

The Role of Knowledge Flow in the Thai GUIN Version of the Triple Helix Model

Lugkana Worasinchai ¹, Vincent Ribière ¹ and Aurélie Aurilla Arntzen Bechina ²

¹Bangkok University, Thailand

²College University I Buskerud, Kongsberg, Norway

lugkana.w@bu.ac.th

vince@vincentribiere.com

aurillaa@hihm.no

Abstract: The "triple helix" model is considered as being a spiral model of innovation contributing to the country and regional improvement by fostering interactions between academic, industry and government. This model highlights the ties between the three parties at different stages in the process of knowledge capitalization and flow. Although, this model has proven to be effective in some countries, some questions remain regarding its effective implementation in Thailand. This paper presents an adapted version of the helix model that could contribute to development of ties among stakeholders through strategic alliances. The success key factors leading to an economic development mission by universities are as well discussed.

Keywords: triple helix model, knowledge capitalization, Thailand, research network, innovation, university-industry interaction, framework G-U-I-N

1. Introduction

Thailand is a developing country and as such it is encountering fierce competition due to globalization. Political plan outlined by the government, stresses the need for Thailand to balance its objectives and target toward "the Sufficiency Economy Philosophy". One of the focuses of the country is oriented not only toward on improvement of the economic structures for trade, production, and tourism but as well towards Science and Technology development advancements.

The Ministry of Science has conducted researches on factors affecting Thailand moving towards a Knowledge-based society. The following issues were identified; Although, R&D budget is specified at 0.4% of the GDP, the real figure showed that only 0.18% was spent in 2003 and 0.24% in 2005 (Krisnachinda, 2004). The figure is quite low compared to the 3.17 % of Japan or even to the 0,68% of Malaysian (IMD, 2007).

In addition, the number of researchers in Thailand is very low compared to other countries. For example, in Thailand the proportion of researchers is 5.7 for 10,000 people, compared to 44.8 in Korea, 65.5 in Taiwan, and 70.2 in Japan.

Since Thailand has invested less in R&D and lags behind other countries, some industries of Thailand have lost a significant competitive advantage towards their global competitors. Recently the Thai government has decided to invest more in R&D, and it is trying to encourage private sectors to invest more in R&D. Private sectors do recognize the needs and benefits they can gain from developing their R&D activities but the main question remains on how to do it?

One solution would be to look closely on how the Thai Government, private sectors and research institution could collaborate together in other to stimulate the Knowledge-based economic development. Among the most popular initiatives, we could mention the triple helix model developed by Etzkowitz and Leydesdorff (1995). The "triple helix" model of university, industry and government is emerging in different regions, countries at various steps of developments and with different socio-economic patterns (Etzkowitz, 2002).

University should be seen as strong actor in economical development through incubators facilities or as scientific/technological pools for Industry.

Governments can help/facilitate the relationship between University-Industry by offering collaboration incentives but also by "pressing academic institutions to make a more direct contribution to wealth

creation” (Etzkowitz and Leydesdorff, 1995). Not only governments but also international and multinational programs (UN, OECD, World Bank, EU) do support economical developments based on this model. Government can provide mechanisms to encourage collaborative R&D among companies, research institutions and universities in order to address knowledge-based economy issues.

Etzkowitz, Dzisah, Ranga and Zhou (2007) introduced the Triple Helix Model III (Figure 1), which showed the relative interdependence of each party. This interaction enhances the best mixed functions and institutions.

