

# CHAPTER 3

## ANALYTICAL FRAMEWORK

In this chapter, an analytical framework for industrial development through industry-university collaboration has been developed, which will be used as a frame of reference and an analytical tool to examine the suitable industry university partnership model for Thailand. From Chapter 2, the partnership models that will be used in this thesis are partnership models that were proposed by Bohez and Tabucanon, 1999 (No-Model Model, Agency Model, Membership Model and Research-Oriented Park Model). The methodological framework employed in this thesis is shown as below.

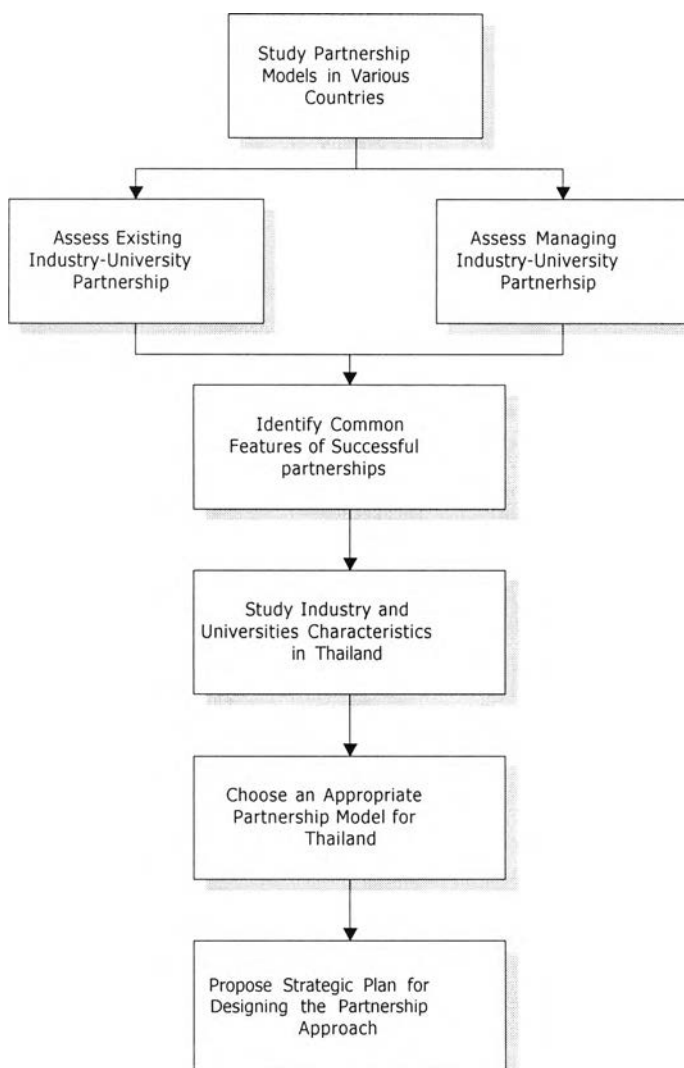


Figure 3.1: Methodological Framework Employed in this Thesis

First, partnership models in various countries are studied in broad perspectives and in-depth perspectives (comparative study). From studying in-depth or comparative study, existing and managing industry-university partnership will be assessed and analysed carefully. After gain experience from other successful universities in each partnership model, the common features of successful partnerships will be identified. Next, data and information about overall R&D in Thailand, and university and industry characteristics in Thailand will be analysed. Then, choose the partnership model that suit with university and industry characteristics in Thailand. Finally, propose the strategic plans for designing partnership approach.

In the next part, analytical framework to assess existing, managing existing industry-university partnership and framework to choose an appropriate partnership model for Thailand will be gave the details.

