Successes and Failures of an Intermediary in Triple Helix Relationships in Developing Countries: the Case of Thailand's Food Industry

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Abstract

For both theoretical and practical reasons, it is necessary to have better understanding of the roles of intermediaries in triple helix relationship in developing countries where systemic failures are much larger and persistent than developed countries. This study compare successful and failure cases in the food industry operated by Industrial Technology Assistance Program (ITAP) of Thailand's National Science and Technology Development Agency (NSTDA). It identifies key success and failure factors concerning three actors in triple helix relationship, namely, recipient firms, university experts, and intermediaries (Industrial Technology Assistants or ITAs).

Keywords: Intermediary, Successes, Failures, Industrial Technology Assistance Program (ITAP), Developing Countries

1. Introduction

Generally the extent of market and systemic failures in developing countries are much larger than developed ones (Leff, 1976 and Chaminade, and Edquist, 2006). Innovation systems and triple helix relationships in developing countries can be characterized as weak and fragmented because of high degree of such failures (Intarakumnerd *et.al*., 2002). To mitigate these failures, different government policies and more effort are needed. Market mechanisms and the standard government intervention in the forms of laws, regulations and incentives are not sufficient to solve these problems. The role of intermediaries is highlighted as an important actor instrumental in mitigating failures. Dodgson and Bessant (1996) indicate that intermediary organizations can facilitate innovation process by performing activities bridging user needs and supply side. They can help to identify specific needs of users, select appropriate options, link with external knowledge sources and so on. These intermediary organizations can take many forms such as research technology organizations (RTOs), industrial and trade

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associations, professional associations, private foundations and so on. Nonetheless, the actual operation and, hence, lesson learned from the work of intermediaries have not been seriously conducted, especially in the context of developing countries.

The aim of this paper is to study the roles of intermediaries in creating and strengthening triple helix relationships and mitigating systemic failures in a developing country. The role of Thailand's Industrial Technology Assistance Program (ITAP) under National Science and Technology Development Agency in the food industry will be highlighted as a case study. ITAP has been chosen as a case study because it has been operating since 1992 and has developed technical consultant projects with more than 1000 firms since then. Therefore, it has enough track record to evaluate successes and failures. ITAP's operating model was based on the "demand driven" and "sharing responsibility" concept that each participating company must pays the expenses of the technical experts who could be from within or outside the country. ITAP pays up to 50% of the expense (but not exceed 500,000 Baht) to the company, in the form of reimbursement. The reason behind this concept is to induce the SMEs to upgrade their technological capability in manufacturing and generates their product and process innovation, and at the same time to make sure that a participating company had the real need and commitment. Recently number of local experts from Thai universities has increased considerably. ITAP has played important roles in initiating and enhancing university and industry linkages which are normally weak in Thailand. Triple Helix relationships among universities, industrial firms and ITAP were formed.

2. Systemic Failures and the Roles of Intermediaries in Developing Countries

In many developing countries, systems of innovation and triple helix relationship are weak and fragmented (Intarakumnerd et al., 2002) and can be considered as emerging ones or ones under construction (Chaminade and Vang, 2006). In other word, systemic failures in the innovation systems or triple helix relationship of developing countries are larger, and, to certain extent, more persistent than developed countries. Although the literature on systemic problems is scarce and dispersed, attempts have been made to identify theoretically some major problems in the system. The IS scholars, for instance, Smith (2000), Carlsson and Jacobsson (1997), Rodrik (2004) and Woolthuis et al. (2005) provide examples of such systemic problems as follows:

a) *infrastructure provision and investment failures*,
b) *transitional failures* (late-comer firms being less capable to foresee the emergence of new technological paradigms),
c) *lock-in failures* (late-comer firms being locked into acquired existing technologies and technology systems),
d) *formal and informal institutional failures* (laws, regulations, norms and routines hampering innovation and capability building),

e) *network failures* (too weak knowledge intensity of exchange or too strong linkages leading to blindness to what happens outside the network),
f) *capability and learning failures* (the insufficient competences of late-comer firms limiting their capacity to learn, adopt or produce new technologies over time), and
g) *complementarity failures* (the competences of the systems of these countries might not complement each other).

Sometimes, main actors in innovation systems or triple helix relationship can mitigate these systemic problems by themselves. However, sometimes, intermediaries are required, especially when main actors do not realize their problems or do not have enough capabilities, or the failures are too large. Intermediary organizations can take several forms ranging from government organizations, research and technology organizations, private-sector organizations (such as industrial associations) or non-profit organizations (such a professional organizations). Nonetheless, in several developing countries, these organizations are also weak. Research and Technology Organisations (RTOs) might be exceptions, since many developing countries put their financial and human resources to strengthen their RTOs.