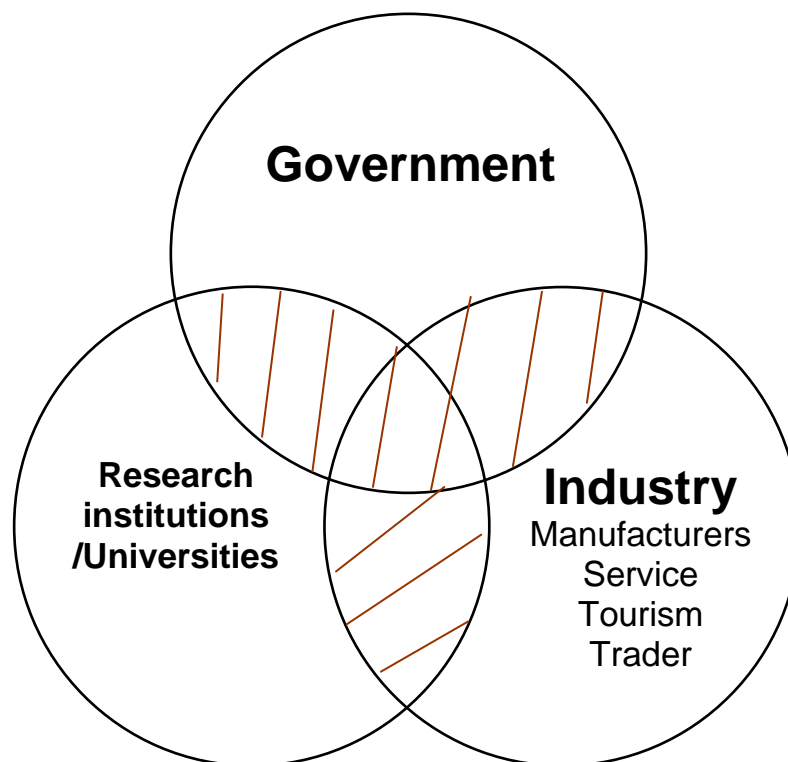


Figure 1: Triple Helix Model

Policy makers and researchers commonly agreed on the necessity of establishing knowledge flow between academia and Industry as one of the most promising factors to strengthen economic development and to foster innovation capability (Hofer, 2004, Hofer, 2005).

Although, it is recognized that companies need to invest in in-house Research and Development (R&D) with the purpose to gain competitiveness, studies show that firms must be connected not only to the open science community but must be as well strongly engaged in research collaboration (Cockburn and Henderson, 1998, Brennenraedts et al., 2006, Sandelin, 2003).

The idea and concepts associated with university-industry partnerships are not new and it is commonly agreed that universities are an important source of new knowledge for industry (Agrawal, 2001a). In the US, some of the most prestigious universities (e.g, MIT) were established more than one century ago to support close research relationships between University and Industry (U-I) (Matkin, 1990).

The Partnership (U-I) has been considered as one of the main factors contributing to successful US innovation and growth the past two decade (Hall, 2004).

There is plethora of research studies on identifying and analyzing cultural, technical, legal and macro-organizational factors governing the success of University- Industry (U-I) collaboration (Hermans and Castiaux, 2007, Leuven and Oosterlinck, 2005, Sandelin, 2003).

A study of the literature (Hofer, 2005, Davenport et al., 1999, Business Higher Education Forum, 2001, Agrawal, 2001b, Johnson and Johnston, 2001) associated with the main factors affecting the

success/effective R&D collaboration between university-industry is summarized in Table 1. For Starbuck (2001) collaborating successfully means doing the right thing, doing it well, rewarding success, and feeding back knowledge from the experience.

We will not describe in much more details these factors since most of them are self explanatory. As Hofer (2005) suggests it is also important to consider the motives for collaboration in order to better understand the driving forces of each party. Based on Hofer's research (2004, 2005) the motives of knowledge transfer for universities are mainly financial and legal (based on their mission). The objectives for industries are mainly related to profits and to increase their stakeholder values (Kremic, 2003).

