University and Industrial Sector Collaboration: The Key Factors Affecting Knowledge Transfer

Yanyong Kodcharat
Faculty of Management Sciences
Prince of Songkla University
Thailand

Akom Chaikeaw
Faculty of Management Sciences
Prince of Songkla University
Thailand

Abstract

The purpose of this documentary research was to study factors associated with university and industrial sector collaboration of knowledge transfer: project management, organizational culture, communication, motivation, social networks and firm characteristics. The relations of the two organizations were based on resource dependence theory which was considered considerably important factors towards both the existence and development of the organization through the resource exchange with certain external organizations, however, the organization will not survive if it is unable to respond to those changes of external surroundings.

Key words: University - Industrial sector, Collaboration, Knowledge transfer

1. Introduction

The university initiates new knowledge and provision of education, while the private sector focuses on the application of the new knowledge in business. Therefore, collaboration between the university and industrial sectors is regarded not only important but also considerably challenging (Dasgupta & David, 1994). Moreover, through collaboration and close inter-relations with the industrial sector, the university has made considerable effort to create or produce more valuable intellectual property for technology transfer. Also, an indicator of management administration which leads to more formal collaboration have been established (Hall et al., 2001). Due to current competitive environment, many organizations are enthusiastic in seeking knowledge for competitive advantages via continuous knowledge development (Nonaka, 1994). In fact, some key organizational factors which influence transfer of knowledge, also affect business organizations (Selznick, 1996).

Actually, the concept of complementarities has been considered to be essential for the co-operation between university and industrial sectors (Teece, 1986). While the university is carrying out research based on its plentiful intellectual resources and research facilities, the industrial sector is fully equipped with practical expertise, and financial resources. In addition, the industrial sector provides not only internship but also employment opportunities (Santoro & Gopalakrishnan, 2001). Indeed, reciprocally, through such inter-relation between the two institutes, the university frequently has access to research grants, and industrial technology advantages. Additionally, an intern would have an opportunity to learn how to solve actual problems which arise during the training, and there is good prospect of employment opportunities for those prospective graduates (NSB, 1996; NSF, 1982 a).

Although the concept of complementarities between the university and the industrial sectors has enabled them to co-operate enthusiastically, their relationship seems not only complex but also fragile due to differences in philosophy and culture (Reams, 1986; Phillips, 1991). The most important obstacles result from an inflexible working structure and inadequate incentives (Brimble & Doner, 2007).

Additionally, both university and the industrial sectors share quite limited relations in terms of technology in certain related fields, such as agriculture, and food industry (Schiller & Liefner, 2007). Generally, most academics believe that their career stability and success are usually derived from one of the most important factors: priorities of creating public advantages, and all of which can be attested through publication of their academic work. To the contrary, this is considerably different from the objectives of certain business organizations which focus on rapid application of new knowledge to markets or commerce (Becher, 1989). Therefore, this difference has caused both academics and the industrial sectors to hold different points of view pertaining to work benefits.

Accordingly, with the aforementioned problems, it is essential to study certain factors which enhance more successful co-operation between the two institutions. Hence, the country can be developed more effectively through the links between education and manufacturing sectors.

2. Resource Dependence Theory and University – Industrial Sector Collaboration

According to resource dependence theory, resources are considerably important for both the development and sustainment of a certain organization via exchanging such resources with others in various forms: monetary, physical resources, information and other social legitimacy. To the contrary, an organization will not be able to survive if it does not respond to those requirements from external surroundings (Pfeffer & Salancik, 1978).
Actually, there are certain different points of view in organizational environment and the ways it affects both behavior and structure of the organizations. Firstly, the organizational environment can affect direct exchange (Thompson, 1967; Pfeffer & Salancik, 1978). This can be carried out by setting up management structure which truly results in assurance of not only resource management but also resource exchange. Therefore, there is an increase in resource dependence based on such exchange relations which eventually leads to establishment of offices with different management to directly administer this matter (Tolbert, 1985). Second, environment refers to understanding and expectation of organizations including social members' behavior (Zucker, 1983).

