CHAPTER 4

EFFECT OF THE PARTNERSHIP MODELS ON THE SUCCESS TO INDUSTRY-UNIVERSITY COLLABORATIONS: STUDY FROM VARIOUS COUNTRIES

This chapter will study the partnership model based on Bohez and Tabucanon (No-Model Model, Agency Model, Membership Model and Research-Oriented Park Model) in several countries and study in-depth in each partnership model to analyse the similarities and distinct differences of all characteristics, across the different partnership models. The following questions will be discussed:

- What are the common features of universities who have been more successful than others in building a viable partnership with industry?
- What are the indicators to measure the degree of success?
- What went wrong with universities who are least successful?
- What are the particular strengths and weaknesses of each partnership model?
- Which characteristics of industry (demand) and university (supply) fit best with which type of partnership model?

The study will assess in depth the selected universities in Asian NICs, especially Hong Kong and Singapore because of more similar culture and geography as compared to Europe and USA. The other reason is the economic players in those countries are similar to the economic players or major business groups in Thailand.

The comparative study will focus in the strengths and weaknesses of each framework variable for each university. It also will bring out the benefits, ideas and integrate them into a strategic plan.

4.1 The Industry-University Relationship/Partnership Model in Some Countries

There are some different types of industry-university relationships practiced in several countries. In this part, each model: No-Model Model, Agency Model, Membership Model, and Research-Oriented Park Model, which have been reported and analysed in the literature, will be shown to in some details.

4.1.1 Model I. No-Model Model

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

4.1.2 Model II. Agency Model

What is "agency" in this case? Agency means broker. The broker does not do the project himself, but the researchers did. Therefore the broker is in between the company and the university researcher. Universities usually lack communication with industries, have less capability in negotiation, no experience in marketing of technology and often an inefficient in administration (procedure, contract, legal issues, patent, etc.). Mostly, both the industry and university researcher do not know each other. The practicing engineers are uncertain about researcher's capability, with whom they should discuss their problems, and whether the researcher is the right person or not. On the other side, university researchers often have no chance to contact industry themselves for the first time. They do not know to whom they should talk, no one covers their transportation cost and there is not enough time for them to visit firms because of their teaching load and own research. Also one visit is not enough to secure a consulting or research contact. Therefore both the researcher and industry need an agency to help them.

There are two example cases representing the agency model. The first is the agency used by many universities and many industries in one location or city like in the case of Korea. The second one is the agency used by many industries but only one university in one location or city like in the case of Aragon in Spain.

4.1.2.1 Industry-University Relationship in Korea

The relationship between the university and industry in Korea is concentrated on research trust, joint lecture, joint research, technical advice, consortium, investigation and other services (Soon, 1995). KOSEF (Korea Science and Engineering Foundation), a government supported non-profit organisation, established centres of excellence: SRC (Science Research Centre) and ERC (Engineering Research Centre) in 1989. Korea used SRC and ERC as the agency between university and industry (Figure 4.1). As of 1999, there are 26 SRCs and 35 ERCs.

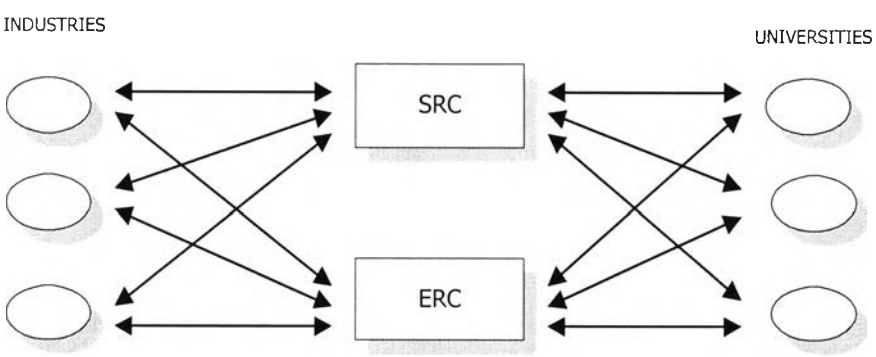


Figure 4.1: Agency Model in Korea

Figure 4.2 shows the functional relations of this agency model in Korea. Before SRC and ERC, KIST (Korea Institute of Science and Technology) was the agency in charge of university-industry collaboration. This strategy based on the agency model was successful in Korea.

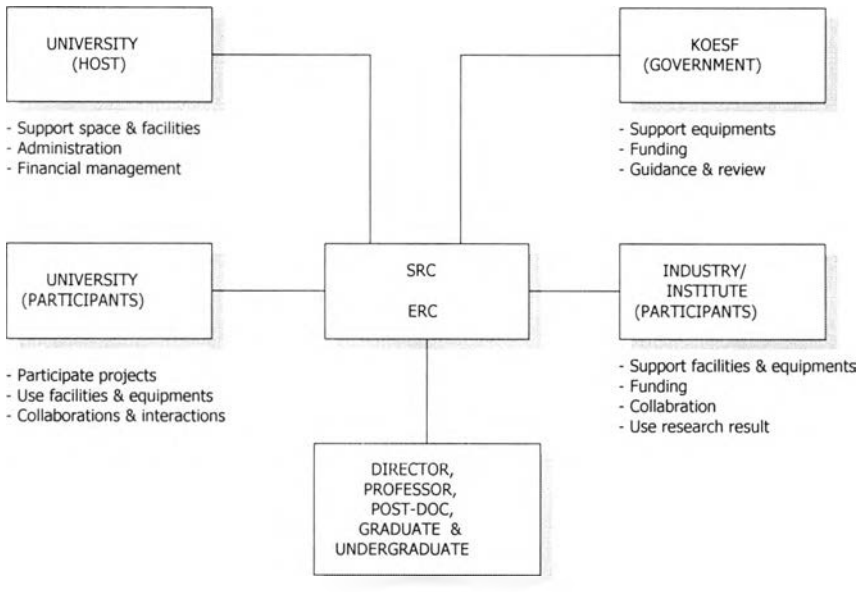


Figure 4.2: Functional Relations in the Agency Model in Korea

Each centre interacts with industry as show in Figure 4.3. Cooperation between these centres and industry has been of various kinds. Cooperation can take the form of a research trust, joint research, technical advice, joint lectures, consortium etc.

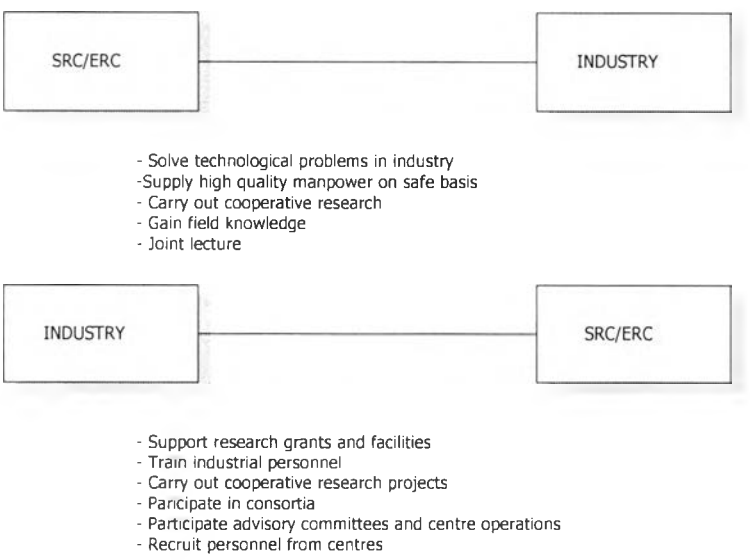


Figure 4.3: SRC/ERC interaction with industry

The problems of relationships between universities and industries in Korea were discussed in publication by Soon (1995). Soon pointed out three problems of university, namely: 1) worsening of the research environment due to shortage of funds; 2) lack of flexibility in universities' organisational system; 3) research tends to be more complex and highly sophisticated, thus there is a need for multiplicity of inputs.

4.1.2.2 Industry-University Relationship Aragon in Spain

According to Sanchez & Tejedor (1995), in Aragon, a region located in the northeast of Spain, the relationship between industry and university is also based on an agency model, like in Korea. There are two Technology Transfer Points (TTPs) as the bridge between university and industries located in the neighbourhood around that university that is shown in Figure 4.4. One TTP is managed by the University of Aragon (established in 1986) and the other one is privately managed (established in 1989).