Table 1: Main factors affecting successful/effective U-I collaborations

Type of research involved (basic vs., applied – technical/non technical)	Different organizational structures	Differing time horizons of the 2 sectors
Staff resources available	Different objectives – Aligning technical and business goals	Institutional reward structures
Brand of university	Prior or current project with company competitors	Lack of collaborative structure
Prior industrial relationships	Lack of motivation	Handling conflicts of interests and commitment
Not knowing each others	Low qualifications	Preserving academic freedom
Not being allowed to work with each others	Lack of trust(s)	Maintaining intellectual property and confidentiality
Not wanting to work with each others	Different cultures	Dealing with financial challenges
Not being able to work with each others	Lack of understanding on how the counterpart organization (I or U) operates	Absorptive capacity

In order to better understand and to represent the forces driving the barriers and enablers of successful U-I relations, different models were developed.

Wang and Lu (2007) developed a strategic framework of successful knowledge transfer between U-I in China. A typology of four types of U-I interactions is represented using a 2x2 matrix. One axis represents the knowledge gap (Low or High) which refers to the degree of institutional proximity as well as the level of mutual understanding across organizational boundaries. The second axis represents the level of knowledge stickiness (Low or High) indicating the complexity and difficulties associated with the process of technology transfer (Wang and Lu, 2007) as depicted on figure 2.

Another matrix, using the same axes, describes the different modes of interactions and activities necessary for knowledge transfer and commercialization to happen based on each quadrant. This framework is interesting since it clearly highlights the fact that not all U-I interaction are the same and that based on the type of relation different approaches and strategies might need to be used in order to succeed.

Since U-I relationships are mainly based around knowledge transfer processes, some frameworks were created based on the well accepted SECI model of Nonaka (2003). The knowledge spiral of Nonaka represents the four knowledge transfers associated with tacit and explicit knowledge. Johnson and Johnston (2004) extended the original SECI model to inter-organizational context of U-I collaborative R&D projects. A sample of 25 U-I project were used to test the model. Their findings validate the fact that the SECI model can also be applied to inter-organizational U-I collaborative R&D projects but they discovered that all of the four knowledge conversions processes must be implemented to fully succeed. Hermans and Castiaux (2007) studied the applicability of the SECI model to U-I knowledge flows occurring in the specific case of U-I collaborative research projects ("exchange relationships in formal research projects undertaken by university researchers and other

university partners” (Agrawal, 2001b)). Once again the SECI model demonstrated to be an appropriate approach to represent not only intra but also inter organizational knowledge transfers.

