that the data can be analyzed. The raw data from interviews is careful scrutinized to make sure that data are accurate and consistent with the theoretical facts. After all interviews are completed, the author transcribes the interviews into written forms. In addition, if part of data is inappropriate or missing, the author tries to obtain more appropriate information by contacting the respondents to make clarifications. In addition, in the processing of editing data, the author is neutral in determining the correct answer or response by viewing the answers from different angles. Then, the author uses coding technique to interpret data; she reads and demarcates segments within data. Each segment is considered as a “code” which shows the associate between data and the studied topic – learning and sharing steps. Sometimes analysis is difficult because “the responses are neither systematic nor standardized” (Michael, 2002). Thus, the author expects to encounter some problem in the interview such as “Don’t know” responses. Therefore, when she comes across such responses; if
they are small then they have insignificant impact on the final result; if they are relatively big, it becomes the major concern when data is processed. There are two possibilities for “Don’t know” answers: the respondents do not actually know the answer or the author does not give appropriate question to obtain information. In the latter case, the “Don’t know” responses are likely due to the failure in interviewing process. In order to avoid that, the interview questions has been carefully selected and related to the results found in the theoretical study. In any situations of un-avoided “Don’t know” responses, the author keeps in touch with respondents to clarify by using easier-to-understand questions.

During analyzing data, the author seeks for patterns of relationship or differences that exist in the collected data. Therefore, the discovered relationships or differences are used to support the proposed model in knowledge formation and transformation to determine “with what validity data can be said to indicate any conclusions” (C.R Kothari, 2004). The processed data is analyzed in order to verify and revise if the proposed models are appropriate for IT professionals in the organization in terms of knowledge formation and transformation. In addition, the motivation and commitment obtained from interviews are also viewed together with the proposed theoretical framework. The aim of the data analysis is to revise proposed models to come up better one. In addition, the data analysis also discovers motivations in knowledge formations and knowledge transformation among IT professionals in organizations. The challenge in analyzing data is to present the responses from participants in a cogent fashion that serves the purpose of answering the research questions. Through the analysis, author also makes some conclusions in the discussion session.

2.2.3. Evaluating methods

In the evaluating process, the author carefully interprets the data in order to reach confirmation that underlines her findings. The author draws “inferences from the collected fact after an analytical study” (C.R Kothari, 2004) which is very important to find out if the findings in this master thesis lies in proper interpretation and if it will be useful in the future. Through evaluation, the author can connect her findings to other researches; propose for further studies; and make others to appreciate the significant findings in her study.

In order to keep objectivity of this research, the author makes sure that she obtains the rigorous and systematic data collection procedures such as cross-checking and cross-validation sources during data collection and analyzing (Michael Q, 2002). Michael Q. (2002, p. 549) also mentioned the common dimensions that received the greatest attention in judging evaluation research proposals namely validity, reliability, measurability and generalizability.

Creswell and Miller (2000) suggest that the validity of a research is affected by the researcher’s perception of validity and the choice of paradigm assumption. Therefore, in this study, the author evaluates validity of the research by strong analysis with comprehensible support from the collected data to the theoretical framework.
Secondly, in evaluating reliability of this research, the author makes sure that high consistency and accuracy of the results and conclusion through repeatedly revising the data.

Thirdly, the author evaluates this research by measuring the levels of acceptable results in order to judge if it has sufficient contribution to the subject area. The measurability is done by checking if the conclusions cover all items listed in research questions and sub-questions.

Fourthly, the author also evaluates the generalizability by assessing the ability to generalize findings to wider groups and circumstances.

Additionally, the author also uses multiple perspectives from collected data in her analysis in order to create strong evidence for her findings and discover the unknown cases.

Section 5.3 will discuss in detail evaluation method used in this study.

2.2.4. Presenting methods

Firstly, the literature review is presented in written form together with summarized table; for instance, the definition of data, information and knowledge are presented in a table which gives the readers the feeling of subject area. Secondly, the author represents the suggested models in both written and model forms. Graphs will be given to support the proposed models in knowledge formation and transformation among IT professionals. After having the processed and analyzed data, it is important to appropriately present the information in different ways to serve the initial purpose of the study. Since the collected data is from interviews, the author decides to use written and visual methods to present data and findings. Visual aids used are vertical picture list; vertical chevron list to display the steps involved in knowledge formation and transformation; diverging radial shows relationships of steps in knowledge formation and transformations; converging radial to show the factors influencing certain steps in knowledge formation and transformation such as realizing the need for information and knowledge; vertical arrow list shows two parallel sub steps such as giving and receiving feedback; etc.

2.3. Layout

This report is divided into 5 chapters and it starts with the Preface session which briefly introduces the master thesis and acknowledgements for contributions.

Chapter 1 introduces background, the research questions, purpose of this study, expected result, and the target group in the empirical study and the authors’ background.

Chapter 2 describes in detail the scientific approach used in this master thesis such as the scientific perspective, methods in the research – data collection methods, analyzing methods, evaluating methods, and presenting methods. Additionally, chapter 2 briefly shows the layout of the report and limitations of the study.
Chapter 3 describes the subject area which answers some of the sub-question theoretically. Moreover, in this chapter, the readers also can find the suggested knowledge learning and sharing phases among IT professionals as theoretical background to conduct empirical study.

Chapter 4 discusses the empirical study with some sections such as interview preparation, participants, interview process, transcribed data and analysis the collected data.

Chapter 5 is the discussion about the main findings as well as revision in knowledge formation and transformation steps. Additionally, this chapter also shows the method evaluation for this research if it is reliable, valid and useful. Moreover, the research evaluation is conducted in this chapter, too. The last section in chapter 5 is speculation for the future.

Last but not least, the appendices shows the references list, interview questions, transcribed data from interviews, and memos of 3 progress seminar.

2.4. Limitation of studies

In the scope of this study, the concept of wisdom is not being considered because wisdom “embodies more of an understanding of fundamental principles embodied within the knowledge that are essentially the basis for the knowledge being what it is. Wisdom is essentially systemic.” (http://www.systems-thinking.org/dikw/dikw.htm). Thus, concept of wisdom would go beyond the purpose of this study. Moreover, this research does not go in detail the information processes which happen in brain such as how information is processed in brain, which parts of the brain involved in, etc. Besides, the study does not discuss business objectives & strategies when discussing organizational knowledge creation, either. Different organizations and businesses have certain objectives and strategies so in order to keep the subjectivity and generalizability of this research, the topic will be left out. Another limitation of this study is that some steps in proposed models cannot be verified from qualitative data due to insufficient proof given by collected data. Moreover, this research does not clearly display the relationship in phases in learning process and 4 levels of knowledge using collected data from empirical study due to lack of necessary information. Finally, Co-design in relation with learning and sharing process is not studied thoroughly due to the same reason above.
3. Subject area
This chapter is designed to answer and explore the sub questions

- What are data, information and knowledge?
- What are the differences between knowledge and data and information?
- What are steps involved in knowledge formation and transformation among IT professional?

Before attempting to address the questions of knowledge formation and transformation, the author attempts to develop some perspectives relating to knowledge such as data, information. In order to have complete and comprehensive framework of knowledge formation and knowledge transformation, the author starts with understanding the definition of knowledge; and how it is differentiated from data, information. In the scope of this study, the concept of wisdom is not being considered. There have been some researchers tried to distinguish among data, information and knowledge. The following table displays some definitions of data, information and knowledge from the previous researchers:

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
<td>Data is about “Know nothing” – data does reveal nothing</td>
<td>Data is represented as symbols (or data is symbol)</td>
<td>Data is raw facts</td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td>Information is about “Know what” – the information users know what the information about.</td>
<td>Data that are process to be useful. Information does provide answers to questions of who, what, where, when.</td>
<td>The information is defined as meaningful, useful data.</td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
<td>Knowledge is about “Know how” – how to make knowledge useful</td>
<td>Knowledge is the application of data and information. Moreover, knowledge answers the “How” questions.</td>
<td>Knowledge in other hand is the clear understanding of information.</td>
</tr>
</tbody>
</table>

Table 2: Views of data, information and knowledge (Jennifer R., 2006)

The following sections discuss more detail in data, information, knowledge and their relationship.
3.1. Data
Webster (1961) defined data as something given, granted or admitted; and something that can be argued or inferred. On other hand, Davis and Olson (1985) had opinion of data as raw material of higher order constructs and data is taken for granted – data as fact. Data has basic attribute as they are true, and they can be verified. Meanwhile, data is defined as discrete, atomistic, tiny packets which do not have any structure or necessary relationship between them. Additionally, in the explosion of information technology area, data is available through many channels thus it becomes an abundant resource in many circumstances. Consequently, people can find themselves drowning in pile of data (Mann, 2004). Data represent some point without referring to either space or time – just like an event without attaching to any context. Therefore, the state “out of context” makes data is meaningless in relation to everything. In other words, data are only the representations of the meanings if we have attached into context or the interpretation system used. Therefore, in general, data are raw facts, and the process of accumulating facts is the process of learning data. When we come across a piece of data which catch our attention, the first thing we might react is attempting to associate attribute meaning to data. The association process relates to other things having connection with data. We try to create context for data in order to get its meaning. So, with enough preparation and association, we should be able to catch the meaning of data. For example, in the empirical study of this thesis, if the collected data is not associated in context and analyzed, there is no way to understand the meaning of data and attach with the proposed frameworks.

3.2. Information
The term information was derived from the Latin word informare which means “to give something a form”. In addition, Michael Buckland defined “information as a thing, information as knowledge, information as a process” (System Development Philosophies lecture notes, Spring 2010). Moreover, information also can be described as message that human/machine transfer between each other. In fact, most people think that information is “disjointed little bundles of fact”. In Oxford dictionary, information is defined as the message that is connected both to knowledge and communication (www.oxford.com). However, the distinction between information and knowledge must be paid attention and the latter section will discussed more on definition of knowledge.

Information is not the collection of data but data after the process of structuring in syntax and semantics. In other words, the collection of data without any relation between the pieces of data is not considered as information. Thus, information is simply an understanding of the result of putting pieces of data and other information together (www.systems-thinking.org/kmgmt/kmgmt.htm). In addition, the structured data is also the perceived value in current of perspective actions or decisions (Davis and Olson, 1985). Webster (1961) defined information as representation, outline, or giving form – which comprised of processed data. Grasping the meaning of information goes beyond simply remembering. Information needs to associate with ones’ cognitive skill so that it can be understood and used in another situation. In
other words, the processed collection of data could become information or not is largely up to the understanding of person who receives data. Putting it in other way, the associations that recipient is able to distinguish with that data collection are the extents of his understanding on the collection – and that have been derived from the past experience.

As mentioned previously, information is the understanding of relationship between pieces of data or other information; it does not provide the basis to explain why the data is what it is, nor if data could change over time or how it would change. Therefore, information is relatively static in time – information is always as it is dependence of the contexts for its meaning and without likelihood indication for the future. Information answers questions of what, where, when and who (Ackoff, 1989). Information has no form; it is not made of pattern, neither. It is important that information may not even exist if the receiver’s immediate objective is not achieved.

3.3. Knowledge

It is commonly belief that information is knowledge; however, there are some distinctions between information and knowledge. It would be shortcoming when information is studied without knowledge. In the above definitions, information is seen without any inherent meaning. Knowledge is the information with given meaning and is considered in the content of understanding (www http://www.systems-thinking.org/kmgmt/kmgmt.htm). If we think knowledge is the substance to be engineered or the material “thing” to be produced, measured; we will not succeed in management of knowledge. Davenport and Prusak (1998, p. 5) define knowledge as, "a fluid mix of framed experience, contextual information, values and expert insight that provides a framework for evaluating and incorporating new experiences and information." Knowledge originates and is applied in the minds of knowers. Knowledge is not only in the form of documents or repositories but also in the routines, processes, practices, etc. The human brain has huge general-purpose capacity to perform mental functions such as language ability, behavior control which associate with our life knowledge, social knowledge, culture, experiences, etc. Kochen (1983) defines knowledge as information given meaning and integrated with other contents of understanding.

There are two types of knowledge which are explicit and tacit knowledge. Explicit knowledge can be expressed in form of language such as sentences, mathematical expressions, manuals, etc and it can be found in books, files, database, etc. Hence, we can easily transform explicit knowledge to others and we also can use computer to process, transmit, and store the knowledge. On the other hand, tacit knowledge is defined as individual experiences and involves in intangible factors such as beliefs, values, perspective, etc. Therefore, it is much harder to express tacit knowledge in form of language. However, it can be converted into words, models, expressions and communicated to others. Furthermore, Nonaka and Takeuchi (p. 63-69) further discuss 4 dimension of knowledge based on the 2 basic types as shown below
<table>
<thead>
<tr>
<th>From tacit knowledge</th>
<th>Socialization</th>
<th>Externalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>From explicit knowledge</td>
<td>Internalization</td>
<td>Combination</td>
</tr>
</tbody>
</table>

**Table 3: Four dimensions of knowledge (Nonaka and Takeuchi, 2005)**

Zeleny (1980) insisted that knowledge is not “processing of information” but a coordination of action. In other words, “knowledge is the network of relations through which they coordinate their actions”; thus, human can use their perception to identify the world in the turbulent situation to create, recreate and adopt knowledge. Knowledge is the distinction of “object” which a person perceives from the past experience so that the separated data and information are connected in the process of distinction.

There are two ways of acquiring knowledge: extracting from experience or perceive from another person who possesses it – both of them are considered as learning. Moreover, people use language as a mean to coordinate the set of coherent actions with operation of distinction. The information is encoded into packages of knowledge so the ability to realize and perceive knowledge is the capability to recognize the content and structural form of something and then use them to formulate new contents and structures. Thus, knowledge can be seen as a comprehensive understanding of information and their connected pattern; and an inclusive learning about knowledge (www http://www.systems-thinking.org/kmgmt/kmgmt.htm). Knowledge can be obtained by the process of analysis and synthesis a set of information and the associated links among them.

Additionally, Quinn, et al. (1996) defined 4 levels of knowledge namely know-what, (cognitive knowledge), know-how (advanced skills), know-why (system understanding), and care-why (self-motivated creativity). The basic process of knowing something is know-what, cognitive knowledge; while the ability to convert the externally learned knowledge to effective real actions is know-how (advanced skills). Moreover, the ability to deeply understand the root of causal relationships underlying a discipline is defined as know-why, system understanding. Finally, the ability to create knowledge through self-learning and analyzing is defined as care-why (self-motivated creativity). In addition, Quinn’s research also showed the fact that the organizations mainly pay more attention on the development of basic knowledge (know-what) while there is lack of emphasis on higher levels of knowledge such as system recognition or self motivated creativity.
3.4. Knowledge formation

Argyris and Schon (1978) identified that there are two different aspects namely: individual’s frame of reference which being validated through the reduction of ambiguity process; and disconfirmation and modification due to the lack of association between received data and information associated to the process of analysis and synthesis of information. Walter B. (2005) mentioned that “knowledge management and learning are highly holistic concepts, difficult to grasp in any particular subfield, emergent, constantly changing”. The main question is that how we avoid reinventing the wheel everyday and how we grasp knowledge fast from the past experience while staying away from repetitive errors.

From the observation of outer world, human mind is able to create and reflect inner representations correspondingly in form of objects, events or states. The prevailing idea that things are outside the brain is inside a person are challenged by the enacted cognition concept by Varele (1984) – cognition is enacted in action and interpretation. In recent neurobiological research, e.g. by Varela (Maturana and Varela, 1984), has revealed that the concept of self-organization and knowledge are created each time over and over again instead of being stored. (Baets, 1999; Baets and Van der Linden, 2000) are of the opinion that cognition is created by an embodied mind which is part of body, sensor and environment. From the events, occurrences and states, individual becomes builder of facts in constructing the contents of knowledge which is concerned with the flow of the world in temporal and spatial terms. Additionally, experiences are the key factors for individuals in acquiring knowledge. For example, based on what a software developer has gained from his/her past experiences, he/she can identify the solution for a software design problems within a shorter time. Other developers have other reaction/solution over the same problems based on the own knowledge and past experiences. It has been shown that it is extremely difficult to explain why they react that way but not the other way, or their knowledge. Facts have shown that there are some IT professionals who are consistently better than others in analyzing and solve problems. So it is important to scrutinize why they excel in order to extract the pattern to build and transform knowledge to benefits others. Despite of dynamic and nonlinear form of knowledge, it is still considered as transferable commodity. For instance, knowledge is seen to pour into individual vessel until it is full.

3.5. Learning cycle

There are different stages of learning described in contemporary learning theory namely: learning through teaching, internalization, social constructive perspective and learning through co-design (which is the highest level of learning). Traditionally, learning was considered as the process of gaining information and knowledge through the More Knowledgeable Other (MKO, Vygotsky, 1978). The learners usually played passive role in learning process without (or with little) internalizing knowledge, and interacting with knowledge givers. There were many drawbacks in traditional learning since the importance of internalization of knowledge and
interactions between individuals and the world were not considered thoroughly. Thus, later Jean P. (1950) articulated mechanisms that knowledge is internalized by individuals. In his theory, individuals construct new knowledge through their experiences; in other words, new experiences are incorporated into already existing experiences without modifications. However, the risk of misunderstanding or miss out important information might happen when individuals only internalize knowledge by themselves (without interacting with social world). Additionally, individuals also experience the process of accommodation which they reframe their “mental representation of the external world to fit new experiences”. Later on, Vygotsky (1978) suggested social constructive perspective which argued that social interaction can precede development of learning process. Specifically, social interaction plays fundamental role in learning process. For instance, observing and learning from other people can help individuals in constructing their own knowledge by combining with existing experiences and internal representations of the world. Moreover, when discussing about learning process, the social development where people are working together cannot be left out. For example, person A can create knowledge M and person B can create knowledge N. When they work and interact with each other, more advanced knowledge MN can be created – MN cannot be realized and constructed if two persons work separately. In order words, different person has different ideas and perspectives, when we combine different perspective, we can design and create something which is new and increases the stakeholders’ interests. Phases in learning and sharing process are shown and discussed in the next section.

3.6. Suggested knowledge learning and sharing phases

The learning process always starts with the urge on learners to recognize needs for information and knowledge – which is very essential in the current competitive environment. Thus, the very first step which initiates the learning and sharing process in individual is “Realize the need for information and knowledge” – where the knowledge learners are under pressure of the knowledge economy. Knowledge economy is the term refering to either “an economy of knowledge focused on the production and management of knowledge in the frame of economic constraints, or to a knowledge-based economy” (WorldBank, 2003). There are rapid changes in the economy as well as in working environments such that education systems do not provide particular skills but emphasize on developing skills for knowledge learners the ability to think sharply, make good decisions, and equip them with problem solving skills. In addition, learners do not only learn knowledge from schools or life but also achieve self learning ability as well as obtain knowledge from others. Therefore, the need for knowledge is a very essential step in learning process as Walter B. (2005, p. 170) discussed in his book that “employers pay attention to learning these days because of the need for knowledge”. There are a lot of factors that initialize the need for knowledge such as personal interests in new technologies, techniques, methods; new requirements; the necessity for solving current problems or proposing enhanced solutions for existing issues; etc. These initiators in recognizing the need for information and knowledge are discussed later.
After identifying the need for information and knowledge, the learners proceed to “seeking and collecting information” step – discussed by Meir R. (2010, p. 327) or Walter B. (2005, p. 218). There is great deal of acts in this step since the learners firstly need to form and narrow down the subjects’ area with keywords (terms) in order to search for knowledge. Then, the decision of types of sources and channels to use in finding information and knowledge should be made to carry out the search for required one. In addition, the learners should compare the information from different sources based on some criteria such as relevant, accuracy and currency (Florence, M.S and Hedy, M, 2007). And then, next act is filtering to suitable information and knowledge in order to form concepts and usage of available one (Florence, M.S and Hedy, M, 2007). Seeking and collecting information are lengthy and sometimes learners need to repeat the whole process again to collect useful information. More details on these phases will be discussed in sub-sections of 3.6.

With the information and knowledge in hand, learners proceed to the step of processing and evaluating information by analyzing if it is suited for the initial purpose; as discussed in chapter 3.4 about knowledge formation. Therefore, the concepts will be systemized after organizing and making sense of information from different sources by spotting main ideas, conflicting information, misconceptions, different views, etc (Florence, M.S and Hedy, M, 2007). And then, the learners carry on the phase of “Process and evaluate information” by evaluating its usefulness and trustworthiness. The last thing to do in this step is again eliminating irrelevant information and keeping the remaining portion that can be applied to the work.

The learning process continues with applying and testing information and knowledge into real situation such as working module, as discussed in chapter 3.4. There are few actions that learners need to perform before directly applying the concepts and information into the desired situations such as: editing and synthesizing information for suitable use, re-creating and creating more knowledge, combining the existing with new knowledge to practical concepts. By doing that, the information and knowledge are well-prepared for applying into the real situations by preventing the possibilities of misleading, irrelevant, inaccurate information. However, the knowledge usage phase continues with valuating the concepts based on own experiences, applying to new situations and finally building concrete experience.

Learners continues their knowledge formation process with evaluating the result of applying information and knowledge into real situation in order to judge if the results of the work is acceptable in terms of preciseness and effectiveness – emphasized by Meir R. (2010) or Walter B. (2005). Then the problem solving and knowledge building process should be judged in terms of efficiency, and timely manner. After that, the learners revise the existing strategies, methods, processes to create more valuable ones which can be applied in the future.