There are many small and medium industries around the University of Aragon. Before 1986, collaboration between the university and business firms was very rare and limited to some training courses and lab essays. Because of these two TTPs, the collaboration has grown and become more diversified each year: joint patents and innovations are on the rise; the numbers of contracts and their economic value have almost doubled from 1989 onwards. The company's R&D managers stake that they get benefits from these formal links with the university such as a gain in technical knowledge, new technological services, business image enhancement and improvement in new technology implementation. Under this collaboration, the university gets 10% from each contract.

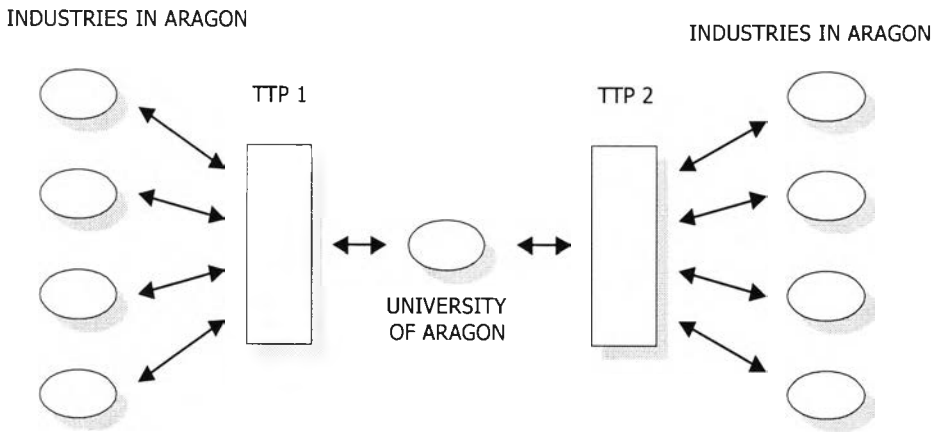


Figure 4.4: Agency Model in Aragon – Spain

Sanchez & Tejedor (1995) study the industry-university relationship in peripheral regions: the case of Aragon in Spain. They pointed out seven reasons

for the barriers in the industry-university partnerships: 1) frequent delays in fulfilment of objectives, 2) university staff are too theoretical and not very practical, 3) too many regulations, 4) financial difficulties, 5) cultural barriers, 6) disharmony and discord during R&D development, and 7) intellectual property disputes and patenting disagreement.

4.1.3 Model III. Membership Model

The membership model is unique and comparable to a scientific club. Industrial firms have to become a member first, before getting the service from the university. Membership fees are paid monthly or yearly. This model is quite new for other countries outside the USA. The university must have very good technological capabilities, must be popular, be a leading university among others, have a good image in the society, have high credibility, a lot of experiences in industrial service, and preferably must have introduced many patents, good research.

4.1.3.1 University of Minnesota – USA

The University of Minnesota established the Engineering Research Centre for Interfacial Engineering (CIE) funded by NSF (National Science Foundation) as much as 40%, 30% from industry, and the rest from university and state sources. Interfacial Engineering is a coherent cross-disciplinary activity that focuses on the design and manufacturing of products and processes whose performance depends on interfacial forces and transport.

Company involvement in the centre is governed by a standard membership agreement between the university and the company. According to the membership agreement, sponsors can license all intellectual property developed in the centre. Affiliates are limited to developments in the program of which they are members. (Evans and Tirrell, 2000)

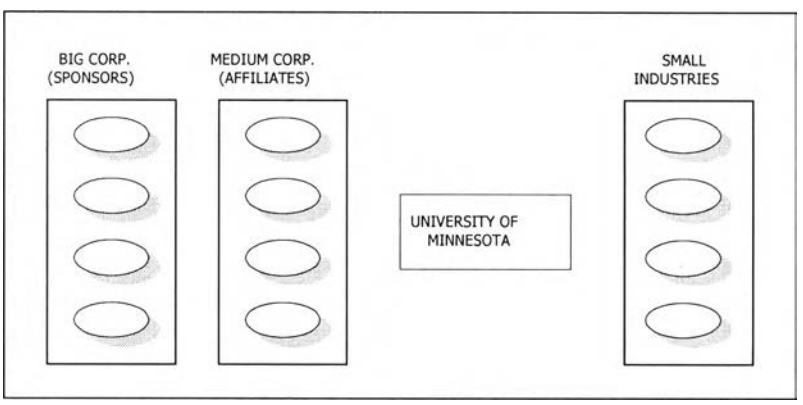


Figure 4.5: Centre for Interfacial Engineering of University of Minnesota

According to Evans, Starbuck, Kiresuk and Gee (1993), the CIE mission is to establish the centre of interfacial engineering as a national resource that industry

can draw on for the knowledge base to make decisions on the processing, fabrication, and performance of interfacial systems; also to educate a new generation of system-oriented engineers with the cross-disciplinary skills to design and manufacture interfacial products.

One of four the CIE visions is to establish synergistic transfer of technology between CIE and its industrial partners. Three of four CIE strategies (the forth is not relevant for industry) to accomplish the CIE vision are

1) To accelerate the development of interfacial engineering via specific research programs and provide a test-bed for real-time analysis of interfacial processes
2) To deliver to industry the necessary fundamental understanding of the basic processes via short courses, faculty and industry residencies and workshops
3) To have a significant impact on the technological competitiveness by providing new tools for design and manufacture of reproducible, reliable and cost effective interfacial products.

In its fourth year of operation, the CIE has 51 member companies: 15 sponsors who pay $75,000 per year and who are involved in activities throughout the centre; 19 affiliates who pay 0.03% of sales with a cap of $25,000 per year and are involved in only one research program; and 17 small companies who pay the minimum membership fee of $3,000 and participate in problem solving teams focused on a project that directly addresses their needs.

One of the hallmarks of a CIE operation is the development of a strategic plan to guide the development of the centre's program and provide benchmarks against which to measure progress. A number of the achievements are summarised as follows:

- Graduated 522 students with centre experience;
- Established the Characterisation Facility via a $7 million equipment investment;
- Delivered short courses and workshops to companies;
- Hosted company researcher on campus as Industrial Fellows; and
- Developed textbooks, multimedia instructional materials, courses and practical experiences for students.

4.1.4 Model III. Industry-University Research-Oriented Parks

In this model, there are industrial estate and university in one big location (see Figure 4.6). They interact directly with the nearest university/industry. There is no agency in between. The relationship is mostly informal and based on short-term projects; some involve continuous product development through formal and long-term partnerships.

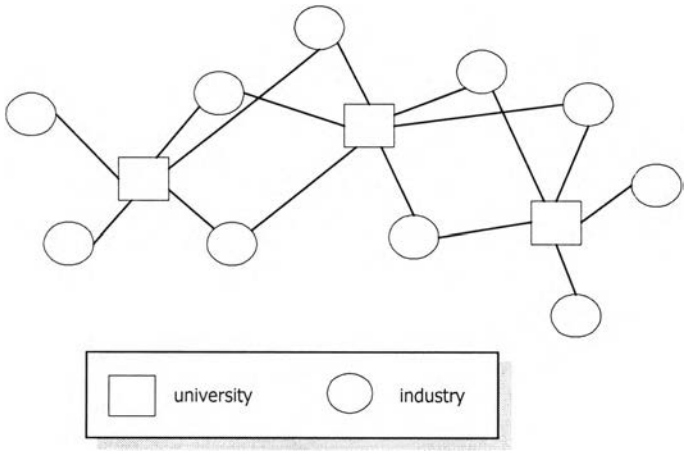


Figure 4.6: University-Industry Research-Oriented Parks Model

There are two example cases of this model that are Surrey Research Park in the United Kingdom and Northrhine Technology Centre and Science Park in Germany.

4.1.4.1 Surrey Research Park – The United Kingdom

Within the European context, the United Kingdom is the country in which science parks have been implemented and analysed in a more systematic way. The development of British science parks has been a direct consequence of two main events. One is the reduction of financial support to British universities from Government. The second relates to the lack of technological dynamism within the British industrial sector and, as a consequence, the increasing necessity of improving industrial performance. With the idea of placing firms and universities in the same physical space and expecting their closer linkages, science parks seem to represent a partial solution to these problems.