Both state agencies and private sectors have different practices on various supporting capital sources. In other words, state agencies' financial support is mainly derived from the government, whereas private sectors' income is based on goods, services or provision from other private organizations (Tolbert & Zucker, 1983). Indeed, the receipt of external resources: monetary resources, physical resources and proper human development resource are essentially vital for organizations as a whole.

Accordingly, in order to encourage their competitive potential in the current environment, not only university but also the industrial sectors are essentially required to develop their knowledge, technology, process, products or services. More importantly, various forms of resource dependence from external organizations are especially necessary in response to the requirements within the organization itself.

3. Patterns and Definition of Collaboration in Knowledge Transfer between University and Industrial Sector

According to Barnes et al (2002), collaboration refers to improvement in efficiency of certain innovations in order to obtain a certain new and better thing, such as low cost technology with less risk, and through collaboration, organizations will have access to particularly profound knowledge and technology. Meanwhile, Teece (1986) claimed that the most suitable alternatives for organizations are those which can be related to inclusiveness, complementariness and relatedness among institutions. Based on Szulanski (1996), knowledge transfer is the process of knowledge exchange between sources of knowledge and sources of receivers. According to Laursen and Salter (2003), collaboration means direct participation of both university and industrial sector through various activities, such as provision of research funding, training partnerships as well as technical service contract. In addition, both research units and researchers are supported by the industrial sector as well. It may be concluded that collaboration of knowledge transfer between university and the industrial sector refers to the improvement of working in order to obtain a certain new good outcome, including access to not only profound knowledge but also technology.

Patterns of collaboration between the two major institutions have different levels: individual level, groups, institutions, sectors, and national level.

Collaboration could be carried out in various ways, such as purchasing university research results (patents) on an ad hoc basis, employing faculty members as regular consultants, coaching of firm employees by university researchers, training of firm employees by professors, joint publications by university professors and firm employees, joint supervision of Ph.D. and Master degree theses by university and firm members, joint IPR by university professors and firm employees, access to special equipment of firm/university with or without assistance from owners of organizations, investment into university's facilities, regular acquiring of university research, contract research, and joint research projects (Inzelt, 2004).

4. Factors Related to Collaboration of Knowledge Transfer between University and Industrial Sector

4.1 Project Management

Over 30 years, the project management has been well-known to be the essential tool in handling complex activities more efficiently than the conventional one. Also, an introduction of a new project often causes the organization to turn to applying different project management. The actual project management, which includes technical development and procedures, brings about not only achievement of work but also acceptance by experts. According to British Standard in Project Management 6079 (BS 6079, 1996), project management refers to planning, monitoring and controlling of all components in the project. It also includes incentives for those involved so that the project's goals can be achieved with in the specified time, cost and quality. Meanwhile, Barnes et al (2002) maintained that project management always focuses on objective setting, project planning, progress monitoring, instituting realistic project aims, and the importance of the project manager's role which directly affects project efficiency through his responsibility. This is also consistent with Hauschildt et al (2000) who stated that the project manager plays important roles in managing a project efficiently with the support from other concerned parties through effective communications. Furthermore, according to Hauschildt et al (2000), the establishment of precisely explicit objectives is essential, particularly at the initial stage of planning. With explicit communication objectives, certain misinterpretation can be avoided. Moreover, effective communications include not only explicit but also practical strategies through various forms, such as written communication, and frequency of meetings. In fact, the three main factors of success: project planning, progress monitoring and project management development via mutually agreed project plan allow concerned parties to share the ideas in planning, and during the operation of the project. Monitoring progress can be done by periodically summarizing project status (Barnes et al., 2002).