RTOs are independent, non-corporate, research and technology organisations funded by government, the private sector or both (see Rush et al. 1996). There is a general belief that the role of RTOs is limited to generating new knowledge through research and development. In fact, due to the resources they possess in terms of human capital and facilities, RTOs can play equally important roles in promoting the *diffusion and use* of existing and new knowledge in the economy. Scholars such as Kandel (1994) accept that RTOs are not uniform organisations, and that they vary according to sector, region, country and industry. Nevertheless, they argue that the contribution of RTOs in terms of technology transfer to support the innovative activities of firms is even more important than the research activities that they conduct. RTOs can also perform a 'bridging role' that links research activities with those implementing the products of research (Hertog and Huizenga 2000). Lente et al. (2003) note that RTOs can play a role as a new type of intermediary organisation that functions at a system or network level, in contrast to traditional intermediary organisations that operate mainly bilaterally. These 'systemic intermediaries' are important for long-term and complex changes, such as the transition to sustainable development, that require more systemic efforts to articulate needs and options, the alignment of relevant actors and the support of learning processes. In this respect, Dodgson and Bessant (1996) suggest that RTOs can perform activities to bridge user needs and the supply side, as shown in Table 1.

Table 1: Functions of RTOs as Intermediaries in Innovation Processes

User needs	**Bridging activity**	**Supply side**
Technology	Articulation of specific needs Selection of appropriate options	Sources of technology
Skills and human resources	Identification of needs Selection	Labour market

	Training and development	Training resources
Financial support	Investment appraisal Making a business case	Sources of finance venture capital, banks, government etc.
Business and innovation strategy	Identification and development Communication and implementation	Environmental signals – threats, opportunities etc.
Knowledge about new technology	Education, information and communication Locating key sources of new knowledge Bridging links with the external knowledge system	Examples of best practice Emerging knowledge base
Implementation	Project management Managing external resources Training and skill development Organisational development	Specialist resources

Source: Dodgson and Bessant (1996).

However, studies of these types of intermediary functions of RTOs are still limited (as most previous studies focus on knowledge creation functions of RTOs), especially in developing countries where systemic failures are much larger and complex. This paper, therefore, aims to fill in this gap by examining a successful intermediary program of a leading RTO, National Science and Technology Development Agency (NSTDA), in Thailand.

3. Methodology

We have taken two approaches. Firstly, we examined mid-term and final evaluation reports of 50 ITAP projects in the food industry written by external experts and ITAs within the year 2007-2008. We then draw general observations on factors determining successes and failures of these projects. Food industry was selected since it is a resource-based industry. Many developing countries, including Thailand, depend very much on this sector economically and socially. Secondly, we selected a very interesting longitudinal case study to substantiate our general observation and pinpoint detailed characteristics leading to failures and successes.
Here we define a failed project as the one not meeting objectives as specified in contracts, possibly leading to no reimbursement after termination. On the other hand, a successful project is defined as the one either meeting its objectives, or producing workable products/processes at the end.

4. Main Finding: Analysis of Evaluation Reports

By examining mid-term and final evaluation reports of 50 ITAP projects in the food industry written by external experts and ITAs within the year 2007-2008, the successes and failures of projects depend very much on three following factors:

A) The willingness, readiness, and learning and absorptive capacity of participating firms.

Characteristics of Firms	Successful Projects	Failure Projects
Understanding of own problems/needs	know what the problems/needs are and can prioritize them	do not adequately study their problems or see many problems/needs but cannot prioritize them
Attitude of owners/executives	give the projects high priority and consider them as critical for future successes of companies	do not fully and continuously support (or view the projects as additional work subsidized by government)
Resources put into project	provide enough and continuous financial and human resources to work with outside experts from university	not enough and infrequent support
Participation from relevant departments of the company	projects were acknowledged as 'company' project and fully participated by concerned departments	projects were considered as 'department' project with little support from other departments
Readiness to carry on after the projects finished	projects have been integrated into future organizational strategy. Resources were allocated to carry on the activities	activities ended or not being pursued substantially after the projects finished

B) Capability and creditability of university experts

Characteristics of university experts	Successful Projects	Failure Projects
Academic capability	enough capability to carry out the projects	not enough or not suitable capability
Industrial experiences	having relevant industrial experiences especially ones similar to the projects	no or little experiences
Degree of attention and time spent in the projects	give enough time and continuous attention throughout the projects	do not follow the projects through

C) Capability and dedication of ITAs (Industrial Technology Assistants working for ITAP)

Characteristics of ITAs	Successful Projects	Failure Projects

Matching capability	enough ability to match expectations of firms with capabilities and limitation of university experts	not enough suitable capability
Analytical skill	Able to determine key success factors of projects	Unable to identify critical success factors
Trust building capability	Able to build mutual trust between firms and experts	Unable to reduce or illuminate distrust between the two parties
Monitoring capability	enough ability to set projects' milestones (breaking down projects into smaller phases) and monitor accordingly	directionless work procedure without milestone and dedication
Problem-solving capability	ability to solve problems emerged during the projects and fine-tune different expectations of both sides	not enough ability or taking side with one party.