According to Vedovello (1997), the Surrey Research Park started to operate in 1984. It is located in an economically well-developed region of the country. It is owned and run by the University of Surrey, which has a strong interest in facilitating links between its academic staff and firms located on its park. The park is managed by a team of full time employees. Its work had concentrated both on routine activities (e.g. promoting and marketing the park and attracting new tenants, property management, public relations, raising finance, etc.) and on activities supporting tenants and the university (e.g. fostering links between the university and park tenants, legal advice to tenants and the university concerning patents and licensing). The park is as a mechanism of interaction between two different social agents (firms and universities), have facilitated the establishment of informal, formal and human resources link.

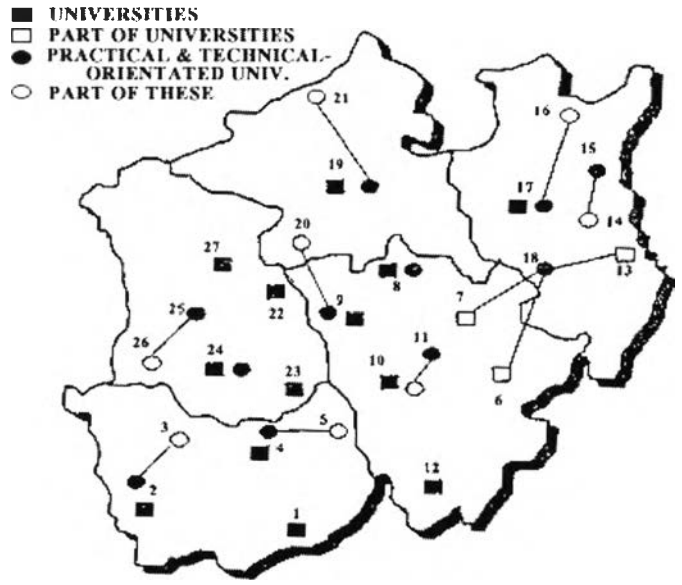
4.1.4.2 Northrhine Technology Centre and Science Park – Westphalia – Germany

According to Staudt, Bock, Muhlemeyer (1994), in the Northrhine Technology Centre and Science Park – Westphalia – Germany, the roles of

universities relate to the existing of industrial estates or technology parks. The tasks for universities are technical counselling, and providing source for technical know-how (database, market analysis, library facility & services). There are demands on service provision by technology centres and science parks in technical consultancy, interfirm cooperation, information on university service provision, search for consultants, business development support, technology research, arrangement of workshops, project management, databases, patent counselling and market analysis. Mostly the companies use technology centres and science parks for development, search for ways of implementing ideas, developing of ideas, construction of prototypes, product launch and production.

Over the past two decades, over 100 institutionalised industry-university cooperation research efforts with technology transfer have attempted to satisfy the disparate goals of the industry and university. The results show successes and failures. Some analysts are of the opinion that the expectations regarding the transfer of technology from university to industry are high.

The main management tasks for Northrhine Technology Centers and Science parks are clarifying their competences concentrating tasks, acting/demand orientation, offensive marketing, establishing personal contacts, constructing networks, skill enhancement, etc. Figure 4.7 shows the geographic location and linkages of government-sponsored centers of technology transfer in Northrhine-Westphalia.



01. Bonn
02. Aachen
03. Julich
04. Kohn
05. Gummersbach
06. Meschede
07. Soest
08. Dortmund
09. Bochum
10. Hagen
11. Iserlohn
12. Siegen
13. Hoxter
14. Detmold
15. Lemgo
16. Minden
17. Bielefeld
18. Paderborn
19. Munster
20. Gelsenkirchen
21. Sluinfurt
22. Essen
23. Wuppertal
24. Dusseldorf
25. Krefeld
26. Monchengladbach
27. Duisberg

Figure 4.7: Northrhine Technology Centre and Science Park – Westphalia – Germany

There still exist some barriers and potential risk for the industries and universities relationship in Northrhine Technology Centre and Science Park. Reasons for lack of cooperation between small business and research and higher education, also studied by Staudt, Bock and Muhlemeyer (1994) that have investigated the role of technology centres and science parks in the transfer process between the research and education and small business, through Northrhine Technology Centre and Science Park – Germany. The reasons found are: 1) the firm has not considered the need for assistance in the search for a technical infrastructure and know-how from the research and higher education sector; 2) the firms feel they have no demand for collaboration with university; 3) no adequate cooperation partner; 4) turned out to be complicated; 5) expenses are too high; 6) fears of know how drain from university to firms; and 7) physical distance.

After the relationships between university and industry have been studied in each model, they are summarised in Table 4.1. In section 4.2, each industry-university partnership models will be analysed in-depth in order to gain experience from successful universities, to identify the common feature of successful partnerships and to assess which partnership model is most compatible with certain market conditions.

Table 4.1: Summary of the Relationship Between Industry and University

Case	Type of Relationship	Type of Services (Linking Mechanisms)	Universities	Industries	Benefits to Universities	Benefits to Industries	Government's Role	Environment Support
South Korea (Soon II Ahn, 1995)	- Formal - Through ERC & SRC formed by KOSEF	- Research trust - Joint lecture - Joint research - Technical advice - Consortium - Investigation	Many universities	Many industries	- Research grant - Scholarship - Research contracts - Played important role in national economy	- Become internationally competitive - Tax incentive - Financial incentive - Recognition of Intellectual Property Rights	- Provide fund, scholarships - Supporting collaboration - Support related industry to compete on innovation and differentiation	Daeduc Science Town
Aragon-Spain (Sanchez and Tejedor, 1995)	- Formal - Through TTP	- Research - Consultancy - Technical assistance	University of Aragon	Small & medium companies	- 10% form each contract - Able to finance its yearly R&D programme	- Gain in technical knowledge - New technical services & implementation - Business image enhancement	- Tax credits - Information network - Direct advisory assistance - Funding	Aragon Industrial Park
USA (Evans, Strabuck, Kiresuk and Gee, 1993)	- Formal & non formal - Membership (CIE)	- Short course - Work shop - Providing new tools for design & manufacture	University of Minnesota	51 companies as the members of CIE	- Yearly membership fees - For students practical experience	- Interfacial connection - More competitive - Get new tools	Funding (NSF)	Interaction of CIE members
England (Vedovello, 1997)	- Formal & non formal	- Research contract - Joint research - Consultancy - Human	University of Surrey	Many industries (60 firms located on park)	- Not available	- Access to univ. research and consultancy - Recruitment of speacilised R&D	Not available	Located in an well developed region so that has small role of external factors

Case	Type of Relationship	Type of Services (Linking Mechanisms)	Universities	Industries	Benefits to Universities	Benefits to Industries	Government's Role	Environment Support
		research links				staff - Environmental of region		
Germany (Staudt, Bock and Muhlemeyer, 1994)	- Formal & non formal - Big/wide networking between industry & univ.	- Technical consultancy - Work shop - Research - Database - Patent counselling - Market analysis	Many universities	Many small & medium companies	Not available	- Funding & staffing - Meet all demands in cooperation, tech., skill enhancement, start-ups	Not available	Northrhine Technology Centre & Science Park

4.2 Comparative Study about Existing Partnership Models

This part is comparative study about existing partnership models in several countries. The study will assess in depth the selected universities in Asian NICs, especially Hong Kong and Singapore because of more similar culture and geography as compared to Europe and USA. The other reason is the economic players in those countries are similar to the economic players or major business groups in Thailand. The comparative study will focus in the strengths and weaknesses of each framework variable for each university.

The following tables were designed to compare the variables of each university, grouped by partnership model. Tables 4.2-4.6 show the summary of data gathered through past studies, Internet and mailed questions. Table 4.2 shows the summary of No-Model Model including University of Indonesia, De La Salle- The Philippines, Hong Kong University, and Hanoi University of Technology. Table 4.3 gives the summary of Agency Model in University of Twente—Netherlands, University of Oregon—U.S.A, Institute of Technology Bandung (ITB)—Indonesia, and Royal Melbourne Institute of Technology (RMIT)—Australia. Next, Table 4.4 shows the summary of Membership Model in Hong Kong Polytechnic University and National University of Singapore. Table 4.5 shows the summary of Research-Oriented Park Model in Texas A&M University—U.S.A, Nanyang Technological University—Singapore, Lund University—Sweden, and University of Manchester—England. For Table 4.6, it shows the more detail in university characteristics in Hong Kong and Singapore.