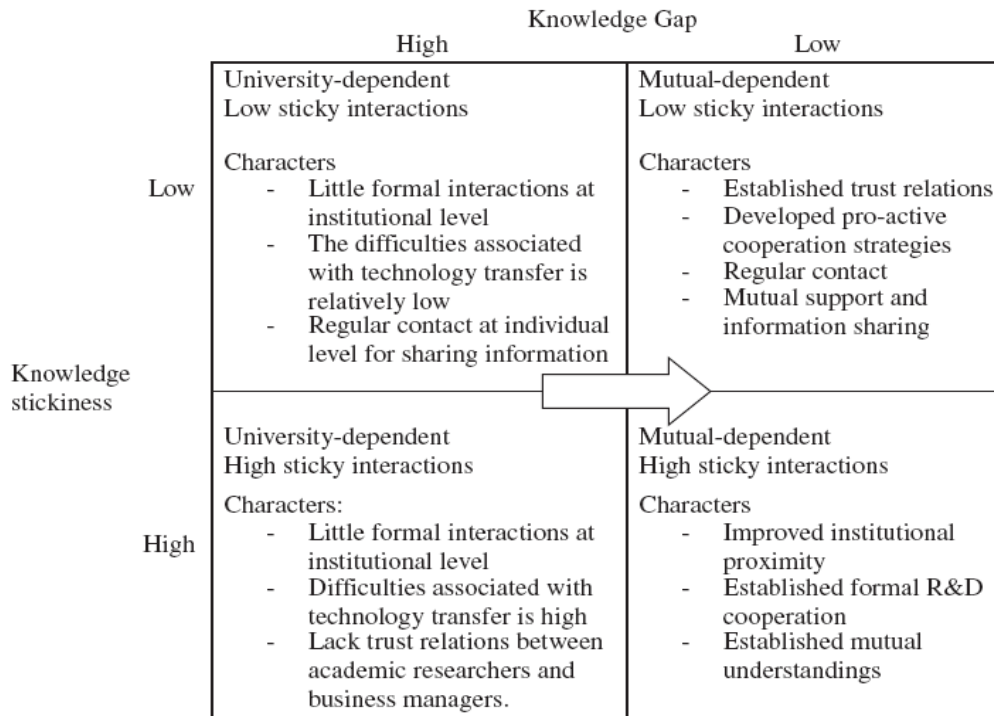


Figure 2: Typology of U-I interaction and knowledge stickiness (Wang and Lu, 2007)

Although, the large amount of literature related to the linkage U-I, it is not obvious that the various suggested models or framework are suitable for the Thailand context. There is a still a stringent need for research to assess and understand the success factors for such partnerships in Thailand. In our research study, we focused on delineating a framework (G-U-I-N: Government, University, Industry and Networks) encompassing the main factors that could make U-I relationships more successful in Thailand. Knowledge capitalization and flow is considered as an important enabler of this framework.

The next section describes the context of study in Thailand and the adopted methodology with the aim to identify the challenges and issues related to research collaboration between Industry and universities. The last section, based on data finding and literature review, outlines a general model for a successful G-U-I-N Partnership and discusses the implication of the implementation of such model in Thailand.

2. Context of study

2.1 Background

Thai companies are currently looking for ways to remain competitive and sustainable, they are considering Research & Development (R&D) as an important activity to boost their innovative capabilities (Sumitra and Thongprasert, 1997).

Private sectors do recognize the needs and benefits they can gain from developing their R&D activities. Many innovations could not have happened without academic research outcomes (Beise and Stahl, 2004). However many issues or concerns need to be tackled carefully and especially since university – industry relationship is increasing further such for instance, difference attitude toward the Intellectual Property Right (IPR).

Krischinda (2004), conducted a study about the IPR in Thailand and highlights that although the first IP Laws were set in 1979, there is still no Government’s Law on IP partnership. Memorandums of Understandings (MOU) and project contracts are the only legal documents used for University-Industry partnership practices. These documents state the agreements about the ownership of IP assets, the sharing of work benefit, time terms, work secret practice, and permission on some

publishing or work disclosure. The latter, goes against the spirit of academics for an open science community by preventing or academic work to be published (R. Florida, 1999).

Thai universities are in a transition phase, shifting from traditional universities to modern universities. Capital and labor are no longer the main factors that drive the Thai economy; “Knowledge and Innovation” are becoming key action in a knowledge based economy. Thai Universities play an important role in safeguarding, producing and distributing knowledge to the Thai society (Igel and Numprasertchai, 2003).

Thai universities are divided into two types: public and private universities. Public universities get financial support from the government, while private universities do not. Private universities depend mainly on student tuition fees. Managing a private university in Thailand is a constant challenge. The education sector in Thailand is becoming competitive not only among Thai universities but also among foreign universities. Many foreign universities, from different parts of the world, are coming to Thailand to establish collaboration with Thai universities under different forms such as, exchange students and exchange faculty members. Therefore, the education cooperation among foreign universities and Thai universities is now growing.

The growth rate of the population of Thailand and the social structure are also changing. The birthrate in Thailand, like in many others countries in the world, is decreasing directly impacting the number of students getting into the university. The number of universities increasing and the number of students decreasing makes the education sector more and more competitive. In other words, universities are still running with the same fixed costs with less income resulting in administration nightmares.

Thai universities have to find new sources of incomes to survive and a closer collaboration with the private sector might be a solution for universities to generate additional revenues by capitalizing on their intellectual asset. However, it is as recognized that there are issues preventing an effective R&D collaboration between University and Industry (Igel and Numprasertchai, 2005).