According to Austin (2004), project management is regarded as one of the important tools in managing work of the new era, especially the work with special characteristics and work requiring multiple skills. This includes management of large and small projects. Moreover, a lot of organization work has increasingly become a large project due to rapid changes and pressure from competition. Generally, projects are of different types and size. However, project components still remain the same, and all of which are included in a model of project management which is composed of four steps as follows: (1) setting and establishment of the project (2) project planning (3) project operation management and (4) project termination, the final stage, in which learning is considered an important activity, through assessment of work performance specified in project objectives within the fixed period and budget.

4.2 Organizational Culture

There is diversity of culture in various organizations; that is, organization members may not hold the same beliefs, nor do they share the same thoughts. Organizational culture can be defined as shared basic assumptions which have been learned and applied by a group to solve problems in order to not only adjust themselves to suit the external environment, but also to integrate them into organizations. Based on justified consideration, this continuous practice has been passed to the new members as a practical way of perceiving thoughts and feelings related to those problems (Schein, 1992). Based on Robbins and Coulter (2005), in the past, organization executives played an important role towards either success or failure of such organization, but at present, the executive is merely viewed as an organization symbol. In fact, in the present organizational management, achievement or failure is actually derived more from those affected external environmental factors than from the executive himself. Therefore, not only organizational culture, but also the organizational environment should be carefully considered, particularly the real meaning of organizational culture.

In other words, it refers to both values and systematically shared beliefs within the organization, which has been used as behavior codes for its members. In short, organizational culture includes values, the shared beliefs among its members as well as standards of practice within such organization.

Importantly, differences in organizational culture between the two organizations: university and the industrial sector should be carefully considered in order to achieve thorough understanding in working together. According to Ervin et al (2002), normally, the collaboration between the two institutions differs in objectives, and course of time. While university focuses on creation and provision of knowledge, the main objectives of the industrial sector are to present new products as soon as possible to the market, by using the most recent innovative production processes, and to offer efficient services in a highly competitive environment, as well as to tackle problems arising from work performance. However, some academics hold different points of view. They, emphasize new concepts, patterns and some explicit findings. This is in accordance with the study by Elmuti et al (2005) who stated that it is quite hard and difficult to achieve success in collaboration due to their differences in organizational culture: timescales, objectives and value systems. Therefore, it is considerably essential that bilateral balanced satisfactions should be sought.

Additionally, according to Barnes et al (2002)'s study on effective university- industry interaction, by assessing six projects, a study case of collaboration in research and development projects and by analyzing some literary work on collaboration management published in academic journals, it was revealed that certain problems arising within academic and industrial collaboration are, in fact, related to their different perspectives, priorities and values. This is also consistent with studies by Burnham (1997), Champness (2000) and Gregory (1997) who stated that under different perspectives, university puts emphasis on academic achievement, such as publication of academic work, and application of research in teaching and learning, whereas the industrial sector focuses on the rapid introduction of collaboration outcomes to the market based on mutual understanding and obtaining equal benefits. Nevertheless, an example of conflict usually occurs when the university is not able to adequately respond to those requirements of the industrial sectors, particularly in terms of research collaboration. Apparently, there is tendency that academics' or researchers' satisfaction will be more emphasized than for their counterparts. Accordingly, it is essentially necessary to set the balance of requirements of both parties based on mutual understanding.

4.3 Communication

There are various types of communication. The first one is the inter - communication among organizational members through which communication management, provision of information and maintenance of working relations among staff are the sole responsibility of the manager. The second is the formal and informal communication among various sections within the organization. Communication in relation to the public is the third type with the aims not only to report on general organizational performance, but also to advertise certain merchandise and services to its customers in general. The last one is a kind of inter-communication among organizations for co-operation (Grunig, 1975). Hence, communication is essentially required because it can lead to transfer of feelings, requirements and thoughts which eventually enhance better understanding so that organizational objectives will certainly be achieved. In fact, since academics of varied disciplines hold different points of view towards encountered problems or particular issues related to their interests, there is a wide diversity of meaning in communication.