Table 4.2: Summary of No-Model Model

Criteria	Univ. of Indonesia	De La Salle – The Philippines	Hong Kong University	Hanoi Univ. of Technology
UNIVERSTIY CHARACTERISTICS				
- Tech. Capabilities*	Operative	Operative	Supportive	Innovative
- Ownership	Government	Private	Government	Government
- Vision/Mission**	NA	NA	To offer highest standards of teaching, research and undertake services to community	NA
- Research Budget**	3-5%	NA	> 5 %	NA
- Internal Barriers	HR cap., commitment, faculty owned service, values conflict	Lab facility, time available	Risk of failure, HR cap., commitment, financial incentives	Financial, incentives
- External Barriers	Industry has different values & idea	Lack of marketing information	Lack of marketing information	Lack or marketing info, competition
INDUTRY PARTNER CHARACTERISTICS				
- Tech. Capabilities*	Operative	Operative	Operative	Operative
- Sectors	Telecom, electrical, computer, automobile, chemical, real estate, electronics	NA	Telecom, information, electrical, electronics, computer, real estate, gov. dept., construction	Telecom, electrical, electronics, machinery, chemical, automobile, steel, computer
- Level of Marketing**	100% local without export	NA	Multi and local with export	NA
- Level of Technology	Medium & high-tech	NA	High-tech	High-tech
PARTNERSHIP CENTRE CHARACTERISTICS				
- Location	On campus	On campus	On campus	On campus
- Management	Depends on univ. managt	Depends on univ. managt	Depends on univ. managt	Depends on univ. managt
- Staffs	Existing & new staffs	Existing staffs	Existing staffs	Existing & new staffs
- Laboratories**	Existing lab.	Existing lab	Existing lab	Existing and new lab
- Income shared	2.5% for university	Case by case	No uniform	10% for univ.
- Time available	10% for service	8	Case by case, max	Depend on each

		hours/week	20%	faculty
- Coop. with Public R&D	Yes	Yes, manpower	Yes, database	Yes
- Coop. with Private R&D	Yes, HR development	No	Yes, practical application demand	Yes
- Weaknesses	Too theoretical, delay, cultural	NA	Not commercial operated, no target, no strict dead line	Financial difficulties
- Strengths*	Experts, close interaction, high experience	NA	Champion, integrate diff. specialist, close interaction	NA
LINKING MECHANISM				
- Consultancy	> 50	NA	> 50	> 50
- Research	NA	NA	> 50	> 50
- Joint Research	NA	0	> 50	21-50
- Consortium***	0	0	11-20	NA
- Licensing***	0	0	NA	11-20

* Critical Success Factors ** Complementary Success Factors *** Indicators for Partnership Success

Table 4.3: Summary of Agency Model

Criteria	Univ. of Oregon	Univ. of Twente	ITB (department level)	RMIT - Australia
UNIVERSTIY CHARACTERISTICS				
- Tech. Capabilities*	Innovative	Supportive	Operative, transaction	Supportive
- Ownership	Government	Government	Government	Government
- Vision/Mission**	As a comprehensive research university, to serve students, people, nation, world through the creation & transfer of knowledge	To offer teaching & research with focus on excellent quality, high international standard and integration of tech. & social sciences	NA	Undertake research programs that address real world issues within an international community context
- Research Budget**	NA	NA	$ 3,000,000	> 10%
- Internal Barriers	Financial	Staff's interest	HR capabilities	Teaching duties (time available)
- External Barriers	Foreign company's rules as parent company	NA	Foreign company's rules as parent company	Government policies

INDUTRY PARTNER CHARACTERISTICS				
- Tech. Capabilities*	Transaction	Operative	Operative	Innovative
- Sectors	Electronics, computer	Telecommunication, chemical	Telecommunication	Telecommunication, niche market
- Level of Marketing**	60% multi, 40% with export	Multinational	80% local without export	100% multinational
- Level of Technology	High-tech	High-tech	High-tech	High-tech
PARTNERSHIP CENTRE CHARACTERISTICS				
- Location	On campus	On & off campus	On campus	On campus
- Management	Depends on univ. managt	Depends on univ. managt	Independent with univ.	Independent with univ.
- Staffs	Existing & new staffs	Existing & new staffs	Existing & new staffs	Existing & new staffs
- Laboratories**	Existing and new lab	Existing & new lab	Existing and new lab	Specialized lab
- Income shared	NA	100% for university	17% for university	25% for university
- Time available	5% for service to industry	Depends on situation	30-40% for service	20% for service
- Coop. with Public R&D	No	Yes, input depends on the project	Yes, funds	Yes
- Coop. with Private R&D	Yes	Yes, input depends on the project	Yes, funds and expertise	Yes
- Weaknesses	Many regulation, cultural barrier	Too theoretical, cultural	Delay	Many regulation, finance
- Strengths*	Able to make good proposal, determine proper project length	Close interaction, have champions	Close interaction	Partner share technical needs
LINKING MECHANISM				
- Consultancy	> 50	> 50	11-20	11-20
- Research	21-50	> 50	1-4	21-50
- Joint Research	11-20	> 50	1-4	11-20
- Consortium***	21-50	21-50	0	11-20
- Licensing***	1-4	11-20	0	5-10

* Critical Success Factors ** Complementary Success Factors *** Indicators for Partnership Success

Table 4.4: Summary of Membership Model

Criteria	Hong Kong Polytechnic Univ.	National Univ. of Singapore
UNIVERSITY CHARACTERISTICS		
- Tech. Capabilities*	Innovative	Supportive
- Ownership	Government	Government
- Vision/Mission**	To conduct application oriented education and research	To excel in teaching & research and contribute to the nation's development
- Research Budget**	> 10%	3-5%
- Internal Barriers	HR capabilities, objective conflict	Risk of failure, time available
- External Barriers	Cultural difference	Lack of marketing info, HR capabilities of company partner
INDUSTRY PARTNER CHARACTERISTICS		
- Tech. Capabilities*	Operative, transaction	Operative, transaction
- Sectors	Construction, real estate, electrical, computer, machinery	Telecommunication, construction, electronic, electrical, machinery, chemical, computer, mechanical, environment material, biotech.
- Level of Marketing**	70% with export	Multinational, local with export, local government agencies/ departments
- Level of Technology	Medium and high-tech	Medium and high-tech
PARTNERSHIP CENTRE CHARACTERISTICS		
- Location	On campus	On campus
- Management	Independent with university management.	Depends on university management
- Staffs	Existing & new staffs	Existing & new staffs
- Laboratories**	Existing and new lab	Existing & new lab
- Income shared	35% for university	All for university
- Time available	One day/week for service to industry	10% for consulting
- Coop. with Public R&D	Yes, get funds	Yes, people who able to relate to industry
- Coop. with Private R&D	Yes, get funds and expertise	No
- Weaknesses	Cultural barrier, too theoretical	Too theoretical, communication skills
- Strengths*	Close interaction, manager has high industry experience	Have champions, manager has high industry experience, close interaction, partner provide more than just money
LINKIGN MECHANISMS		
- Consultancy	> 50	> 50
- Research	> 50	> 50
- Joint Research	21-50	> 50
- Consortium***	11-20	5-10
- Licensing***	21-50	21-50

* Critical Success Factors ** Complementary Success Factors *** Indicators for Partnership Success

Table 4.5: Summary of Research-Oriented Park, Source: Mowery (2000), Widiawan (1997), Win (1999), Hobday (1997) and own summary