It would be significant shortcoming if knowledge formation in learning process does not come together with knowledge sharing because through knowledge sharing, individual can build,
update, and review his knowledge which can lead to innovations. For example, chapter 3.5 said that Vygotsky (1978) suggested social constructive perspective which argued that social interaction can precede development of learning process. Moreover, organizations also benefit from knowledge sharing by having more creative ideas; more jobs done effectively with high quality; reduce resource since the situation of “reinventing wheels” is prevented. Knowledge sharing phase starts with the emerged needs and ideas of sharing; in order words, the desire to prevent reinventing or reduce searching time for individuals. After that, the tacit knowledge should be converted into explicit ones so that everyone can view, read or listen to. During the process of converting, the learners also input creative inference which is useful and valuable (Florence, M.S and Hedy, M, 2007). Then, the procedure for sharing is developed, such as: prepare materials; arrange sharing session or make appointment, organization the criteria in sharing sessions; etc. After that, the material is ready with expressions in own terms of the knowledge givers (also the knowledge learners). Finally, the sharing session is held by having either presentations, knowledge sharing sessions or reviewing documents (Tom J., 2006).

Besides the six steps in knowledge formation and transformation discussed earlier, there is a very important step which plays a crucial role in learning and it can affect the rest at significant degree. That phase is “Suggest, give, and receive feedback” which is at the centre and having impact on every other phase in learning and sharing process – Mark W. (2000). Feedback giving and receiving are art whereby both parties need to appreciate and require tactful behavior. The way in which feedback is given and received adds to the learning process. In some steps the feedback givers should take into account as: at first fully review the items to be evaluated for accuracy; prepare and arrange the idea; describe the purpose of feedback specifically rather than generally; be descriptive in giving constructive suggestions and comments by finding the similarities with own knowledge or the dissimilar ideas (Tom J., 2006). On other hand, the learners who are receiving feedback need to be open and look at feedback as a gift; even though, they might not agree fully with the feedback, they should take a step back and listen carefully to it. If there is unclear fact or items, they need seek for clarifications or ask for examples from others. Moreover, taking notes if possible is to keep the record of feedback and the learners might discover the insight and usefulness of feedback. Thus, they can record the areas needed to be investigated further to proceed examining the usefulness and applicability of feedback (Tom J., 2006). Lastly, they eliminate the irrelevant information to retain and apply relevant one in feedback.

The radial cycle to show relationship among phases in learning process to the centre step as “Give and receive feedback” is shown in Figure 1
Figure 1: Steps in Knowledge formation and transformation

The following sections discussed in higher level of detail the steps involved in knowledge formation and transformation based on the theoretical background discussed in chapter 3.3, 3.4 and 3.5 researches or books from Meir R. (2010) or Walter B. (2005) or Mark W. (2000); supervision from the author’s supervisor and teacher; and the author’s reasoning analysis.

3.6.1. Realize the need for information and knowledge

Besides the limited knowledge obtained academically such as the one from schools, lessons, training, etc, there is enormous and huge amount of knowledge existing in this on-going and developing environment. Thus, knowledge own by one individual is only grain of sand in the vast desert or a drop of water in the huge ocean. There are various reasons for learners to recognize the need for information (Walter B., 2005, p. 170). For example, in IT firms that provide world-first innovations and sustainable services to collaborate more seamlessly with customers, a software engineer has to realize the importance of continuously update his/her knowledge in order to catch up with the ever-endless IT development. Thus, the first item initiates the need for information and knowledge is new technologies, methods and techniques. In this fast developed environment, everyday there is large amount of new technologies produced and knowledge discovered. Thus, the ones created yesterday can be considered as obsolete. For example, in the end of 90s, Java was popular and widely used. However, shortly, C# was introduced and quickly became the most widely used programming language compare to others. So, if a software engineer does not update himself with new knowledge, sooner or later he will become lost in this competitive environment. Realizing the need for information and knowledge through updating new technologies, method and techniques developed is the self conscious process which is happening at different level for different individual (Florence, M.S and Hedy, M, 2007).
Besides, the new requirements come instantly in order to create new products, tools, services with new functionalities to meet expectations of customers. Thus when the new requirements are required, employees should be able to apply own knowledge into real situation or search for suitable information and knowledge. Therefore, the urge to seek for knowledge is realized. Besides new requirements, the need to solve existing problems; and improve and enhance existing module also initiate the process of realizing the need for information and knowledge. So, the learners seek knowledge in the chosen subject, area, filed to build the concrete platform of knowledge on regular basis to perform the job’s requirements. Otherwise, he/she will move backwards and will be rapidly overtaken by other colleagues who are able to grasp and embrace the new technology and absorb knowledge accompanies it. In the empirical study, the realization of the need for knowledge will be analyzed based on the replies from respondents in order to review and revise the situations to know the need for information and knowledge.

![Figure 2: Initiators in recognizing needs for knowledge](image)

### 3.6.2. Seek and Collect information

After understanding the need for information and knowledge to serve own interest in new technologies, methods, techniques; and supply sufficient skills to carry out new requirements, solve existing problems, improve and enhance current works; the learners keep on with seeking and collecting information. Firstly, the subject, key terms or concepts must be formed and narrowed down as much as possible by defining what kind of information and knowledge is needed for learning process and can serve the pre-defined purposes. The subjects should be narrowed down in well-defined way rather than including everything of interest which might not be helpful in the learning process (Florence, M.S and Hedy, M, 2007). The learners should eliminate every area or aspect from the initial ideas and concentrate on fewer main points which will form an interesting information and useful knowledge later. For example, the subject can be pinned down to definition, applications and examples rather than taking wider subject.

With the keywords in the subject area, the search for information and knowledge step continues by defining types of sources and channels to use in order to gain most evaluable and useful
insights. There are some criteria for deciding if the sources for knowledge should be used such as speed in retrieving, the amount of available information, the reliability of source, the cost involved in using information and knowledge and most important one is the applicability of knowledge. In this fast growing environment, speed plays an important role when retrieving knowledge because in some situations, the faster the learners grasp information, knowledge; the more benefit they can achieve. Most noticeable example is information in stock market where time plays an essential role. With more available information and knowledge in timely manner, the seeking and collecting process can be helpful since learners have more sources to compare, obtain or eliminate (Tom J., 2006). However, the learners must take into account that the sources must be reliable since everyone can contribute to the knowledge pool and not all of them are trustworthy or relevant. For example, there is a huge amount of information available in Wikipedia – the web-based Encyclopedia that enables users to create and edit interconnected web pages for various types of information and knowledge (from Wiki). Even though, there are more and more learners using Wikipedia as a source for knowledge but the question of reliability is still unanswered. Everyone is able to update the information in Wikipedia so it is not 100% warrantee to be true or trustworthy. Thus, the learners should consider this aspect when choosing the sources for seeking and collecting information and knowledge. The cost involved in the source of knowledge is also the issue for learners to decide which source to use. There are some free or cheap channels to search for knowledge such as the Internet, books, magazines, etc. There are some quite expensive such as experts, consultants… Most of the time, learners try to search for cheapest resources in finding knowledge and their last resort should be more expensive channel such as 3rd party – it is often the case companies or employers will cover the cost incurred. Lastly, the applicability of information and knowledge residing in the sources is also very crucial in deciding if it is the suitable sources to seek.

![Figure 3: Factors to decide sources for seeking knowledge](image)

From the criteria in selecting sources for information and knowledge, the learners start seeking and collecting required information and knowledge from various sources (Huppe, C. and
Unterstein, K., 2002) Nowadays, it is much faster and easier to grasp a piece of information from different sources such as the Internet, books, people, etc. For example, the release of new technologies or products can be distributed all over the world within less than a minute through the Internet. Thus, the first source learners would use is the Internet due to the fast speed, approachability, freely available of large amount of information. Secondly source can be books which described in-depth knowledge. Thirdly, for employees, they can search for information and knowledge from internal documents which have been created and maintained by other colleagues who have been using the information and knowledge for the job. The internal documents are quite reliable and specific for the job’s scope. In addition, it is very fast to search and easy to verify with others in the organizations. That is also the fourth source to seek and collect knowledge. Learners can make use of this valuable source of information and knowledge by learning from their experiences, accomplishments, mistakes, etc. Moreover, from people, learners can review, and revise their knowledge in order to re-create and create new one. They also have opportunities to view their knowledge from different view which they might find interesting insights. Figure 4 shows the main sources available for learners.

![Main sources for information and knowledge](image)

**Figure 4: Main sources for information and knowledge**

Using the information and knowledge from various sources, the learners must be able to compare different information to seek for suitable one based on some criteria such as relevancy, accuracy or currency. Firstly, the information and knowledge should be relevant to the field and the purposes of learners. For example, a software engineer searches for the particular method to develop a software component using a certain design pattern. He requires the information and knowledge fit his purpose with various examples in usage and application. Secondly, the information and knowledge residing in sources must be accurate as false information can create hole in knowledge or create misunderstanding. Consequently, wrong information and knowledge can reduce the quality of the product. Thirdly, the time frame is also important in judging for information and knowledge from different sources because it is possible that the outdated information and knowledge is no longer applicable to the work.
Figure 5: Requirements for information and knowledge

After comparing information and knowledge from different sources, knowledge learners continue the seeking process by filtering the information and knowledge: eliminating unnecessary information and knowledge; and retaining the useful one. This is important because the learners must employ past experiences and the ones from others in order to identify practical and valuable information and knowledge (Duffy, J., 1999; George, A., 2006). The pace involves thinking and pondering; and putting high level of concentration in order to obtain deep thinking and contemplation. While filtering and retaining the required information and knowledge, learners also form concepts and initial ideas in the usage of information and knowledge.
Forming and narrowing down the subjects + terms to search for by defining what kind of information is needed for learning purpose

Define what kind of sources and channels to use
- Fast
- Amount of information
- Reliability
- Cost
- Applicability

Search for required information and knowledge
- Internet
- Books
- Internal documents
- People

Compare different information from different sources
- Relevant
- Accuracy
- Currency: timelines of information

Filter the information

Form concepts and usage

Figure 6: Seek and collecting information
3.6.3. Process and evaluate the information

The purpose of processing and evaluating information and knowledge is to reduce the risk of using fraudulent information; thus, this is a very important step in learning and sharing process. Knowledge learners continue with “value based on own experience” the edited and synthesized explicit knowledge from previous phase. Thus, they can build complete system understanding and posses the ability to deeply understand the complex discipline through evaluation. For example, when IT professionals combine separated design documents of different modules in software into one whole document for reference in latter phase of development, they have to use their own experience to evaluate if the information provided is sufficient and suitable for the combined documents.

Based on theoretical background said in chapter 3.3, 3.4 and 3.5; the author identifies four sub-steps happen in processing and evaluating the information. The step starts with analyzing if the information and knowledge is suited for the purpose by engaging information in a source and extorting pertinent information. Once again, the learners must evaluate the information based on its scope, accuracy, currency and links to other information. Consequently, learners can use the pertinent information and knowledge which is workable.

After analyzing information and knowledge, the concepts should be systemizing into suitable categories through organizing and making sense of information and knowledge from different sources. The step can be done by spotting the main ideas, conflicting information, misconceptions, different view, etc. This pace required extensive pre-knowledge and experience of learners in order to proceed in the right path. Otherwise, the learners must then complete the task through trial-and-error. There is one more very effective step to proceed with this step which is feedback phase –the feedback giving and receiving phase and the relation with the rest of the phases will be discussed in the sub sections of this chapter later.

After information and knowledge are systemized into organized concepts; the learners must evaluate it for the usefulness and trustworthiness of information and knowledge before applying into the real situation or build knowledge. Lincoln and Guba (1985) suggested 4 questions concerning trustworthiness that are important for any kind of inquiry:

- How do we know whether to have confidence in the information?
- How do we know the degree to which the information and knowledge apply in other contexts?
- How do we know the information would be repeated if the study could be replicated in essentially the same way?
- How do we know the degree to which the information emerges from the context and the respondents and not solely from the learner?
After that, the remaining portion that can be used for the initial purpose is retained by learners.

**Figure 7: Process and evaluate information**

3.6.4. **Applying and testing with adjustments**

The fourth step in knowledge learning and sharing process is applying and testing information and knowledge into real situation using appropriate adjustments. The first thing the learners should do in order to apply information and knowledge into use is to revise once more time by editing and synthesizing information for suitable use. For example, the free software component from the Internet is very appropriate for development work but the software engineer cannot just directly use the component without revising and making any modifications such as: changing the layout, colors, display of the component, etc. to make it fit the software product. Through steps of revising, the learners might re-create and create more knowledge and ideas (Florence, M.S and Hedy, M, 2007). Let’s take the previous example of software component, when the software engineer revises the original information, the new ideas can be emerged such as adding more functionalities and creating more effects for the components to increase user-friendly attribute and usability of the software product. The process is complex due to the combination of existing knowledge and experience with the new information and knowledge to practical concepts. Thus, it requires tactful and witty skills and experiences of learners to thoroughly consider and apply
information and knowledge. After that, the revised information and knowledge is applied into real situation and then the learners should evaluate the concepts again based on own experience during the step of using information and knowledge in order to amend for suitable use (test implications of concepts in new situations step discussed by Ming-Ten T, 2006). Thus, from the information and knowledge used in real situation, the learners are able to build their own knowledge so that they can apply to another new situations – by doing that, knowledge is kept revising, evaluating, and testing in real situations. Eventually, learners can build concrete experience which provides the basis for create new experiences.

Figure 8: Applying and testing knowledge with adjustments
3.6.5. Evaluate the result of applying information

After the learners have built concrete knowledge by using and applying into new situation, they must carry out the next step: evaluate the result of applying information and knowledge in order to increase the impact of using strategies in learning process in the future. The evaluation step is a highly unique and complex process that incurs at particular time in a certain way. Sometimes, result of evaluation can include the feedback and suggestion or outside experts. Through the evaluation process, the learners learn how to do better in the future by verifying that they are doing what they think they are doing. The first action is judging the results of applying and using knowledge in term of preciseness and effectiveness. The step is to scrutinize if the application of knowledge is as a high quality as required in timely manner (Florence, M.S and Hedy, M, 2007). By doing this, the learners can receive more opportunities to improve the strategies used in the light of experiences. Then, the learners judge the problem solving and knowledge building process to structure learning process in such a way that it can generate relevant and appropriate knowledge and experience that they can apply in the future situations (Ming-Ten T, 2006). The results are some recommendations and suggestions which can be used for enhancing knowledge; thus the learning process can be improved.

The importance of evaluation in learning process is apparent but the evaluation will be more useful and practical if the learners can revise existing strategies, methods and processes in their learning. In other words, the learners should use evaluation recommendations and lessons for enhancing and increasing performance. They should also actively participate in evaluating process in order to find new suggestions and recommendations to apply to new situations. Consequently, the learners are able to create more effective methods in the future which also means that their learning process has improved and the learners can deliver the result in more efficient and less costly way (it matches the step of concrete experience presented in the learning cycle proposed by Ming-Ten T.(2006).

![Figure 9: Evaluate the result of applying information](image_url)
3.6.6. Sharing knowledge

Knowledge sharing is a systematic process for acquiring, creating, synthesizing, presenting, sharing to achieve individuals’ and organizations’ goal. Through knowledge sharing, the knowledge resided inside employees’ (individuals’) mind or stored in explicit form such as paper, books, files is transferred and processed in another employee / individual’s mind. Knowledge sharing can help fostering innovation by encouraging free flow of ideas, boost the learning process, reorganizing the value of knowledge as well as learners, create more effective working environments, etc. (Walter B., 2005; Mark W., 2000; Vygotsky, 1978; etc.)

Firstly, the learners who want to share knowledge should emerge the needs and ideas of sharing originated from the desire to prevent of reinventing or reducing the searching time for others. With own tacit knowledge, they start thinking about the ideas of sharing to other employees so that everyone can learn and improve the working process. Thus, they should internally build the concept they want to articulate explicitly. It is often that only when the tacit knowledge is expressed explicitly, the employees as well as business can make full use of it. In addition, the individuals who share that knowledge also have opportunities to revise and update their own knowledge through feedback or comments from others. In other words, this is learning through the others’ point of view – co-design learning process (Louis, L.G. and Michel, S, 2008). Let’s take the example of an IT professional who has tacit knowledge about design patterns. When he converts it to explicit knowledge, the pattern can be shared and used among other colleagues. Consequently, the quality of software is enhanced since the knowledge has been developed and tested over years. Moreover, it is also possible that the individual himself/ herself or other employees revise or experience and create inference process to improve the knowledge and internalized to new knowledge.

From idea of sharing knowledge, the knowledge holders proceed to convert tacit knowledge into explicit one. Moreover, when converting to explicit knowledge, the knowledge holders use dialogs, discussions, reflections, etc. (figurative language) to highlight the similarities and relations among various concepts. Next action is to create inference: From the metaphor in process of converting tacit knowledge into explicit the knowledge holders have chance to review and revise to create more creative inference and innovative approach in the explicit knowledge. Consequently, they not only possess “know-how” knowledge but also experience the self-thinking and self-learning processes which can derive the “care-why” knowledge. In this step, the knowledge holders are able to polish and develop more innovative ideas to express into explicit forms (Ming-Ten, T. and Kuo-Wei L., 2006). For example, when reviewing the explicit knowledge (design pattern) produced before by an IT professional, he/she is able to improve to more advanced design pattern.

Knowledge sharing can be in verbal or written forms by the step of expressing in own term. This is very important step and the quality is based on the experiences of learners since different
experience creates different explicit knowledge and the other learners can obtain different ideas. To prevent any misleading information or knowledge, the shared material and methods should be revised by others before, during and after sharing sessions. In other words, the step of feedback giving and receiving has close relationship at very high degree (Tom J., 2006). Finally, the knowledge learners perform sharing through presentation, knowledge sharing sessions, documentations. However, this does not concludes the sharing process since it must be continued with feedback, suggestions, improvement and the whole learning cycle starts all over.

Figure 10: Sharing knowledge

3.6.7. Feedback / comments giving and receiving

The last and also the most important step in learning process is feedback, suggestions, comments giving and receiving. Feedback is a certain form of input on the work that can come from colleagues, supervisors, or others who have interaction with learners. Sometimes, it is quite formal such as pre-arranged meetings or information as short verbal conversation or through email. Especially for IT professionals, giving and receiving feedback happen very often during the product development cycle. By receiving feedback, the learners can have clearer ideas of how well they are doing or which aspect they should improve and how they are about to do that. Feedback can help individuals perfect themselves by improving their learning cycle, revising their knowledge. Feedback giving and receiving require diplomatic communication skills from both parties: givers and receivers in order to handle the feedback tactfully and make full use of it (Lane, and White, 1998).

Firstly, the knowledge learners who give feedback should have complete understanding in the subject and the fields by fully reviewing the items to be evaluated for accuracy. The feedback
givers can have entire picture about what is going on and the ways to do that; so they can emerge some ideas and suggestions. This is a complex act as it requires extensive experience and expertise knowledge in order to generate feedback. Then, the givers need to put time and thoughts into the step of preparing and arranging ideas and feedback. The givers should think of collective and concrete examples that can illustrate their points in the feedback. Additionally, they also have to put efforts in order to make sure to balance the constructive feedback with positive feedback. After that, they should inform the reviewees about the ideas of giving feedback by arranging a formal meeting or informal conversation. Thus the feedback receivers can be well prepared about what is going on. Before giving the feedback the givers must brief the reviewees by describing the purpose so that receivers have clear expectations about the sessions (Lane, and White, 1998). After that, the feedback givers descriptively give supportive and constructive suggestions and comments by finding the similarities with own knowledge or dissimilar ideas (Tom J., 2006). The givers also have to create a supportive context for feedback through prepared documents or examples; they also must be positive in demonstrating that they have observed and valued the efforts spent. By giving feedback, the givers are not only able to help others to learn and improve their knowledge, but they can learn from reviewing, revising and update their knowledge, too.

Secondly, the learners who receive feedback should have good communication and personal skills in order to accept and make use of feedback even though in some cases, they can feel feedback is hard to accept. However, feedback provides an opportunity for learners to review and revise their own knowledge. Thus, they should listen to feedback carefully to have a chance to reflect on and thoroughly process the feedback. Active listening skills are very helpful in this situation. If there is any doubt, the learners should seek for clarifications or examples from the feedback givers and other colleagues. Questions should be asked to clarify what is being said and why. Taking notes can help learners to keep track of the ideas and information derived from feedback. Thus, new doubts or ideas can incur and the learners can ask for more verification (Louis, L.G. and Michel, S, 2008 ). After the feedback session, learners must process feedback by using notes, examples or documents provided through the process of record the areas that learners need to investigate further and examine carefully the usefulness and applicability of feedback. Because feedback is considered as one type of explicit information and knowledge, some steps in evaluating information can occur as well (Florence, M.S and Hedy, M, 2007). After all, useful pieces of feedback is retained and applied to correct or enhance the work.
In fact the relationship between “Giving and receiving feedback” step and the rest of learning process phases is not mutual exclusive but is a close relation and helps supporting each other. Some examples of the relationship between Feedback giving and receiving with the rest of learning steps are described shortly. The learners can emerge the need for information and knowledge from the influence of other people such as the feedback that contains new information and knowledge or the need for searching methods, ways to verify given comments and suggestions. Moreover, in the phase of seeking and collecting information and knowledge, the learners also should ask for the suggested information or reliable sources from their friends, colleagues. Or they can even ask for suggestions, information and knowledge from the others as main sources. The step of “Process and evaluate information” will be more efficient if the learners can receive supportive and constructive feedback from others (Florence, M.S and Hedy, M, 2007). By having feedback earlier when processing and evaluating information, they can avoid the irrelevant or misleading knowledge which have enormous impact in latter phases of learning process. Thus, the result information and knowledge will be more accurate, higher quality, better for use, etc. The relationship between two steps can be described as: when processing and evaluating information, the learners have considered others’ views in one issue with his/her perspectives when evaluating the explicit knowledge – sometimes it is considered as co-design process (Louis, L.G. and Michel, S, 2008 ). When learners apply information and

**Figure 11: Giving and receiving feedback**

- Fully review the items to be evaluated for accuracy
- Prepare and arrange the idea
- Describe the purpose of feedback
- Descriptively give supportive and constructive suggestions and comments by finding the similarities with own knowledge or dissimilar ideas

- Listen carefully to the feedback
- Seek for clarification or examples from other colleagues
- Note feedback
- Record the areas that learners need to investigate further
- Examine carefully the usefulness and applicability of feedback
- Retain and apply feedback

• Giving feedback

• Receiving feedback

- Fully review the items to be evaluated for accuracy
- Prepare and arrange the idea
- Describe the purpose of feedback
- Descriptively give supportive and constructive suggestions and comments by finding the similarities with own knowledge or dissimilar ideas

- Listen carefully to the feedback
- Seek for clarification or examples from other colleagues
- Note feedback
- Record the areas that learners need to investigate further
- Examine carefully the usefulness and applicability of feedback
- Retain and apply feedback
knowledge, and test with some adjustments, this is the time that they need feedback the most. Feedback is useful when the learners apply knowledge learnt through observations and reflections since there is no explicit form of conversation when they observe others doing the work and learn from that. However, the suggestions and feedback must be generated when they apply the information and knowledge into real situation in order to help them execute the knowledge correctly and effectively. When the results of information and knowledge are evaluated, learners also need supportive and constructive feedback and suggestions from others such as supervisors, colleagues or others who are involved (Tom J., 2006). From the feedback received, learners can revise their learning process in order to obtain and construct more effective and efficient strategies to apply to future situation. When the information and knowledge is shared, they also need to receive feedback thus they can view the knowledge from different points of views. Consequently, with beneficial discussion and teamwork, all learners in the team can create new range of knowledge which does not existing if individual works separately. This is the highest level of learning process – co-design.

