CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Research has played an important role in this new world as it is an important factor for an organization to survive in the real world, particularly the discovery of new knowledge or innovation occurred during research processes. This knowledge helps organizations in many ways, for instance, it can reduces production cost, solve problems, and helps in decision-making in business process. These things increase manager's ability to deal with big change such as Tom Yum Kung crisis or Hamburger crisis.

Many countries rely on the crucial role of researches especially the advantage for stimulating the economics. There are many attempts to support research by other organizations such as allocating a part of their budget to use in R&D, set up R&D department in their organization, and distributing fund for research at other academic institutions (Bowen, 2005).

Universities are one of the organizations which have responsibility to run researches in many disciplines. Due to the research capacity, there are many high potential researchers and doctoral students. Every year, there are many valuable research results produced from all universities in this world. These results also contribute to social and communities in many ways, for example, providing academic services to communities, publishing the researches in academic journals and

conferences, and applying research results to communities (Chang, & Trubow, 1990; Monsted, 2002).

To achieve the research, research management is strongly required. Research management should be based on research information of researchers for the research planning and decision making of administrators to be more efficient. However, research management in universities still face with the problem as it still lacks research information due to many reasons.

First of all, researchers are not willing to share their research information to universities because most researchers have direct individual grants from the outside. When they submit all their information they only submit to their grantors, not to universities. Thus, universities do not know current researchers' performance. Secondly, research information is very dynamic; many researchers may change their research interest and topics from time to time due to many factors, for examples, their interests, their supportive fund, their research resources, and new academic trends.

Chiang Mai University (CMU) is one of the competent universities in Thailand which gives high priority to research. The university has made research the most important university's missions and assigns researching to be another task for lecturers besides teaching. There are many well-known researchers in various fields, and these researchers receive grants from many sources, both domestic and oversea. However, as same as others universities, CMU lacks the research information supporting decision making.

The lack of information makes the expertise and research direction of researchers unknown to the administrators. When grantors visit the university, the administrator cannot answer to grantor's questions about their own researchers.

3

Furthermore, without complete information, administrators cannot create efficiency research funding and researcher evaluating mechanism. Evaluation mechanism of researchers generally uses KPI System (Key Performance Indicators System), and with the lack of research information, KPI system cannot measure certain researcher potential. Therefore, some kind of strategic management such as building center of excellence cannot be planned easily.

There are many efforts for solving this kind of problem. At faculty level, one of these efforts is developing research database system or Management Information System (MIS). However, this solution still has a trouble as the developing database is distributed in many levels; university, faculty, and department. Each level might uses different database design and different platform, so combining all systems together is difficult or impossible.

At university level, another attempt is building the main database where all of the levels can access it. But detail or fields of research information are rougher than using in the level of faculties, because the design is focused only at the requirement of the university administrators, not faculty administrators, and many options of database serve only for the university administrators. Consequently, no faculty wants to supply the information and they turn back to use their own databases. Besides, researchers do not provide their information for many reasons such as they do not recognize the benefit of giving their information, reluctant to fill up, or have no time for it. Further on when time passes, some researchers change their interested topic, causing information in database to be outdated. From these reasons, universities encounter with incomplete information and dynamics of research.

Current information of lecturers is scattered in many websites, particularly in vocabularies or keywords. These keywords might be subject, techniques, technology, tools, or application that researchers used in their researches and these keywords can identify research direction and expertise of researchers. Keywords should be extracted and stored in research database automatically for reducing the problems mentioned above. In order to do this process, *text mining* is used. Text mining is the process of deriving high-quality information from text. High-quality information is typically derived through the estimation of patterns and trends through means such as statistical pattern learning. It begins with structuring the input text, deriving patterns within the structured data, and finally evaluation and interpretation of the output. One type of text mining can extract concept or entity from input text ("Text mining", 2009).

Practically, the problem of the meaning cannot be solved by using only text mining. Vocabularies or keywords extracted from text mining may refer to the same thing in different words. For example, if the keyword of the researcher is *ceramic*, it means he/she does the research about *nanotechnology*. On the other hand, the same keyword can refer to the different meaning as well, for instance, the term *wiki* can refers to quickness or the name of open source software.

This kind of problem can be solved by storing data from text mining with *semantic web technology*. This technology is used in *semantic web* to increase the quality of search result, and the web uses *semantic model* to design its database. One kind of semantic model is *ontology* that enables to recognize the two keywords refer to the same thing in the different terminology (Castello & Jacobs, n.d.). By using ontology when searching for information in semantic web, the search system will look

not only for the information itself, but also the meaning of that information. This technology enables the outcome of a search to be more precise to the direct meaning of the information.