Regarding the communication in collaboration between the two institutions, Mohr and Spekman (1994) explained that communication behavior is the indicator of not only collaboration relations but also organizational achievement, and all of which usually result in close relation maintenance. Communication behavior includes communication quality, information sharing, and participation among organizations. Above all, communication is one of behavioral qualifications which are highly important towards organization success because all organizational functional work solely depends on the communication processes. Based on Tuten and Urban (2001), communication is considered an important key for organizational collaboration, and in order to achieve successful collaboration, certain improvement should be made in communication, including frequency of communication, accuracy and willingness in sharing information.

Moreover, explicit communication strategies are also regarded as important factors for project management, such as setting of meeting frequency, written communication, types of reports based on different objectives, and course of time specified in each step of collaboration (Barnes et al., 2002). In addition, internet system can also be used as an interesting communicative tool not only in the meetings and consulting sessions, but also in being a new collaboration partner (Hanel & St-Pierre, 2006).

4.4 Social Networks

Generally, social networks play an important role towards resource collection, professional management and potential sources of organizational consultants (Birley, 1985). Similarly, according to Ostgaard and Birley (1994), social relations are regarded as important sources of resources, especially during the initial phase of project operation. In fact, knowledge progress results from both formal co-operation of community of academics and through informal communication of social networks (Crane, 1972).

Based on Garton et al (1997), social networks can be defined as a group of people, or organizations which hold certain social relationships, such as being friends, working together, exchanging of information and having interaction in order to achieve certain desired objectives through certain exchanges of experiences, resources and information. According to Gregory (2007), social networks refer to the relationship among groups of people or organizations which share similar interests, and through such networks, one is able to gain certain benefits by learning from others. Meanwhile, Lea et al (2006) explained that social networks mean a group of people, organizations or social organizations which are socially related in terms of being companions, and co-working. Moreover, the achievement of business which is based on both transfer of skills and provision of capital, in fact, results from relationships among such social network members. In short, the meaning of social networks is the relationships among groups of people or organizations which share common interests, and with such networks, one is enabled to get certain advantages by learning from others so that operational success of an organization can be certainly attainable.

Importantly, social networks lay emphasis on relationships, participation exchanges of knowledge, and update of information which is advantageous for problem solving among their members. Indeed, there are many advantages of social networks, such as the ability to create value, collection of resources and authority, as well as work accomplishment (Weber & khademian, 2008). In addition, both the strength and cohesion of social network relationships are important for sharing not only knowledge but also cohesion at an advanced level; therefore, these will enable collaboration partners to get access to sufficient information for further work benefits (Burt, 2004).
As the business operators, they will certainly get benefits from principal advantages of social networks, namely access to knowledge, information and advice networks. Moreover, through the relationships with a particular professional organization, one has an opportunity to contact not only an expert, but also to gain certain important data (Freeman, 1999). Additionally, according to Lea et al (2006), the concept of social networks is actually derived from the links of relationships without a blocking wall between organizations and various environments. As a result, many conventional social networks have been changed into new ones which can be easily accessible to organizations and all kinds of knowledge through the use of both technology and the internet, and all of which will enable the organizations to establish networks not only locally, but also abroad.

4.5 Motivation

According to Edwin (1996), motivation refers to a kind of driving force which activates certain behavior in order to achieve the desired objectives, and certain positive approaches should be applied as a driving force, such as work performance in response to satisfaction of various requirements. Otherwise, some negative approaches can also be used, namely enforcement of strict working disciplines through various methods. Based on Cribbin (1981), driving force is a process which urges any work operators to improve their task, and they will be rewarded for the better outcomes of their work. Consequently, all their efforts and fullest potential will be totally dedicated to the task. However, if there is a decrease in motivation, the efforts in performing work will certainly decline. Additionally, Robbins (1994) explained that motivation can be referred to as a desire to do a certain thing under individual conditions of ability, satisfaction and requirements. To conclude, motivation refers to a special desire to perform a certain task within either organizational or individual conditions of ability, satisfaction and requirements.