### 3.1 Analytical Framework to Assess Existing Industry-University Partnership

Based on the finding of the Literature Review in Chapter II, the analytical framework is proposed. The framework covers the variables **Linking Mechanism, Technological Capabilities of Industry, and Technological Capabilities of University**. These variables are suggested by Ramanathan (see in chapter 2 part 2.7) and Bohez and Tabucanon, 1999. The indicators for *Linking Mechanism* are Consultancy, Contract Research, Joint Research, Consortium, and Licensing. *Technological Capabilities* for both *Industry* and *University* are assessed by the same indicators, i.e., Operative capability, Transaction capability, Innovative capability, and Supportive capability. These three variables will be analysed for each partnership concept, namely No model applied, Agency model, Membership model and Research-Oriented parks model. Additionally, a framework for managing such partnership is presented.

The comparative analysis for each partnership type will cover partnership approaches of universities in Developed Countries, Newly Industrial Countries and Developing Countries, and the type of Linking Mechanisms preferred and neglected by each university in those countries. In addition, the benefits, strengths and weaknesses of different partnership forms and linking mechanisms will be analysed.

It is very important to build a consistent terminology, as the terms used in different studies in the literature are not consistent and often difficult to compare. Therefore, the following definitions are provided to assess each variable and its indicators.

#### 3.1.1 Definition of Partnership Model Categories

Partnership model means a certain way or pattern of partnership between industry and university. Most authors agree that not only one pattern can be applied for industry-university partnership strictly. For example: one university committed to the Membership model will accept a non member company as customer if there is a new

project brought in even though with different standard cost. Each university will determine which model is dominant in its partnership with industry compared to others. Other universities may apply all three kinds of partnership models, for example, first Science Park Model, then establish a technology transfer club (Membership), and get projects through its agent office (Agency). Details of the definition of partnership model categories given by Bohez and Tabucanon are repeated as follows:

### **No-Model Model**

No particular procedure or channel is applied when the university is contacted occasionally by industry or vice versa.

### **Agency Model**

There is an agent between university and industry as a one-stop shop or one-stop information. Sanchez & Tejedor (1995) called it Technology Transfer Point, while Soon (1995) named it Excellent Research Centre (ERC and SRC).

### **Membership Model**

University and industry contact each other through an engineering/scientific club established by the university. Industries as the members pay the membership fee annually. The University of Minnesota called it Centre of Interfacial Engineering (CIE), and the National University of Singapore named it Intronk, while Hong Kong Polytechnic University has a Business Technology Centre (BTC) Club.

### **Research-Oriented Parks Model**

University establishes a research-oriented park mostly to accommodate high-technology industry their neighbourhood. Usually faculty members of the university are involved in technology development for the companies located in science/technology park. Research-oriented park is a zone for research and development, industrial standard testing, quality control, product design, information service and consultation activities. It is operated with commercial orientation, located near industrial estate, staffed by professional or technical personnel, comprising hi-tech companies and an excellent university. It is supported by sufficient infrastructure such as transportation, water supply, electricity, telephone and facsimile, waste treatment, rooms for laboratories. The purposes of establishing the Research-Oriented Park are to develop the basic science and the application of technology.

## **3.1.2 Definition of Linking Mechanisms Categories**

Linking mechanism means type of university service (Bonaccorsi & Piccaluga, 1994). With reference to the amount of technological content delivered (Table 2.2 in Chapter II), five linking mechanisms, which provide real technological partnership between university and industry, have been chosen. Those are: Consultancy (Sounder,

1993), Contract Research (Bonaccorsi & Piccaluga, 1994, Autio & Laamanen, 1995), Joint Research (Bonaccorsi & Piccaluga, 1994, Sounder, 1993), Consortium (Bonaccorsi & Piccaluga, 1994, Autio & Laamanen, 1995), and Licensing (Sounder, 1993).

### **Consultancy**

Technical advice to industry by faculty members both individually and as a team constituted by the university. Usually this mechanism does not need laboratory facilities on campus.

### **Contract Research**

Conducting research by faculty members for industry on campus.

### **Joint Research**

Faculty members and industry engineers are doing research together.

### **Consortium**

Doing research together in a group consisting of various organisations, such as universities, government research and science foundations, institutes and private firms.

### **Licensing**

Commercialising university research results through license agreement with a firm.