In the past, faculty members in Thailand conducted researches based on their expertise without thinking about benefits or commercialization of the research outputs. Faculty members contribute their knowledge to the society for free. Thai faculty members normally distribute knowledge in an untargeted way (general target) as described in Table 2. Most of the time the research is abandoned on the shelf of the library or laboratory and it is only used for academic purpose.

Table 2: U-I knowledge transfer adapted from Hermans and Castiaux (2007)

	Distribute Knowledge to General Target	Distribute Knowledge to Specific Target
Direction	University ⇔ Business Sector	University ⇔ Business Sector
Knowledge	Explicit Knowledge	Explicit Knowledge and Tacit Knowledge
Channels	Magazine Newspaper Formal Meeting Journal Conference proceedings Patent	Consulting works University and Industrial Collaboration

Recently, the Thai Ministry of Education decided to cooperate with the Department of Industrial Promotion to promote research cooperation between universities and private sectors. They started the project by inviting private companies to propose research questions corresponding to their company needs. The second step consisted at looking for universities which had the potential to conduct research and who could answer the companies’ research questions. Two parties which belong to the government and the company will provide funding support, and the university will allow faculty members to spend time to do research. Professional proposals from foreign countries will be given a higher priority. This is the starting point in Thailand for knowledge sharing between universities-industries and research networks. Such collaboration will allow universities to switch from untargeted knowledge transfers to a targeted one, enabling interactions and dialogues between the two parties (Cf. table 2).

Thai universities are slowly starting to partner with private sectors in research project cooperation, consulting projects and practical training for students. As Davenport et Al. (1999) suggested, Universities and Industries should start to work on gradually complex and demanding projects that will allow to respect cultural differences, to gain collaboration experience and more importantly to build trust. Thailand adopted such approach.

Furthermore, five years ago, the Board of Higher education of Thailand decided to make quality assurance a priority for all universities in Thailand. It defined Key Performance Indicators (KPI) to measure the quality of Thai universities. Three years ago it defined a new main KPI associated with the implementation of knowledge management. Many Thai Universities were strongly invited to implement a Knowledge Management plan. The fact that Thai universities are now implementing QA and KM makes them operate in an environment that is closer to the business world. It might also become a factor that will make industries realize that universities are becoming more open and flexible and that they might now be ready to engage into more complex and advanced collaboration and R&D projects.

The following section describes the cases study of the furniture Industry, it represents a good illustration of the incremental approach taken by Thailand. It contributed to the delineation of specific framework identifying factors hampering U-I collaboration.

3. Research methodology

3.1 Data collection

For the purpose of this research project, we selected 4 companies in the furniture industry sector and one governmental organization (the department of Trade and Industry).

The four companies are family business companies and are clearly labor-intensive. They depend heavily on Thai craftsmanship and local materials such as wood, bamboo and rattan.

The empirical investigation aimed to explore the process of collaboration between companies and universities in Thailand. The purpose was to determine the factors facilitating or inhibiting such partnerships and leading to the specification of a collaborative framework. Another purpose was to understand the knowledge capitalization and flow from Academia to industry and its limitation. With the aim to comprehend such complex interactions of the U-I linkage, the adopted research methodology for collecting data was based on the combination of various approaches, such as qualitative methods encompassing in-depth interviews, and reviewing various documents from the selected organisations.

Several focused and semi structured interviews were conducted with different managers, executive people, researchers, teachers, and policy maker. According to the respondent profile, questions were opened or closed.

The questions focused on knowledge process flow in U-I linkage, interaction level between the two institutions, outcomes exploitation, Intellectual property Right, expectation from both parties, challenges and tensions encountered while collaborating, scientific research publications, effectiveness of such partnerships, type of support provided by industry to University, expected role of the government, and so forth.

A second set of data was collected using an ethnographical approach based on a long-term observation of a group and participation in that group. This concerns more the universities with the researcher's participation.