3.7. Relationships between phases in learning process and 4 levels of knowledge

The previous part described 4 levels of knowledge developed by Quinn, et al. (1996) as cognitive knowledge (know-what), advanced skills (know-how), system understanding (know-why) and self-motivated creativity (care-how). Thus, the suggested relationships between 4 levels of knowledge and 7 phases in learning process are shown in

![Figure 12: Relationships between phases in learning process and 4 levels of knowledge](image-url)
The first three phases in learning process – realize the need for information and knowledge, seek and collect information and process information and knowledge – have close relationship with cognitive knowledge. The result of these phases is know-what knowledge which is “the basic mastery of a discipline that professionals achieve through extensive training and certification” (James B.Q., et al, 2009). Even though this knowledge is essential, it is far from sufficient for commercial success in this continuously changing environment. Thus the phase “Apply and test with adjustments” translates the theoretical concepts into effective execution and results in advanced skills – know-how knowledge. By applying and testing with adjustments – applying rules of a discipline to complex situation - the learners have developed the “most widespread value-creating professional skill level” (James B.Q., et al, 2009). Moreover, they continue developing deep knowledge of the cause-and-effect relationships underlying a discipline through the phase “Evaluate the result of information”. Therefore, the extraordinary value can be created through evaluating result and move beyond execution of tasks to solve more complex problems – by deep understanding on the interactions and unintended consequences of knowledge. Moreover, “Share information and knowledge” has connection to self-motivated creativity (care-why) knowledge in terms of will, motivation and adaptability for improvement, quality and success. Only with highly motivated and keen spirit, the knowledge learners can thrive in sharing knowledge with the other. Finally, “Suggest, give and receive feedback” covers four levels of knowledge due to the mutual relationships with the rest of learning and sharing steps.

The empirical study of learning and sharing process among IT professionals will describe in greater details of the phases with influenced factors, steps and the result of each phase.

3.8. **Factors influencing knowledge learning**

The study of knowledge formation is not complete if we ignore the factors that have significant impact on the process. This study explores 4 influential factors that trigger the learning cycle such as external environment, learning intention, knowledge acquisition ability, and individual motivation.

Kogut and Zander (1992) suggested that the organizations would encourage employees to start learning and gaining knowledge if they faced a competitive environment and need to reintegrate and utilize its knowledge as well as absorb new one. Additionally, Dodgson (1993) mentioned that the changes in external environment would affect the attitudes of the employees towards learning process. For instance, the more obvious of the changes, the easier the members of organizations engage in learning. Nevertheless, pressure is always the greatest conflict between organizations and external environment; thus, organizations react to the pressure by promoting new observation and ways corresponding to the environment. Consequently, the pressure in external environment can be the catalyst for the organizations as well as their employees to speed up the learning process in order to resolve the problems they are facing.
Together with the changes in external environment, the learning intention of employees is also a main factor that has significant impact on learning process of employees and organization. Hamel (1991) defined learning intention as the ability of the members to “take the initiative and actively seek good learning opportunities”. The better learning environment for employees can be established when the organizations strongly focus on learning and are willing to bring, the more knowledge to their employees. Thus, it will foster the employees’ learning intention and reduce the chances of resistance to learning. Consequently, it will help the organizations to speed up the learning process. Thus, this is an endless loop with two interactive parties namely organizations and their employees. The learning intention is also increased by the competition within the organizations’ environment – the learners tend to take more initiative actions in obtaining the contents of knowledge, observing surrounding environment, forming the concepts to be more ahead in competitions. Therefore, there is high chance for employees to complete the learning cycle.

Traditionally, the organizations only focused on explicit knowledge from books, media but did not train their employees in order to convert explicit knowledge to implicit one. However, the situation has changed recently; they pay more focus on the employees’ learning cycle; not only forming concepts but testing concepts in real situations and obtaining concrete experience. However, know-what and know-how knowledge are insufficient for employees in this unstably changing environment externally and internally since the job is no longer a routine one especially IT jobs. The reason is that, in order to work with information technology, IT professionals are not only required to form adequate concepts but grasp more experiences and be creative in their job (Louis, L.G. and Michel, S, 2008 ). They need to observe their working environment and question about job’s content and the relationship to its context and motivations. In other words, the employees must pay more attention and give more care to the process to complete the job and consider about ways to make more improvements. Consequently, employees reach “care-how” and “know-how” level of knowledge (Ming-Ten, T. and Kuo-Wei L., 2006). Therefore, they can make effective usage of their experience and knowledge; then the process of revising and improving knowledge keep going on.

Moreover, a very important factor that affects the learning process is the ability to recognize knowledge acquisition (Chang, S., 2010). Moreover, the skills should be seen from both sides: knowledge holders and knowledge learners. For instance, in externalization learning model, the knowledge holders need to convert their own tacit knowledge into explicit forms so that the knowledge learners are able to absorb knowledge. This mainly depends on level of processing and manipulating tacit knowledge to express into explicit forms such as texts, diagrams, metaphors. The reason is that the more deeply and comprehensive knowledge is explained, the better it will be for the learners to grasp. Additionally, the learners’ ability to process information also plays significant role in learning process (Florence, M.S and Hedy, M, 2007). Specially, the ability of learners to carry out semantic encoding of content can improve learning process by making the sentences more meaningful.
4. Empirical study

The above chapter discusses 7 different steps involving in knowledge formation and transformation based on theoretical background. In order to build strong evidences and verify the suggested framework, the empirical study is carried out. The collected data is analyzed based on the theoretical framework in knowledge formation and transformation discussed earlier. Thus, the last three sub research questions are answered after the empirical study.

In the sub question: What are steps involved in knowledge formation and transformation among IT professional? The collected data from empirical study tries to explain and verify the theoretical framework.

The sub question: What resources IT professionals use to form their knowledge?, is answered by exploring the opinions and experiences of IT professionals in carrying out their daily work life.

The factors mentioned in sub-question: What are the factors influent the processes of forming and transforming knowledge facing by organizations and IT professionals? Are also revised and explored using the evidences given by collected data.

4.1. Interview preparation

The purpose of interviews is to yield in-depth responses about people’s experiences, opinions and knowledge about how they form and transform knowledge to support and enhance their work. In order words, interview questions try to capture and communicate the respondent’s stories in their learning and sharing knowledge process. Therefore, open-ended interview questions are used to get the perspective and experience from each individual; which will lead to great perceived impact. Additionally, the author also puts some closed-ended questions to initiate the opened questions and being the leading questions to set up an acquiescence response.

As the previous chapter discussed the suggested learning and sharing process with 7 steps; the set of questions should allow the respondents revealing the main research question in relation to 7 learning steps. The author aims at having clarity and focus in set of questions by distinguishing major steps in learning processes. In other words, the research is a basic research which tries to create steps in knowledge formation and transformation from the understanding of the experience of IT professionals in learning and sharing knowledge. The process of finding and using information sometimes is considered to consist of some steps:

- Realizing the need for information
- Seeking and collecting information
- Process and evaluating information
- Using information
- Evaluating the result of information use
- Sharing information
- Feedback giving and receiving

Thus, the interview questions are prepared based on the above steps in knowledge formation and transformation. Besides, the factors that affect IT professionals in learning process are also asked. This report encloses interview questions in appendix. The expected responses are experiences and behaviors which are used to explore respondents’ experiences, actions, activities and insight about knowledge formation and transformation they have done to support their job purposes. The questions were prepared as neutral without any bias about races, job titles, etc. to collect appropriate data.

4.2. Participants

The qualitative research methodology is chosen with in-depth interviews in order to study the issue of knowledge formation and transformation in depth and detail. Nine IT professionals spent some of their time to respond to interview questions. All of them are now working in companies or organizations in Singapore. There are 3 respondents working as Project Officers in Nanyang Technological University. They are working in designing and building software which is leading-edge research in machine learning, and multimedia research. One of respondent is working as software engineer in TechSemiconductor. The respondent is responsible in building and maintaining in-house systems that support wafer manufacturing. Another respondent is software engineer in Siemens (Singapore) and is responsible in design and developing safe embedded systems for automobiles. Additionally, an interviewee is working as software engineer in NCS in design and implementing software for customers with direct interactions with them. Besides, one software engineer with similar tasks working in Crimson Logic is also participating in this research. Moreover, two software engineers in R&D department of Yokogawa Asia are also keen to take part in this research. They are responsible to design and develop PRM and PST products which provide automation in site for oil industry.

The primary respondents are aged from 26 till 29 and have working experience ranging 3-7 years. All of the respondents have university degree (either bachelor or master degree). This study focuses on the mentioned specific group of participants in order to obtain objectivity as much as possible due to some reasons as followings.

Firstly, the qualitative research is not “constrained by predetermined categories of analysis contributes to the depth, openness, and detail of qualitative inquiry” (Michael, 2002, p. 14). Michael also discussed that quantitative approach has major advantage of possibility to measure the reactions of many people to limited set of questions. Therefore, the collected information can facilitate comparison. However, with qualitative method, a much smaller number of people and case are studied which can reduce the generalizability. Thus, the homogenous group of audiences helps to keep the objective of this research in-depth, detailed and focused.
Secondly, with the age of 26-29 and 3-7 years of working experience, the participants are mature enough in their job especially with IT job which requires very much in on-job-building experience. In other words, they have sufficient understanding, competence and familiarity in working and learning process. For example, an average software engineering with only 1 or 2 years experience is not capable enough in carrying out the job and building sufficient knowledge. In addition, IT job depends heavily on experience and familiarity with the IT related information such as helpful, reliable resources, books to build knowledge. All the respondents are holding university degree which also indicates that they are more sophisticated in term of knowledge building and sharing.

4.3. Interview process

The qualitative interview begins with “the assumption that the perspective of others is meaningful, knowable, and able to be made explicit” (Michael, 2002). The author follows the “Standardized open-ended interview” approach (Michael, 2002) to collect qualitative data through open-ended interviews. In this approach, the author asks each participant the same set of interview questions. This approach is chosen to make sure that the list of issues is to be explored in the course of an interview to make sure that all the issues were covered. Additionally, the author also wants to minimize variation in the questions posed to interviewees by having the same set of questions.

Usually, each participant was in contact up to 1 week before the interview to as to make sure the interviewees consent so the author could set up the convenient date and time. At that time, the purpose of the study was explained to interviewees with the objectives and interview. In addition, the author also explained why they were chosen to participate in the interviews, the expected process to carry out interviews with and duration were also briefed. All participants consented to have voiced interview through communication software such as Skype and Yahoo. They also agreed with recording the interviews. In the meanwhile, the prepared interview questions set was reviewed and updated to be more suitable for the objectives of the research. Additionally, standardized interviews were used to prevent the variations in data which created by differences among interviewees. Consequently, the author could concentrate in the data which is guarded against deviation and still open-ended in the sense that the respondents still provide their own words, thought, insights in their answers. Additionally, standardized questions made the data analysis easier since the author can locate the answers to the same question. Approximately 2 days before the interview date, questions were sent to the interviewees for them to know precisely what is going to be asked and what is not going to be asked so that they can have better preparation in the subject. Besides, the interviews were taken through geographical difference so there is time difference; therefore, it was only possible to interview each participant for approximately half hour. Thus, the author sent a set of focused interview questions in order to save time for respondents and to establish priorities for the interviews.
The interview was conducted with summarized key objectives in the study followed by the set of prepared questions. The interviews were conducted from 9th to 14th April 2010. Each interview took up to half an hour and was conducted in English. After finishing interview, the author transcribed collected data into readable form by keep the original information and insights from participants’ point of view.

4.4. Transcribed data

The transcribed data in this section consists of verbatim quotations with sufficient context to be interpretable. Therefore, the voluminous raw data are organized into readable form with major categories to be interpreted in relation to the framework of knowledge formation and transformation discussed in above section. Transcribing data offers “the transition between data collection and analysis as part of data management and preparation” (Michael, 2002, pg 441). Additionally, in the transcription process, the raw data do not include judgments if what occurs is good or bad. From the transcriptions, the author could obtain the opportunities to get immersed in data which will lead to emergent insights about data that will be useful in analysis phase.

This analysis section organizes the responses in the patterns that follow the suggested learning framework discussed in the previous chapter. The analysis follows analytic deduction which verifies the framework of learning and sharing process based on the qualitative data collected from the interviews.

From the stories told by participants, this section’s purpose is to test the theory discussed above in learning and sharing among IT professionals. Particularly, the data collected from group of IT professionals working in Singapore are used to test the framework built. The author follows analytic deduction technique which verifies and revises the proposed framework by using qualitative data. The following section analyzes each step in learning and sharing process in order to confirm or update the framework.

4.5. Analysis

4.5.1. Realize the need for information and knowledge

Most of respondents realize the need for new knowledge if they are given new requirements for their jobs such as new functionalities, module, product, etc.; or when they need to resolve existing problems such as “being stuck in the problem”, “program error” – in other words, when they are in the middle of something and realize that they cannot proceed further - so they need to find the solutions for problems; the job requires enhancing, optimizing existing products or receiving the modules handed over from others). As one interviewee replied that

*My knowledge acquisition happens when there are new requirements for new products; for different software products or different requirements at first, there are a set of certain*
knowledge and information should be studied thoroughly in order to be well-prepared in the job.

“The certain knowledge and information should be studied thoroughly” could be the enquiries from colleagues, bosses, etc. These enquiries force them to render an absolutely correct answer or solution. Besides the above reasons, there are 3 respondents continuously update their knowledge due to the fast-changing of IT field – ascertain their knowledge. They reported as following:

Well, as a software engineer in IT firm that provide world-first innovations and sustainable services to collaborate more seamlessly with customers, I have realized the importance of continuously update my knowledge so that I can catch up with the ever-endless IT development.

I realize the need to search for knowledge when I need to keep updated with new technology or when it is required for work.

I search for new knowledge regularly because IT has been changing and updating in very fast pace thus to keep myself with keep-to-date information, I search for knowledge every day.

This is interesting that the number of responses that keep update knowledge continuously and on regular basis is relatively quite low. There are two possible reasons namely they do not explicitly realize the process of updating new technologies, terminologies or they actually only update these when there is requirements as two responded that

I realize the need to search for knowledge when I encounter a new terminology (term), is put into a situation where I need to solve a problem that is new to me, I need to get more information about that field.

Sometimes, the knowledge I should search for is the current design and implementation as well as the used technologies of the module or program.

Additionally, there are 2 interviewees said learning is never-stopping process: they only stop when they feel they have learnt something. Then they will continue with the updating knowledge journey. The proposed framework has identified most of the scenarios that IT professionals want to seek information and knowledge. In either situation, the process of learning and sharing of IT professionals occurs daily by actively looking for new information, knowledge from various sources; the following section discusses the process of seeking and collecting information.
4.5.2. Seek and Collect information

To narrow down the area of knowledge, the learners set out the scope of information; two interviewees explicitly reported that they labeled the term or defined the set of certain information and knowledge first and then seek for it.

In the step of finding information and knowledge to get right answer fast, the attributes of sources become very important because the learners demand more traits from the resources. The most commons in the discussions were to enhance seeking for information and knowledge experience as rapidity of finding information, the amount of available information and knowledge with reliable level, the cost incurred and the applicable properties.

For instant, when reporting about the speed characteristics of the resources they are considering, the respondents said that

*In my experience, most accurate knowledge will be internal documentation (in company), thus it takes less time to understand the concepts using because the knowledge has been used and tested within the organization. Therefore, internal documents are really useful for me.*

*The Internet is very fast channel to search for information – sometimes I can obtain the useful information in only 10 minutes. I can also control the time of my own to search.*

*I use those sources because they are easily available and effective. For example, by searching in Google using the keyword I can find a lot of useful information almost immediately.*

The quotations above illustrate how learners think and consider the speed of seeking information. They prefer having resources which are fast and easy to search; one possible explanation is that searching for information and knowledge can be a real struggling experience as there are huge amount of information available everywhere especially in the Internet. Thus besides speed, the respondents also care about the amount of available information, one respondent said that

*Sometimes it can be time consuming to find the exact information and to evaluate information.*

On the other hand, some thought that

*The Internet is always up-to-date and has a huge range of knowledge (almost everything is there in the Internet)*

*I use online sources because there is huge information available*

*I use Google search because I can find a lot of interesting and useful information and knowledge from that based on my search criterion. In discussion forum, I can grasp*
different opinions and comments about certain methods and techniques used to solve the problems.

There are different views on the amount of information available from the resources to seek and collect information. Some thought that it was an advantage but other thought oppositely as it would take more time in finding correct information. This phenomenon does not show contradiction as there are many factors influence the process of seeking for information such as the popularity of information and knowledge, the differences from different sources, etc., and especially experiences of learners. Moreover, despite of the huge amount of available information in the Internet, the origin of the information is often important to consider; for instance, if the origin is not well accepted or established, the learners cannot confidently make use of its content.

The third characteristic of resources IT professionals care about is reliability as some of them reported that

*I use those sources because of the accuracy of information provided. I believe that the information was contributed by a lot of experts in IT and they have tested in their products. Example of sources from internet is forums, example source code, Microsoft online publications, etc... Knowledge from books is reliable as well. The circulated magazines are really popular in automation industry so that information in them is reliable and helpful for my job.*

*I read e-books because they are convenient to use whenever I have my computer or PDA device with me. The information provided in e-books is reliable and in great detail which is very useful for me.*

Seeking and collecting reliable information and knowledge are very important for knowledge learners in general and IT professionals in particular. Not only does it affect the quality of jobs, reliability can have enormous influent on learning process. For instance, if the information and knowledge are inaccurate, there might be big holes in the learners’ knowledge which will lead to unpredicted consequences in the future.

Besides, cost of the sources also has some impacts on the choices of resources. Most respondents said that they try to search for free information and knowledge at first before coming to other options which are not freely distributed. For example, one said “*Information is freely available in the Internet with contributions from experts all over the world*”. Some consider using internal documents and knowledge residing in other colleagues due to there is no cost involves and they are useful and applicable for the job scope as one interviewee commented that “*my working environment encourages learning from colleagues so I have very good opportunity to obtain in-depth knowledge from more experienced colleagues.*”
Everyone realizes the use of the Internet to search for more information and knowledge (which is the explicit knowledge) and most of them spend 2-3 hours per day on the Internet. All respondents come to the Internet because it is free with huge amount of information available; moreover, some of trust information in the Internet. On other hand, some only trust those reliable and widely used sources such as MSDN, digital library. They also put convenience as one reason for using the Internet. Besides, some IT professionals also use books because they have detailed information, and were written by experts as one reported that he would read book to acquire in-depth knowledge, or another commented as “I use book to acquire knowledge but it happens seldom. I read books when I need to learn some techniques (programming language...). The reason is that, books have step by step instructions which I can build depth knowledge”. As mentioned previously, internal documents are also one type of sources IT professionals looked for when acquiring knowledge.

However, there are four respondents explicitly realizing the resources from colleagues as following:

\begin{center}
When I want to clarify things or when I feel stuck, when I need idea, when I need comments; I will approach my supervisors. When I work in a team, when I know they’re knowledgeable in the field I’m working I will ask my colleagues.
\end{center}

There are 2 aspects of this phenomenon: respondents who do not often acquire knowledge from colleagues are quite independent in building their knowledge; however, this can show limitation in the externalization process. It may be the case that they do not really realize the process they acquire knowledge from colleagues. For instance, all of the respondents have some interaction with colleagues in form of meetings, discussions about the job scope. The fact is that, in the latter part of interview session, there are few questions discussing about knowledge gained from colleagues and 100% of respondents confirmed that they have obtained knowledge from their colleagues as this is one of the way to build knowledge. Other perspective is that the respondents who realize the usefulness of acquiring knowledge from colleagues are likely to make more use of it. Additionally, the time span they spend on acquiring knowledge vary: some of them are able to determine approximate time; some said that it depends on their job scope.