Criteria	Texas A&M Univ.	Nanyang Technological Univ.	Lund University – Sweden	Univ. of Manchester
UNIVERSTIY CHARACTERISTICS				
- Tech. Capabilities*	Supportive	Supportive	Supportive	Supportive
- Ownership	Government	Government	Government	Government
- Vision/Mission**	To making a difference in our state, nation and world	To train leaders, professionals & entrepreneurs for Singapore	To ensure that the research result be put to use in society, as far as possible, to intensify co-op between univ & industry	NA
- Research Budget**	> 10%	Depend on proposal	> 10%	> 10%
- Internal Barriers	Location, finance, incentive, commitment	Staff's interest, objective conflict	HR capabilities, values conflict	Finance, objective conflict
- External Barriers	Lack of marketing info.	Lack of marketing info.	NA	Lack of marketing info., gov. policies, unprofessional image
INDUTRY PARTNER CHARACTERISTICS				
- Tech. Capabilities*	Innovative	Operative, transaction	Innovative	Innovative
- Sectors	Telecom, construction, electronics, chemical, computer, electrical, real estate, agricultural	Telecom, construction, electronics, chemical, computer, electrical, steel, machinery	Telecom, construction, electronics, chemical, computer, pharmaceutical, wood processing	Telecom, construction, electronics, chemical, computer, electrical, real estate, aerospace, steel, automobile, plastic, oil, wood processing, gas, environment, water, defence machinery
- Level of Marketing**	60% export, 10% multi	Various	Multinational and local with export	65% multi, 30% export
- Level of Technology	Medium & high-tech	Low, med, high-tech	High-tech	Medium & high-tech
PARTNERSHIP CENTRE CHARACTERISTICS				
- Location	On campus	On & off campus	On campus	On & off campus
- Management	Depends & independent	Depends on univ. management	Depends on univ. management.	Depends on univ. management

	with univ. management			
- Staffs	Existing & new staffs	Existing & new staffs	Existing & new staffs	Existing & new staffs
- Laboratories**	Existing and new lab	Existing & new lab	No need lab for consultancy	Existing & new labs
- Income shared	All for university	All for team	NA	Variable arrangement
- Time available	25% for service	1 day/ week	NA	20% for service
- Coop. with Public R&D	Yes, exchange ides, funding	Yes, facility & funding	Yes, planning & fund	Yes, commission & technical facility
- Coop. with Private R&D	Yes, sponsorship	Yes, facility & funding	Yes, money & experience	Yes, commission research
- Weaknesses	Financial, intellectual property, many regulation	Faculty too theoretical, intellectual property	Too theoretical, cultural barrier, intellectual property	Financial difficulties, intellectual property
- Strengths*	Champion, close interaction, industry provide not just money	Champion, high exp., industry share, variety disciplines	Can make good proposal, close interaction	Champion, can make good proposal
LINKING MECHANISM				
- Consultancy	> 50	> 50	> 50	> 50
- Research	> 50	> 50	> 50	> 50
- Joint Research	> 50	> 50	> 50	> 50
- Consortium***	> 50	> 50	> 50	> 50
- Licensing***	> 50	1-4	> 50	> 50

* Critical Success Factors ** Complementary Success Factors *** Indicators for Partnership Success

4.2.1 Indicators to Measure the Degree of Success of Industry-University Partnership

The success indicators of industry-university partnerships are number and kind of linking mechanisms established, with consortium and licensing as the highest value and consultancy as the lowest one. The criteria for critical success factors and complementary success factors are depending on the relationship between each variable in Table 4.2-4.5 and number of type of linking mechanism for the whole universities, especially consortia projects and product licensing. If there is a strong relationship (almost all universities have those relationships), that variable will be called "critical" success factor. If the relationship is not strong enough (not all or the majority universities have the relationship), then that variable will be call "complementary" success factors.

Consultancy and research are the most popular services to industry. The linking mechanisms of joint research and consortium indicate a higher level of success than just either research or consultancy. That is why the numbers of joint research or consortia, found in this survey, are less often than the first two mechanisms. Regarding the consortium, there are two possibilities. The university is playing either a major or a minor role. Even if the university is playing the minor role, it does not mean that the capability level of that university is low. No low quality university will be chosen to participate in a consortium. It must have high credibility, sophisticated laboratories, high technological capability, outstanding scientific publication, excellent faculty, good image, etc. Licensing is a unique mechanism. The level of technology transferred through licensing can be lower than the technology content in a consortium, but from a commercial point of view, licensing is a better indicator and easier to measure to assess the partnership's success. It provides a real evidence for industry-university partnership because university products are used by industry for commercial purpose. That is something real, not just written in the book, kept in the library and brings benefits to the nation's society or other people in the world.

Other indicators to measure a university's quality are patent and spin-off company. The number of patents and spin-off companies already established indicated how high the university's technological capability is, but these kinds of evidences are not a part of industry-university partnership. Patent can be granted by the patent office, but this does not guarantee that industry uses it. Every university can spin-off a company without collaborating further.

4.3 Common Features of Successful Universities in Partnerships with Industry

The common features of universities who have been more successful than others in building viable partnership with industry are:

4.3.1 Technology Capabilities of Universities

- The universities technological capabilities are at least innovative.
- The universities have the same as or higher technological capabilities than industries either the whole university or only department.
- The higher universities technological capabilities, the more successful are their partnerships with industry.

One important factor for success is that the university's technological capabilities must be the same as or higher than those of industry. The university has to assess the technological capabilities of each department and also understand what technological capabilities industry has. The university also has to analyse and match its supply with demand. Without these steps, it is not possible to establish a partnership. Universities with high technological capabilities usually have chosen a partnership model while universities with less capability usually have no partnership model, except Hong Kong University and Hanoi University of Technology. Hong Kong University's researchers prefer to work individually, while Hanoi University of Technology met financial difficulties. There is also an interesting statement by National University o Singapore (NUS), which has a problem it technological capabilities of industry clients are too low; this resulted in the fact that managers/engineers from industry could not understand what NUS people referred to when they discussed possible cooperation.

4.3.2 Technological Capabilities of Industry

- Universities have to know potential customers technological capabilities.
- Industries' technological capabilities are (at least) transaction capabilities (innovative is better).
- The higher industries' technological capabilities, the higher recognition of the importance of partnerships, and the more success in partnership with university.

Universities who have industry clients with innovative technological capability or at least transaction capability are more successful than universities who have industry clients with operative technology capability only. Those successful universities usually choose the Membership or Research-Oriented Park Model and some of them chose the Agency Model. Technological capabilities of industry clients are an important success factor for the partnership. Higher technological capabilities of industry impact on the way management thinking. They recognize the need to innovate together with university. Industry with low technological capabilities only aims to buy or copy technology from aboard.

4.3.3 Partnership Models

- Universities which had chosen and implemented a partnership model are more successful than others.
- Universities which had chosen the Research-Oriented Park Model are the most successful in partnership with industry followed by Membership Model and Agency Model.

The difference between adopting and implementing a formal partnership model and no model is the formality of partnerships namely the manager, office, overhead cost,

negotiation with the customers, policy, contracts and etc. Top management of the university has to appoint a manager to manage the agency or membership office, club or research-oriented park. The university also should provide an office for the centre who takes responsibility for partnerships. There will be overhead costs. The manager's activities formalize the relationships with industries and make them more professional service provided by individuals in universities who have no formal mechanism applied. Therefore, the relationship between a university and industry is more formal than the relationship between a university without model and its' customers.

4.3.4 Linking Mechanisms

- The successful universities have more projects in all kinds of linking mechanisms.
- Successful universities participate in consortia and issue product licensing.

The various linking mechanisms of the partnerships are output of and real evidence for the relationships. Universities who are more successful have more projects for each type of linking mechanism. Consultancy presents the lowest level of partnerships, while licensing is the highest level. For this reason, most universities have many consulting projects but only a few products licensed.

Those features shown above are very critical. There are some more common features of universities who have been more successful in partnership with industry, but they are less critical than the first four variables above. These features are:

- Government intervention makes the university active, dynamic and has protection to deal with industry clients.
- Government intervention makes universities do as well as possible.
- University tries to know the industry needs.
- Industry invites university faculty to discuss its problems.
- Ratio between number of lecturers and number of students.
- Universities' scope and focus of internationalisation.
- Percentage of research budget compared to university annual budget.
- Good combination and close synergy of explicit commitment in university's vision/mission, clear and reachable goals/objectives.
- Recognising HR personal goals.
- Willingness to work as a team.
- Collaboration with public R&D institutes.
- Industry's level of marketing (export or multinational).
- University has special laboratories.
- University has strengths, which are related to partnership (especially having champions).

- Building credibility and meeting customers' needs with service advantage characteristics.

4.3.5 Matching Demand (Pull) and Supply (Push)

The successful universities through personal contacts try to find out and understand what needs or problems industry has. On the other hand, industries' managers who had a modern thinking and recognised the role of universities in supplying innovations will come to university. These steps are required for matching the service and consulting supply by university and demand by industry.