Finally, further data were collected by analysing a variety of documentation including scientific and technical reports, internal notes, research contracts, collaboration agreements, newsletters, Memorandum of Understanding, students internship agreement, literature reviews and so forth.

3.2 Finding and discussions

The Thai Furniture Industry is now on a decline for many reasons. Firstly, it is due to the decreasing market shares in international markets. The Thai Furniture industry is financially dependent on the international markets, and it is now facing strong competitions. The major competitors in the

international market are China and Vietnam. Thai companies cannot compete with these two major players due to the fact that these countries have lower labor cost. In addition, the Thai furniture industry has not continued to improve the quality of products and designs and it lost the high end markets to other competitors. Furthermore, Thailand does not have concrete plans to improve the quality of raw materials, especially woods.

Some large firms are suppliers of the well-known furniture chains abroad, such as IKEA, Wal-Mart, and TARGET. These large firms are able to survive in the competitive markets because they have strong relationships and long term contracts with large retailers. They produce mass products and export them with lower prices due to economy of scales. For these companies, improvement in technology and engineering processes are considered as key success factors for the business. Moreover, the large-sized firms are aware that research and development is a necessity and therefore some works in that direction are already on their way.

Medium sized companies have little possibilities to exploit this competitive advantage. Medium-sized firms are the dominating group in the furniture industry in term of number of firms in Thailand. In order to be able to compete both at national and international level, medium-size firms need to understand the rules and the issues that will allow them to gain market shares. The key success for this group is innovative product development and respect of distribution deadline. Several strategies are considered. For example, studying the need of specific groups of customers and designing customized products in order to satisfy those specific markets. Managers and owners of this type of business mentioned that even though they are aware that creating product corresponding to user's requirement is crucial for their business, they still cannot afford to hire someone dedicated only to product design. Therefore, the only way for them to introduce new ideas of products is to provide internship options to students specialized in product design. This type of collaboration should be perceived as a win-win situation. Firms benefit from this cooperation due to lower costs compared to setting up their own R&D departments. Professors and students benefit by gaining business experiences and also by earning some additional incomes.

In addition, by strengthening such collaboration beyond a simple network connection, it should be easier to apply for some research funding support provided by some universities or governments. Considering the pole of existing expertise within Thai Universities, it is important to define more formally the mechanisms fostering collaboration between Universities and Industry.

Some current experiences clearly demonstrate the benefits of having such bilateral collaboration and cooperation. For example, if a professional Thai institution for Agricultural sectors conducts research on raw material improvements, the furniture industry will definitively benefit from it. In addition, the university could also develop specific curriculum or teaching program such as: forestry management. This type of education could fulfill partially the company's needs in term of availability of local competences. Furthermore, government offices such as the Royal Forest Department have a long history of research. A research division focuses on developing method and technology dedicated to forestry and wildlife. Therefore, we believe that this governmental office could help universities and furniture companies to establish partnerships by sharing their own experience and by providing mechanisms enhancing such collaboration.

For the production and manufacturing processes, there are numbers of Thai Universities that have expertise area in industrial productions and that could easily provide knowledge and advice to Thai companies.