The respondents think of resources for information and knowledge when they encounter problems, facing difficulties and searching for solutions. In addition, they also reach those sources when they feel the lack of information and knowledge; or they want to confirm certain information; or when they need more data, ideas to carry out the jobs. Judging a piece of information or knowledge is true or false is very critical. When there is information and knowledge in hand, they need to compare different information from different sources in order to seek and collect the right one based on some criteria such as relevant, accuracy and currency (timelines of information). It is practical situation, most of interviewees agreed that they would stop searching for information and knowledge they their needs have been fulfilled: problem solved, able to apply and complete their task at hand at certain accepted level. The accepted level
is very different from different people with different experience… For instant, some interviewees reported as following

I decide to stop finding information when more than one sites suggested the same solution and the solution is tested to work. From that, I can make sure the method I use is correct and my solution works perfectly and effectively

... when the information knowledge suits my need, and proved to be the most effective solutions based on facts and analysis...

The above quotation from one respondent shows that the trust laid on 2 similar information indicates the lack of verification at online resources. Thus, the same information from 2 different sources can be relevant but it is not warranted that it is accurate. However, it can be understood that the respondent verifies the information and knowledge by duplicating the search in multiple sources and looking for discrepancies between the search results. From this point of view, the learner is able to obtain more reliable results. In the meanwhile, others make sure about the accuracy of information and knowledge by searching from trusted and well-known sources such as internal documents, colleagues, MSDN sites, etc. Additionally, the currency of information and knowledge is always crucial aspects for IT professionals who are working in the unstoppable development of technologies, knowledge. For example, one respondent reported that he cared about the currency of information from internal documents by checking the latest documents which described latest version of products and technologies used. The result of comparing different information from different sources is used for filtering out irrelevant information and knowledge to keep only relevant and useful ones. Thus, from that, the concepts are formulated to be ready to process and evaluate. Before discussing the next step of evaluating and processing the raw information and knowledge; it is important to highlight some of the views in obtaining knowledge from colleagues.

Most of the respondents think that they learn by observing purposely because they want to learn the specific knowledge, when the amount of knowledge they have is limited in certain subject area. Few scenarios mentioned are: observing colleagues solve the problem, seeing the way they handle problems with skills and tips. In observing colleagues during discussion about the software, the respondents can learn from the good experiences their colleagues have. As one respondent said that

I observed my colleagues making an electronics circuit, asked them how to do connecting, etc. From doing that, I can learn the methods to make good quality electronics circuit and I can apply it when the task is given to me.

The examples in observing colleagues are surrounding building technical knowledge such as observing colleagues making electronic circuit to learn the method to make good quality ones and apply when the task is given. Four respondents mentioned about observing the way source
code is done by colleagues and how it is done to build their own knowledge technically. There is one interviewee reported that sometimes the learning process from other people happened coincidentally “while doing projects with other colleagues for example during peer-review or discussion session”

Some interviewees learned technical knowledge such as: setting up visual C# project, reading documents properly, designing methodology, designing pattern, and preparing documents. From observing their colleagues, they can learn tips and techniques which enhance the quality of work or make the work faster or more effective approaches to carry out the job and solve problem. In other words, they can observe how a senior approaches a problem and compare that with their own methods thus they know the differences and know why one way is better than the other. The interesting point is that one respondent even could learn from her colleagues when she is explaining information and knowledge to others. In fact, it is wrong perception to think that you cannot gain anything when you are teaching and sharing to others; you also gain a lot in the process of sharing because you have opportunities to revise your knowledge once more and it is possible to create new ideas by doing that.

It is very interesting that there are 3 interviewees mentioned about soft skills learnt from observation: attitudes towards the existing problem, the techniques in handling with customers, the skills to obtain and share information and knowledge. Besides technical skills, soft skills are also type of implicit knowledge which not only IT professionals but everyone has to build in their life. When having sufficient soft skills they can make their learning processes more effectively. They have recognized the soft skills because some of them mentioned about these they learnt from observing their colleagues. For instance, some soft skills the respondents mentioned are: attitudes towards difficult situations, writing skills to conceive knowledge in clearly written form, the way to give supportive and encouraging feedback, problem solving skills.

There are only 2 respondents explicitly mentioned if they have some created ideas from observing their colleagues however due to confidential information, the creative ideas cannot be discussed here about its quality and contribution to the work. However, creative idea can be very simple as the new method to make the source code run faster or new process to reduce the heavy job on certain software module. Therefore, it is possible that most of interviewees think creative ideas as something “big” and “unimaginable”. Sometimes, something new is what they are working on; the result of their work is new product, new documents, new paper or presentations.

4.5.3. Process and evaluate the information

In the learning process, the step of processing and evaluating information is very critical because it can attribute to the quality of information and knowledge gained which ultimately influences the results. To evaluate information and knowledge, most of respondents use trusted resources so that they feel more confident about the information they have found (as mentioned previously). Moreover, they also rely on their own experiences to check the information. One respondent
mentioned about using Wiki as the first source to evaluate the information and knowledge: this can be misleading because wiki is contributed by everyone so the information there is not 100% true. The interviewees commented that they would analyze if the information and knowledge is suitable for their purpose as following

*After having the useful information in hand, I will proceed with processing the information by linking them to relevant fields I am working on*

*From the information and knowledge I have found, at first I read briefly first to see if it’s applicable for me and if it’s interesting.*

The above quotations show the phase of engaging the information and knowledge into the sources to be suitable for initial purposes. The differences between this pace and the filtering information in seeking and collecting step are that it involves higher mental process from the learners and more analytical abilities. After that, the respondents reported that they extort the pertinent information and knowledge which is useful for their purposes. A very interesting aspect here is some of respondents would like to evaluate information and knowledge by asking recommendations and suggestions from their colleagues, supervisors since they trust the knowledge within the organization which is really helpful in learning process. Then, the concepts are systemized by organizing information and making sense of information from different sources by spotting main ideas, conflicting information, misconceptions, different views, etc, as one participant said “I will scrutinize carefully the information to make sure that I fully understand it.”

Moreover, the learners evaluate the usefulness and trustworthiness of information/ knowledge. Six respondents agree about the applicability aspect of information and knowledge to apply for their job. For example: “the sources give me the example usage of knowledge so that I can learn how to use it fast”, “the information should correct my misunderstanding or to confirm and construct your own understanding”, “the information must be useful to find out the root-cause of the problems, requirements and the method to resolve that.”, “serve as a mean to solve my doubt and problem”. They also care about the way information and knowledge is represented: “I also prefer the knowledge in well-written and easy-to-understand manner.”, “clear and easy to understand solution”. Again, in this step there are 2 interviewees care about the cost occur in using information and knowledge and one cares about how many man-hour resources needed to implement the information. One respondent would use own experience to judge the usefulness of information and knowledge.

Before applying to the real situation, the interviewees agreed to again filtering out irrelevant and remaining the portion that can be used in the work or build knowledge in order to “draw bigger picture of understanding”
4.5.4. Applying and testing with adjustments

In the interview question of using information and knowledge to real situation with adjustments, even though answers received look quite different from each other but all respondents have the common reply when they apply the information and knowledge they have; for example, one mentioned “I have to adjust / tune the solution to fit into my systems”. On other hand, before using information and knowledge, most of them go through the step of editing and synthesizing information for suitable use. Then, they can re-create and create more knowledge such as

“I think about the effective way to apply those information and knowledge in my task. I believe that by doing that I can make the knowledge my own.”

After that, knowledge from different sources is combined with the existing knowledge to create the practical concepts “I will express the knowledge in written form using my understanding about the knowledge or information which is suitable for my job. It is usually the documentation process that I need to combine the available information.”

It is really interesting that three respondents do not really acknowledge the process of combination in their learning process as they do not recognize how they combine explicit knowledge from books, the Internet to the written form to store or share in the organization. One example they give is using free component from the Internet and they would include its design in the detailed design document. This is apparent example of how IT professionals are combining explicit knowledge into explicit one. The author believes that every IT professionals or at least everyone the author has interviewed have done that before. In order to have stronger argument in combination, the author re-approached the interviewees to confirm about it. The result is that everyone has done that often in their jobs. Few examples in combining knowledge interviewees reported: transforming information from documentation, books or the Internet to more readable form so that others can view and understand. The knowledge is expressed in written form using own understanding on the suitable knowledge or information.

The gained concepts are applied based on own experiences; on other hand, this is the phase of testing knowledge in real situation. Even though there are few opinions that they do not test the knowledge they gained in real situation but the way they do that is actually testing. For example, one software engineering said:

No, I don’t test the knowledge because I gain in real situation such as knowledge obtained when I am designed or implementing particular software. However, from the knowledge I gain, I will apply the knowledge in real situation. It happens daily when I am working.

Almost other interviewees agree testing knowledge in real situation is important process to enhance knowledge quality to apply to their job. Some of them said that it depends mainly on the type of knowledge they got. Two respondents mentioned that they obtained knowledge from real working experiences – that is also the situation they have tested their knowledge. While applying
the concepts to real situations, the learners also evaluate the concepts again based on own experience in order to utilize best value of knowledge. Thus after applying knowledge, the learners are able to re-apply to new situation as “trying new ways to do something when I feel it can be done more efficiently (gain new knowledge and test knowledge in real situation)”.

Kolb (1976) was of the opinion that, when a person is observing and experiencing the surrounding, he/she would frequently form certain concepts and then test these concepts in real situations. Once a certain degree of success is reached, these concepts become his/her concrete experience and will be used in the future.

### 4.5.5. Evaluate the result of applying information

It is very essential to evaluate the result of using knowledge so that the learners can learn more effective way to use their knowledge or fulfill what is missing or misunderstood. To evaluate the result, most of IT professionals participated in the interviews have realized the importance of updating and enriching knowledge especially in IT field because it is always changing and updating. Thus, they keep on equipping themselves with knowledge using the Internet, books, and publications. The first purpose is to apply into their daily job, the second one is to keep them update with new technologies, new methods to keep up to date with the latest happenings in IT world. With solid knowledge, they can judge the results of using information and knowledge in terms of preciseness and effectiveness. For instance, one software engineer noted the experience in evaluating the usage of available knowledge in real situation as “the information and make it as my own knowledge by trial & error by applying to real situation”. Then, the learners can judge the problem solving and knowledge building process as one said that “there may be holes in my understanding of the knowledge and I look to fill it up”. Evaluating is the effective way to revise existing strategies, methods, processes to create more effective methods in the future. Enriching and enhancing knowledge play very important role to have skills to create more effective method in the future. From collected data, there are 3 respondents consciously realize that they are enriching their knowledge by asking colleagues and supervisors. There is one interviewee updates her knowledge through training. In fact, almost organizations send their employees to internal and external trainings. Despite that almost respondents did not mention about trainings to enrich and update knowledge, it does not mean trainings do not exist. After the interviews, the author has confirmed with the respondents if they attend training sessions to improve their knowledge; the result is that 100% of them have done that before. Besides, testing knowledge against real situation also helps in creating more effective methods in the future but unfortunately, no information was provided regarding to this in the interviews. Thus, the revised framework will eliminate this sub-step.

### 4.5.6. Sharing

As discussed earlier, all respondents agreed that colleagues (friends) are as the sources for gaining information and knowledge as well as involving in their learning process. In order to achieve effective knowledge sharing environment in the team particularly and organization
generally, the learners should emerge the needs and ideas of sharing as the desire to prevent reinventing knowledge or reduce the search time in the team. All the respondents agree sharing knowledge to others and they are willing to receive or accept knowledge sharing from other colleagues because it is a good practice that organizations should adopt. Respondents reported some reasons that promote knowledge sharing as when knowledge within team and organization is approachable, fast, free, reliable as knowledge has been used and tested, and applicable as it is specific for the working environment, fast and effective to evaluate. However, the respondents do not mention the cost that entail in this sharing practice. Some considerations should be taken care of are: the time management in sharing, the man power, maintenance cost and productivity. Additionally, it is possible that other colleagues have encountered the same problems so through sharing they can increase efficiency. As they think if knowledge sharing is enabled in working environment, it will create a lot of benefits for both individuals and the organizations: improve productivity, improve the quality of development, and create opportunity for employees to look at the problem from different views. For all reason, the needs and ideas of knowledge sharing emerge as one interviewee mentioned that “The team, the company can grow together by sharing”.

From collected data, it is noted that every interviewee has unique experience in knowledge such as sharing through presentations, or articles in interesting topics, source code, trainings, etc. In any example, the first act they would do is expressing their own knowledge explicitly; on other hand, they need to convert from tacit knowledge into explicit one to enable sharing. The below quotations show step if converting tacit knowledge into explicit one

*Before company meeting, I need to prepare slides to share my knowledge in the field I’m working on. The others do the same. I also need to write weekly reports to my supervisor and he will share them to anyone for whom he think the knowledge is applicable.*

*I usually express my own knowledge through documents & training. I present my own knowledge by answering questions or explain to others about the method used in my development.*

*As a project officer, I often need to do research and write research papers. When I am writing research paper, I put the knowledge I have learned and create into written form so that the others researchers and readers can read; understand and giving feedback to me. The written papers are always in formal form so that they can be published by research community.*

*Situation that I express my own knowledge: in written forms, I have documents such as specification, design, implementation, test plan and test documents. Those are required from my development in order to keep track of the development process and keep the quality of product in high standard.*
At the same time of converting knowledge, the learners also produce creative inference in the knowledge such as

*When I have found new knowledge to solve the problem, I can create my own article about that and present to the team for verification/validation. By doing that, knowledge is revised and validated in both individual and team level. That can improve the knowledge building level in organization.*

In order for the creative inference occurs, it requires the immersion of information from another conceptual space which is then used (Franz S., et al., 1997) – the conceptual space existing in the learners own experiences with interference of explicitly available knowledge. When knowledge are expressed in documents, papers or explicit ideas with creative inference; learners proceed to develop the procedure for sharing such as sharing sessions, presentations, peer previews, etc. to express their knowledge in own terms.

Besides the steps in knowledge sharing, interviews also aimed to discover the necessary requirements to share knowledge effectively. Everyone knows the important of working with a team especially for IT projects because it is very common to work with others to design and implement software products. Thus, teamwork is really important as one respondent said that

*My company often assign big project to each team. There is no way one person can doing it alone without the help and cooperation from others. That’s how I realize the importance of teamwork. With organized team, I can learn soft skills such as how the team works together, how they solve problem together as unite entity. Additionally, I also gain technical knowledge.*

At first, the seriousness of every team member can help in the knowledge sharing process as everyone should put a lot of effort in knowledge sharing. On the other hand, the respondents reported that knowledge sharing only can be nurtured in the open environment where everyone is open-minded and willing to learn by receiving feedback, and giving feedback to others. In open environment where everyone shares common language with shared working experience thus it is easier to communicate and exchange information. The open environment is also the one which has encouragement from organization and management level. The organization also encourages that by having common systems to store all knowledge together such as master database which stores all useful, helpful and available knowledge which are relevant to the job. Therefore, they can build the fundamental knowledge. For instant, one participant said that it would help knowledge sharing if there is “*open working environment where the organization encourages knowledge building and sharing among members*” and other said it would be good for sharing if there is “*effective discussion whereby all the aspect of the knowledge can be analyzed and everyone is free to discuss*”. In addition, the interviewees also reported that team and organization should have common place to share knowledge; thus it can be accurate, specific to the job and gives examples and implementations are the easiest way to share information.
From the collected data, all organizations that interviewees are working with have realized the importance of knowledge in improving the quality of product and updating knowledge of their employees. Such as, all interviewees are having at least one system to share knowledge from internal email system to well-established system such as digital library. One interviewee mentioned about posters to announce about breakthroughs or major events and incidents inside the organizations as well as outside. This is a very good channel for employees update the latest news. The roles of KM systems are mainly on keeping “the lessons learnt to share with others so that everyone is aware of human errors, mistakes to avoid it next time”, and can broaden knowledge of employees. One noted that “the systems in my organization are user-friendly and helpful”. Sharing role can be shown that experts put their knowledge to system which will be available for everyone in the company. By having KM system, everyone is able to search for the information in the systems or contact resourceful colleagues for solution to solve their problems. The system can enable these employees to look for partners to solve the problem together such as the third party.

Some companies have knowledge sharing process such as conducting exchange session where software engineers share latest technologies and methods used in the organizations. Everyone is updated with the news and it is useful for future because if the team is about to work with the same technology, the knowledge can be transferred effectively without searching for the solutions from scratch. For example, they said that

There are some Intranet systems in my company that support knowledge transfer and knowledge sharing among employees. They have roles of sharing, searching and partnering. Firstly, the sharing role can be shown that experts put their knowledge to system which will be available for everyone in the company. Secondly, everyone is able to search for the information in the system or contact resourceful colleagues for solution to solve their problems. Thirdly, the system can enable employees to look for partner to solve the problem together (I prefer partners as the third parties who are working together with us)

Moreover, most of the respondents use the KM systems available in teams or organizations on regular basis (daily) and they trust the systems. The reason they gave were: systems were built by experts of the organizations, the information and knowledge derived from real working experiences so it has been used and tested. In addition, the documents posted in the systems are the ones what explained the specifications, design, implementation, test of the product; they are approved by different people such as team leaders, managers. Moreover, they are really reliable and useful to apply to work because the seniors have considered all the aspects of works based on adaptation to the culture and working environment. They also said that the systems are useful for the work as software engineers because the information there is related to what they are working on. Using the systems is fast and easy. There is a lot of knowledge which is very deep in the systems so it is easy to get some help from others.
They trust the systems but not blindly. They also consider the accuracy, usefulness, up-to-date of the information posted. Such as one interviewee said: “I do verification to ensure the trustworthiness of the information by checking with my colleagues and supervisors or check from the Internet to see what they have discussed about that” or other one mentioned that “I evaluate it by having to sieve through all commits as a portion might have been updated in a later commit.”

There are 2 respondents who are not using the KM systems in the companies at all: “I seldom use those systems: based on pre-existing knowledge which I have already built through my working experiences”, “I have never used those systems because my work requires specific knowledge which doesn’t involve any other team in the company”: Actually, they do not realize the systems in correct functionalities because they mentioned some of the document systems in their companies or they should have email system; thus they have been using those system quite often. However, there is one interesting aspect here: some systems do not serve the need of everyone in the organization or not everyone can value the use of it, thus the process of knowledge learning can be affected by this situation.

It will be shortcoming if teamwork is not mentioned in knowledge sharing since it plays very essential role and has big influence on the learning and sharing process. As two software engineers said that it was common that software projects are big so that the companies need a team in order to development. In addition, in this competitive working environment, there is no way one person can work alone without help and cooperation from others. Working in a team, IT professionals can discuss about design, implementation, and test method. In addition, they also can discuss about the techniques to improve the speed, user friendliness, quality to software product.

Working in team can improve communication between each member and how to work together, thus it will increase effectiveness and working spirit of the team. As one interviewee said that “Without helping each other there may be delay in the development which can cause hindrance in the schedule”. Moreover, working in a team can enable team member in gaining technical knowledge by updating, verifying, polishing own knowledge.

I think the importance of teamwork can be view as followings: to build up a small community which can help to resolve the problem together, to share the knowledge and make it available to new comer, which will accelerate the learning curve, and to provide the active environment to validate/verify the new knowledge provided by members.

Additionally, the team members also feel valuable when giving constructive feedback to others: willing help each other by giving feedback and taking feedback keenly. Most importantly, by working in a team, they can develop better methods in doing the job which can be very difficult to find out when everyone works separately as participants said
For example: we work together to find best ways to create communications channel for different module in most effective ways. Sometimes when we are working together, we have developed better methods in doing the job which can be very difficult to find out when everyone works separately.

I believe that: The better your team is, the better yourself can be. Each team member becomes expert in different parts, we work together to bring all these knowledge to build systems.

One respondent reported her experience in teamwork as “My experiences are: willing to help each other, willing to listen to feedback and giving feedback.”

4.5.7. Feedback / comments giving and receiving

The final and central step in learning and sharing process is feedback/ comments giving and receiving – critical step and should be encourage among members in the organizations. There are two dimensions in this step as giving and receiving feedback which include the set of sub-steps discussed earlier.

Firstly, the respondents said the steps they would do to give feedback as “when there is a need and my colleagues are really helpful in correcting me when I have misunderstanding or doubt” after carefully reviewing the items to be evaluated; preparing and arranging idea and then describing the purpose of feedback – unfortunately, the collected data does not explicit show these steps of feedback giving.

The participants described in more details when they are receiving feedback such as

Firstly, I listened carefully, after that I analyze how the feedback can be used in my tasks. If there is anything I am unclear, I ask my colleagues for more verifications. Finally I apply the feedback to my work and ask for comments from my colleagues. This is an on-going process which helps me to enhance my knowledge and improve technical skills.

The first act in receiving feedback is listening carefully with notes so that learners can understand fully the feedback and in order to seek for clarification and examples from others to have “discussion together to better understand and receive comments from others and discussion thoroughly with my colleagues to study if the feedback is applicable to my work”.

After receiving feedback, the process of considering and analyzing information start all over since feedback is type of information and knowledge which can help IT professionals in enhancing the quality of work in faster and more effective way. Thus, the feedback is further processed as: record the areas that need to be investigated further; examine carefully the usefulness and applicability of feedback; and retain and apply feedback. For examples, some participants described these steps as followings
I take feedback very seriously like I try to understand it clearly, study it to see if it is suitable for my job, ask my colleagues if I don’t understand something; apply feedback to make my work more efficient with higher quality.

When I receive feedback from others, I will proceed analyzing the feedback to see whether it is the scope of the system.