4.3.6 University Characteristics

Table 4.6 Summaries of HKU, HK PolyU, NTU, NUS Characteristics

Criteria	HKU	HK POLYU	NTU	NUS
No. of Students	14,400	20,245	14,300	22,287
Lect. : Student Ratio	1: 18	1: 21	1: 50	1: 14
No. of Fac. & School	9	6	10	12
Research Focus	Basic Research	Applied Research	Basic Research	Basic & Applied Research
Research Budget	US$ 370 million (> 5%)	US$ 94 million (> 10%)	Depends on proposals	US$ 144 million (5-10%)
No. of Research projects/year	2,000	1,220	> 1,000	> 1,500
Ownership	Government	Government	Government	Government
Tech. Capabilities	Supportive	Innovative	Supportive	Supportive
National Culture	High Power Distance	High Power Distance	Competition	Competition
Reward System	Acknowledgment & promotion	Acknowledgment & compensation	Acknowledgment & compensation	Acknowledgment & promotion
Leadership Style	NA	Delegation	NA	Delegation
Creativity	High	Very high	Very high	Very high
Need, belief, perception	Do as they want	NA	NA	Acknowledgment
Professional skill level	High skill, all lecturers are Ph.D. holder	High enough	High enough	Very high, so many patents and licenses they have produced
Team Work Ability	High	Very high	Very high	Very high
Willingness to team work	Prefer individual responsibility	High, will work as a team	High	High
Risk-taking	Quite low, less encouragement from top management	Quite high	Quite high	High

The relative amount of funds for research differs in each university analysed. Thus, it is not possible to generalise by partnership model. All universities with a research-oriented park have research budgets of more than 10% of the annual university budget, higher than universities, which choose other partnership models. Since the research budgets in different universities comprise different kind of allowances, it is not appropriate to use the research budget as an indicator for partnership with industry.

The land area of Nanyang Technological University (NTU) is one factor, which influenced NTU in choosing the Research-Oriented Park Model as its partnership model with industry. With an area of 200 ha and the campus located in Jurong, near Jurong Industrial Estate, NTU gets benefits and develops the partnership through renting out some campus areas to industrial companies. Although National University of Singapore (NUS) does not have such empty places for industry, the faculty is involved in two government science parks on Pasir Panjang Street, next to NUS. NUS is more successful than NTU, especially in licensing. NUS is very active in producing patents, both local and US patent, beside spin-off companies. Land areas of universities in Hong Kong are smaller than Singapore's university, because the cost of land in Hong Kong is much higher than Singapore, beside there is no possibility to expand the land anymore. The only possibility is expanding the vertical like other high-rise buildings.

Although the number of NUS students is the highest among others, the ratio of number of lecturers and number of students is the smallest. This ratio is very important. It shows how many students can be guided by each lecturer. Low ratio means there is an opportunity to do services beside teaching.

Number of courses offered by universities in Hong Kong are much more than number of courses in universities in Singapore. HK PolyU with the highest courses offered is more a teaching university. The service to industry is also much more in training form, besides doing applied research. Number of faculties or schools shows how diverse the service range of those universities is. Number of faculties or school in HK PolyU is the smallest, because it focused on technical fields.

Research budget in dollars and number of research projects per year could not measure the commitment of the university's top management. The percentage of research budget compared to annual university budget can be assumed as one factor to measure it, but hat factor is not the only one. HK PolyU provides a research budget of more than 10% of the annual university budget, corresponding to its mission, strategic plan to have more number of specialist centres and full time staff to do the service. This proves the strong commitment of top management to partnership with industry.

Commitment of top management, risk of failure, human resource capabilities, financial incentives, time available, staff's interest, objective and value conflict are the internal barriers for industry-university partnerships. These barriers could not be categorised because all partnership centres in all partnership models have the same barrier. Almost universities lack of marketing information that is the external barrier. This phenomenon seems to contradict with the strengths of partnership centres, that is, close interaction with industry. If the centre has close interaction with industry, it cannot

lack marketing information. One possibility, the centre is not close enough with industry. The centre is not active enough to search or pursue information about the need of industries as the market or customers. Another possibility could be that this barrier is related to the strategy, especially marketing strategy and internal barriers.

Looking through the vision and mission, HKU still focus on teaching and advancing knowledge. HKU seems to lack top management's commitment to service for industry. Basic research, long term and very high-level technology are HKU's research focus. KHU prefers to do it for government rather than industry, that's why the research budgets too much bigger, but there is less direct output to industry.

Related with reward system, the need of lecturers is also about acknowledgment. NUS lecturers have very high professional skills level. They have self-motivation to do innovation and take responsibility.

Teamwork and risk-taking are very important in partnership with industry. Administrators need support from academic personals, while academic personals need administrators to deal with industry customers. This phenomenon shows the team work should be good, except KHU who prefer individual responsibility if risk-taking is low, the innovation acceleration is also slow. Nobody wants to take the risk. Fortunately, it does not happen in KH PolyU, NTU and NUS. That's why KHU does not have spin-off companies and little licensing projects.

4.3.7 Industrial Firm Characteristics

There is a great variety of industry partners are, from local companies without export, local companies with export to multinational companies. University can succeed in partnership with industry if industry's scope of marketing is multinational. The wider the market the higher the competition and the better the quality. That's why multinational and local companies with export activities need a kind of partnership with university. Universities with Research-Oriented Parks, Membership Model and some of the universities with Agency Model have industry clients with wide scope of marketing. They are more successful compared to universities without partnership model who have a narrow scope of marketing. Industry with narrow scope of marketing will never think about R&D cooperation with university. That is not an urgent demand for that kind of industry.

Sectors of actual and potential industry partners are almost the same for every university, despite a great variety of fields. Industry sector is not a success factor, because all of models had industry clients from the same sectors.

Most of the companies were medium to high-tech companies' level. Level of product or process technology is not a success factor too. High-tech company has no guarantee to make a partnership successful. If depends on university's and industry's technology capability, and the match of supply (by university) and demand (by industry).

4.3.8 Industry-University Partnerships Centre Characteristics and Barriers

Building a new laboratory or a special one is a special one is an important for success. Most successful universities use the new laboratories for supporting their service to industry. Laboratory equipment for teaching purpose (for student, specially undergraduate) usually less qualified than for research or service purpose. For example, the class or tolerance of equipment for teaching purpose is 5%. It does not matter. The price of that equipment is quite low. The equipment class for research purpose must be less than 1% or 0.5%. If this qualified equipment is used for teaching purpose, some students who use it carelessly can reduce the equipment quality. The class is not less than 1% anymore. It is difficult to adjust again. Another reason for not using the laboratories mix with teaching purpose is the time. For example, the researcher wants to use the equipment or the laboratory but at the same time some students are using it for a practical exercise or their thesis. This problem can discourage the researcher.

The other most important part to make a partnership successful is the university strengths. Having champions are used by the most success university such as Manchester University, Texas A&M University, NUS, NTU, Twente University and Hong Kong University. The second one is close interaction with industry through informal contact, regular visit, formal contact, or through the alumni. This strength is applied by Texas A&M University, Hong Kong Polytechnic University, NUS and Twente University. The third success factor is an ability to make a good proposal. Manchester University, Lund University, and Oregon State University recognise this strength. The other success factors are "the centre manager has high industrial experience", applied by NTU, NUS, HK Poly University, and "interdisciplinary approach" applied by Manchester, NTU, HK University. The last success factor but not least, industry partner provides not just money but also a person who has time, ability, interest, responsibility, and etc., applied by NUS, Texas A&M University. It is difficult to ask industry to do it for university. Other factors are less important because other universities who are not success also do the same as the success one.

Most universities have no strategy focus for providing services to industry. Most universities recognise quality, reliability, human approach, and promotion as their strategy. Some recognise positioning were their strategy, but no focus which strategy they choose. Strategy can be an important factor for success, but in this case no university recognised what is their real strategy. They try all ways as well as they can.

All university-industry partnership centres of both successful or less successful universities are on campus, but a few ones have outreach office. Close interaction with university is the main reason to put the centre on campus. The other one is the cost of establishing an outreach office. Almost all universities are government owned and get research fund every year from government. Most partnership centres are non-profit. Only one-third of the centres have motivation for income or additional remuneration for the faculty. The others are for university image and involve in technology development of industry. That's why the income from research activities still low. Although the motivations are different, its could not be categorized that the success

universities chose profit oriented motivation and the less successful ones has chosen non-profit oriented motivation, or vice-versa.