## 3.1.3 Technological Capabilities of Industry

Technological Capabilities refer to the capability to perform technological activities, or activities which systematically utilise knowledge in transforming inputs to outputs, according to a particular production process. Most industries in developing countries are helped by parent companies. This is not an industry-owned capability. Technological capabilities of industry can be analysed along the following categories (Bohez and Tabucanon, 1999):

### **Operative Capability**

Capability to transform inputs into outputs effectively and continuously, including planning, controlling, maintenance, predicting, change over to new models and networking.

### **Transaction Capability**

Capability to plan and implement technology transaction (selling and buying effectively, which includes, justify the technologies to be bought/sold, identify

suitable sellers/buyers of technology and most suitable mechanism for buying/selling technology, and negotiate it.

### **Innovative Capability**

Capability to come out with technological innovation for strengthening current business and exploring new technology bases, which include: carry out product/service innovation, process innovation, and introduce core competence leveraging innovation.

### **Supportive Capability**

Capability to develop, integrate and improve operative, transaction and innovative capability, which include: formulate a technology-based development scenario, develop expeditionary and future-oriented market intelligence, knowledge creation and extracting latent skills.

## 3.1.4 Definition of Technological Capabilities of University

Technological capabilities of university means the capabilities of universities in operation, transaction, innovation about all matters which are related to technology, especially laboratories equipment, equipment for research, design and making prototype. A technological capability of university variable has the same indicators with Technological Capability of Industry variable, but with different definition for each indicator (Bohez and Tabucanon, 1999):

### **Operative Capability**

Capability to deliver the university services which is related to technological matter such as teaching, doing research, providing consultancy.

### **Transaction Capability**

Capability to choose and to buy the appropriate technology for university laboratories office equipment, research facilities, etc.

### **Innovative Capability**

Capability to come out with new design, new teaching material, product prototype, technical research result, etc.

### **Supportive Capability**

Capability to develop, integrate and improve all capabilities above.

## 3.2 Framework for Managing University-Industry Partnership

This framework (see Figure 3.2) covers managing service innovation in a university. Major components are:

- Industrial Firms Characteristics
- Type of University-Industry Partnerships
- University Characteristics
- Barriers in University-Industry Collaboration

This framework is based on literature reviews in chapter 2 in part of the structure of industry demand side and university supply side, relations between component of technology and linking mechanism of technology transfer, and barriers in the industry-university partnerships.