In addition, all participants take feedbacks seriously as they are the hints for them to improve themselves and to enrich their own knowledge and they apply feedback then it is applicable for the work after the analyzing process. Some mentioned that feedback also helped them to find out holes in their knowledge; so they can fill in the misunderstanding or something missing. On other hand, feedback helps them judge if their method is applicable and they are in the right path. One said “receiving and giving feedback are on-going processes when working with a team”, thus, feedback giving and receiving keeps repeating during the product cycles.

Almost everyone agree with the importance of feedback and the companies also encourage feedbacks among employees. From feedback systems, the quality of knowledge employees own can be improved therefore the quality of products will increase. Additionally, feedbacks can encourage and improve communications among employees which are very important in working as a team. Since they think feedbacks are really important for their works, they take them really seriously. At first, they receive feedback from either supervisors or colleagues; they analyze feedback to find the suitable use to their work. If there are any doubts they ask for verifications. Then they proceed to apply for job. By receiving feedback, employees can update more knowledge in timely manner, effective, and the knowledge is reliable because it is from the reliable sources and has been tested. From feedback, they can re-enforce their strengths and correct their mistake or weakness so quality of work result will increase. The learners can learn from them through the ways their colleagues think, analyze and solve problems, better solution for the problems. However, there is one interviewee who does not really use feedback for his job, this can be resulted from the less encourage feedback-giving environment or feedbacks are not within the desired scope. The author believes that the organizations also consent about the important of feedback in improving quality of product, help employees in learning process, update and validate employees’ knowledge, improve communication among employees.

Giving feedback is the communications process which both sides should possess some tactful actions in order to avoid conflicts and enable open-mind, free learning environment. However, despite of the importance and usefulness of feedback, all the organizations interviewees working with do not have established physical feedback systems to encourage employees giving and receiving feedback in the well-defined process. The lack of care in investigating in feedback can lead to problems in communication since not all employees have tactful communication skills. It might degrade the initial purpose of feedback. Currently, IT professionals realize email and conversations as processes in giving feedback. They are fast, efficient but not well-defined

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because sometimes it may happen incidentally. Feedback through email can be inefficient sometimes because employees ignore or do not have chance to read email. With feedback in informal conversations, sometimes it cannot be taken seriously or no responsibility or credit taken or given.

The interviewees also reported feedback giving and receiving step happens in all other steps of learning and sharing process; the examples of connections from collected data as following

- With realize the need for information and knowledge

  *The third scenario I need acquiring knowledge is receive modules handed over from others. Specifically, when other colleagues resigned or moved to different projects and they left their module to me, I have to study the specific cases with certain technology and knowledge in order to handle the projects successfully.*

When receiving modules handed over from others, the interviewee has to attend hand-over sessions which would involve various feedback giving and receiving acts.

- With seek and collect information and knowledge

  *Learning from my colleagues is also a way I am using to acquire more knowledge because the knowledge gained from them are very applicable to my job.*

- With process and evaluate information

  *To evaluate knowledge and information from the sources, I receive recommendations from my colleagues, supervisors.

  Other sources I use are the reliable sources such as from colleagues and different opinions from friends to evaluate the information and knowledge I have found.

  The other sources I take to evaluate the information and knowledge found are recommendations from colleagues.

  Based on individual analysis and experience, I will evaluate the value of the information, and call a meeting to discuss with team members to have more feedback and response about my evaluation. Since my company encourages knowledge sharing among employees, everyone is very keen in evaluating other’s knowledge and information in very friendly way.*

- With apply/ test information with adjustments

  *In my department, peer reviews are really common and happens regularly (specifications reviews, design reviews, code reviews, test plan reviews, etc) so that I can maintain and enrich my knowledge by listening to others.

  For example, when facing difficulties, can ask colleagues if they have better solutions. I am lucky that my team is very supportive and available when I need help.*

- With evaluate the result of applying information

  *Or I also can ask for opinions from my colleagues and supervisors who are more experienced and familiar with the task – it is fast and reliable for me as well.*
Whenever I read or receive information, knowledge from colleagues or friends, I bookmark it so that I can use it in the future.

With sharing knowledge

In fact, by sharing knowledge to others we also have the responsibility to help improve the development and opportunity to look at knowledge from different view and maybe receive feedback to update more knowledge. In the past, I taught the build engineer of other teams how to build in VS2008. And they did follow what I taught.

4.6. Factors influent learning and sharing process

The interviewees mentioned some technical factors that affect their learning process such as: the availability of knowledge from books, the Internet. For example some information are widely available in the Internet such as commonly used design patterns, but some are not widely used such as ways to work with an particular enterprise software; up-to-date information thus it can keep the product not outdated; the reliability of the information; economy and market may not cause new technology to immerge causing lower learning rate; application: “if the information can be applicable to my work, I will be keen to learn”; cost of the information and knowledge to obtain.

Besides that, there are many “soft” aspects mentioned by respondents that affect their learning process such as the working environment with encouragement from company and helpful colleagues – team spirits and appreciation. Some of the factors are: willingness to share knowledge from colleagues; friendliness of working environment with friendly, open colleagues; the support from management team and company systems; “my motivation when I am working”; interest: “if the topic is interesting for me, I will be willing to learn”. Therefore, the companies should do something to increase interest of employees in learning because encouragement from the company in building and sharing knowledge also play crucial role in learning and sharing process. Additionally, one important aspect is the working environment such as team buildings, open-mind colleagues.

In order to stimulate motivations: the most important factors observed from responds are the encouragement from management team and the better team with credit systems, accomplishments in work. All of these factors can be combined as the working environment factors to encourage motivation. Besides the environment factors, there is self perceived factors which also can increase motivations at work: the quest for learning new things and doing things better, interest (with interest, the person will feel more motivated), the knowledge own through improving and enriching knowledge. From collected data, the interviewees would be motivated if there is

... the accomplishment of work when I have enough knowledge, the encouragement from management team, the willing to share knowledge from colleagues.
I will feel more motivated in building and sharing knowledge when there are award systems for employees who have worked effectively and created new ideas to support and improve the quality of software.

I will feel more motivated in building and sharing knowledge when I work with better team. For example, the good team is the team that everyone is really into sharing and free discussion about information and knowledge. The member is also open to receive feedback and give feedback to each other. They take feedback seriously as valuable contribution in learning process.

In building and sharing knowledge, I am motivated by helpful colleagues who are always available when I need and provide me a lot of useful information or give me valuable feedback. Additionally, the encouragement from the university also make me more motivated in my learning process because I feel useful and I feel my work has contributed into research area.

I think a credit system to give aware to those who share new knowledge is very effective way to increase employees’ motivation in building and sharing knowledge.

Some participants self interests as motivation factors

Improving and enriching own knowledge make me more motivated in building and sharing knowledge.

The most important thing is interest, I think with interest I can build and sharing knowledge effectively.

In my experience, the quest for learning new things and doing things better can motivate me in building and sharing knowledge.

Some organizations have done some actions to encourage learning and knowledge sharing such as: reward system for creative and new ideas or high quality products with fast, effective method, pay for training course, “Xchange session where employees share working experiences and products have been developed in the departments”, “meetings or seminars for us to share knowledge and providing feedback”, promote clear and transparent communication bridge among departments

It is interesting that one respondent does not see any action done by his organization to encourage learning and knowledge sharing. When the author verified with him, it is true that his company does not invest into knowledge building and sharing, knowledge was built and learnt from his initiative and interest. The motivation was derived from himself. This is most probably the outriner.
5. Discussion

5.1. Conclusion

Basically, the interviews confirm learning and sharing process discussed previously. After discussing the suggested framework in knowledge formation and transformation in chapter 3.6 based on theoretical studies, there should be some mechanisms to verify and confirm the validity of the framework. The author aims to give complete and comprehensive framework that described steps involved in knowledge formation and transformation among IT professionals. In order to serve that purpose, the empirical study (interview) is helpful to verify and revise the suggested framework. Firstly, from the analysis of collected data, the author is able to revise and update some steps in knowledge formation and transformation which are not shown obviously. Secondly, the author can also add more influent factors that have strong impact in knowledge formation and transformation among IT professionals. The result from empirical research can be used to assess the merits advance in practice (Joanne L., et al., 1993). The findings derived from empirical study can help to answer research questions as well to serve the purpose of this study. Thirdly, the empirical study exposes some areas in knowledge formation and transformation that has not been considered by the author.

Chapter 3.6, 3.7 and 3.8 discuss the steps in knowledge formation and transformation, relationship between learning phases and 4 levels of knowledge; and factors influencing knowledge formation and transformation steps. Moreover, chapter 4 discusses the empirical study which is used to support and revise the theoretical framework. In this chapter, the revised framework is discussed using analysis of collected data from interviews.

The situations proposed in the first step are matched with responses from interviewees. Moreover, in the second step – seek and collect information and knowledge – there are some respondents in favor of noting convenience as on reason for them choosing the suitable source. Thus, the sub-sep is revised to include convenience as one factor influent “Define which sources and channels for seeking knowledge”
From the stories told by participants, learning through observations happen daily in both conscious (8 over 9 interviewees) and unconscious (1 interviewee) ways from purposely viewing the ways other working and imitating the same to coincidently learn from other colleagues when there are interesting knowledge such as tips to using the software faster and more efficiently. So, the figure below expresses the phenomenon.

Additionally, all interviewees also review knowledge and skills that the interviewed IT professionals learn from others (supervisors, colleagues) in both technical and soft skills. In other words, all respondents confirmed that they have obtained knowledge from their colleagues as this is one of the methods to build knowledge. From observing others, not only technical skills but soft skills are formed and developed. Additionally, knowledge can be learnt from both sides (Louis, L.G. and Michel, S, 2008 ). The figure below summarizes knowledge and skills gained learning from others. 
The next sub-step to be revised is under seeking and collecting information: Comparing different information from different sources. From collected data, the interviewees are in favor of choosing sources which have clear presentation style such as well-written, clear and easy to understand.

In addition, because there are few interviewees who really acknowledge the sub-step “Combine the existing with new knowledge to practical concepts”, the revised step “Applying and Testing with adjustments” eliminated that – This does not mean the learners do not experience combination step but it can be implicitly understood in the previous one.
Similarly, there is not enough evident showing sub-step “Create more effective methods in the future” in the “Evaluate the result of applying information” learning and sharing phase; therefore, the revised step will eliminate this sub-step.

**Figure 17: Revised Applying and Testing with adjustments**

**Figure 18: Revised evaluate the result of applying information**

Besides findings discussed in previous chapter, this section is dedicated to some important facts which do not belong to any mentioned subject. From stories told by respondents, sharing plays an important role in learning processes due to some advantages. Additionally, the participants
trust colleagues as a channel to build and enrich knowledge – one of the best ways to construct knowledge.

**Figure 19: Benefits of sharing knowledge**

Sharing knowledge is an effective way for learning and sharing process since there are so many benefits achieved from sharing knowledge as mentioned previously. It will be dangerous if people consider their formal learning (such as from classes or trainings) as the only mean for their career (or they think lessons learnt from classes are enough in their learning process). It can be said that knowledge is the key to build a “learning society” thus ignoring the access knowledge from others and sharing knowledge to others would be shortcoming in learning process. In other words, realizing the importance of learning from others can enable learners enhancing and improving learning and sharing process (Tom J., 2006 and Louis, L.G. and Michel, S, 2008).

Additionally, teamwork can stimulate sharing step by providing various advantages as listed in the figure.
Another findings can be concluded from stories told by participants is the requirements that they think are necessary to boost the feedback giving and sharing steps. These requirements are represented in the below figure.

**Teamwork**

- Improve communication between each member
- Increase effectiveness and working spirit of the team
- Enable team member gaining technical knowledge by updating, verifying, polishing own knowledge
- Feel of belonging

**Figure 20: Benefit of teamwork**

All participants reported that they test their knowledge in real situation at different levels – in one form or another form – such as test while working on the tasks, test while evaluating the result, test based on contributed feedback from others.

Another fact is that collected data confirms the processing feedback step is similar to processing new information mentioned earlier. It can be explained that feedback is a type of new information and learners need to process using similar techniques and own experience. Feedback is on-going process and can happen formal and informally from formal arranged meetings to informal conversations during coffee breaking (Louis, L.G. and Michel, S, 2008).

It is an interesting fact as the reported data show most of organizations do not implement feedback systems to support the learning process for employee in giving and receiving feedback. There are only some systems to keep track of software quality or documentations but they do not
explicitly do the work of feedback system. However, organizations are striving to build suitable working environment for employees. The reason is the supportive working environments are very important for the learning process of employee: such as colleagues, encouragement from companies (encourage learning, giving feedback, send employee for training, credit and reward systems, system for KM and feedback), company update employees’ knowledge by buying books, 3rd party.

Co-design is also one remarkable aspect in sharing knowledge; unfortunately, the collected data does not reveal further on this topic (Roberta H. et al., 2007).

5.2. Method evaluation

As mentioned before the author followed creative research in this study so there is much less structured and cannot be always preplanned – which can lead to changes of plan. The initial plan of the research was to find out knowledge formation and transformation among IT professionals based on 4 different learning cycles namely socialization, internalization, externalization and combination; and 4 different levels of knowledge (know-what, know-how, know-why, care-how). However, after tutorial session with her supervisor, the author modified the based framework in order to obtain the desired results from qualitative data. To be specific, instead of examining the knowledge formation and transformation among IT professionals using the 4 learning models and 4 different levels of knowledge, the author decided to arrange the learning and sharing process using 7 organized steps. By doing that, the collected data was well-suited the purpose of this study. Therefore, interview questions were prepared based on the learning and sharing steps in order to explore the participants’ learning experience.

Basically, the collected data has revealed most of the aspects in learning and sharing knowledge except for those listed below

- “Combine the existing with new knowledge to practical concepts” in “Apply / Testing information and knowledge with adjustments”
- “Create more effective methods in the future” in “Evaluate the result of applying information”
- Detailed information on “Giving feedback”

However, the basic structure of learning and sharing phases are successfully constructed and confirmed by qualitative data. The stories told by interviewees significantly contributed and supported the proposed learning and sharing process. For example, some portion of collected data verified the rightness of most learning and sharing steps. Moreover, the collected data also contributed to the framework revision thus the author can update the framework to be closer to the facts reported by participants.
Additionally, there are some new aspects discovered from collected data such as the benefits of sharing knowledge, teamwork, the requirements for effectively giving and receiving feedback, etc. Thus, the evaluation section has discovered most of aspects of learning and sharing process; additionally, the research questions are answered, too.

5.3. Research evaluation

The major purpose of this study is to explore and investigate experiences of IT professionals in Singapore in learning and sharing knowledge process in the patterns (steps) that follow suggested learning and sharing framework discussed previously. It is relatively clear that the data and analysis have answered researched questions with additional statements that are useful for future study. As mentioned previously, the author uses different dimensions namely validity, reliability, measurability and generalizability.

The author applies method of evaluation suggested by Michael Q. (2002) of “looking for data that support alternative explanations”. Therefore, the differences in data help increase confidence in the suggested framework of knowledge formation and transformation. For example, there are different views on the amount of information available from the resources to seek and collect information but this phenomenon does not show contradiction as there are many factors which influence the process of seeking for information such as the popularity of information and knowledge (session 4.5.2). Thus, the author can find “best fit” result for this study and she is able to keep track of alternatives, consider and test these during data analysis. Therefore, the validity of the research is assured because the suggested theoretical framework is guarded by the collected data from empirical study and carefully consideration of the topic from different perspectives such as from different points of views of IT professionals. For instance, after analyzing collected data, the author revised suggested framework in knowledge formation and transformation in order to be sure that the framework is closely linked with the empirical study. Additionally, the validity of this research can be proved by the focus on how well evidences are provided; analysis and descriptions are presented appropriately in relation to the reality of the situation such as the revised steps in knowledge formation and transformation in order to build a better framework. For example, in the analysis, the author retains steps which are verified by collected data and eliminates steps which are not shown clearly by empirical study. Interview questions were prepared to cover most important aspects in knowledge formation and transformation such as need for knowledge, collection of information, process and evaluation, application, evaluation of results, sharing, and feedback. Therefore, the collected data are well-represented to answer the research questions. Moreover, the validity of this research is showed by well-defined research questions based on the author’s previous working experiences. The purpose of this study is well-defined so the author can confidently say that the researches questions are well-defined.

In term of reliability, this research has built reasonable levels of consistency and trustworthiness. In order to get the research topic, the author has read some books and articles which are in the
same area. Based on her own interests and various studies, she keeps the thesis objective from
different perspectives. In addition, the sources of information are textbooks, articles in scientific
journals, conference proceedings, IT professionals’ interviews… which are considered reliable
and useful for the research. The interview questions are prepared by the author and then
evaluated from the more experienced researchers’ point of view – the author’s supervisor. That
will make sure the questions are still within the objectives of the topic. For example, the author
purposely put additional questions to verify that there are 100% interviewees obtain knowledge
from colleagues even though they do not answer that in the first few questions. Additionally, the
fact that the knowledge formation and transformation framework was built based on the strong
theoretical background and empirical study makes the study more reliable. Moreover, the author
also repeatedly revised the framework which can be closely matched with collect data.

To make sure the result serves initial purpose of this study, the author created a good plan for
this research and followed the plan progressively. Additionally, the interview questions were
well structured to obtain the research’s objectives and achieve findings which are sufficient to
answer research questions. Moreover, the author followed the research methodology techniques
in data analysis, evaluation and presentation to reach research standard so that the measurability
level of the research is assured. In order for the readers to understand well this study, discussion
of the assumptions, findings and analysis in appropriate language and format; and presentation of
the findings with strong evidence. Additionally, in some cases, after the interviews, the author
has confirmed with the respondents if they agree with a certain answer such as attending training
sessions to improve their knowledge; the result is that 100% of them have done that before
(session 4.5.5).

Even though there are some aspects in learning and sharing steps cannot be fully explored from
the study, the author believes that this study has fulfilled the initial purpose – study about
learning and sharing process among IT professional in Singapore. As the interviews were
conducted only with 9 participants, the number is not large enough to generalize in whole target
groups. Despite of small number of participants, the results can be used as the base study for
further researches on learning and sharing process among IT professionals. During the
interviews, the author ensures that bias do not impact the respondents’ perspectives in order to
obtain the accurate findings. In dealing with negative cases, the author uses these to broaden the
“rule” or even change the “rule” such as addition of presentation style property in "Compare
different information from different sources" or convenient property in "Defining which sources
and channel for seeking knowledge" step. The author adopts analytic induction method, so the
negative cases would become “the centerpiece of the analytical strategy for revising and fine
tuning hypotheses and conclusion” (Michael Q., 2002). For example, some steps in knowledge
formation and transformation are tuned and revised to suite the data from the conducted
interviews. By illuminating different statements made by different respondents, the author
reveals and exemplifies how the IT professionals generate knowledge/ knowledge formation
process. On the other hand, the author also studies how different people relate to the Internet or
any available sources of information to form their knowledge. The outliner cases opened new thinking about IT professionals’ experience in knowledge formation and transformation such as considering Wiki as trusted source or trusting information if it is mentioned in different sources - similar information indicates the lack of verification at online resources but it can also be understood that from looking for discrepancies between the searches, the quality of result is improved. In addition, the transformation among them is also discussed. New knowledge formation will stem from how IT professionals make different distinctions and generalization from the huge available information in the Internet and other IT professionals.

According to C.R Kothari (2004) interview technique has many advantages over other methods of collecting data such as:

- Depth information can be achieved.
- Both interviewer and interviewees have great flexibility as they have chance to restructure questions or provide the answers from different points of view.
- The interviewer has free choice of selecting who will be his interviewees.
- The interview can be recorded.
- The interviewer can catch the informant off-guard with almost spontaneous response from interviewees.
- Etc.

However, there are some disadvantages of interview method:

- Sometimes, interviews can be time-consuming due to misunderstanding or further clarifications.
- Bias can exist in the interview.
- It is difficult to get proper rapport with respondents to have effective interview.
- Etc.

Advantages win over the disadvantages of the interview so the author focuses on conducting efficient interviews. In order to conduct effective interviewees, the author prepares set of interview questions in advance. And then, her supervisor reviews and gave feedback so that the author could make sure she has the proper questions in order to conduct interviews as expected and achieve her objectives in the master thesis. Additionally, as suggested by C.R Kothari (2004), the author also creates “friendly atmosphere of trust and confidence so that respondents may feel at ease”. Finally, the author uses email as the main media to contact the interviewees when she needs any clarifications or answers to support her argument. After data is collected, the author proceeds to data analyzing step which is discussed in the following section.
5.4. Generalization

Lincoln and Gubba (1985) distinguish between two kinds of generalization namely nomothetic which is based upon rationalistic, law-like stance; and ‘naturalistic generalization’ which is mostly based upon personal, direct experience. So, in this section, the author adopts the latter one as “the notion of nomothetic generalizations that are truly universal to all times and situations”; “If there is a “true” generalization, it is that there can be no generalization” (Lincoln and Guba, 1985: 124).

In this chapter the subject of generalization of this study is discussed – generalization means that the results of this study (revised framework in knowledge formation and transformation) are valid outside studied cases. In other words, the theoretical study is not limited to any specific case.

Firstly, the author was aware that generalizable property of a research is very important to judge its usability in the topic area as cited by Bell (1999). In this research, the different points of view from interviewees are well taken care of such as the negative replies and new opinions are being discussed and considered to keep the generalibility level; for example, the property of well-representation of resources which IT professionals consider when they obtain knowledge.

Secondly, the use of theoretical background from literature review helps generalize the suggested framework; and the empirical study works as strong evident / proof to establish rigid the suggested theoretical background in knowledge formation and transformation. Thus, the objectivity of this research is secured; and the results can be considered to be generalizable without limiting to any specific target group – the discussion about target group will be discussed shortly.