Based on the thorough literature review and explicit study assessment, it was found that there are many kinds of motivation which enhance academics to collaborate with the industrial sector (Lee, 2000):

1. To obtain research grants.
2. To prove theory or to test research results.
3. To gain more advanced knowledge based on the research which is being carried out.
4. To publicize university missions.
5. To obtain business opportunities.
6. To apply knowledge derived from problem solving into the classroom.
7. To obtain both internship and employment opportunities.
8. To obtain stable and secure research funding for research assistants and laboratory apparatus.

Meanwhile, based on most reviews of the literature, the reasons why the industrial sector needs to join collaboration with university are as follows:

1. To solve certain technical problems.
2. To develop both products and new processes.
3. To conduct certain research this eventually leads to registration of a new patent.
4. To improve product quality.
5. To adjust and improve research and development directions.
6. To gain access to new research work.
7. To maintain relationships and networks with the university.
8. To obtain a certain research with good quality.
9. To select graduates for employment.

In addition, in order to effectively develop the collaboration between university and the industrial sector, based on the points of view by researchers, academics and operators, motivation of stakeholders is also considered. Basically, motivation of university is to be academically accepted; namely, the publication of academic work in some well-known journals, and presentation of papers at conferences. This also includes the needs to obtain research funding, personal financial benefits, scholarships for students of graduate studies and the support for laboratory apparatus. Meanwhile, both business sector and operators share similar motivation. That is to say, both knowledge and technology are needed in conducting their business. Also, they expect to obtain financial benefits, the right over technology as well as to make use of both product innovation and processes prior to their rivals.
Importantly, willingness and motivation to learn and work with university truly depend on CEO's initiatives, leaderships and visions of research and development team work respectively. Nevertheless, research and development have sometimes been conducted within the organization itself so as to keep company secrets.

4.6 Firm Characteristics

There are diverse meanings of firm characteristics. Agrawal (2001) defined the firm characteristics as something which influences organization capability in utilizing certain external knowledge. In addition, Joseph and Abraham (2009) stated that firm characteristics, in fact, influence interaction between university and the industrial sector. This can be proved by considering their being a research and development organization, size, length of organization foundation as well as its location. To summarize, firm characteristics, generally, refer to certain organization distinctiveness which influences its capability in utilizing knowledge from outside with the consideration of organizational size and its geographical location.

Actually, geographical closeness particularly plays an important role in cohesive relationships between the two institutions. It, also affects transportation costs, customers' responsiveness and utilization of available resources (Santoro, 2000). Based on Tether and Tajar (2008), the size of business organization is positively related to the sources of knowledge. In fact, there is a tendency for larger firms to operate innovation projects with more extensive resources in finance, personnel and certain social advantages, such as reputation.

Furthermore, Agrawal (2001) stated that certain firm characteristics, namely absorptive capability, and geographical location also affect organization ability in using external knowledge. Meanwhile, Joseph and Abraham (2009) claimed that certain firm characteristics: the length of organization foundation, size and its location truly affect usage of information sources selected by both university and state research institutes.

5. Conclusion

There are six principal factors which are related to collaboration of knowledge transfer between university and the industrial sector: project management, organizational culture, communication, motivation, social networks and firm characteristics. The relationships of the two institutions are based on resource dependence theory. In other words, the organizational existence and development are essentially dependent on the resources, and vice versa. The organization will not be able to survive if it is unable to respond to changes of external environment (Pfeffer & Salancik, 1978). Once there is a collaboration project between university and the industrial sector, each party is required to closely follow management process so as to achieve a certain successful and efficient project. Additionally, to keep balance and to decrease certain conflicts in the future, a thorough understanding of differences in organization culture is essentially considered, and the good communication helps promote much more successful collaboration.

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