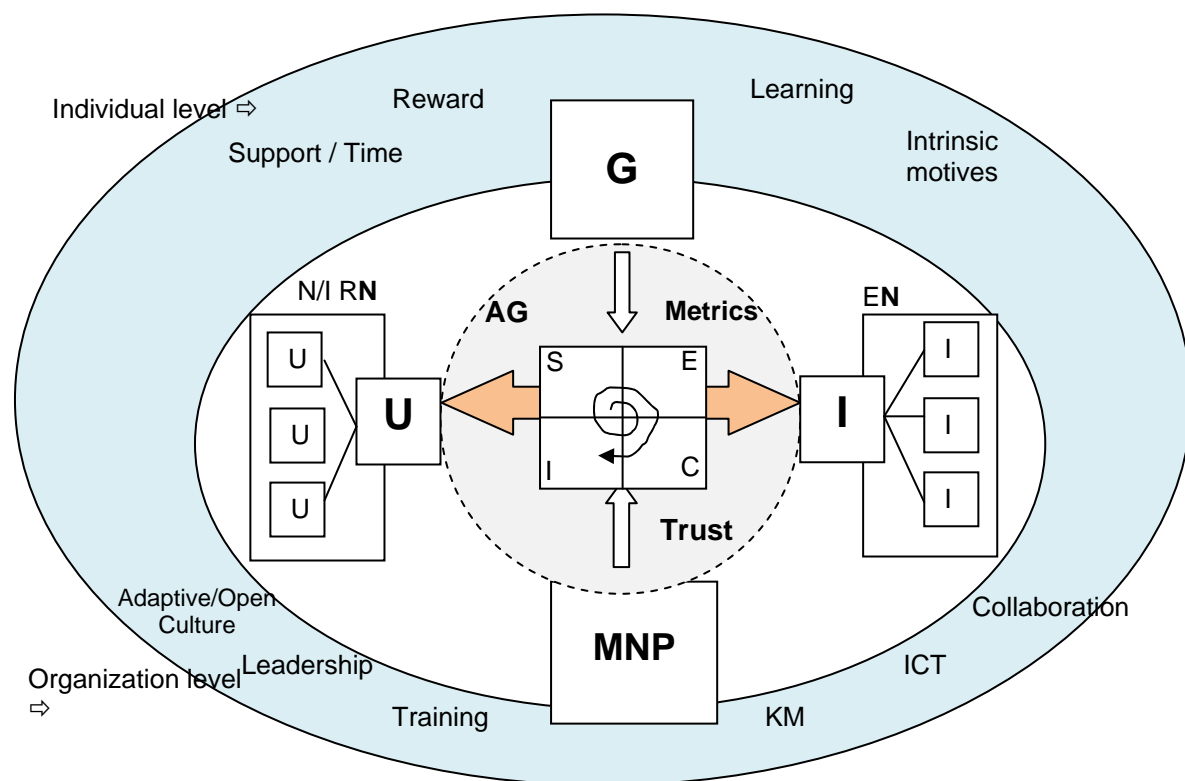
We believe as well that the Federation of Thai Industries could largely contribute to the establishment of Industry–University linkage. The Thai Furniture Association is very well aware of problems and issues encountered by SME's. By playing the interface between universities and the national governmental body, it could easily expose these issues and promote U-I collaborations.

One important issue mentioned during the interviews of managers of SME's furniture manufacturing is related to the lack of means to reach international markets. Since most Thai universities have affiliation with overseas universities, they could seek assistance in gaining expertise and knowledge from their foreign counterparts.

The furniture case study might look very simple but for an emerging country like Thailand it is an important stepping stone that will lead to more advanced and complex collaborative projects in various fields.

4. The G-U-I-N model

Based on our literature review and based on the needs of Thailand in term of R&D partnerships we developed the G-U-I-N (Government, University, Industry, Networks) framework depicted on Figure 3. The large horizontal arrow at the center represents the R&D relationship/partnership between University and Industry. For this relationship to start a catalyst is needed. This catalyst, in the case of Thailand, comes primarily from the Government but it some cases can also be provided by multi-national programs (e.g., European Union, OECD, World bank, UN, ...). For this relationship to succeed, the objectives, goals and strategies of all parties must be aligned and some metrics of success must be defined from the beginning in order to monitor the progress and success of the relationship all along the project. If the different parties don't trust each other's the relationship cannot be effective and successful. Trust must be gradually developed and maintained all along the R&D project and it will also facilitate future project relationships. The R&D relationship will be based around knowledge discovery and knowledge transfer processes, so knowledge (tacit & explicit) must be properly managed (codified, shared, transferred, maintained, ...) that is the reason why the SECI model of Nonaka (2003) is represented at the center of the relationship between all parties. In our current competitive time and due to the inter-disciplinary nature of most of the current R&D Projects (e.g., biotechnology, alternative energy, ...) universities need to collaborate/partner with other national and/or international universities in order to cover the full spectrum of knowledge required to complete such projects. We define such linkages as research Networks.