The output from applying semantic model for inferring research information is research ontology, which is a tool for synergizing university management with key researchers. Building research ontology starts from the assessment of Intellectual Capital (IC) at stakeholder perspectives. This assessment uses Skandia model, the popular intellectual capital model, for identifying intellectual capitals in research aspect efficiently. After that, these intellectual capitals will be used to design research ontology. Research root ontology will be designed with normalization or generalization technique in the beginning. Then the root ontology is refined to complete research ontology, and the research ontology is implemented in Protégé, open source ontology builder software developed by Stanford University.

According to the assumption mentioned above, this thesis is proposed in order to develop the new research management framework that base on semantic model and used as a prototype by Chiang Mai University (CMU), Thailand. There are three different research areas in CMU which are, Health Sciences, Science & Technology, and Social Sciences & Humanities. The Health Sciences encompasses six faculties and one research institute. Science & Technology encompasses five faculties and one research institute, and Social Sciences & Humanities encompasses seven faculties and one research institute.

The result of this study is a research ontology model used for synergizing the university research activities by using key researchers as a common vocabulary inside the university. This result is used for communication between administrators and

researchers and between researchers and researchers as well. Administrators use it for setting strategic and mission of research affair and researchers can use it for selecting their research group. In addition, it can be used for identifying key researchers, specifying researcher expertise and direction, setting up research clusters, forming multidiscipline research, and recommending research cluster priorities.

Since the organizational and institutional structure of CMU is as same as other public universities in Thailand, the results from this research can be reliably used as a representative of the other universities in Thailand.

1.2 Objectives of the Study

The objectives of this study are:

1. to understand research management in universities.

2. to study semantic model and apply to research management.

3. to propose research management framework with semantic model for synergizing the university research management with key researchers.

1.3 Scope of the Study

1.3.1 Study research management of universities especially Thai universities.

1.3.2 Develop capability management system responding to stakeholder requirement. By using this system, administrators will know what lines of research capacity should be built and recognize the experts in those lines.

1.3.3   The input data of the system come from researcher KPIs which are one kind of intellectual capital. Intellectual capital will represent the value perception from universities' stakeholder.

1.3.4   Use Chiang Mai University (CMU) as case study. CMU research information covered three different areas: Health Sciences, Science & Technology, and Social Sciences & Humanities.

    1.3.4.1 The Health Sciences encompasses six faculties and one research institute.

    1.3.4.2 The Science & Technology area encompasses five faculties and one research institute.

    1.3.4.3 The Social Sciences & Humanities area encompasses seven faculties and one research institute.

1.4 Novelty

The novelty of this research is

1.4.1   The obtained intellectual capital of researchers.

1.4.2   CMU ontology commitment in research management.

1.4.3   The decision support system based on semantic model.

1.5 Beneficiaries

Key beneficiary for this study are universities, which need to understand their expertise and research direction in order to formulate strategic plan. This will increase the competence of universities especially at research point of view.

A successful study will provide a new research management framework and increase the research management capability of administrators in solving problems, making decision in shorter time, and minimizing the risk in the organization when confronts with big change.

The successful design of research ontology will facilitate administrators to formulate new multi-discipline research clusters according to requirements of the world market and Thai society. Consequently, administrators will be able to treat researchers in the suitable way, and creates satisfying environments for the researchers, resulting in better quality works.

Lastly, the academic communities certainly are another major beneficiary of successful research. This new framework will be the new idea of using intellectual capital theory and semantic web technology in research management.

1.6 Definitions

- **Key researcher** is the researcher who has high capability in research, famous, and able to lead a university into a research university.

- **Ontology** is a kind of knowledge representation used for sharing common understanding or describing any concept in hierarchical format. Its format is in term of a collection of terms and a description of their relationships.

- **Ontology commitment** is an ontology for sharing common commitment of organization between administrators and staffs.

- **Ontology language** is a computer language used to specify an ontology such as OWL (Web Ontology Language).

9

- **Semantic web technology** is the technology used in semantic web to represent index or keywords in term of semantic model, which enable to distinguish keywords by using not only terminology of keywords but also the meaning of those keywords. An example of semantic model is ontology.

- **Semantic web** is a web using semantic web technology as the search solution. Search system of this web will increase the quality of search results. This web enables the outcome of a search to be more precise to the direct meaning of the information.

- **Skandia model** is a popular intellectual capital model used to identify, measure, and manage intellectual capital in organization.