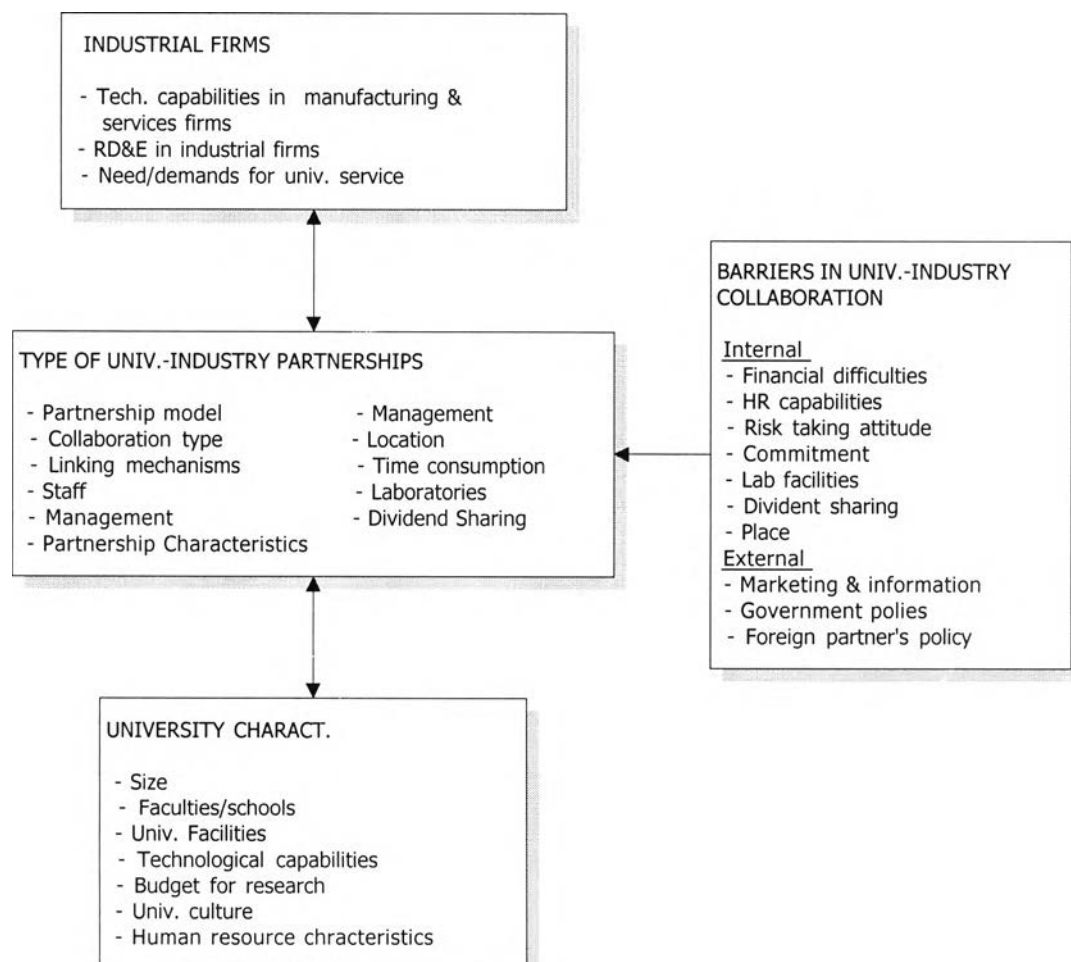


Figure 3.2: Managing Industry-University Partnership Framework

This framework will be used to assess and compare the university's management approach observed in existing university-industry partnerships in other countries (Chapter IV). It also will be used to assess Thai universities and Thai industry. Based on this analysis, a suitable partnership model will be proposed for implementation for Thai universities.

### 3.2.1 Industrial Firms

It is very important to know technological capabilities and needs or demands of industrial firms as customers. Without recognising this first, it is difficult to offer right services to industry. To measure industry's technological capabilities, it is needed to know about their laboratories equipment, and their research and development.

### 3.2.2 University Characteristics

#### **Size**

The number of students and lecturers can be used to assess the size of a university. The lecturers:students ratio and number of lecturers who are professors, doctoral graduates, master graduates and bachelor graduates have an important impact on the individual faculty's time available for outreach activities and research.

#### **Faculties and Departments**

A well-known name of the faculties and departments is very important. Usually universities that have a faculty of Engineering provide technological services for industry. On the other hand, the number of undergraduate and postgraduate programs is also important to differentiate general universities from research universities. Postgraduate programs are more prone to foster research than undergraduate programs

#### **Ownership**

The owner has very important influence on the top management. In public universities, the owner is the government. Private universities are owned by shareholders or foundations. Usually the chairperson is very dominant in all sectors, especially finance and human resource recruitment. Sometimes the foundation does not only establish rules, but also very tight control to avoid corruption and mismanagement.

#### **University Facilities**

University facilities such as laboratories, separate building for research activities, special room or building to deal with the customers, special manpower to manage the research centre or industry-university partnerships will give impact

to university services for industry. If top management concern and encourage staffs to collaborate, top management should take care about those facilities.

### **Technological Capabilities**

Technological capabilities of university can be measured by how often the changing of laboratory's equipment is done and how the university develops its laboratories (by itself or bought/donated from industry). Research type also shows the university technological capabilities. University doing basic research usually has higher technological capabilities than university which doing applied research or just marketing analysis.

### **Budget**

The percentage of R&D expenses as compared to annual university expenses per year will show how important R&D activities are in that university. Some universities have both an R&D centre and Centre for Industry-University Partnerships.