5. A Case Study: *A Corn Cider Vinegar*-producing firm

The owner's family set up a company in 1989 to produce pickled baby corn. The company's first factory was opened in the same year and is situated in a prime area for the cultivation of baby corn in Central Thailand. Employing over 230 full-time workers, this plant has a production capacity of 10 tons (drain weight) per day, or over 3,600 tons per year. In 1997, on the firm expanded its production capacity with the construction of a second factory located in Northern Thailand. An area that is also favorable to baby corn farming. With a production capacity similar to that of its counterpart in the Central region, therefore, in total, the firm currently has a production capacity of more than 7,000 tons per year.

A turning point came when the company felt that they wanted to produce vinegar, an indispensable ingredient for their pickled baby corn, by themselves. In the past, they bought a large volume of natural vinegar for pickled baby corn production and it was risky in terms of inconsistent quantity and quality of vinegar as well as fluctuating prices. At the beginning, the company did not have enough knowledge and technology. Therefore, they searched for an external expert. Finally they found one professor from King Mongkut's Institute of Technology Ladkrabang who used to developed vinegar producing microorganisms. The research project aimed at making vinegar from sugar cane began with the financial support from the Thai Research Fund (TRF), a key research funding agency in Thailand. The initial result was not so satisfactory, as the scent of the product was too strong for customers. Nonetheless, both sides did not give up. A subsequent research project targeted on making vinegar

from boiled water used in baby corn cooking . This time the research yielded a satisfactory result and the trust between the two parties increased.
Knowledge on process technology was transferred from the university expert to the company. A key transfer channel is through a research assistant who worked full-time with the professor. After the project was finished, he subsequently became a production manager of the company.

However, the challenge is on deploying technology successfully developed in lab scale to production scale. The company faced scaling up problems and, with a recommendation of the professor, contacted ITAP to help as an intermediary. ITAP invited a group of experts from another university to work on a project of establishing a new factory producing vinegar from baby corn cooking water. The role of this group of experts was to provide consultancy on plant layout design, processing equipments selection, equipment design and making. Nevertheless, the construction of the manufacturing unit faced difficulty due to unexpected increase in the cost of an important raw material. The cost of setting up the processing line now rose up to as close to the cost of buying these equipments from overseas. This had not been foreseen either by the company or the group of experts which might not have enough industrial experiences. As a result, the company decided to import the technology from an overseas company specialized in vinegar technologies. The imported technology proved to be very effective but with high production cost.

Still, the company's ambition of localizing production technologies was there. The company still wanted to have its own microorganisms and locally made fermentor for future expansion of the business. The professor (the first expert) was sent by the company to study the production process at the overseas company. This turned out to be a real window of opportunity to deeply understand the essence of science and art of vinegar production process. Afterward, to improve and fine tune the technologies, three research projects were initiated between the professor and the firm. ITAP again was the intermediary of these projects. Starting with a smaller production scale, a new production system was developed within the same factory. Later, scaling up the new production system was successfully implemented. Now the company finally owned technology for fermented vinegar with lower cost.

This long endeavor provides us with several lessons. On the company side, company executive's dedication (a never-give-up attitude) to have its own technology, and understanding of the long-term nature of R&D are critical factors. In addition, it understands its own problems very well, prioritize them, and provide attention and resources accordingly are also a key success factor. This also includes their investment in sending a university expert to learn from a external source of knowledge in a foreign country. On the university expert side, the expert's academic excellence, understanding of the industry, and continuous attention (especially having a full-time research assistant for the projects) are obviously key critical success factors. On the intermediary side (ITAs), the monitoring and problem-solving abilities and continuous assistance for several subsequent projects proved to be indispensable factors. All in all, the case study sheds the light on an evolution of triple helix relationship between the

company, university experts and ITAs. It substantiates the main findings from the aforementioned evaluation reports.

6. Conclusion

This study attempts to partially fill in the gap on understanding the roles of intermediaries in innovation systems and triple helix relationship in developing countries where systemic failures are much larger and persistent than developed countries. By comparing successful and failure cases of Industrial Technology Assistance Program (ITAP) of Thailand's National Science and Technology Development Agency (NSTDA), it identifies key success and failure factors concerning three actors in triple helix relationship, namely, recipient firms, university experts, and intermediaries (Industrial Technology Assistants or ITAs). Based on ITAs' evaluation report and an interesting case study, the paper elucidates resources, capabilities, skills and attitude of the three parties, required for successful projects. As a result, it has both policy and management implications on triple helix practices, especially on selecting the right participating firms and university experts and successful project implementations. Apart from increasing willingness and absorptive capacity of recipient firms, and selecting suitable university experts, capability of intermediaries themselves need to be enhanced, so that they can effectively functions. Government policies should pay attention on this aspect beyond standard polices addressing market failures.

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