Moreover, this research adopts two practical principles recommended by Arksey and Knight (1999) in “making a more plausible case for plausible case for generalizing from interview findings” so that the analysis and findings would give more generalizable results. The first principle discussed about the selected sample that allows for the topic to be viewed from all relevant perspectives. In this study, the author is certain that the respondents in the empirical study are good representatives for IT professionals in any organization. The selection of interviewees that were typical of the population of IT professionals based on Gray D. (2004). From the argumentation given by Gray (2004), this study has taken intensive samples which focus on the cases that are typical of the population – as discussed in chapter 4.2 that the participants have sufficient understanding, competence and familiarity in working and learning process. Therefore, the author believes the empirical study target groups are experienced to provide and describe their own experiences in knowledge formation and transformation from different relevant perspectives. It is interesting that the author also finds some new opinions or ideas during analyzing collecting data. The second principle is increasing the sample size and
Arksey and Knight (1999) suggested that the size of eight is often sufficient – in this research, the sampling size is 9 which is more or less satisfied the typical sampling size.

Additionally, the interview questions are designed with repetition of similar questions about knowledge formation and transformation. For instance, the author purposely repeats questions relating to gaining knowledge form colleagues so that the respondents could reveal their full experiences. As a result, the author is able to gain complete and consistent view in the topic. By doing that, the collected data is at certain level of confidence for validity of findings. Thus, the findings from the interview can be generalized to a wider population. Besides, the interview data is studied and analyzed as they are collected until the author was able to draw clear perspectives which are repeated and the data saturation is reached (Gray D., 2004). Thus, the findings are secured to be able to generalize to the population of IT professionals.

5.5. Speculation for the future

In this research, the author has represented the initial framework shows steps in knowledge formation and transformation among IT professionals using the theoretical background from contemporary studies and analyzed data from empirical study. The author then identified four important issues which may help to shape the future research in this subject area, namely the role of employers in knowledge formation and transformation, the relationship between employers and IT professionals in knowledge formation and transformation happening within organizations’ boundaries, the current tools and processes which support knowledge formation and transformation in the organizations, and Co-design in knowledge formation and transformation among IT professionals.

Firstly, future researches can conduct empirical studies which focus on employers and realize the point of views from them in knowledge formation and transformation such as how they think about the current steps in knowledge formation and transformation (Miller, C.S. and Dettori, L., 2008 and Aldred, C., 1997), what they recommend in order to improve the processes, what they do to support employees in learning process, etc. With complete view from employers, the future studies can combine all findings in order to build more comprehensive view in knowledge formation and transformation. The results can be used as the guideline for learners (IT professionals) and organizations in learning process.

Moreover, the relationship between employees and employers in knowledge formation and transformation are also candidate for future research (Louis, L.G. and Michel, S, 2008). Thus, by having understanding the relationship among them, there will be more improvements in learning processes which can be benefiting both parties.

Additionally, the future researchers can investigate the current tools and processes which support knowledge formation and transformation in the organizations by conducting empirical study with both employers and employees. Examples of tools and processes support knowledge formation
and transformation in organizations are knowledge based systems, processes to enable knowledge sharing in organizations. The data from empirical study in knowledge management tools can be used to analyze based on the model suggested by Zeng, Y.R et al. (2008).

The last idea for future research is Co-design which is simulated by teamwork: the technique to enable co-design for new knowledge is created. For example: if everyone works separately, probably not the same knowledge is created. The final result would be more efficient and more effective learning process. There are some searches study co-design in relation to learning and sharing process but only limited on class-room boundary such as Mary (2007) in A Collaborative Co-design Approach for Student-Centric Learning Commons or Garlatti, S., et al (2006) in The Co-Design of Scenarios for a Didactic-based E-learning System viewed as an Adaptive Virtual Document, etc. Besides, Roberta H. et al. (2007) discussed a new co-design method for government practice making through workplace learning. However, none of them have discovered the benefit of co-design to create new knowledge in learning and sharing process generally. It would be interesting topic to investigate in the future.
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Appendix Interview questions

- In which cases do you realize the need to search for knowledge?
- What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)
- In what case you think about using those sources?
- Why do you use those sources (systems in your company, or internet)?
- How do you know that you have finished finding information, knowledge?
- Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – the Internet, book, etc? (Recommendation from colleagues, reliable sources…)
- What aspects do you consider when you evaluate the usefulness of information/ knowledge found?
- What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?
- How do you maintain and enrich your knowledge?
- Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?
- Do you often test the knowledge you gain in real situation? How often do you do that?
- Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?
- Would you like to share knowledge to other colleagues and why?
- Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.
- What do you think are the necessary requirements to share knowledge effectively?
- Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?
- Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?
- Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?
- Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?
- In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)
- Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?
- What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?
- How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?
- Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?
- Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?
- What make you more motivated in building and sharing knowledge?
- What are your organizations doing to encourage learning and knowledge sharing?
Appendix Transcribed data

1st interview

In which cases do you realize the need to search for knowledge?
- When I stuck with problems to design or implement a certain functionality of software product, I feel it is the time to search for knowledge. Thus, I am able to solve the problems.

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)
- There are two sources that I often use in order to acquire knowledge: internet and from people. I often search for information from the internet around 8 hours/week; and obtaining information and knowledge from others (friends, colleagues) around 2 hours/week

In what case you think about using those sources?
- When there are any problems, I think of internet as the first choice. Additionally, when experts or more experienced colleagues are free to help me with the problems, I will take that as second choice.

Why do you use those sources (systems in your company, or internet)?
- Information is freely available in the Internet with contributions from experts all over the world. Moreover, internet is very fast channel to search for information – sometimes I can obtain the useful information in only 10 minutes. I can also control the time of my own to search. The information and knowledge from colleagues are reliable and for-sure useful for my work.

How do you know that you have finished finding information, knowledge?
- I would finish searching for information and knowledge when I find that it can solve my current problem in effective way

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)
- No, I do not use any specific sources to evaluate the sources contain information and knowledge. I only use my own experience to evaluate the information.

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?
- There are three aspects I consider when I evaluate the usefulness of information and knowledge. First aspect is the preciseness of the information since it plays essential role in the quality of the software and module I am working on. Second aspect I will use the information and knowledge if they are easy to understand. Thirdly, other criteria I use to evaluate information and knowledge I have found is if they have deep explanation.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?
- After I evaluate the information and knowledge and make sure that they are useful to use, I will apply them to solve my problem. I will use the information and make it as my own knowledge by trial & error by applying to real situation.

How do you maintain and enrich your knowledge?
- To maintain and enrich my knowledge, I keep overcoming more problems and learn from them so that I can learn more useful techniques and methods to apply to my work. Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?
- Besides information/knowledge from the internet, books, I often learn from my colleagues. For example, asking them if I have problems, in peer preview. Additionally, I also learn from them through the ways they think, analyze and solve problems. Therefore, I will obtain the most effective methods to solve the problems. Addition, through gradual learning from colleagues, I can make the knowledge my own and it is good way to verify my knowledge, too.

Do you often test the knowledge you gain in real situation? How often do you do that?
- I often test the knowledge gained in real situation. To be clear, most of my knowledge is obtained from my own working experience. Thus, the knowledge has been already applied directly to real situation. In my opinion, this is the best way to form knowledge.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?
- Yes, I think it is very important to share knowledge among employees rather than finding information from Internet on my own. The main reason is that it is really fast and efficient to have an expert to help in the situation. Additionally, they are more experienced so the information and knowledge presented are really reliable an expert to help because their knowledge has been used and tested in the same working environment.

Would you like to share knowledge to other colleagues and why?
- Of course because I think that by sharing knowledge to other colleagues we can help each other to improve ourselves. Additionally, when sharing knowledge with others, I have chance I revise knowledge by myself and receive comments from other. It is very helpful to validate my own knowledge as well. In addition, I can learn more by looking through different views of my colleagues.

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.
- I usually express my own knowledge through documents & training. I present my own knowledge by answering questions or explain to others about the method used in my development.

What do you think are the necessary requirements to share knowledge effectively?
- In order to have effective knowledge sharing environment, I think we should have a common place to put all knowledge together such as master database which stores all useful, helpful and available knowledge which are relevant to the job. By doing that, all the team members can search information/knowledge in a very easy manner.
Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?

- Yes, there are some intranet systems in my company that support knowledge transfer and knowledge sharing among employees. They have roles of sharing, searching and partnering. Firstly, the sharing role can be shown that experts put their knowledge to system which will be available for everyone in the company. Secondly, everyone is able to search for the information in the system or contact resourceful colleagues for solution to solve their problems. Thirdly, the system can enable employees to look for partner to solve the problem together (I prefer partners as the third parties who are working together with us)

Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?

- I have never used those systems because my work requires specific knowledge which doesn’t involve any other team in the company.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?

- My work doesn’t require me to combine available information in organizations into newly information so I don’t do that

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?

- Yes, giving feedback is very common in my team because from feedback everyone can learn through good suggestions and mistake of others. Additionally, by giving feedback, I can look for the method to apply to my work so that I can avoid the mistake i made before.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)

- Example of situation I realize the need to acquire knowledge by observing from other colleagues: when I debug my program and my colleague helps me out. I think it is better to learn from expert in debugging because I can learn from my colleague tips and technique to find the sources of the problems and effective approaches to solve. It happens purposely for my cases because I am very keen to learn from others when observing the ways they work with the difficult situation. Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?

- From observing others are working, I can learn from their attitude how they face their problems such as the ability to keep calm in search the solutions. I think it is very helpful for me because having good attitude when encountering difficulties can help me work better

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?
- The most thing I have learn from colleague is attitude such as: not hiding my own problem because when I share it with my colleagues they are willing help to make things work better. Thus, when I face a problem, I usually show it to them and ask for their help if I cannot solve by myself. By doing that I also can improve my knowledge and learn from my colleague the way to resolve issues.

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?
- In average, I receive feedback from my colleagues 3 times/ week. I take their feedback seriously, as I know these feedbacks are hints to improve myself and to enrich my own knowledge.

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?
- Yes, I think that feedback is very necessary in learning. We have training in my company. And after the training, both trainer & trainee need to give feedback about the others. I think that it provides great opportunities for both to revise and validate knowledge from each other.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?
- I believe that: The better your team is, the better yourself can be. Each team member becomes expert in different parts, we work together to bring all these knowledge to build systems.

List the factors that you think can affect your learning process (from both externally and internally)
- Factors that I think can affect my learning process are: Motivation, Condition of working environment, How often to update and perform learning process. First of all, motivations play very important part in learning process because it can affect both quality and quantity. Motivation can come from encourage of the team/organization I am working with or from the thoughts of having improved knowledge. Secondly, condition of working environment can also affect my learning process; for instant, I am working with very experienced and helpful colleagues who are keen to help me any time I encounter issues in my work. Additionally, my company also encourages knowledge sharing which makes me feel more confident in sharing knowledge with others. Lastly, the frequency that I update and perform learning process also affect me a lot since it can show how my learning process has been carried out and what I have learnt from that.

What make you more motivated in building and sharing knowledge?
- I will feel more motivated in building and sharing knowledge when I work with better team. For example, the good team is the team that everyone is really into sharing and free discussion about information and knowledge. The member is also open to receive feedback and give feedback to each other. They take feedback seriously as valuable contribution in learning process.

What are your organizations doing to encourage learning and knowledge sharing?
- To encourage learning and knowledge sharing: My company pays for training course. Additionally, when employees give innovative idea, they can receive award in form of money and certification from the company.
In which situation do you realize the need to search for knowledge?

- Well, as a software engineer in IT firm that provide world-first innovations and sustainable services to collaborate more seamlessly with customers, I have realized the important of continuously update my knowledge so that I can catch up with the ever-endless IT development. My knowledge acquisition happens when there are new requirements for new products; for different software products or different requirements at first, there are a set of certain knowledge and information should be studied thoroughly in order to be well-prepared in the job. The second scenario I need to search for knowledge is new release of technologies. Working as software engineer, continuously updating information, knowledge plays crucial role because technologies keep changing in this environment. Maintaining latest technologies can help me keep my competitive position and support me in working. The third scenario I need acquiring knowledge is receive modules handed over from others. Specifically, when other colleagues resigned or moved to different projects and they left their module to me, I have to study the specific cases with certain technology and knowledge in order to handle the projects successfully.

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)

- Firstly, I would use the internal documentation related to product/module which I am working on. For example, the specifications of software/module are very useful for me to acquire more data, information and knowledge. Secondly, I will conduct more research on available technologies that are related to product and module. It’s my daily activity when I am working, well it is not so determined how many hours I work in acquire data, information, knowledge because it varies accordingly to software and module scope.

In what case you think about using those sources?

- I will use those resources to confirm the understanding, and obtain in-depth knowledge to product/module so that the work can be carried out smoothly as I expected.

Why do you use those sources (systems in your company, or internet)

- In my experience, most accurate knowledge will be internal documentation (in company), thus it takes less time to understand the concepts using because the knowledge has been used and tested within the organization. Therefore, internal documents are really useful for me. Besides, I think that internet is also helpful in case of researching relevant information because they are freely and accessibly available.

How do you know that you have finished finding information, knowledge?

- It’s self-assessment process, until I find that I am able to handle the product/module at certain accepted level – there is no standard in accepted level, this is only based on my working experiences.

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)

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Besides the internal documents available in my company, I also often use sources from the internet such as www.experts-exchange.com, www.redbooks.ibm.com, www.oracle.com/education/oln, http://bdn.borland.com/. They are extremely useful for me because the information provided is from experts from all over the world.

What aspects do you consider when you evaluate the usefulness of information/knowledge found?

- There are few aspects I need to consider when I evaluate the usefulness of information/knowledge I found. Firstly, the information should correct my misunderstanding or to confirm and construct your own understanding. Secondly, the information must be useful to find out the root-cause of the problems, requirements and the method to resolve that. In conclusion, the information and knowledge I find from the sources should help me in finding problems and solutions for the software/module I am working on.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?

- After having the useful information in hand, I will proceed with processing the information by linking them to relevant fields I am working on. Finally, I am able to draw a bigger picture of understanding.

How do you maintain and enrich your knowledge?

- In order to maintain and enrich my knowledge, I keep myself updated with new knowledge daily

Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?

- Besides information/knowledge obtained from internets, books and internal documents, I also acquire knowledge from my colleagues because I think that knowledge gained from more experience colleagues in the matter is very valuable for me. Additionally, I am also being tutored by senior colleagues; and I think that is also a good way to quickly understand the problem and grasp the knowledge to proceed with the job.

Do you often test the knowledge you gain in real situation? How often do you do that?

- It mainly depends on how often I am using the knowledge. In the situational that my job scope – given project - needs to update regularly I need to test my knowledge more often.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?

- In my opinions, information and knowledge from the Internet can be from many trusted and un-trusted resource and sometimes I have to spend a lot of time in filtering and evaluating process - it might take more time than finding the information process. Meanwhile, obtaining information and knowledge can be done quickly and reliably with colleagues. In addition, by communicating with others, I am not only able to build my knowledge but also polish my existing one.
Would you like to share knowledge to other colleagues and why?
- Well, the answer is Yes because I think that it’s always good to have someone verify/validate your knowledge.

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.
- I can give one example such as: When I have found new knowledge to solve the problem, I can create my own article about that and present to the team for verification/validation. By doing that, knowledge is revised and validated in both individual and team level. That can improve the knowledge building level in organization.

What do you think are the necessary requirements to share knowledge effectively?
- I think there are few important necessary requirements to share knowledge effectively namely: Open environment, positive feedback and active response. Firstly, with open environment where everyone has free right to talk and share knowledge, members can feel more natural in obtaining knowledge from others. Secondly, positive feedback is very useful in polishing knowledge. Finally, active response is the necessary requirement in knowledge sharing so that everyone can feel more motivated in sharing knowledge.

Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers?
- In my company, we have some systems that support knowledge transfer and knowledge sharing among software engineers.

If so, can you list them with roles and your opinion about them?
- Some examples of the systems use in my company are: Micro Focus, Borland knowledge base system.
- Their purpose in use is to broaden knowledge for software engineers.
- They are very user-friendly and helpful for us.

Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?
- I have been using these systems on a daily basis because they are the knowledge base of company which was done by senior employees. The systems provide information/solution for all products. Therefore, I think the knowledge in these systems are really reliable and useful to apply to make work because the seniors have considered all the aspects of works based on adaption to the culture and working environment of my company.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?
- I think this will be done with article process, and public into intranet/external knowledge sites. By doing that, the others can view and obtain useful information.
Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?

- Yes, in my company it's always an interactive process between team members. I can give feedback or get feedback from them, which update your own knowledge base properly.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)

- I think the situation can happen with soft skill knowledge. I need to observe more than just reading from books/internet, and some practical experience will be helpful to equip the knowledge gained.

Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?

- Observe senior colleagues dealing with customer (how they talk, the words used, voice, when to keep silence etc..) is a good example if you're working in project-based company.

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?

- Soft skills improved (as mentioned in previous answer)

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?

- Yes, it's a long practical process ... so give/get feedback is a positive aspect to help your improvement faster

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?

- No we don't have any systems for feedback as organization-wide. However, it's a internal team process: for instance whatever you do will be monitored by other team members, and the feedback is along the way with members in the team.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?

- I think the importance of teamwork can be view as followings:
  - To build up a small community which can help to resolve the problem together.
  - To share the knowledge and make it available to new comer, which will accelerate the learning curve.
  - To provide the active environment to validate/verify the new knowledge provided by members.

List the factors that you think can affect your learning process (from both externally and internally)

- Factors that can affect my learning process are: Out-dated documentation, unpopular knowledge (which is not often discussed on internet). The out-dated documents are sometimes very dangerous for software engineer, for example: the design document of first version of the software product can be very different from the recently built software
(let say like 5th version). The other factor is unpopular knowledge which are those that are not usually used among IT experts so they are not often discussed in Internet

What make you more motivated in building and sharing knowledge?
- I think a credit system to give aware to those who share new knowledge is very effective way to increase employees’ motivation in building and sharing knowledge.

What are your organizations doing to encourage learning and knowledge sharing?
- We have credit system to encourage everyone in learning and knowledge sharing. For instance, credit will be counted every month for article contributing
**3rd interview**

In which cases do you realize the need to search for knowledge?
- Most of the time when I am working, I realize the need to search for knowledge. Mostly, when I’m assigned a job in new area, when I want to improve the performance

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)
- Internet (3 hours/day), my supervisors (1-2 hours/week), my colleagues (2-3 hours/week), books(2 hours/week), publication (3 hours/week), talks (1 hour/week).

In what case you think about using those sources?
- Internet, books: the first things I think about when I need more knowledge.
- My supervisors: when I want to clarify things or when I feel stuck, when I need idea, when I need comments.
- My colleagues: when I work in a team, when I know they’re knowledgable in the field I’m working.
- Publication, talk: to update myself with new knowledge.

Why do you use those sources (systems in your company, or internet)?
- Systems in my company: they’re most applicable for me.
- Internet: always be up to date and has a huge range of knowledge (almost everything)

How do you know that you have finished finding information, knowledge?
- I think that knowledge is never enough especially when I am working with IT – it is continuously changing and updating. I will always keep looking for more information and I use it at the same time.

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)
- To evaluate knowledge and information from the sources, I receive recommendations from my colleagues, supervisors. In addition, I use the popular and well-known websites like IEEE, ACM,etc – which are tested and reliable resources.

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?
- I will consider the applicability and the way that information and knowledge is written. For instant, if the knowledge is applicable for my work, I will consider using it. Moreover, I also prefer the knowledge in well-written and easy-to-understand manner.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?
- From the information and knowledge I have found, at first I read briefly first to see if it’s applicable for me and if it’s interesting. If it has passed the first round, I will scrutinize carefully the information to make sure that I fully understand it. Then I think about the effective way to apply those information and knowledge in my task. I believe that by doing that I can make the knowledge my own.
How do you maintain and enrich your knowledge?
- To maintain and enrich my knowledge, I need to keep equipping myself with knowledge using internet, book, publication, asking colleagues and supervisors. For example, searching for new technologies, new methods to do the task. Or I also can ask for opinions from my colleagues and supervisors who are more experienced and familiar with the task – it is fast and reliable for me as well.

Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?
- Besides information and knowledge from Internet, books; to gain knowledge, I often read publication, or asking colleagues and supervisors.

Do you often test the knowledge you gain in real situation? How often do you do that?
- Yes, I test the knowledge gained few times per year when doing my work.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?
- Yes, I think it is really important for employees to share knowledge rather than finding from internet alone. The reason is that their knowledge may be very valuable and more applicable for others in the same company, working in the same field, which may not be found in internet. Additionally, their knowledge has been used and tested in their task which makes it more valuable. Moreover, it is fast and efficient to ask colleagues.

Would you like to share knowledge to other colleagues and why?
- Yes, I like to exchange knowledge with others. Both will gain and the company gains too because I have chance to review my knowledge and update it when my colleagues give me feedback and comments. Sometimes, I also can correct my misunderstanding about the issues.

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.
- Before company meeting, I need to prepare slides to share my knowledge in the field I’m working on. The others do the same. I also need to write weekly reports to my supervisor and he will share them to anyone for whom he think the knowledge is applicable.

What do you think are the necessary requirements to share knowledge effectively?
- Requirements to share knowledge effectively: the seriousness every team member takes into account when sharing knowledge because if they feel this is a serious process of sharing knowledge, it will be effective and benefit everyone. Second, I think we should put a lot of efforts in knowledge sharing, it can encourage knowledge givers and learner more motivations to discuss. Lastly, accuracy of knowledge is also important because with incorrect information and knowledge, it may affect the team and quality of work.

Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?
There is no intranet in my company but there is an internal email system and internal mail list to contact each other. I think it’s helpful for us to share knowledge with each other. Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?

I use them every day. I will do verification to ensure the trustworthiness of the information by checking with my colleagues and supervisors or check from the Internet to see what they have discussed about that.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?

I have never done that before. I write my documents which can use part of the available information from the sources.

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?

I receive feedback from my supervisors. I ask for their advices to improve my weakness. For the strengths that they compliment me, I will try to keep enforcing them.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)

It happens purposely when I heard about good things they have done and about how expert they are in the area that I’m interested in for example during discussions or information conversations.

Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?

For example: I observed my colleagues making an electronics circuit, asked them how to do connecting, etc. From doing that, I can learn the methods to make good quality electronics circuit and I can apply it when the task is given to me.

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?

I have learned few things from my colleagues. For example: I learned how to set up a visual C project, how to read a paper properly, etc. however, there is no new creative ideas though.

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?

I receive feedback from my colleagues most of the time. I think that the feedbacks are very valuable. Firstly, I listened carefully, after that I analyze how the feedback can be used in my tasks. If there is anything I am unclear, I ask my colleagues for more verifications. Finally I apply the feedback to my work and ask for comments from my colleagues. This is an ongoing process which helps me to enhance my knowledge and improve technical skills.

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?
- Yes, I think it’s really necessary. However, we just have the email system to encourage and support feedback from others. Because most of the time we discuss and contribute comments to others face-to-face.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?

- My company often assign big project to each team. There is no way one person can doing it alone without the help and cooperation from others. That’s how I realize the importance of teamwork. With organized team, I can learn soft skills such as how the team works together, how they solve problem together as unite entity. Additionally, I also gain technical knowledge.

- My experiences are: willing to help each other, willing to listen to feedback and giving feedback.

List the factors that you think can affect your learning process (from both externally and internally)

- Externally it’s the availability of knowledge sources such as books, internet.
- Internally, it’s the willingness to share knowledge from colleagues, the support from management team and company system.

What make you more motivated in building and sharing knowledge?

- The accomplishment of work when I have enough knowledge. The encouragement from management team. The willing to share knowledge from colleagues.

What are your organizations doing to encourage learning and knowledge sharing?

- They let us work in team, often organize meetings or seminars for us to share knowledge and providing feedback.
**4th interview**

In which cases do you realize the need to search for knowledge?
- I realize the need to search for knowledge when I need to keep updated with new technology or when it is required for work.

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)
- To acquire more data, information, knowledge, I often use Google, Library/books, Colleagues. Based on accessibility, Google is used most often, usually on a daily basis. Library/books are used less regularly.

In what case you think about using those sources?
- For indepth learning such as learning a new language, books might be more useful than say google. For finding examples or a particular application of knowledge, google is more useful due to its larger and more diverse pool of information.

Why do you use those sources (systems in your company, or internet)?
- I use those sources because they are easily available and effective. For example, by searching in Google using the keyword, I can find a lot of useful information almost immediately.

How do you know that you have finished finding information, knowledge?
- I know that I have finished finding information and knowledge when I am able to apply it and complete the task at hand or when I have learnt what I need or want to know about the new technology.

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)
- When using internet to search for information, one good way for me to evaluate the sources are feedbacks from other internet users on the bottom of the page. For example, in discussion forum or codeproject page, feedback on online information is usually contained on the page itself.

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?
- I would consider three aspects when I am evaluating the usefulness of information and knowledge: Examples, applicability, ease of understanding. Examples aspect means that the sources give me the example usage of knowledge so that I can learn how to use it fast. Applicability aspect means the usefulness of the information and knowledge to my job. Ease of understanding is very important for information and knowledge because in this fast-changing environment, the easier the information and knowledge, the more widely used it is.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?
- If the information was researched to overcome a work obstacle then the information is used to do so. The information is processed and made my own then it is improved upon and adapted to be used in the particular circumstances for which I need it.

How do you maintain and enrich your knowledge?

- I maintain and enrich my knowledge by keeping up to date with the latest happenings in the IT world, and taking on personal projects to improve myself.

Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?

- Other sources I use to gain my knowledge: trying new ways to do something when I feel it can be done more efficiently. By doing that, I can both gain new knowledge and test my knowledge in the real situation simultaneously.

Do you often test the knowledge you gain in real situation? How often do you do that?

- It is depending on the type of knowledge. An example would be while I have knowledge on virtualization; it might not be applicable to my jobs cope. Smaller scale knowledge such as programming knowledge is usually tested through implementation.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?

- It is also depending on the type of knowledge and whether it is applicable to the person with whom the information is being shared.

Would you like to share knowledge to other colleagues and why?

- It will help those in my team to work better and faster thus benefiting the project as a whole.

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.

- When I have implemented a portion, the code is usually well commented, the comments are logged in SVN and my part is clearly marked. Knowing that i implemented a portion of code, if others need information on how to adapt it, they can ask me.

What do you think are the necessary requirements to share knowledge effectively?

- Examples and implementation are the easiest way to share information.

Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?

- Internal wiki - Useful for task lists, but without proper management it can get messy.
- SVN - Documented what the code does and how to use it. Also possible to Diff and see what was changed how the knowledge was implemented

Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?

- SVN - Yes. 80% of the time search for information. I evaluate it by having to sieve through all commits as a portion might have been updated in a later commit.
Wiki - No, too messy and sometimes the information is not reliable because everyone can access and edit the information.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?

- No, I don’t do that in my work

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?

- Nope, I haven’t given any feedback. The current system works fine for me. If feedback is given to improve the system, I will welcome it but will still evaluate the changes before seeing if the changes will encourage me to use the new system.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)

- I will gain knowledge by observing other people working when the other colleague is more skilled at a particular subject which I need to obtain the knowledge to apply to my job to make it more efficient with higher quality.

Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?

- Example is the: By looking at their code in SVN

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?

- I have learnt new knowledge. Sometimes I have new creative ideas to support my work however the information is confidential so I cannot tell in detailed.

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?

- I often receive feedback from colleagues whether that portion of the code works. If they inform me about bugs, there may be holes in my understanding of the knowledge and I look to fill it up. And it is very helpful for me to verify with them.

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?

- Yes, by having feedback, I can fill holds in my knowledge and update, too. However, in my company, there is no system to encourage and support feedback. We only use email, formal or informal conversations to share knowledge to each other.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?

- Usually I work with a team in developing software products and we often have discussion about design, implementation, and test method. Additionally, we also discuss about the ways how to improve communication between each module as well as communication between members of the team to improve effectiveness and spirit of team. Sometimes, new knowledge is created during discussion.
List the factors that you think can affect your learning process (from both externally and internally)
- Factors I think that can affect my learning process: Availability of information and examples of implementations. Sometimes the information is widely available in books or internet; but sometimes the new technologies or techniques are not so common in IT communities, it makes it really difficult for me to learn especially the example usage of such knowledge.

What make you more motivated in building and sharing knowledge?
- If it benefits the project, or i feel the person might be interested.

What are your organizations doing to encourage learning and knowledge sharing?
- There is nothing in my company to encourage learning and knowledge sharing
5th interview
In which cases do you realize the need to search for knowledge?
- I realize the need to search for knowledge when I encounter a new terminology (term), is put into a situation where I need to solve a problem that is new to me, I need to get more information about that field. Since I am working as project officer in research department of a university so having deep knowledge in the terminology and field is very crucial for carrying out my job. I also need knowledge when I encounter problems in design and programming.

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?) In what case you think about using those sources? Why do you use those sources (systems in your company, or internet)?
- In order to acquire more data, information and knowledge, I often use Internet, digital library in the university, books from the library. I use these source everyday at least 2 hours
- Internet is my first choice everytime I need to acquire more data (especially wikipedia) because it is widely used, free and fast. Moreover, I also use it because it is convenient and huge data available.
- The second source I use is ACM Digital Library of NTU. Every time I need to get info in a research field especially when I need to prepare writing research paper. I use the ACM digital library because it contains a huge collection of published papers and journals which have been contributed from researchers in universities from over the worlds and it is a very reliable sources because the information has been reviewed by the research community
- I use book to acquire knowledge but it happens seldom. I read books when I need to learn some techniques (programming language,…). The reason is that, books have step by step instructions which I can build depth knowledge.

How do you know that you have finished finding information, knowledge?
- I will stop searching for the information when I have found enough info to solve the problem/question at hand so I can apply to solve my task

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)
- I will use book to evaluate the information if I cannot find it in wikipedia

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?
- I consider few aspects when I evaluate the usefulness of information/ knowledge found such as: it has enough information I require, it can serve as a mean to solve my doubt and problem so that I can apply in the future situations.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?
- After I have finished finding the information: I analyze it to apply in solving problems, answer my doubts. I usually keep reading and analyzing the resources to find better ways until I feel satisfied
How do you maintain and enrich your knowledge?
- To maintain and enrich my knowledge, I search for it when there is a need. After I read it carefully to grasp full understand what the information or knowledge is about and to make sure if it is the information I have been searching. This is on-going process.

Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?
- Besides information and knowledge from the Internet, books; I often ask more experience colleagues or friends about the area so that they can provide me useful information. I think it is also very fast way to obtain knowledge.

Do you often test the knowledge you gain in real situation? How often do you do that?
- It depends on the need for knowledge. For example, if the knowledge is the one that I purposely search for, I will apply it directly to my job – test in the real working situation. Otherwise, I do not really test at all until I have chance to use it in my job.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?
- I think it is Important for employees to share knowledge rather than finding information from internet by ownself because through sharing, the knowledge has been combined, verified and applied to real situation so that there is no time waste in validating knowledge again. Thus my colleagues and I can save a lot of time in sharing knowledge. Additional, this is a very safe, reliable and fast way to obtain knowledge, too.

Would you like to share knowledge to other colleagues and why?
- Of course, because by sharing knowledge I can have chance to gain knowledge in timely manner and I also can make sure knowledge is reliable.

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.
- As a project officer, I often need to do research and write research papers. When I am writing research paper, I put the knowledge I have learned and create into written form so that the others researchers and readers can read; understand and giving feedback to me. The written papers are always in formal form so that they can be published by research community. Additionally, I also discuss the information and knowledge with my other colleagues when there is an issue or I need confirmation from more senior colleagues. The discussions are sometimes formal meetings or information conversations during coffee breaks.

What do you think are the necessary requirements to share knowledge effectively?
- The necessary requirements to effectively share knowledge are that: open-minded colleagues with willingness to contribute feedback to others and accept feedback from others. Additionally, the quality of knowledge is also important in sharing knowledge effectively.
because only with qualified knowledge, the value of it can be recognized and it can be applied to working situations.

Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?

- Because I am working with university, there are very good digital library system and library books where I can find reliable information and knowledge. Roles of digital library: search for books and papers in related area such as image processing, embedded systems; retrieve the information. In the library, I can search for books related to my working tasks and borrow them. Besides the 2 systems, there is no other system to share and transfer knowledge. In the team, we often share knowledge by having meetings and discussions.

Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?

- Yes, I use digital library very often, almost everyday because from the published research papers I can gain knowledge in terminology in the field precisely. I also use it because it is very fast and freely available in the university. I seldom borrow books from library unless there is a need for me to understand something thoroughly and step by step. In my opinion, these 2 systems are really trustworthy because the information and knowledge have been reviewed by a lot of experts in the area.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?

- As a project officer, writing papers is my normal job. To be able to write a good research paper, I have to search to related articles or journals papers which explain deeply about the theories and subject areas. From the knowledge in those papers, I will build the discussion in background section in my own paper based on my own understanding about the subject before coming to the main work.

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?

- Yes, we often have meetings when there is need for verifying information and doubt. Additionally, before submitting papers to editors, we can hold meetings to discuss about the feasibility and applicability of the paper. I take feedback very seriously like I try to understand it clear, study it to see if it is suitable for my job, ask my colleagues if I don’t understand something; apply feedback to make my work more efficient with higher quality.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)

- I observe other colleague to acquire knowledge when I need to solve problem immediately or I need the information within a short time and don’t want to spend time in search from internet or digital library.
Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?

- Example: I observe the way my colleagues do their work to learn for myself the best way to carry out the job. Or I observer them doing the experiment to have more creative ideas and topics for my research.

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?

- I have learnt a lot from my colleagues such as: their skills in doing the work effective, their attitudes towards difficult situations, their writing skills to conceive knowledge in clearly written form, I also learnt from the way they give feedback in supportive and encouraging manner.

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?

- When I gain knowledge from observation, I will apply when there is a need and my colleagues are really helpful in correcting me when I have misunderstanding or doubt. I consider the feedback serious because I think it is very valuable for my work and it can help me doing better job.

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?

- I don’t think so.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?

- Working with team is very common nowadays. It is really important to work with other people in the team to provide effective job because we can learn from each other, we can update, verify, polish our own knowledge by working with a team. In my job, to create new findings, the value of teamwork plays important role.

List the factors that you think can affect your learning process (from both externally and internally)

- Factors that I think can affect my learning process are: Externally: the amount of available information from internet, digital library, books. The reliable of information in the internet. Internally: the working environment such as team buildings, open-mind colleagues; the encouragement from the university.

What make you more motivated in building and sharing knowledge?

- In building and sharing knowledge, I am motivated by helpful colleagues who are always available when I need and provide me a lot of useful information or give me valuable feedback. Additionally, the encouragement from the university also make me more motivated in my learning process because I feel useful and I feel my work has contributed into research area.

What are your organizations doing to encourage learning and knowledge sharing?
I can receive reward in terms of money and certificates when I have published my papers. In addition, it can benefit me in my research career.
6th interview

In which cases do you realize the need to search for knowledge?

- I realize the need to search for knowledge when I’ve encountered a program error or when I need to find solution to problems. Sometimes, the knowledge I should search for is the current design and implementation as well as the used technologies of the module or program. Moreover, I will search for the methods to solve the problems based on the known technologies used.

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)

- There are three main sources I often use to acquire more data, information and knowledge such as: searching in google, view websites which is developer Network and discussion forum for developer. I acquire knowledge daily and approximately 1 to 2 hours per day.

In what case you think about using those sources?

- I think about using those sources when the error / implementation is new and there’s no clue of how to solve them based on past knowledge acquire; for instant, no one in the team is able to help with the error or implementation.

Why do you use those sources (systems in your company, or internet)?

- Firstly, I use Google search because I can find a lot of interesting and useful information and knowledge from that based on my search criterion. Secondly, the developer networks have been built and maintained by developers who have extensive experiences in designing and implementing software. Moreover, there are a lot of other developers who are actively contribute in developer network in helpful information, comments, feedback to the available information,. Thus I think the information and knowledge in developer network is quite reliable. Thirdly, in discussion forum, I can grasp different opinions and comments about certain methods and techniques used to solve the problems. However, sometimes it can be time consuming to find the exact information and to evaluate the information.

How do you know that you have finished finding information, knowledge?

- I decide to stop finding information when more than one sites suggested the same solution and the solution is tested to work. From that, I can make sure the method I use is correct and my solution works perfectly and effectively.

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)

- Other sources I use are the reliable sources such as from colleagues and different opinions from friends to evaluate the information and knowledge I have found

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?

- I consider the usefulness of information and knowledge when it gives a clear and easy to understand solution. In addition, I also think the information is useful when it is free and fast to search for.
What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?

- With the information I have, I carefully study it to have better understanding, then I analyze the possibility to apply to my work. After that, I have to adjust / tune the solution to fit into my systems

How do you maintain and enrich your knowledge?

- To maintain and enrich my knowledge, I often attend courses and bookmark good sources for future use. My company usually sends employees to external training courses to enrich their knowledge; I think it is really good way for me to update my knowledge. Additionally, whenever I read or receive information, knowledge from colleagues or friends, I bookmark it so that I can use it in the future.

Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?

- The other sources I use to gain knowledge are from colleagues who might have encountered the same problem before. So, they can help me in resolving the problems which can help me to save a lot of time in struggling in finding and solving the problems have been there in my team. I usually ask my colleagues’ help if the problems I am having is new for me. If they know the problem, they will spend time to work with me to resolve them

Do you often test the knowledge you gain in real situation? How often do you do that?

- Yes, I often test the knowledge I gain by implementing it in my work. After the knowledge is implemented, it also has to go through different test phases such as: unit tests, integration test, final test, user test… Therefore, I feel confident about the knowledge I have form.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?

- Yes, it is very important. By doing so we can save time wasted on exploring and the knowledge shared will be gone through one more test phase by revising with other. Sometimes, new ideas are generated through the process of sharing knowledge. Additionally, by sharing knowledge among employees, whole company can grow together

Would you like to share knowledge to other colleagues and why?

- Yes if the person is willingly enough to learn because I think it is fastest and most efficient way to obtain knowledge. No if the person is only looking for a quick way out, we all draw the same pay after all.

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.

- When fellow team member encounters an error and is unable to solve, I will help take a look at it. Since I’m more experienced with the system, I am able to visualize things she is not able to.

- When I first join the team, my manager will brief us on the domain knowledge of the client’s business. With that we could gasp concept of the system quickly.
What do you think are the necessary requirements to share knowledge effectively?
- To share knowledge effectively, the members should have clear-minded, willingness to learn, fundamental knowledge must already exist before receiving more knowledge, and the open and encouraging environment for learning and sharing.

Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?
- Documentation (Technical Specs, User Manual) are available. Technical Specs allow developer to quickly understand the system logic and to assess effort required for enhancement. User Manual allows user and new developer to quickly understand the system functionality.
- Developer Network (MSDN etc)

Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?
- I seldom use those systems. Since solution proposed will usually be based on pre-existing knowledge which I have already built through my working experiences in my company so I seldom require querying on the systems.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?
- After I find and evaluate the information, I will analyze it to find out the aspects I can use for my job. Then, I will express the knowledge in written form using my understanding about the knowledge or information which is suitable for my job. It is usually the documentation process that I need to combine the available information.

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?
- Yes, of course because my company values the feedback giving process in order to improve and enhance the quality of products and the working environment. When I receive the feedback, I will accept it willingly and study it afterwards. It is very often the case that feedbacks are useful for me to improve my work.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)
- I often observe others working when we are having discussion about the module or software. I also observe them when they help me find out the solutions for problems or when I am showing them how to proceed with information. It is wrong perception to think that you cannot gain anything when you are sharing to others; you also gain a lot in the process of sharing because you have revised your knowledge once more and it is possible to create new ideas by doing that.
Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?
- Example: when I am given tasks to solve existing problems in the old systems which I am not familiar with. I need to observe my colleagues when they are working with the existing system and show me how to use these systems. By having deep understanding about existing systems I can build and form my own thoughts about how to implement new modules and solve the existing problems.

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?
- From observing my colleagues I learn the way they work and sometimes I also learn some tips which can make my work more efficiently (such as new design patterns, shortcuts, etc). Yeah, I have got some creative ideas from that, for example: the idea to make the production software faster.

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?
- It is daily process; we give and receive feedback everyday during team discussions or conversations during break. I take feedback very seriously because I believe that the feedback is useful for my work.

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?
- Yes, it is necessary in learning. However, my company does not have any formal system to support feedback, we only use emails to communicate or talk face-to-face when there are needs to give feedback to each other.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?
- For example: we work together to find best ways to create communications channel for different module in most effective ways. Sometimes when we are working together, we have developed better methods in doing the job which can be very difficult to find out when everyone works separately.

List the factors that you think can affect your learning process (from both externally and internally).
- Factors that can affect my learning process are: Internally: my motivation when I am working, the friendliness of working environment with friendly, open colleagues, the reliability of information and sources; encouragement from the company in building and sharing knowledge. Externally, cost of information from third party or internet.

What make you more motivated in building and sharing knowledge?
- I will feel more motivated in building and sharing knowledge when there are award systems for employees who have worked effectively and created new ideas to support and improve the quality of software.

What are your organizations doing to encourage learning and knowledge sharing?
- Sadly, besides sending employees to external training courses to enrich knowledge, my company does not take any actions to encourage learning and knowledge sharing. There are only some activities going on in my department such as previews, discussions, presentations.
7th interview

In which cases do you realize the need to search for knowledge?
- I search for new knowledge regularly because IT has been changing and updating in very fast pace thus to keep myself with keep-to-date information, I search for knowledge every day. Additionally, when I have tasks which are unfamiliar to me, I also need to search for information and knowledge to work on it.

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)
- To acquire more data, information and knowledge I use three main sources: the Internet, books, circulated magazines. From Internet, I usually search for information from popular and reliable links such as codeproject.com, Microsoft MSDN. We have study corner in our departments with a lot of available IT books which are also source I am using to acquire more knowledge. Additionally, we also have circulated magazines which are about domain knowledge in automation industry; this is a very good sources for me to update both technical skills in IT and domain knowledge in automation.

In what case you think about using those sources?
- I think about using those resources, when there is lack of information or knowledge in doing a particular task, I refer to these sources which are very helpful. In addition, from my own experience, I find that information from those sources are really effective for my task.

Why do you use those sources (systems in your company, or internet)?
- I use those sources because of the accuracy of information provided. I believe that the information was contributed by a lot of experts in IT and they have tested in their products. Example of sources from internet is forums, example source code, Microsoft online publications, etc… Knowledge from books is reliable as well. The circulated magazines are really popular in automation industry so that information in them is reliable and helpful for my job.

How do you know that you have finished finding information, knowledge?
- I will finish finding the information and knowledge for specific task when a particular job is done correctly reviewed by the peers and supervisors.

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)
- I do not really use any sources to evaluate the information and knowledge from internet and book. The reason is that, I often check out from the trusted link such as codeproject, and msdn portal – which are contributed by a lot of experts.