The personal contact of universities in this study both from successful or less successful universities is the most frequent way in getting order from industries. It relates with one factor of university strengths, that is, close interaction with industry. For well-known university, having experts or champions is a strength factor to get order, too. The weakness factors of all partnership centres are almost the same. They are, financial difficulties, too many regulations, and delay in project completion. The faculty members are too theoretical and there are problems in intellectual property rights.

Most partnership centres have cooperation with both public and private R&D institutes. Their inputs are financial support, facilities, experts and information. In addition, there are no uniform rules in income shared and faculty time provided for service to industry. Most universities have set up a rule for income shared and the rests look at it case by case. If the monthly salary of the faculty is including the service, the whole incomes of every project are for university. NTU encourages the people to do services through income shared (100% of contract is for the team members). Faculty time provided one day per week is getting popular. It is easier to supervise or to measure the effectiveness of the faculty, rather than talk about the percentage of faculty time. Most of this time is used by consultancy service.

Cooperation with public or private R&D institute, rules of income shared and time provided for service could not be categorised. It relates with university rewards system. For example, all incomes from research of NUS are for university. Faculty gets fixed salary (high enough, and no faculty has no research job). NTU chose different system. All incomes for the project team, the university only gets good image, publication materials and royalty (for licensing).

About two-third partnership centres, its management depends on the university management. Usually universities subsidise the centres, especially paying manpower salary, providing a place and utilities. Five for every six partnership centres use both existing staffs and hire new ones. On the other hand, two-third centres use both existing laboratories and build special ones to support the service to industry. HK Poly University has chosen the centre's management is independent from university management. Its services are focus on applied research and training course, based on immediate needs of industry. High risk taking and its service characteristics made HK Poly University self-confidence to make the centre's management independent or self-finance. Unfortunately, the management (depend or not depend on university management) and using new staff could not be correlated with successful or less successful university.

Personal contact is the favourite way to get order from industry. Hong Kong University contacts industry through its alumni. All centres use technology push strategy in preparation to get started. There are some ways to make universities get closer to industry, through undergraduate student attachment program, visiting industry, and informal contact off campus. HK Poly University sets up the program first, then makes informal contacts to see the needs of the program. That's why HK Poly University does

not face an external barrier such as lack of marketing information as other universities do. There are some internal barriers, such as risk of failure, HR capabilities, objectives conflict, staff's interest, commitment of top management, financial incentives and time available of faculty.

4.4 Common Features of the Least Successful Universities

Most universities want to have successful partnerships with industry. Although they have government support, wide land area, the output of partnerships is often still low. There are many reasons for this. The common features of least successful universities surveyed are:

- Low technological capabilities (operative, transaction)
- Potential industry partners depend on foreign company
- Low technological capabilities of potential industry partners
- Wrong customer identification and segmentation (local company without export, low level of production technology, lack of information about industry needs)
- Lack of champion, poor human resource capabilities
- No commitment of top management and senior staffs, no explicit mission, no clear objectives, no strategy, lack of research budget
- No intense interaction, no idea how to communicate
- Low quality of universities' laboratories and equipments
- Too many regulations, not responsive
- Too high teaching load, too high students/lecturers ratio
- Faculty are too theoretical
- Frequent delays in project completion is reducing credibility

In most developing countries, industries just think how to make quick profit. If they know there is a need for a certain product, they will buy the machine for production or equipment, install it, send the operator to get training, produce products, then sell it. The criteria for buying the machine are the price (low price) and having business relationship with the supplier. They never think to improve the machine or create a new one by themselves, because the suppliers already have offered a new one (this is also not the latest technology in supplier's home country, but more modern than the first one).

Supply push by universities usually is strong, while demand by industries is weak. Supplier or parent company of industry always offers the new equipment. In supplier's country, the equipment which suppliers sell it to industries in developing countries is not the latest technology anymore, so they sell it with cheaper price. Supplier provides all industry needs such as equipment, maintenance, computer program, training, and consultation. All of these could not be supplied by universities. Universities could not be

supplier's competitors. Universities have to find the right industry needs, which are not supplied by others.

4.5 The Particular Strengths and Weaknesses of Each Partnership Model

The success factors and indicators of various partnership models have already been discussed above. They are technological capabilities of university and industry. Other important factors are the integration of university, industry's scope of marketing, and specialised laboratories provided. The last but not least factors are university, strengths, linking mechanisms especially consortium and licensing. The most important factors to measure the successes of industry-university partnerships are technological capabilities of industry (demand) and university (supply), and type of linking mechanism. There is a requirement for industry-university partnerships. The technological capabilities of university must be higher than those of industry in order to gain a benefit from collaboration. This depends on industry characteristics in a certain country. If innovation is not pursued by industry, it is difficult to build a partnership with industry. Industry just wants to copy and buy technology from aboard. If university's technological capabilities are lower than industry's, there is no possibility for partnership, as in this case, industry does not need university.

The other important factor is the type of partnership model. From Table 4.2 to 4.5, universities with a Research-Oriented Park have been most successful, followed by Membership Model, Agency Model and those who did not apply any model.

The common features for whom had chosen in each model and benefits/weaknesses of each model are discussed as follows:

4.5.1 No-Model Model

Universities that had chosen no particular partnership models have the following common features:

- Low level of technological capabilities in the university.
- Low level of technological capabilities in industry.
- Small number of linking mechanisms (emphasis on consultancy and research).
- No explicit commitment to cooperation with industry in university mission.
- No integration between university mission, goals, and strategy
- Industry partners were local companies without export activities.
- Use only existing laboratories.
- Have no important strengths, such as having champions.

There is an interesting phenomenon. Hong Kong University, National Taiwan University and Hanoi University of Technology have higher technological capabilities

but they still chose no particular partnership model. While they rank high in technological capabilities, they do not meet the other requirements.

The benefits of choosing no-model model are:

- No investment for office, manpower and overhead cost.
- Not many regulations.

The weaknesses of choosing no-model model are:

- No coordination.
- Difficult communication with industry.
- No direction in service development.
- No experience in negotiation.
- Not enough knowledge about intellectual property.
- Usually faculty does not understand business people very well.

4.5.2 Agency Model

Universities that had chosen the Agency models have the following common features:

- High technological capabilities of university.
- Low technological capabilities of industry.
- More types of linking mechanisms (emphasis on consultancy, research, joint research and some consortium).
- Explicit commitment in mission.
- Industry partners were local companies with export activities.
- Use existing and build specialised laboratories.
- Have few important strengths, such as having a champion, close relationship with industry.

The benefits of choosing Agency Model are:

- Close interaction with industry through the manager.
- Better in negotiation with industry than the researcher.
- Better in preparing proposals than the researcher.
- There is a good coordination among departments.
- Sharp in determining proper project length (have experience about it).
- Less possibility to delay in project completion.
- Less possibility to delay in project completion.

- There is someone (agency manager) who in charge in project planning and monitoring.

The weaknesses of choosing Agency Model are:

- Investment in office, manpower and overhead cost.
- Regulations.
- Sometimes the agency manager is a single fighter.
- Need administration staffs to maintain the relationship, meeting with industry and administration duties.

4.5.3 Membership Model

Universities that had chosen the Membership Model have the following common features:

- High technological capabilities, university was well known, high credibility, has vast experiences, was recognised by industries and society, has national or international reputation and records showing great quality and successful partnerships.
- Average technological capabilities of industry.
- All types of linking mechanisms (many consortia projects and producing licenses).
- Very clear and explicit commitment in mission.
- Industry partners were multinational and local companies with export activities.
- Used existing and build specialised laboratories.
- Had many important strengths such as champions, close relationship with industry, were able to make good proposals, and has a manager with strong industrial experience.

The benefits of choosing Membership Model are:

- Stable income for university from membership fees.
- Focus on constant and limited customers regarding the university's service capability.
- Knowing customers profile and needs better.
- Possibility to guide industry continuously from the beginning to success.
- Intensity on service, not diversity (too diversity will impact to customer's impression).
- Better in communication with industry, very close.

The weaknesses of choosing Membership Model are:

- Difficulty to set a champion as the service leader.