AG: Aligned Goals, Objectives, and Strategy

SECI: Nonaka (2003) spiraling model (Socialization, Externalization, Combination and Internalization).

MNP: Multi-National Programs (European Union, OECD, World bank, UN, ...) sponsorships

G: Government sponsorship

N/I RN: National & International Research Networks (University collaborations, Research projects, Institutes, Faculty exchange program, visiting Professors, Research fellowships, Post-Doc, MOU, Joint academic programs, ...)

EN: Enterprise Network (Partners, Suppliers, Stakeholders, Customers, Contractors, competitors (coopetition), ...)

Figure 3: G-U-I-N Framework

On the other side, industries might also need to involve their partners, suppliers, customers, contractors or even their competitors in such project. We describe this linkage as the Enterprise Network.

The interaction between all these parties cannot succeed without some key enablers. The enablers can be categorized in two groups: individual and organizational. People involved in such U-I R&D partnerships must be motivated to do and must be provided with an enabling environment to conduct fruitful research and collaboration. Based on our literature review and based on our personal experience, we believe that participants should be fully supported by their institution to participate in such projects and that they should be given as much time as required to achieve their objectives. In the case of universities, too often professors involved in such projects still have to teach or participate in various committees or administrative works which distract them for their research project. Reward (of all types, and designed based on the need of each individual) should also be implemented to encourage the various types of participants. Learning will also be an important individual factor, since people want to grow from such experience by acquiring new knowledge and skills. Last but not the least, intrinsic motives must drive the motivation of each individuals, particularly on the academic side. Forcing academics to join a research project/team, if they don't really see a clear value/benefit from them, will end up in failure.

The enablers on the organizational side are also very important. As mentioned before, the business world and the academic world operate in completely different ways and have completely different values, beliefs and traditions. Both parties are aware of this culture differences and they need to be open and flexible enough to accept them and to take advantage of this diversity. In order to successfully engage into such "culture clash" both parties must be prepared and that's where leadership and training play an important role. Information and Communication Technologies will enable the U-I relationships by providing supportive and collaborative tools, particularly when the different members of the various networks (University and Enterprise) might be based in different regions or countries. Finally, knowledge Management (KM) processes and practices must be implemented to capture, store, maintain and distribute knowledge associated with the R&D project. Igel and Numprasertchai (2004) conducted some initial research in Thailand regarding the role of KM in university R&D projects. Their findings show that KM helped university research organizations to manage their projects more efficiently (time, cost and quality) and to extend their potentials through close interactions with external partners.

KM can also help in term of learning from successes and failures. Best practices, lessons learned and other mechanisms can be put in place to capture the experience associated with projects so time is not wasted reinventing the wheel and mistakes are not repeated. We also think that the use of Communities of Practice (CoP) could be a valuable tool to involve all the parties described on the G-U-I-N framework. The length limitation of this paper limits us to develop in more details each aspect of the framework but it will be source of future publications.

5. Conclusion

Knowledge management is currently considered as an important strategy to move Thai universities forward and to help Thai industries to become competitive again. Universities in Thailand now are in the transition period. Most universities are shifting themselves from teaching-based universities to research-based universities. Therefore, universities are called up now to play a more active role in Knowledge-based economy.

In today's economy, knowledge is the main source of innovation. It requires to be captured and combined with other knowledge coming from different sources (disciplines, networks, ...) in order to foster innovation. Managing such processes as well as the proper knowledge transfer between the various players in U-I R&D relationships is critical. We developed a framework (G-U-I-N) that we believe includes the most important factors necessary for the successful collaboration between Universities and Industries.

The financial involvement of the firm, long term partnership condition, trust building, patents opportunities and potential valuable outcomes of the research are all conditions for a successful U-I linkage .

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