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?
- Since I don’t really use any source to evaluate the information and knowledge found, my own experience is used for the usefulness of the information.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?
With the information I have, I analyze it to find effective way to apply directly to my tasks – the knowledge has been resided in me.

How do you maintain and enrich your knowledge?

- I maintain and enrich my knowledge by reading books, internet and listening to people during reviews. As I mentioned earlier, books are really reliable source for in-depth knowledge. There is a lot of information in the internet as well, and it is really fast to find good information. Additionally, in my department, peer reviews are really common and happens regularly (specifications reviews, design reviews, code reviews, test plan reviews, etc) so that I can maintain and enrich my knowledge by listening to others.

Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?

- As I mentioned before, I listening to other people during reviews and observing them solving the problems

Do you often test the knowledge you gain in real situation? How often do you do that?

- Yes, after have found knowledge, I apply directly to my tasks thus I believe it can reveal more effective ways to perform my work. I often do this every day when I am working

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?

- Yes, it will be very specific to the job being done. Example specific projects have specific knowledge required and someone within the organization understand the flow. But the downside is that it is limited to what the person has done in the past project since it might or might not be useful or suitable for the currently projects.

Would you like to share knowledge to other colleagues and why?

- Yes. I think that sharing knowledge creates bonhomie and it is important to knowledge. I will get to know more things and u might find a better way to deal with a problem

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.

- Situation that I express my own knowledge: in written forms, I have documents such as specification, design, implementation, test plan and test documents. Those are required from my development in order to keep track of the development process and keep the quality of product in high standard. In later development, the software engineers can easily access those information to learn what have been done in the software. In verbal form, I share my knowledge through peer previews and in presentation to other members.

What do you think are the necessary requirements to share knowledge effectively?

- Requirements to share knowledge effectively are open working environment where the organization encourages knowledge building and sharing among members. Moreover, employees are supportive to share knowledge with each other.
Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?
- In my department there is document management system, internal portal. They are useful in sharing formal information regarding the projects undertaken. They are easily accessible for the staff and used to gather information about specific projects

Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?
- I use those systems every day to retrieve, update existing documents and upload new ones. I think the documents in these systems are trustworthy since they are build by the company and have been reviewed by a lot of members of the team. Whenever project design and development in progress, these portals are used

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?
- One example is that: when I use one free component from code project, I include the detailed design of that component in my design document (design should be related to my module)

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?
- None so far

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)
- When I know that the amount of knowledge I have is limited in certain subject area, it happens sometimes during design and code reviews where I get to observe others work style such as ways they solve problems or create new ideas to make the work more efficiently.

Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?
- Example when I observe my colleagues to form my knowledge: Code review and design review is a formal process of knowing others work

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?
- I have learnt a lot of things from my colleagues such as: Better design methodology and using design patterns for a particular type of problem. In addition, I also learnt problem solving methodology

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?
- So far none received in my team, no formal process defined, too

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?
Feedback is very important as it helps me judge whether I am going in the right direction. Feedback is often provided and received during peer-previews. Teamwork is very important in organization. How do you realize the importance of teamwork? Can you describe some experiences in teamwork you had to build and create new knowledge?

- Sharing some one’s tasks to help out in the development process. Without helping each other, there may be delay in the development which can cause hindrance in the schedule.

List the factors that you think can affect your learning process (from both externally and internally):

- Internally it is the job, repeated monotonous job hinders learning. Externally, the economy and market may not cause new technology to emerge causing lower learning rates.

What makes you more motivated in building and sharing knowledge?

- In my experience, the quest for learning new things and doing things better can motivate me in building and sharing knowledge.

What are your organizations doing to encourage learning and knowledge sharing?

- To encourage learning and knowledge sharing, my department has done some activities: Specialized knowledge sharing programs held by a member of every department every month. Held for 1 hr – to exchange ideas and information.
8th interview
In which cases do you realize the need to search for knowledge?
- Being a software engineer working in a university, the search for knowledge is needed to develop new applications, to enhance and optimize the current applications. Firstly, when new application is required, I need to search for knowledge to find out the available technologies or feasible techniques to design and implement the applications effectively. Additionally, when there are requirements to enhance and optimize the current applications, the urge to search more knowledge increases since I think it requires more skills in enhancements than building new applications (I need to know in-depth both the current method used and search for better ones)

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)
- In my opinions, any IT related sources will do the task of acquiring more data, information, knowledge. For instance, I always use internet, Microsoft publications, books, and information and knowledge from colleagues. There are so many freely available information from Internet, these information are shared by a lot of experts in IT. Moreover, Microsoft publications such as MSDN are very reliable resources because they are contributed by best software engineers and the information were widely used and tested. Books are also one source that I use to acquire more knowledge because there is structured information provided by books which help me follow the information and build knowledge easily. Learning from my colleagues is also a way I am using to acquire more knowledge because the knowledge gained from them are very applicable to my job. I utilize the above available sources everyday for more than 8 hours per day.

In what case you think about using those sources?
- When there is a need to have broad knowledge, I will use internet as it is faster and various info can be found. On the other hand, have a deep knowledge, I will use books.

Why do you use those sources (systems in your company, or internet)?
- It is easily accessible in the company: internet is available in my company so I can search for information or read online Microsoft publications from Internet. My company also provided some IT books which are very useful for me to build knowledge. Last but not least, my working environment encourages learning from colleagues so I have very good opportunity to obtain in-depth knowledge from more experienced colleagues.

How do you know that you have finished finding information, knowledge?
- I would stop the process of search information/ knowledge when the information knowledge suits my need, and proved to be the most effective solutions based on facts and analysis
Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)

- Based on individual analysis and experience, I will evaluate the value of the information, and call a meeting to discuss with team members to have more feedback and response about my evaluation. Since my company encourages knowledge sharing among employees, everyone is very keen in evaluating other’s knowledge and information in very friendly way. That is very good way to evaluate and test my own knowledge because I can heard opinions from different angles when my colleagues provide feedback about the information I have found or learned.

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?

- There are two aspects I consider when I evaluate the usefulness of information/ knowledge I have found. First of all, it is the cost incurred of obtaining the information for example: if the information is freely available or cost at what amount. Since every organization cares about the cost incur in building IT systems, it is very important aspect the PM as well as team members must take into account. Secondly, I also need to consider how many man hours resources needed to implement the information. The result of second aspect also leads to cost incurring in building software.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?

- After I find the information and build my knowledge, I will apply the information when it is necessary.

- There are three phases I process the information namely: analyze, evaluate, and broadcast. Firstly, the information should be analyzed if it is suited the purpose. Secondly, it is evaluated for usefulness and trustworthiness. Lastly, I will broadcast the information obtained.

- It mainly depends on what the knowledge to make it available to my own. If the information is from books or internet which I can obtain easily at low cost, I will build it to my own knowledge. Otherwise, if the information is from the third party software, I can suggest the company to buy it.

How do you maintain and enrich your knowledge?

- In order to maintain and enrich my knowledge, I usually keep on searching, look out for knowledge related to the field I am working on, joining forums, etc. Therefore, my knowledge is always refreshed and updated to catch up with the on-going changing technologies and competitive working environment.
Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?

- Besides information and knowledge from Internet, book; I gain knowledge from my colleagues (mention earlier). I would obtain knowledge from more experienced people from asking them for specific information, knowledge; review and receive feedback from them; open discussion with others.

Do you often test the knowledge you gain in real situation? How often do you do that?

- No, I don’t test the knowledge because I gain in real situation such as knowledge obtained when I am designed or implementing particular software. However, from the knowledge I gain, I will apply the knowledge in real situation. it happens daily when I am working.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?

- Well, yes, it is very important for employees to share knowledge rather than finding information from Internet. The reason is that, sharing knowledge can save a lot of time for each individual. Moreover, the information shared has already been tested and applicable in the specific tasks. Additionally, colleagues are very accessible and often friend to approach

Would you like to share knowledge to other colleagues and why?

- Of course I would love to share knowledge to others because I think by doing that the individual as well as team can improve the productivity

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.

- In my team, when one shares information, we normally present our knowledge among ourselves in some informal meetings or so-called knowledge sharing sessions. In the session everyone is free to sharing knowledge and give feedback to others’ information.

What do you think are the necessary requirements to share knowledge effectively?

- I think to share knowledge effectively we should have effective discussion whereby all the aspect of the knowledge can be analyzed and everyone is free to discuss.

Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?

- Yes, there is, in our company we are using a system called Documentum, where all the lessons learnt to be posted to share with others so that everyone is aware of human errors, mistakes to avoid it next time. Besides, we also share about our break through. Together with the system, we do have posters to announce about breakthroughs or major events and incidents
Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/ websites?

- Yes, I do often use those systems. The reason is that these systems are of course trustworthy because before information is available to normal users, all the information needs to be approved by managers in the company. Additionally, the information is also very useful for my work as software engineer in the company because it was built by those who have been working within the same organization.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?

- In my team we usually do that: This is the process of transforming information from documentation, books or internet to more readable form so that others can view and understand. For example, when I feel that there is better ways to alter information to better present the information, I will read it first and then study if there is any related information. After that, I will present and prepare the information in written form based on the original one and my own understanding.

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?

- Yes, giving feedback and receiving feedback are daily processes in my team because we think by doing that we can improve the quality of knowledge we own and therefore the quality of products will be improved as well. Well, when I receive feedback from others, I will proceed analyzing the feedback to see whether it is the scope of the system.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)

- I usually acquire knowledge by observing from other colleagues while doing projects with other colleagues for example during peer-review or discussion session. For my case, it happens coincidentally.

Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?

- One example I can think of is: Finding out the reason why things are doing in that way. Thus, from the rational reason I will form the knowledge by myself.

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?

- From my colleagues I have learnt few ways to work such as: I have learnt how to prepare documents to propose certain design architecture for new applications.
How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?
- It is hard to say because it depends on the phases of project, for example, when it is in design phase, we often discuss together to get better understanding and receive comments from others, it happens daily. However, during implement phase, the frequency of discussion reduces depending on the need of everyone. If there is feedback, I will discuss thoroughly with my colleagues to study if the feedback is applicable to my work.

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?
- Yes, feedback is very important in my learning process. In my company there is no system to encourage and support feedback, we only do that through conversation or communicate by email.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?
- When working with a team, I can verify my knowledge and update it continuously. Additionally, I also feel valuable when giving constructive feedback to others. Usually we have sharing + open discussions which are informal meeting where everyone feel free to contribute and comment.

List the factors that you think can affect your learning process (from both externally and internally)
- Externally: reliability of resources from internet, cost of the sources.
- Internally: encouragement from organization (since some companies see searching information from internet as useless netsurfing activities and waste company time and resources.); friendly and open-minded colleagues, motivation in working…

What make you more motivated in building and sharing knowledge?
- Improving and enriching own knowledge make me more motivated in building and sharing knowledge.

What are your organizations doing to encourage learning and knowledge sharing?
- Currently, my organization is having encouragements in learning and sharing knowledge such as: the company promotes a clear and transparent communication bridge among all the departments thus it will be benefit for all employees in the organization.
9th interview

In which cases do you realize the need to search for knowledge?

- I realize the need to search for knowledge when I receive new requirements for new developments or solving existing problems; the urge to search for knowledge comes when I am reading the requirements.

What sources are you using in order to acquire more data, information, knowledge? How often do you use each of them? (Hours per day, week?)

- I usually search online or e-books to acquire more data, information and knowledge. The frequency using the source largely depends on the job scope and my availability. For instance, if I’m quite free, I will use them whole day. Otherwise, I will use unless I am having difficulties.

In what case you think about using those sources?

- I will think about using online sources or e-books when I am facing difficulties during development and need to search for the solutions.

Why do you use those sources (systems in your company, or internet)?

- I use online sources because there are huge information available, it is free and fast to search for, it is contributed by a lot of experienced people. I read ebooks because they are convenient to use whenever I have my computer or PDA device with me. The information provided in ebooks is reliable and in great detail which is very useful for me.

How do you know that you have finished finding information, knowledge?

- I will stop finding information and knowledge when I know that the information and knowledge can be successfully applied to the program. It is often the self-evaluated process because I mainly base on my own experience.

Is there any sources of referencing you are using to evaluate the sources contain information and knowledge – internet, book, etc? (Recommendation from colleagues, reliable sources…)

- The other sources I take to evaluate the information and knowledge found are recommendations from colleagues and msdn which are reliable and tested.

What aspects do you consider when you evaluate the usefulness of information/ knowledge found?

- The main aspect I consider when evaluating the usefulness of information and knowledge I have found is its application to the development.

What do you do with the information you have? How do you process information? What have you done to make the available knowledge to your own?

- With the information I have, I firstly go through the information first to study if it is really applicable or reliable for my work. Then I take the part which is applicable to use.

How do you maintain and enrich your knowledge?
- I maintain and enrich my knowledge by reading articles from Msdn & and knowledge in e-books

Besides information/knowledge from the Internet, books; what other sources have you used to gain knowledge? (observing others, practicing, …) Can you describe how you are about to process that?

- Besides information and knowledge from internet, ebooks; I also gain knowledge by learning from colleagues. For example, when facing difficulties, can ask colleagues if they have better solutions. I am lucky that my team are very supportive and available when I need help

Do you often test the knowledge you gain in real situation? How often do you do that?

- I don’t often test the knowledge I gain in real situation. Only when I am about to use it, then I apply to my development and test it carefully.

Do you think it is important for employees to share knowledge rather than finding from the internet by your own? Why?

- Yes, I think it is really important for employees to share knowledge rather than finding from internet by my own. They can better make me understand the knowledge and relate with the real development situation.

Would you like to share knowledge to other colleagues and why?

- Yes, of course. In fact, by sharing knowledge to others we also have the responsibility to help improve the development and opportunity to look at knowledge from different view and maybe receive feedback to update more knowledge.

Describe the situation that you express your own knowledge into written or verbal forms to share with your colleagues. Additionally, describe how others do that.

- For example: in the past, I taught the build engineer of other teams how to build in VS2008. And they did follow what I taught.

What do you think are the necessary requirements to share knowledge effectively?

- The requirements to share knowledge effectively are: the common language – the common voice in department without any bias or discriminations; communication skill – very important because it is much easier with people with good tacit when sharing and receiving knowledge; and good knowledge of yourself – only when you know knowledge you have yourself best, you can help other to absorb and understand the knowledge

Is there any system (intranet) in your current company that supports knowledge transfer or knowledge sharing among software engineers? If so, can you list them with roles and your opinion about them?

- We have a knowledge sharing session called Xchange. Developers will share their knowledge about the latest technology to others. Usually the teamleader will be the presenter and the session is quite useful.
Do you often use those systems and why? How do you evaluate the trustworthiness of these systems/websites?
- We have the session once every month. I think it is trustworthy because it is created by the senior employees, used and tested by them.

Combining available information in the organizations into newly information is very common nowadays to enable sharing information, knowledge among employees. Can you describe how you do that?
- We share the latest technology in Xchange session by having presentation, written documents, questions and answer session.

Have you given any feedback for those systems or received feedback from your colleagues? How do you take the feedback to improve your working experience?
- Yes. We are going to apply the latest technology into our software development.

In which situations you realize the need to acquire knowledge by observing from other colleagues? (Does it happen coincidentally or purposely?)
- When the situation already occurred before in other development, then we can learn from colleagues.

Observing others working is a very good way to form your knowledge. Can you give some example how do you do that?
- Look into the code in TFS. Or sometimes approach the colleagues directly to ask.

What have you learnt from observing your colleagues? Do you have new creative ideas from that? Can you tell what those ideas are?
- No, I do not really create any new idea, I just follow what he taught.

How do you often receive feedback from colleagues when you are practicing knowledge gained through observation? How do you consider that feedback?
- Unless I find it not applicable, I will go to the colleagues again to ask for advice or I will try to resolve by myself or search online.

Do you think feedback is necessary in learning? Is there any systems in your organizations encourage and support feedback system?
- Yes. We don’t have such system, usually we communicate through email or peer previews or information conversation during breaks.

Teamwork is very important in organization. How you realize the importance of teamwork? Can you describe some experiences in teamwork you have to build + create new knowledge?
- Teamwork is very important, especially the communication between team members.
- When Microsoft SQL Server 2008 firstly came to use, my team member and I work together to investigate the new features and application in our software development.
List the factors that you think can affect your learning process (from both externally and internally)
- Time: sometimes because of the time constraint I cannot spend more on learning
- Interest: if the topic is interesting for me, I will be willing to learn
- Application: if the information can be applicable to my work, I will be keen to learn

What make you more motivated in building and sharing knowledge?
- The most important thing is interest, I think with interest I can build and sharing knowledge effectively

What are your organizations doing to encourage learning and knowledge sharing?
- We have the Xchange session where employees share working experiences and product has been development in the departments
In the first progress seminar of master thesis, the research designs that students were planning or starting to follow were discussed. Each group presented the plans regarding to research design which would be adopted during the 7-week thesis research. After all the groups’ presentation, Anders gave each one some suggestions for improvements as well as comments. The followings note some of the main issues talked about in the first seminar.

- There was one group planned to carry out their thesis in both quantitative and qualitative research methodologies by conducting questionnaire, interviews, and observations. However, Anders suggested that it would be more focus if the group concentrated on only one research methodology. There were few reasons for that such as limited time of the thesis prevented them from having comprehensive and complete research. In addition, following both research methodologies could be tricky to satisfy all the criteria.

- Anders gave me a good number of interviews that would be best for my research design. In the presentation, I misunderstood between quantitative and qualitative research methodologies – the plan was conducting interviews for having deep knowledge in the topic area. Anders made corrections on that and gave full explanation.

- There was one group not sure about the good research methodology to follow, so Anders asked him about his purposes and also explained the available method and gave suggestions for the suitable one.
In the second progress seminar of master thesis, the data collections and analysis that students were planning or starting to follow were discussed. Each group presented their current work on data collections and analysis or their plan in collecting data. Similar to the first presentation, after all the groups’ presentation, Anders gave each one some suggestions for improvements as well as comments. The followings note some of the main issues talked about in the first seminar

- For groups who combined both observation and interview in their study, Anders suggested that the interview questions should be arranged in the manner that in certain topic and related to the observed data.

- Generally, the students should structure the criteria for interview questions from overall to detail levels. Moreover, in data collection process, the level of detail ought to be taken care of because it represents the level of understanding. For example, there was a group who would like to compare search engine among universities in broad and wide manner. Anders suggested that the group should create tables of comparisons based on the initial criteria.

- In my presentation, Anders suggested that the last step in learning and sharing knowledge – Feedback giving and receiving – could cover 4 level of knowledge. I could still keep my current points because it was mostly depending on my own argumentation for that.

- In the seminar, the advantages and disadvantages of sending interview questions in advance were discussed, too. One example of drawbacks was: prevention of simultaneous response; besides, sending interview questions before interview could help both parties reduce interviewing time and focus on the topic.
PROGRESS SEMINAR 3: CONCLUSION

TO: EXAMINER, SUPERVISOR, TEACHER AND CLASSMATES
FROM: DOAN THI CAM THACH
SUBJECT: PROGRESS SEMINAR 1 RESEARCH DESIGN
DATE: 18/03/2010

PARTICIPANTS: ANDERS HJALMARSSON, AND 3 MASTER STUDENTS WHO ARE DOING THEIR THESIS IN SPRING SEMESTER

In the last progress seminar of master thesis, the conclusions were discussed such as what conclusions were there, or how the students could conclude their research after the data collection process. Each group presented the current conclusion or plans for concluding their researches. After all the groups’ presentation, Anders gave each one some suggestions for improvements as well as comments. The followings note some of the main issues talked about in the first seminar

- For one topic with which the student worked with a company to suggest improvements in their developing processes. Anders recommended the student to have inspiration poster placed in the company for reminding employees about the suggestions. That would be a very good way to improve working process.

- Anders discussed with students about the date for final seminar and the report submission procedures.

- Anders also showed the students link to the template for master thesis report. Additionally, he urged the group to contact their supervisors regarding to the study and report progressing.

- …
Högskolan i Borås är en modern högskola mitt i city. Vi bedriver utbildningar inom ekonomi och informatik, biblioteks- och informationsvetenskap, mode och textil, beteendevetenskap och lärarutbildning, teknik samt vårdvetenskap.


Våra ekonomiutbildningar ger studenterna möjlighet att lära sig mer om olika företag och förvaltningar och hur styrning och organisering av dessa verksamheter sker. De får även lära sig om samhällsutveckling och om organisationers anpassning till omvärlden. De får möjlighet att förbättra sin förmåga att analysera, utveckla och styra verksamheter, oavsett om de vill ägna sig åt revision, administration eller marknadsföring. Bland våra IT-utbildningar finns alltid något för dem som vill designa framtidens IT-baserade kommunikationslösningar, som vill analysera behov av och krav på organisationers information för att designa deras innehållsstukrurer, bedriva integrerad IT- och affärsutveckling, utveckla sin förmåga att analysera och designa verksamheter eller inriktiga sig mot programmering och utveckling för god IT-användning i företag och organisationer.

Forskningsverksamheten vid institutionen är såväl professions- som design- och utvecklingsinriktat. Den övergripande forskningsprofilen för institutionen är handels- och tjänsteutveckling inom kunskaper och kompetenser inom såväl informatik som företagsekonomi utgör viktiga grundstenar. Forskningen är välrenommerad och fokuserar på inriktningarna affärsdesign och Co-design. Forskningen är också professionsorienterad, vilket bland annat tar sig uttryck i att forskningen i många fall bedrivs på aktionsforskningsbaserade grunder med företag och offentliga organisationer på lokal, nationell och internationell arena. Forskningens design och professionsinriktning manifesteras också i InnovationLab, som är institutionens och Högskolans enhet för forskningsstödjande systemutveckling.