### **University Culture**

University culture includes national culture, vision/mission, strategy system, incentive system, leadership style, and organisation design. National culture relate to teamwork performance. Vision & mission are very important as guidance for formulating goals, objectives, determining strategy and focus. Incentive system influences the lecturer in collaboration with industry. The organisation design influences to service coordination, service administration and response to the customers. Leadership style play important role in facilitating industry-university partnerships. Each style has different impact on the lecturers.

### **Human Resource Characteristics**

Human resource characteristics have close relationship with research activity. They include creativity, need, beliefs, professional skills level, teamwork ability, and risk-taking. Working as a team is a part of research service to industry. To make the project a success, every person should have a teamwork ability. Risk-taking of failure is influenced by top management. If top management commit and encourage the lecture to talk the failure risk, then the risk taking is high. If top management does not encourage lecturers, then the risk taking is low.

## 3.2.3 Type of University-Industry Partnership

### **Partnership Model Implemented**

Information includes number of past and present consulting and R&D service projects with industry, and the channels for industry to contact the university.



### **Type of Collaboration**

There are three types of collaborations: formal, semi formal and informal collaboration. The differences among them were shown in Table 2.5 and 2.6 in Chapter 2.

### **Phase, Duration and Linking Mechanism of Technology Transfer**

Information in these issues are about continuous cooperation with industry in consulting or R&D, duration of cooperation, kinds of linking mechanisms, mechanisms that brought much income to university, number of cooperation for each linking mechanism, the way to acquire project orders from industry, university's motivation in providing services, income sharing system, the use of this income by university or department. The other data are about rules to balance the faculty member's time between teaching, research and service.

### **Characteristics of Industry-University Partnerships Centre**

It is very important to determine orientation of centre of industry-university partnership, whether profit or not profit, staff recruitment policy, new laboratory provision or use the existing facilities, and the level of centre management dependency on university management.

The last point of analysis deals with strengths and weaknesses regarding industry-university partnerships.

#### **3.2.3 Barriers to Service Implementation**

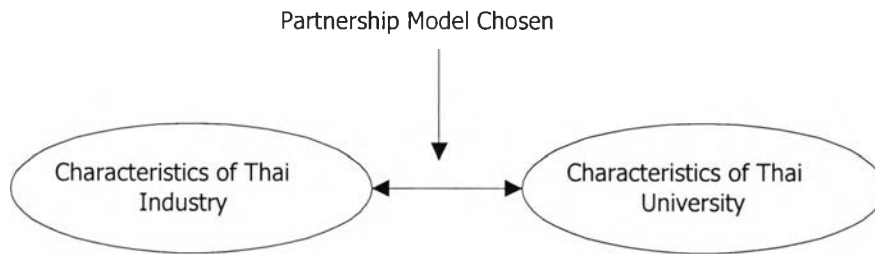
Some internal factors that can be barriers are financial (capital, promotion, operational, incentives), human resource capabilities, risk-taking of failure, commitment of top management, laboratories' facility, university owner, university location, dividend sharing, objectives conflict and value conflict.

Some external factors that can be barriers are lack of marketing information, government policies, foreign company's rule as a parent company and hard competition.

### **3.3 Framework for Choosing an Appropriate Industry-University Partnership Model**

There are four steps leading to the choice of an appropriate partnership model for Thai Universities. The first step, partnership models in various countries are studied in broad perspective. Then, a comparative study about existing partnership models in various countries is analysed carefully. The aim of this step is to gain experience from other successful universities, to identify the common features of successful partnerships and to assess which partnership model is most compatible with certain market

conditions (supply-demand). In third step, data and information about the characteristics and requirements of Thai industries, and Thai universities characteristics, both through researches and interview result collections, will be analysed. Finally, a study to identify strategies for designing the partnership approach will be discussed.



**Figure 3.3: Comparative Study to Assess the Possibility of Implementing each Partnership Model to University in Thailand**

The partnership model that has the biggest benefits and the least weaknesses will be chosen. Then, a detailed strategic plan for implementing it will be discussed in Chapter 4.