- Need to have very good image first before establishing membership.
- Need to maintain the reputation, the good image through continuous excellent services.
- Take much time of club administrator to serve all members.
- Lack of synergy in service if members are too heterogeneous.

4.5.4 University-Industry Research-Oriented Parks

Universities that had chosen University-Industry Research-Oriented Parks have the following common features:

- Very high technological capabilities of university.
- High technological capabilities of industry.
- All types of linking mechanisms (several consortia and many licenses).
- Explicit commitment in mission.
- Industry partners were multinational and local companies with export activities.
- Use existing and build specialised laboratories.
- Have many important strengths, more than other universities with other partnership approach.

The benefits of choosing University-Industry Research-Oriented Parks are:

- Close to customers.
- Income from renting out the place.
- Easy communication.
- Very close interactions.
- Company partners share their technical facilities.
- Company partners provide not just money, but also staff who has time, interest, responsibility and ability.
- Monitoring the progress of selected industries.

The weaknesses of choosing University-Industry Research-Oriented Parks are:

- High investment for providing places for industry on or close to campus.
- Difficult to find industry with innovative capabilities.
- Need more staff to handle utilities.
- Complex problems and busy with non-technical duties such as administrator.

4.6 Fit of Universities (Supply) and Industry (Demand) Characteristics with Partnership Model Type

4.6.1 No-Model Model

The characteristics of university (supply) and industry (demand), that fit best with no particular partnership model applied, are:

4.6.1.1 Universities (Supply) Characteristics

- Universities have low technological capabilities (operative, transaction). In a special case, it can be innovative, such as HKU.
- Universities have few innovative capabilities.
- The universities' staffs prefer to work individually. Every faculty is too busy with themselves (teaching duties, own-business, academic professional activities such as writing a book, journals, member or chairperson of professional association). It is better if everybody takes responsibility for him/herself, otherwise the project completion will be delayed for many times.
- There are two possibilities in getting order. The good staffs, such as in HKU, contacted the industry directly. They do not need an agency to do it for them. The other way is waiting for industry to contact the university. Then university top management passes it to the appropriate departments or research centres.
- Most linking mechanisms they have done are consultancy and research contact.

4.6.1.2 Industry (Demand) Characteristics

- Industry has low technological capabilities (operative, in some cases transaction).
- Industries never think to ask help from university if they can get help from others, such as suppliers, another company in their group or private consultant. Industry will come to university if they know the contact person well, or do not have big funds, or no ways to solve their problems.
- Scope of industry's marketing is local without export. Local market usually does not need specific standards or requirements and less competition compared with international markets. This condition makes industry feel that no need to spend a lot of money for research or innovation.

4.6.2 Agency Model

The characteristics of university (supply) and industry (demand) that fit best with Agency Model are:

4.6.2.1 Universities (Supply) Characteristics

- Universities have higher technological capability. This level allows universities to innovate more frequently.
- Universities have strong commitment through mission, objective, choice of partnership model, and establishing an agency to deal with industry. Through this agency, there is a better coordination among departments, research centres and laboratories. This agency will do better in communication, maintaining the relationship, and negotiating with industry partners. It also looks for more potential customers. This agency will keep and maintain administration, publication, promotion and information service better than no model applied.
- Compared to universities with Membership and University-Industry Research-Oriented Parks Models, the universities have fewer champions and less credibility. The agency is responsible for bridging between departments and industry. The agency does a double work, for university and industry. It has to recognise the university's strengths, to promote it, to recognise industry needs, and then to match them.
- Universities have more linking mechanisms. They start to get involved in joint research, a few consortia and some licensing.

4.6.2.2 Industry (Demand) Characteristics:

- Industry has transaction capabilities, and in some cases innovative capabilities. Therefore, it can cooperate with university. Industry is not just a receiver or recipient of technology.
- Industry is starting to expand their market abroad. To meet with international requirements and standards, industry has to improve quality, reliability, efficiency, etc. industry also will think about innovation, in order to be more capable in competition.

4.6.3 Membership Model

The characteristics of university (supply) and industry (demand) that fit best with Membership Model are:

4.6.3.1 Universities (Supply) Characteristics

- Universities have high technological capabilities (innovative and supportive).
- Universities are well known and have high credibility; otherwise industries would not want to be members of a university's club.
- Universities have to recognise their strengths in order to limit the number of members. The linking mechanisms are including all kinds of mechanisms, and should be continuous and long term.

- Maintaining the services to the members is very difficult, because the members come from different sectors, objectives, level of production technology, etc. formal and informal contacts should be applied together in order to maintain the good image and human relationships.
- Universities have great responsibilities to help the technological development of industry members.

4.6.3.2 Industry (Demand) Characteristics:

- Industry members have transaction capabilities or in come cases innovative capabilities. Industry members will think carefully before deciding to be a member of universities' club, because the membership fee is high. This is a good chance to improve the technological capabilities, innovative capabilities, and technology development under supervision by university.
- Industry should open its planning for the future and invites university to see the say to day operation.
- Industry will get benefits from sharing opportunities with other members.

4.6.4 University-Industry Research-Oriented Parks

The characteristics of university (supply) and industry (demand) that fit best with University-Industry Research-Oriented Parks are:

4.6.4.1 Universities (Supply) Characteristics

- Universities have very high technological capabilities in order to serve and solve the complex problems of industry.
- Universities have all components of innovative capabilities and are able to create synergy among them.
- Universities usually have large land areas to provide some places for University-Industry Research-Oriented Parks. The industry can use that place for its office, laboratories, research centre, etc. in order to cooperate with university experts.
- Universities must be well known and have good reputation, to gain industry's trust. The University-Industry Research-Oriented Park location is not far from either business or industrial centres.
- Universities have to provide full time staffs to manage University-Industry Research-Oriented Park and have enough knowledge about business law in order to create a good relationship with government and industry customers.

4.6.4.2 Industry (Demand) Characteristics:

- Industries' technological capabilities are high, usually innovative capability.

- Industries already have recognised the need for innovation. Usually its business scale is big, and the level of production technology is high. Some of them have own laboratories or research centres.
- Industries have a research budget, are committed to product development in order to keep up with competitors, and are able to compete with others and are a leader in its business sector.

Fit of universities (supply) and industry (demand) characteristics with partnership model type is summarised in Table 4.7. In addition to show university and industry characteristics fitting each partnership model, the sequence of partnership model also is pointed out. From No-Model Model, the partnership can be improved by aiming for the Agency Model. From Agency Model, the partnership can be improved to become either Membership Model or Research-Oriented Park Model. It is not a viable decision if some universities jump too fast, because each model has different characteristics and preconditions for becoming successful. For example, if universities with No-Model Model want to jump to the Research-Oriented Park or Membership Model, the partnership is likely to fail which has an impact on the university's credibility. The partnerships depend on university characteristics and industry client characteristics. Internal condition of university can be controlled or changed by the university, but industry policy cannot be controlled by university. If the partnerships do not bring benefits to industry, they will not cooperate. In this case, government's role is very important in creating an innovation climate among industry; for example, support research funds, provide tax incentive for industry who cooperate with universities.

Table 4.7: The Sequence of Partnership Model

University Characteristics	Partnership Models	Industry Characteristics
- Low technological capabilities (operative, transaction). - Few innovative capabilities - The staffs prefer to work individually. - The staffs contact the industry directly. - Most linking mechanisms are consultancy and research contract.	**NO-MODEL MODEL**	- Have low technological capabilities (operative). - Never try to ask help from university. - Can get help from suppliers. - Local companies without export activities.
- High technological capability (innovative). - Strong commitment. - Few champions and less credibility. - Some linking mechanisms.	**AGENCY MODEL**	- Have transaction capabilities. - Start to expand their market abroad.
- High technological capabilities. - Well-known and high credibility. - Recognise their strengths. - Apply both formal and informal contacts. - Great responsibilities.	**MEMBERSHIP MODEL**	- Have transaction capabilities. - Open its planning for the future. - Invite university to see they day-to-day operation. - Sharing opportunities with other members.
- Very high technological capabilities (supportive). - Have large land areas for the Science/Research Park. - Well-known and have good reputation. - Provide full time staffs to manage the Science/Research Park	**RESEARCH-ORIENTED PARK MODEL**	- Have innovative capabilities. - Recognised the need for innovation. - Has a research budget.